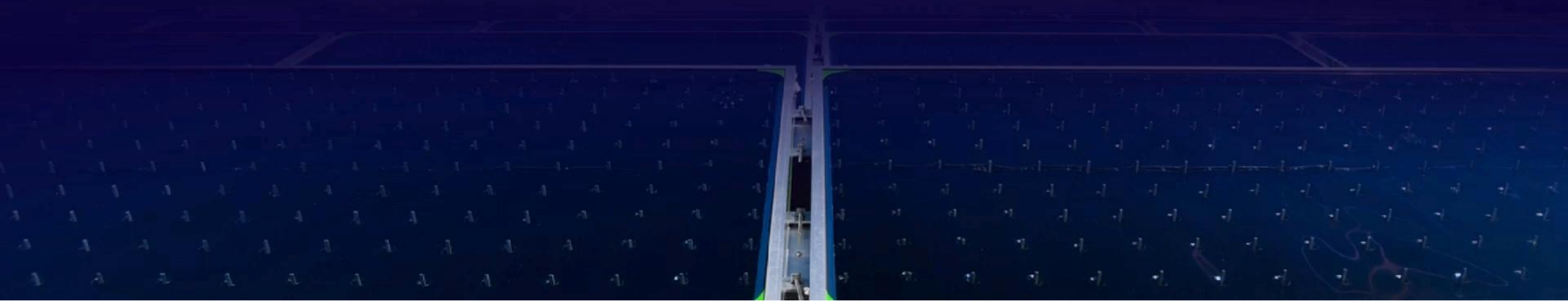


TVP Solar: A solar thermal solution to decarbonize industrial and district heat

Event @The Shifters Switzerland 



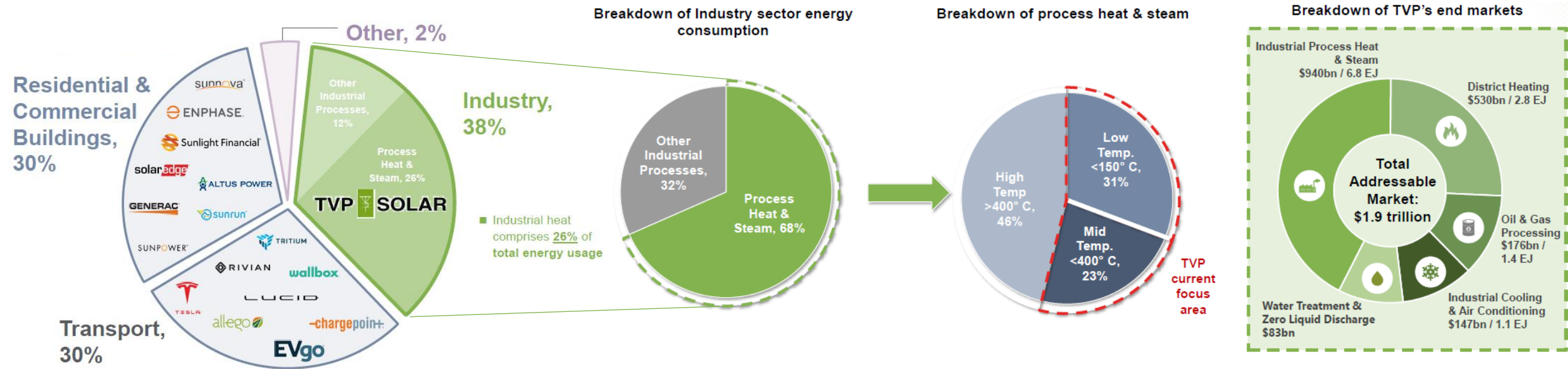
Agenda

Agenda

- Context – Why Solar Heat matters for industrial and city decarbonization
- Company overview: what is TVP Solar?
- Technology Overview – Key principles, technology Features
- Swiss & Worldwide Use Cases
- Q&A

Industrial process heat is the global largest energy end-use, and is not yet fully addressed by renewables

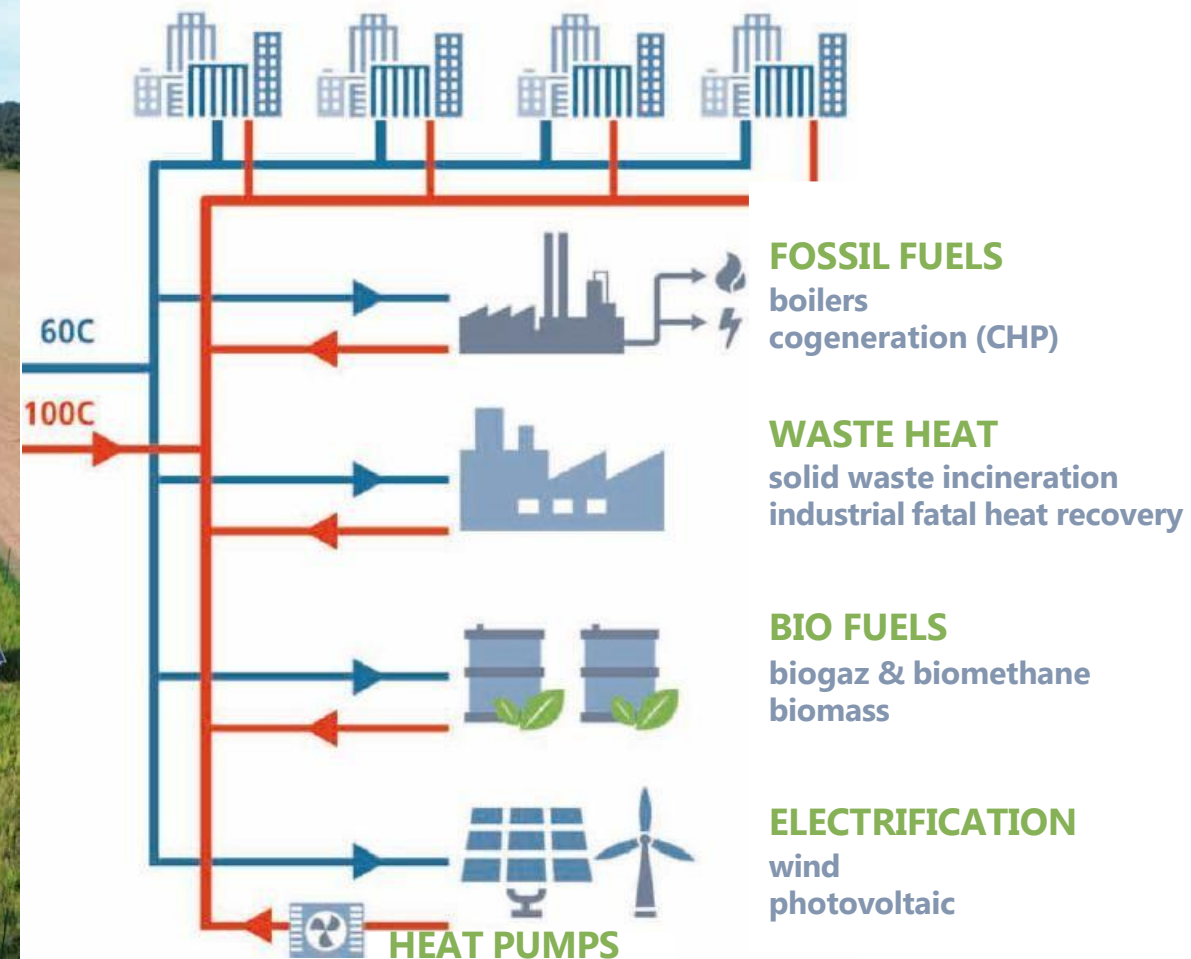
There is an opportunity for renewable heat up to 200°C to substitute fossil fuels and create an alternative to natural gas. Industrial decarbonization is critical to achieve ESG targets



Source: IEA, "Renewables 2021 – Analysis and forecasts to 2026"
BloombergNEF "Hot spots for renewable heat, 2021"

Our goal: substitute fossil fuels

Mostly replacing natural gas to reduce import and secure energy independence for end-users and countries



TVP delivers carbon-free heat for a variety of thermal energy high demanding applications



“SHIP”

Solar Heat for Industrial Process

Boilers, heaters, dryers and storage tanks up to 180°C



“SDH”

Solar District Heating

Boilers, TES, ATEs, PTES and heat pumps up to 95°C



“SHO”

Solar Heat for Oil Processing

Upstream and downstream applications up to 180°C



“SAC”

Solar AC & Heating for Buildings

Absorption chillers 2E up to 180°C or 1E up to 95°C



“SWD”

Solar Desalination & Water Treatment


MED or Forward Osmosis up to 180°C

TVP Solar is a game changer in thermal energy

Breakthrough Proprietary Vacuum Insulation Technology

- The foundation of non-concentrating collectors generating **up 200°C carbon-free heat from sun**
- Derived from LHC experiment at CERN
- **184 granted patents**


High-Tech, Modular Volume Manufacturing

- **Continuous production 24h/24h & 7d/week**
- ISO 9001, 14001, 45001 certified 
- High automation, real time tracking, and remote supervision, **ready for replication**

Global Industrial Decarbonization Strategy for Blue-Chip Customers

- Chosen by the most sophisticated ESG clients 
- Turn-key solar thermal plants or billing heat as service
- Mostly cutting Scope 1 CO₂ emissions

Best Performing Solar Thermal Product in Any Climates

- **10+ years** of operational data 
- Certified by SolarKeyMark and SRCC
- **20-year performance guarantee** with no degradation over product lifetime

Unrivalled Thermal Energy Efficiency Proven in Field and at Scale

- **25+ installations** in 12 countries, including a 37MW 48,800 m² utility-scale deployment
- **>50%** yearly av. sun-to-heat **efficiency**
- Mostly industrial process heat & district heating

Solid Foundations and Track Record

- **185 employees**, including 50 engineers & 5 PhDs
- **CHF 150M+ already invested** as equity, debt and financing from grants (25 awarded)
- Management team with **100+ years of experience**

Decarbonizing the largest Scope 1 emitters

TVP end-clients are the largest thermal energy consumers and the highest energy experts globally

MULTINATIONAL MANUFACTURERS



ENERGY DISTRIBUTORS



FUEL PRODUCERS



Solar Thermal Market Overview

40°C

65°C

180°C

250°C

400°C

Drying, Washing, CIP, Pasteurising,
Boiling, Bleaching, Sterilising

Stationary, non concentrator technologies

Tracking, concentrator technologies

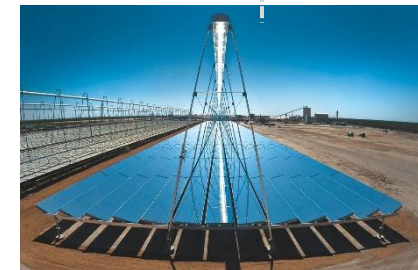
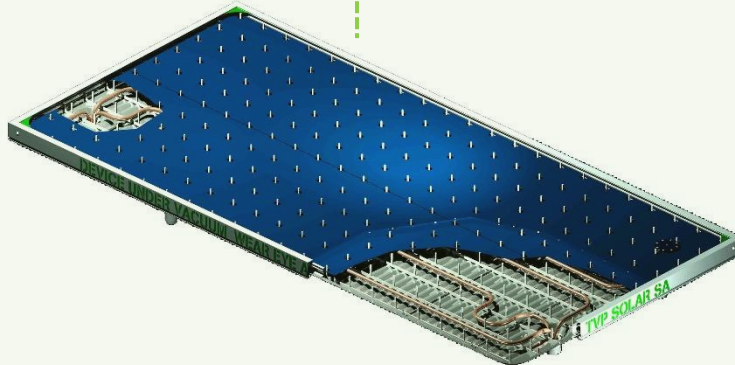
Flat Plate

Evacuated Tubes

TVP High-Vacuum Flat Plate

Parabolic Trough

Linear Fresnel



TVP produces a massive amount of renewable energy, more than anything else on the market today

TVP high vacuum-insulation technology creates a new class of super-performing solar thermal products



184
patents

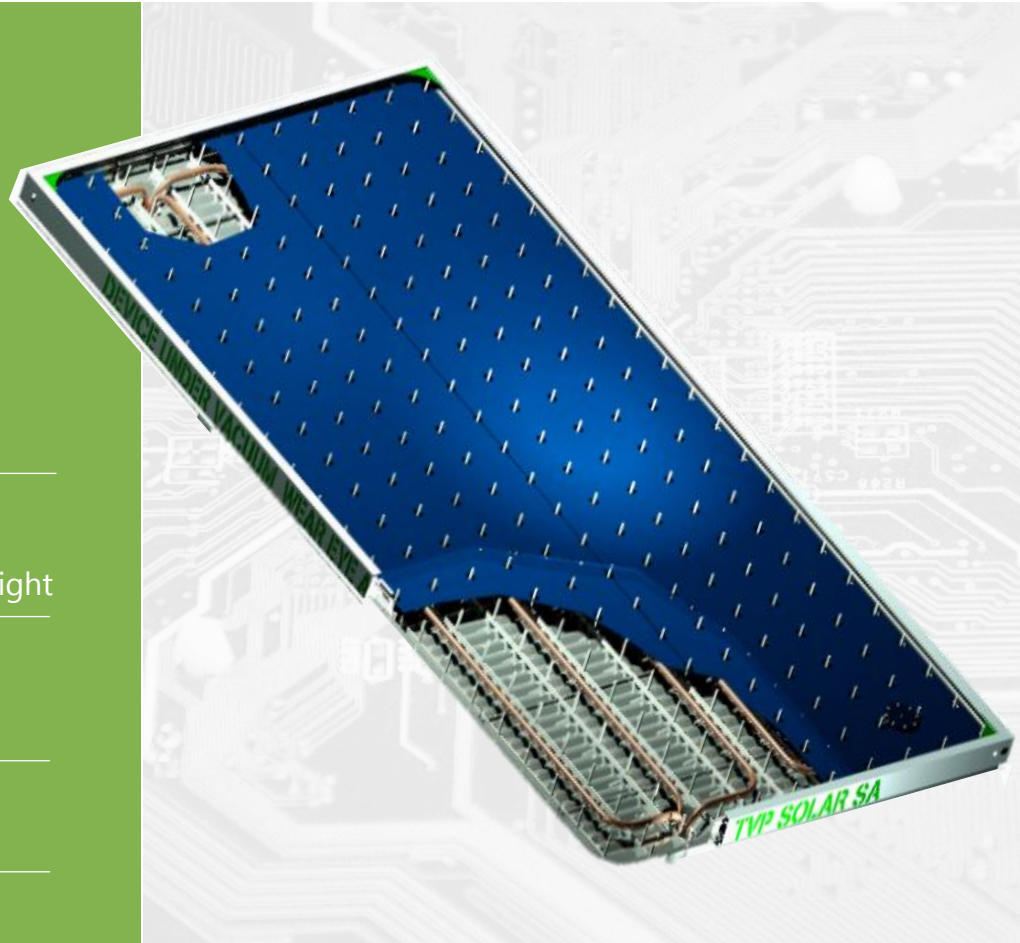
Vacuum delivers unmatched performance

Captures and transforms both direct and diffuse light

25 years with no performance degradation

Zero required maintenance

100% recyclable



World's best performing solar thermal energy

- Certified by SolarKeyMark and SRCC as the world's most efficient and productive solar thermal collector up to 200°C (392°F)
- UNI ISO 11352 certification



Proven in-field in any climate condition

- 30 installations worldwide proving performance and applications
- In any light conditions, including highly-diffused light or winter months
- In any climate conditions, even sub-zero or extremely hot desert climates



Long-lasting durability and robustness

- Guaranteed 25 years, uniquely with no performance degradation
- Made of materials qualified for long lasting high-vacuum retention
- Withstands 10 tons atmospheric pressure per square meter



Reduces OPEX while achieving ESG targets

- TVP delivers thermal energy at < 30 \$/MWh_t or 9 \$/MMBtu
- Requires no scheduled maintenance; no water required to clean
- TVP carbon-free thermal energy avoids 6 to 9 ton/m² of CO₂ emissions
- Enables customers to achieve their ESG commitments

Consistent energy production even in extreme climate conditions

High vacuum insulation ensures maximum performance



TVP works at $> 80^{\circ}\text{C}$ even when covered by snow



TVP works at $> 160^{\circ}\text{C}$ even when covered by dust



Leading the decarbonization of district heating in Europe

Developing as return customers the largest district heating networks builders and operators

Already active in 6 countries with 6 references (47.5 MW)



Supplying carbon-free heat to the largest energy utilities in EU operating DH networks



For Warmtestad in Groningen (NL) the largest solar thermal infrastructure ever



For ENGIE in Racconigi (IT) serving the largest DH operator worldwide



For CCIAG in Grenoble (FR) a booster station on a client rooftop



For Stadtwerke Sonderhausen (DE) a utility scale solar plant



For Fernwärme Teltow (DE) a multi-rooftop distributed solar plant



For SIG in Geneva (CH) exceeding target heat delivery since 2021

Solar CAD II Project



TVP  SOLAR



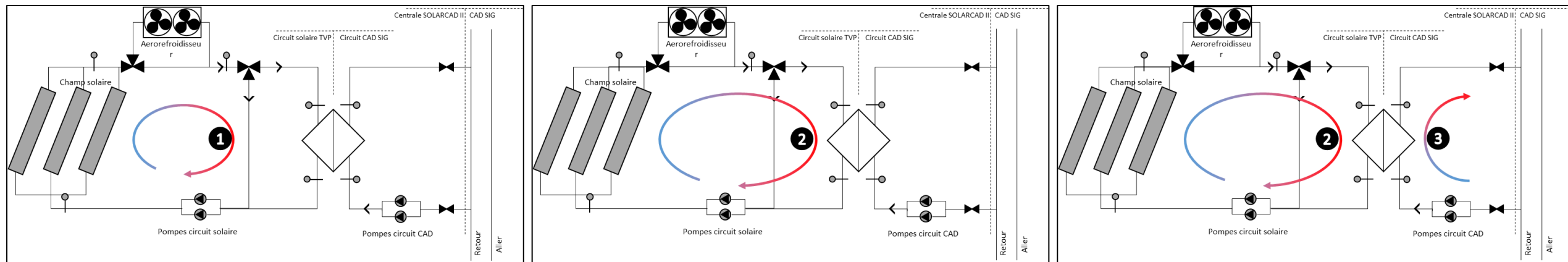
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Fondation Suisse
pour le Climat

784 m² Solar Thermal Plant integrated on CAD SIG District Heating Network to produce >80°C hot water all year round



Control Logic Description



If the irradiance is over a threshold, ($200\text{W}/\text{m}^2$), pumps are activated and heat transfer fluid is raised to nominal temperature

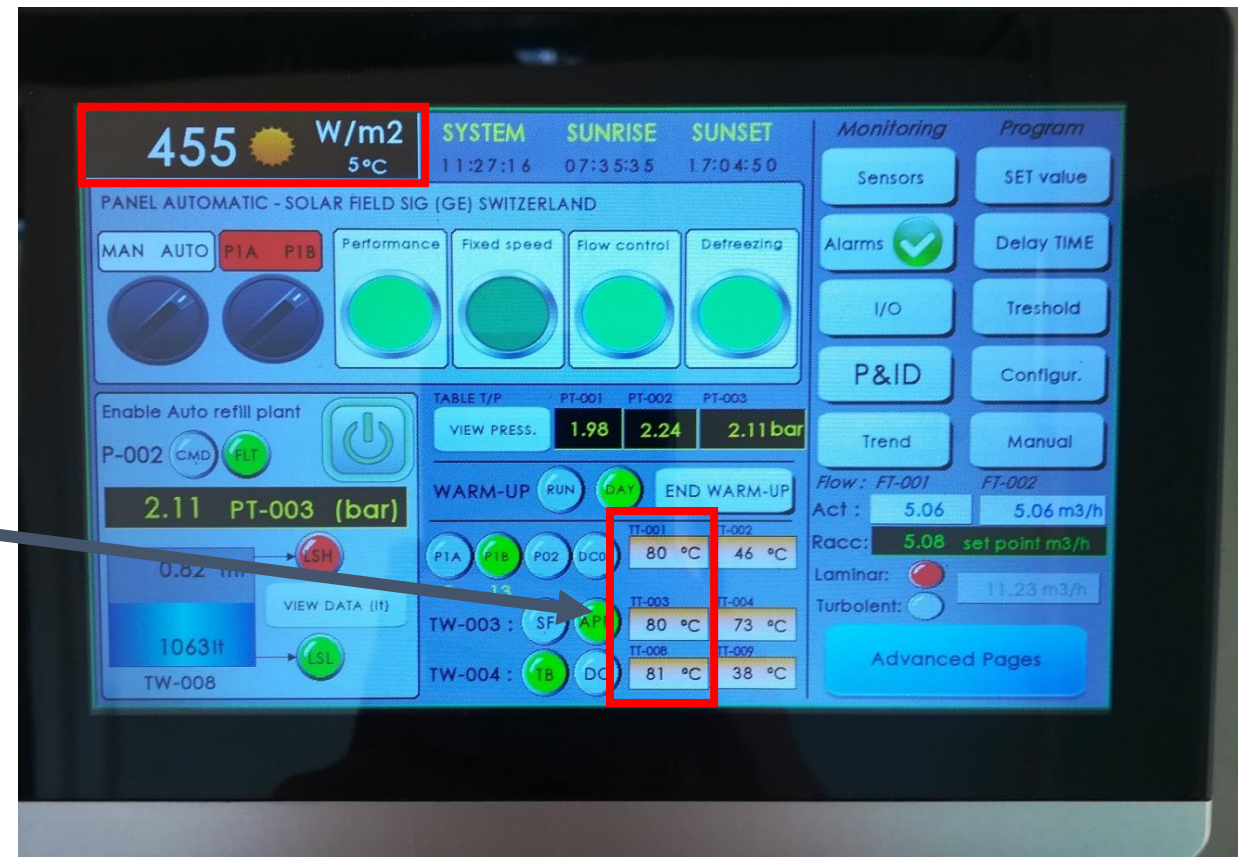
HTF flow is circulated to the heat exchanger once HTF reaches threshold temperature (80°C)

Once flow is active in the heat exchanger, CAD subsystem pumps engage relative to the solar flow

Focus on Winter performance

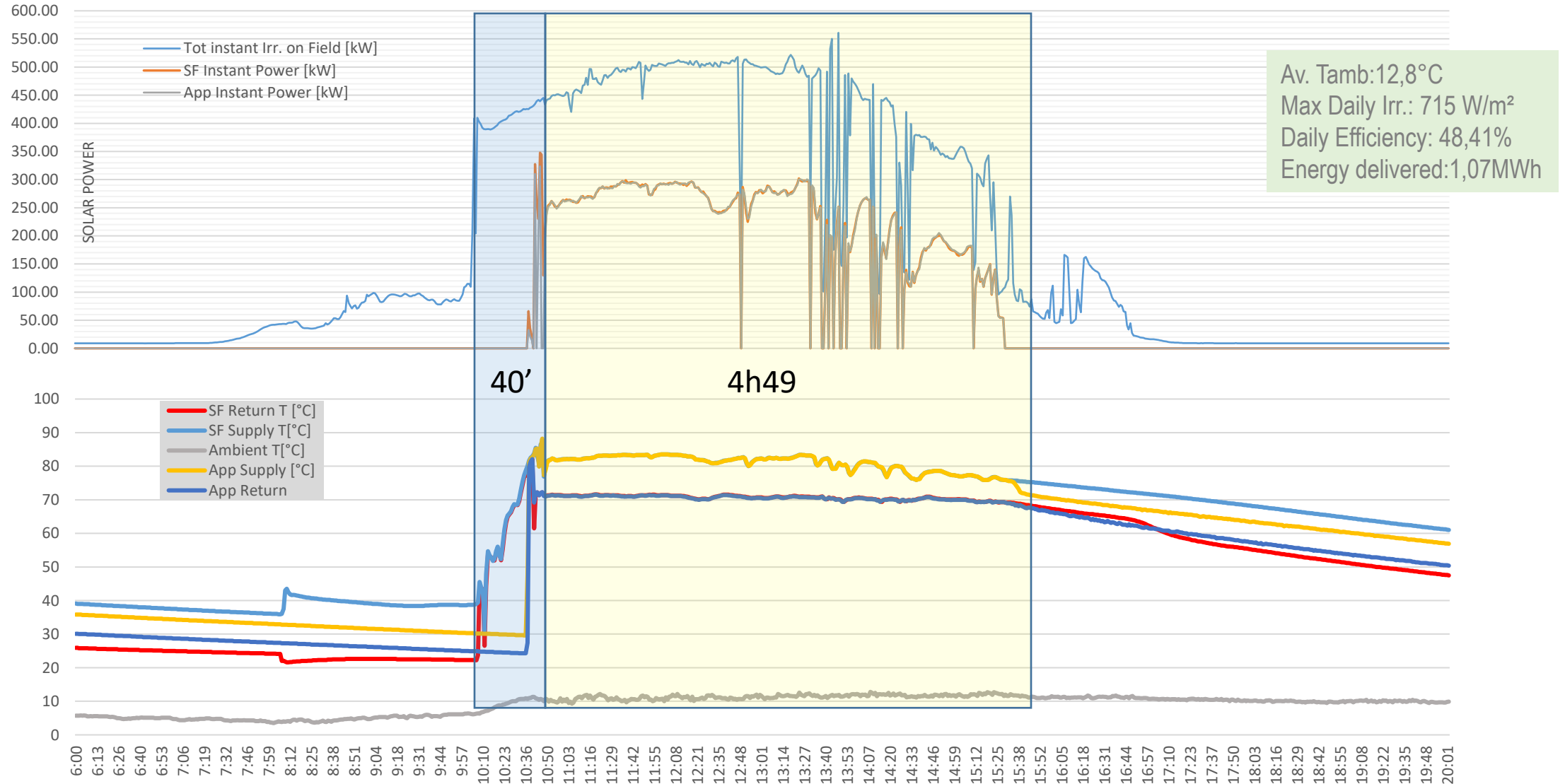


80°C reached even when panels are covered with snow

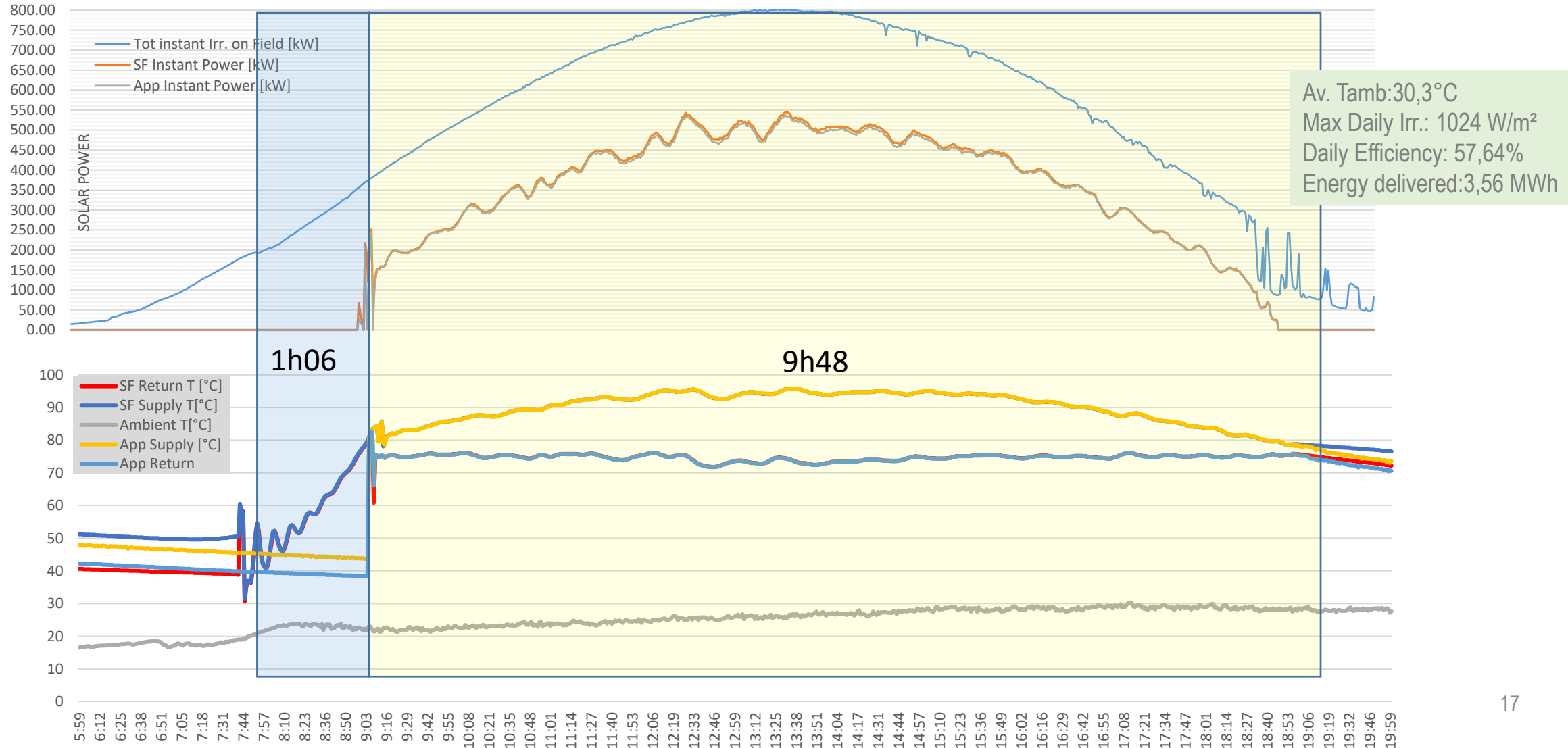


26 MWh delivered to the network in January and February 2021 with poor weather conditions

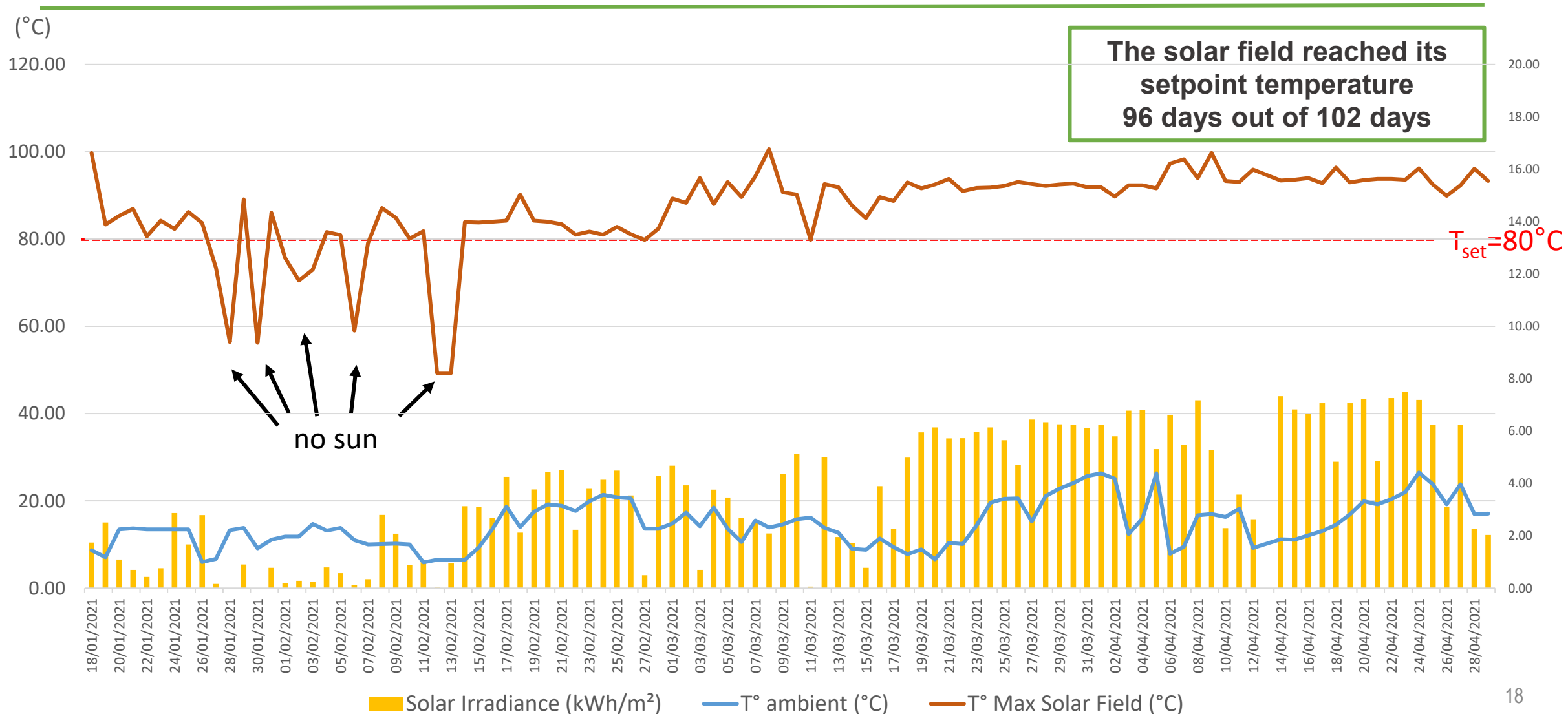
Example : November 5th 2021



Example : June 11th 2021

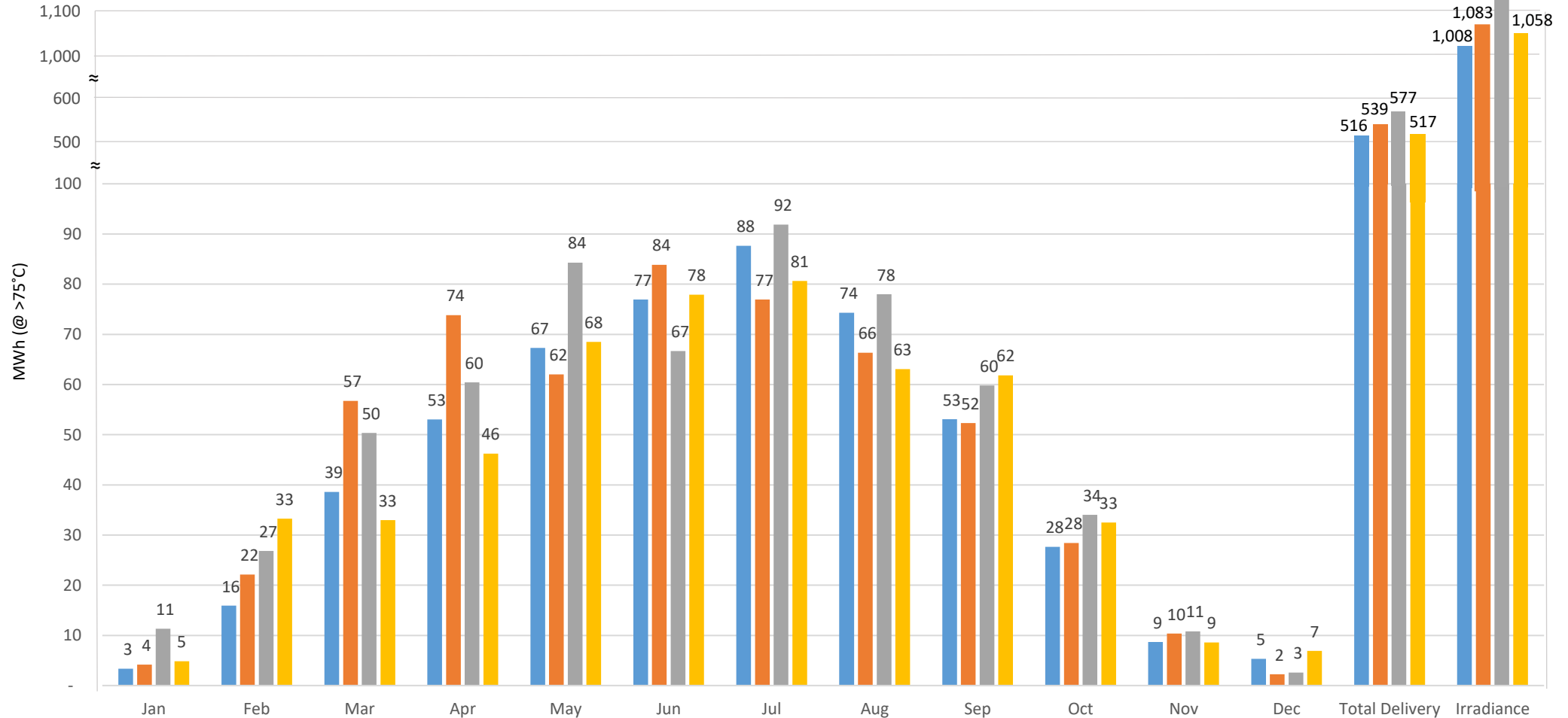


80°C heat delivered during Winter time!



Summary 2021-2023

TVP solar district heating plant at SIG in Geneva (784 m² gross area)



Sources: SIG, for measured energy delivered
MeteoSuisse, for measured irradiance in Cointrin Airport

■ Simulated Energie ■ 2021 SIG Meter ■ 2022 SIG Meter ■ 2023 SIG Meter

The Netherlands – 48'000 m²



<https://novar.uncinc.nl/>

Italy- 1'000 m²



Germany – 6'000 m²



<https://www.360grad-fotos.de/files/mani-ax/rundgang/stadtwerke-sdh/>

Leading the decarbonization of process heat for industries

Developing as return customers the largest industrial multinationals in the world

Already active in 12 countries with 10 references (10 MW)



Supplying carbon-free heat to multinational industrial corporations



For Nestlé (BR) process heat for a dairy factory



For PepsiCo (BR) process heat for a beverage factory



For Larnaudie (FR) boiler fw preheating for food factory



For Aramco (KSA) boiler fw preheating for an oil facility



For EMMI (CH) process heat for a dairy factory



For PepsiCo (BR) process heat for a snack factory



For ORF (UAE) process heat for a rubber factory



For Shell-Vivo (MO) process steam for a lubricant facility



For California Dairies (USA) process heat for a dairy factory



For Martini & Rossi (IT) process steam for a beverage factory


ALREADY SERVING 8 INDUSTRIES:

- FOOD
- BEVERAGE
- DAIRY
- BREWERY
- BIOFUEL
- OIL
- PAPER
- RUBBER

Solar Fondue Project

TVP  SOLAR


GROUP

 Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra


Fondation Suisse
pour le Climat

145 kW Solar Thermal Plant integrated to Emmi Fondue thermal processes to produce $>90^{\circ}\text{C}$ hot water all year round



Solar Industrial Heat – Switzerland



Emmi Fondue- *Langnau*

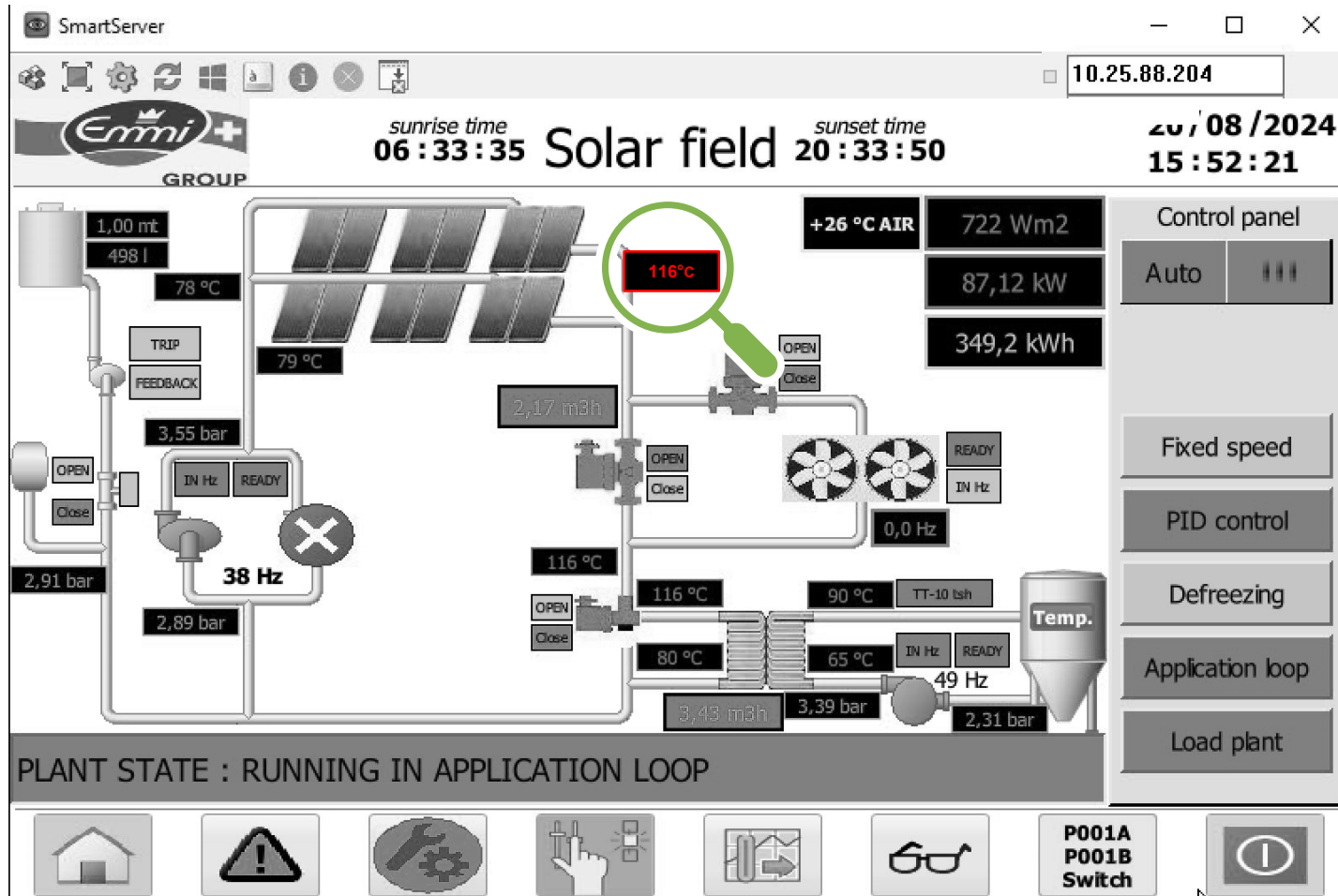
Commissioning Date	Oct 2022
# TVP Panels	109
Panel Gross Area	218 m ²
Mounting	Roof-mount
Application	process heat
Thermal Peak Power	145 kW
TVP Production	163 MWh/yr
Delivery Temp	95°C
Return Temp	55°C
Savings: mazout	21'331 L/yr
Savings: CO₂	55 ton/yr



Sunlight (GHI)
TVP Performance
Avg. Efficiency
Operating Hours
Storage
Client Motivation

1'257 kWh/m²/yr
747 kWh/m²/yr
59,4 %
Daytime
25 m³
CO₂ reduction
energy cost saving

SolarFondue – Dashboard screenshot



"The new solar thermal system reduces our dependence on fossil fuels, secures part of our energy supply, and stabilizes our energy costs."

Gerold Schatt,
Head Group Sustainability
Emmi

Fromagerie de Lignières Project



Solar Industrial Heat – Switzerland

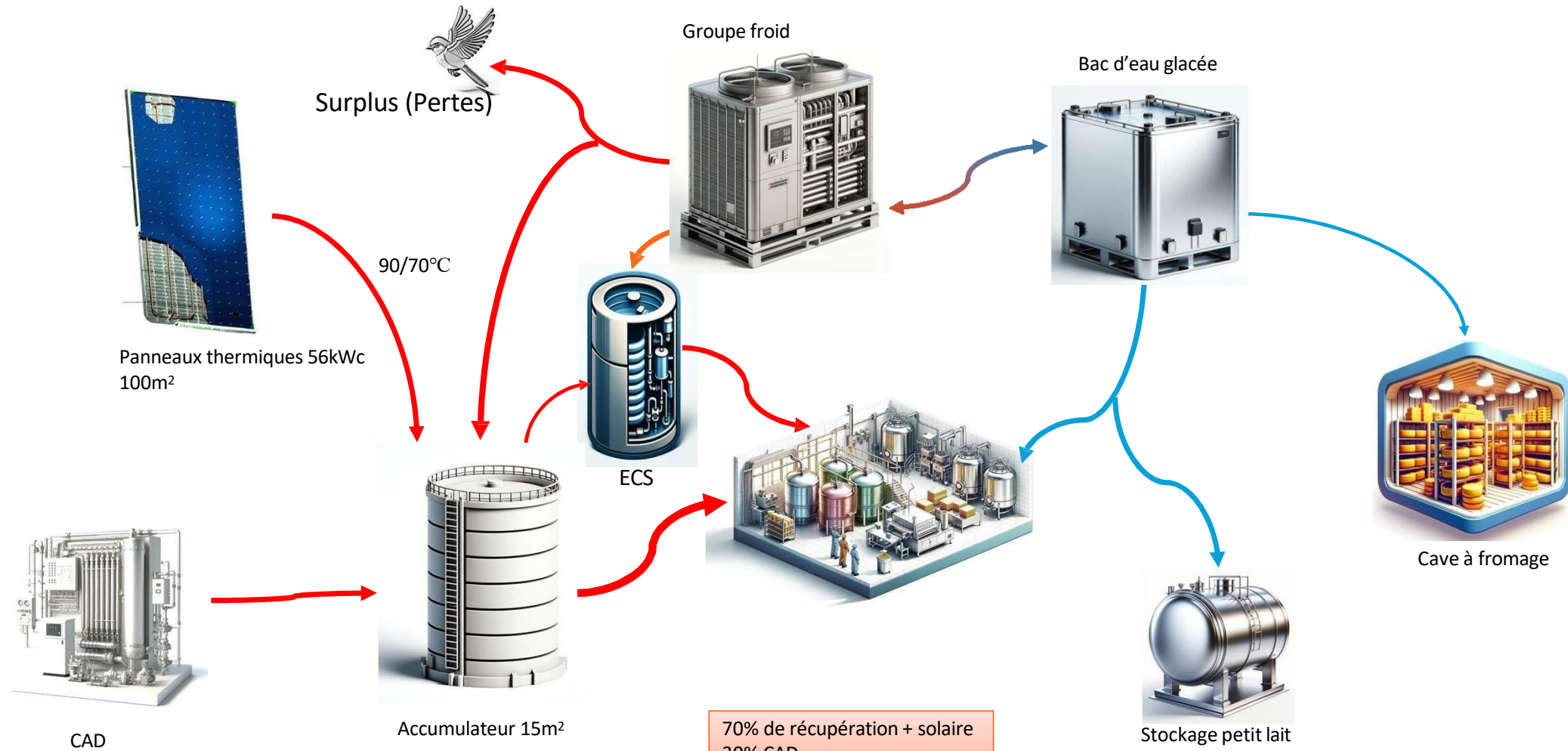
Fromagerie de Lignières - *Lignières*

Commissioning Date	June 2025
# TVP Panels	49
Panel Gross Area	96 m ²
Mounting	Mix ground/roof
Application	process heat
Thermal Peak Power	57 kW
TVP Production	70 MWh/yr
Delivery Temp	85°C
Return Temp	50°C
Savings: mazout	7'000 L/yr
Savings: CO₂	24 ton/yr



Sunlight (GHI)	1'310 kWh/m ² /yr
TVP Performance	729 kWh/m²/yr
Avg. Efficiency	55,6 %
Operating Hours	Daytime
Storage	15 m ³
Client Motivation	CO ₂ reduction

A successful Exit from mazout



70% de récupération + solaire
30% CAD
0% mazout

Solar Industrial Heat – Brazil

Nestlé – Feira de Santana

Commissioning Date	September 2024
# TVP Panels	500
Panel Area	1'000 m ²
Mounting	ground-mount
Application	pre-heating
Thermal Peak Power	687 kW _{th}
TVP Production*	1'024 MWh/yr
Delivery Temp	90°C
Return Temp	40°C
Savings: Fuel	120'000 m³/yr nat. gas
Savings: CO₂	228 ton/yr



Sunlight (GHI)	1'791 kWh/m ² /yr
TVP Performance	1'024 kWh/m²/yr
Avg. Efficiency	58 %
Operating Hours	Daytime
Storage	30 m ³
Client Motivation	CO ₂ reduction energy cost saving

Solar Industrial Heat – Morocco

Shell Vivo - Casablanca

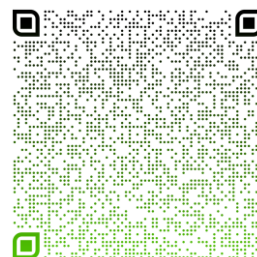
Commissioning Date	Oct 2025
# TVP Panels	893
Panel Gross	1'750 m ²
Area Mounting	ground-mount
Application	Solar steam
Thermal Peak Power	1 MW
TVP Production	1'750 T/yr
Delivery Temp	136°C
Savings: Propane	139 T/yr
Savings: CO ₂	477 ton/yr



Sunlight (GHI)	1'926 kWh/m ² /yr
TVP Performance	803 kWh/m ² /yr
Avg. Efficiency	41.7 %
Operating Hours	Daytime
Storage	No storage
Client Motivation	CO ₂ reduction



Thank you for listening!



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