WEBINAR

TVP SOLAR

Hubs4Circularity
COMMUNITY OF PRACTICE

FROM DESIGN TO IMPLEMENTATION: SOFTWARE TOOLS IN DISTRICT HEATING

A CASE OF THESEUS AND HURRICANE PROJECT

SESSION 1
DESIGN OF SOLAR DISTRICT HEATING (SDH) SYSTEMS

Funded by the European Union

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11 March 2026

Solar District Heating (SDH) Systems

The clean energy solution

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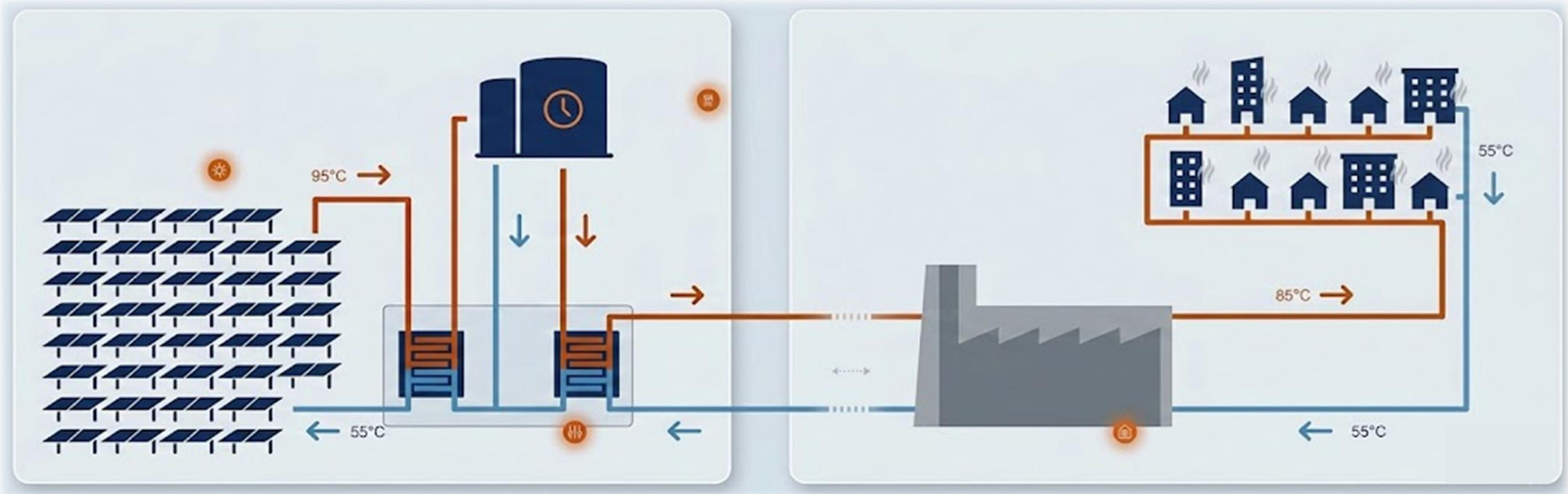
Sustainability: Emission-free heat generation.

Efficiency: Cutting fossil fuel consumption through energy source diversification.

Reliability: Robust technology with an extended lifecycle.

Applications: Ideal for high-density residential areas, offices, schools, and hospitals. Easy integration with existing district heating networks.



Solar District Heating (SDH) Systems

TVP Solar experience in SDH: Operational plant

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Already active in 6 countries (47.5 MW)

- Operational
- Under construction
- Engineering design

Supplying carbon-free heat to operators of DHN

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 Fernwarme Teltow (DE) a multi-rooftop distributed solar plant

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

Solar District Heating (SDH) Systems

TVP Solar experience in SDH: Operational plant examples

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Racconigi - Italy
1029 m² Solar Field
Solar Peak Power:
0.7 MW_{th}
Integration: direct
Hot water @75°C for
district heating network
Energy production:
920 MWh/y

Stadtwerke Sondershausen - Germany
6.200 m^2 Solar Field – 3-Layer Configuration
4.230 kW Peak Power – App: District Heating
Thermal Energy Storage Tank: 1.000 m^3

Zonthermiepark Dorkwerd
Location: Groningen, The Netherlands
Thermal Energy Storage Tank: 6.000 m^3
Project specs: 48.800 m^2 solar field; 37 MW_{th}
Operating Temperature: 69 to 98 °C
Application: District Heating

Solar District Heating (SDH) Systems

Design Tools for Energetic Simulations

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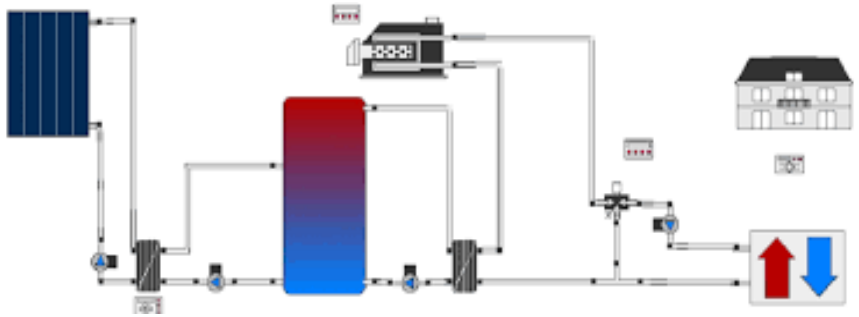
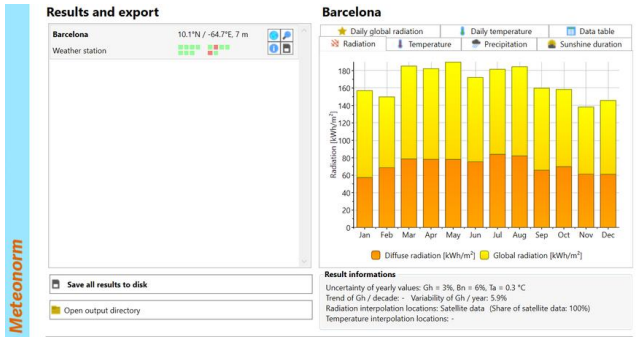
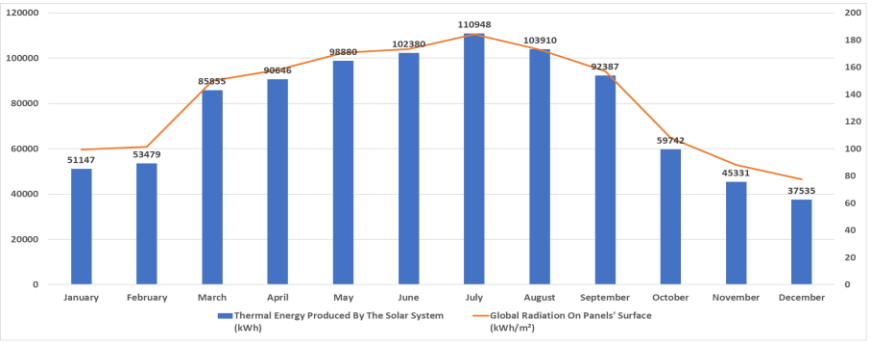
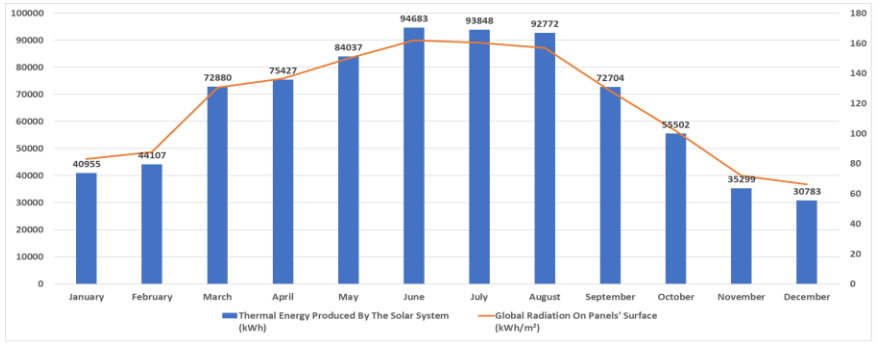
TRNSYS & POLYSUN

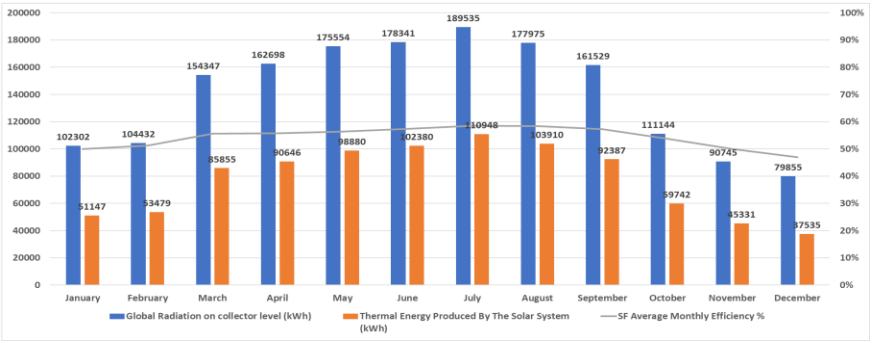


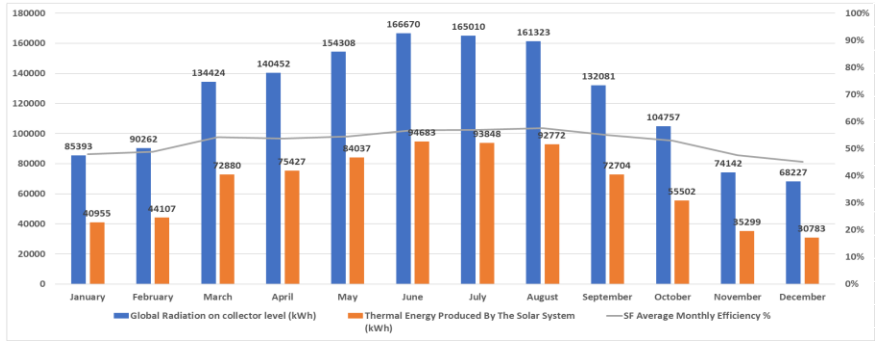
METEONORM











P50 Energetic Report

P90 Energetic Report

APPLICATION SPECS	DETAILS	UNIT
Client/Partner	Engie-Racconigi	
TVP Point Of Contact	Gci	
Country	Italy	
City	Racconigi, Province of Cuneo	
Location Latitude	44,77	
Process	DHN	
Hot Water Density	974,81	kg/m³
Hot Water Specific Heat	4,1933	kJ/kg/K
System Water Inlet Temp	57	°C
System Water Outlet Temp	72	°C
Mean Temp	65	°C
App Flow Rate		kg/hr
Peak Power - MAX		MWh
Peak Power		MWh
Working Days	365	days/year
Working Hours	24	hours/day

SOLAR FIELD SPECS	Summer	Unit	Winter	Unit
Heat Transfer Fluid (HTF)	Pressurized Water		Pressurized Water	
Hot Water Density	980,52	kg/m³	977,73	kg/m³
Hot Water Specific Heat	4,1875	kJ/kg/K	4,1902	kJ/kg/K
Dynamic Viscosity	0,000433	Pa*s	0,000404	Pa*s
Average Annual Ambient Temp	25	°C	25	°C
SF Inlet Temperature	62	°C	62	°C
SF Outlet Temperature	77	°C	87	°C
Mean Temp	70	°C	75	°C
# Of Panels	525	#	525	#
Panels' Tilt Angle	35	°	35	°
Net Aperture Area	1029,00	m²	1029,00	m²
Total Footprint / Installed Area	1852	m²	1852	m²
Solar Field Peak Efficiency	70%		70%	
Solar Field Peak Power	723	kW	718	kW
SF Yearly Thermal Production	932241	kWh/year	922146	kWh/year
SF Average Yearly Efficiency	55%		55%	
HTF Flow Rate	11,51	kg/s	6,85	kg/s
HTF Flow Rate	41442	kg/hr	24660	kg/hr
HTF Flow Rate	42,26	m³/hr	25,22	m³/hr
Solar System Electricity Consumption	5471	kWh/year	2596	kWh/year
Solar Field Working Hours	9	hours/day	9	hours/day
Pipe length (up to TB)	200	m	200	m
Connectors length	473	m	473	m
Storage Tank Size		m^3		m3
SF MODULE	1	#	1	#
SF Strings	33	#	33	#
Panels x Strings	16	#	16	#
SF Array Piping	3	Inch	3	Inch
SF Orientation - South-West	10,2	°	10,2	°

Solar District Heating (SDH) Systems

Thermal Energy Storage (TES) – Daily Buffer Tank

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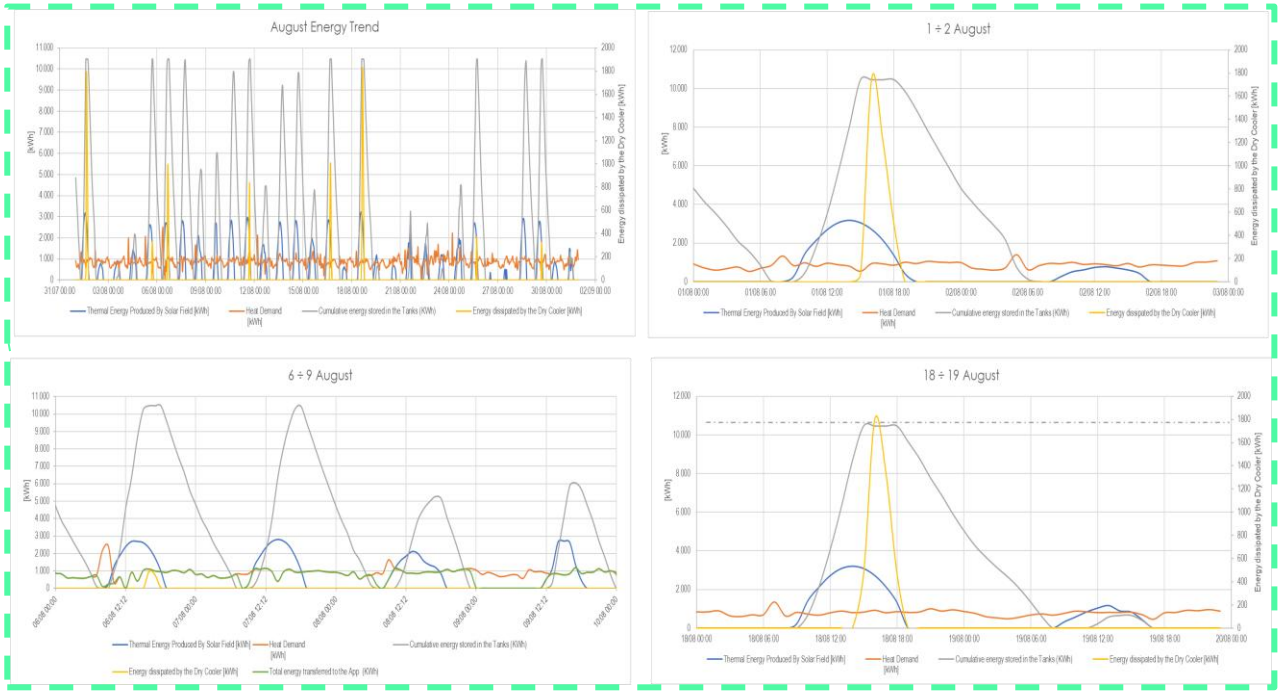
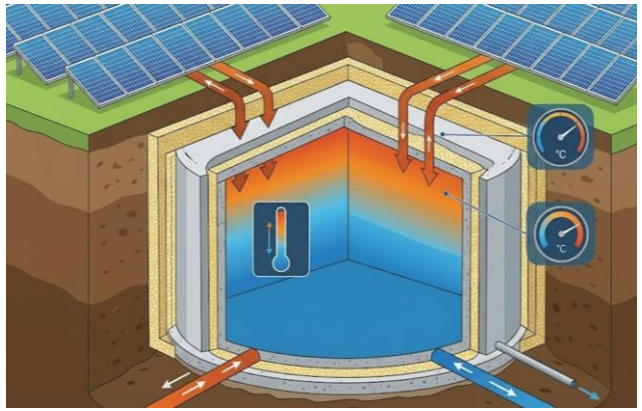
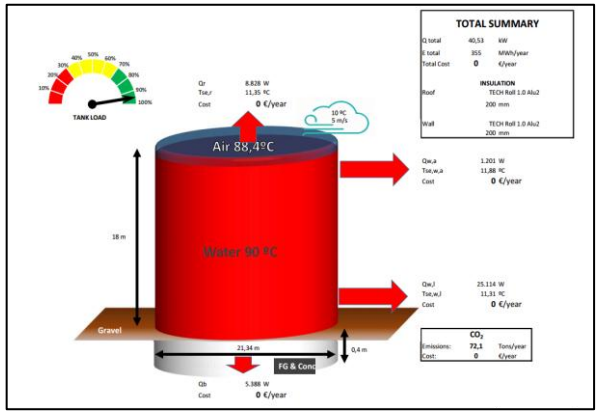
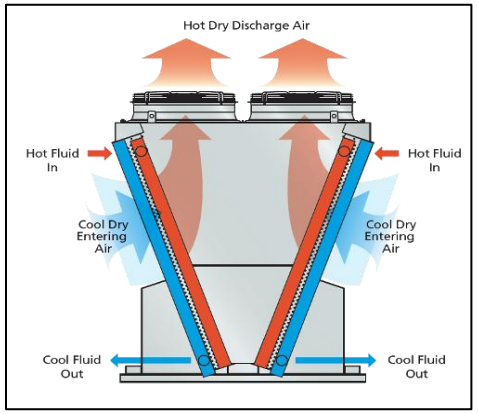


OUTPUT







Solar District Heating (SDH) Systems

Main design steps and tools for SDH system

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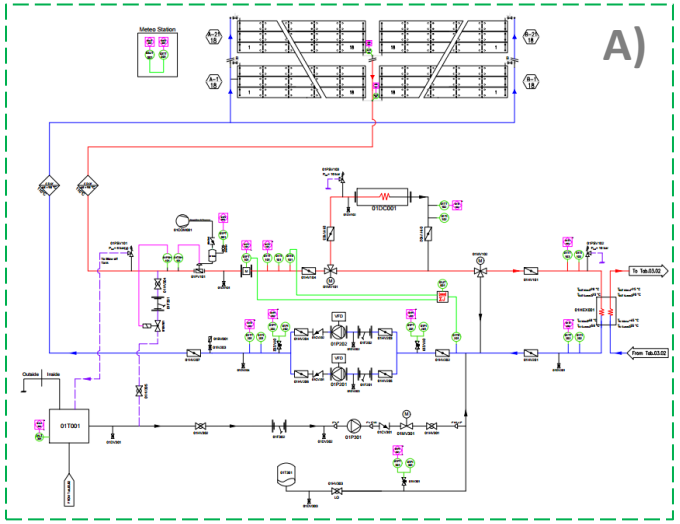

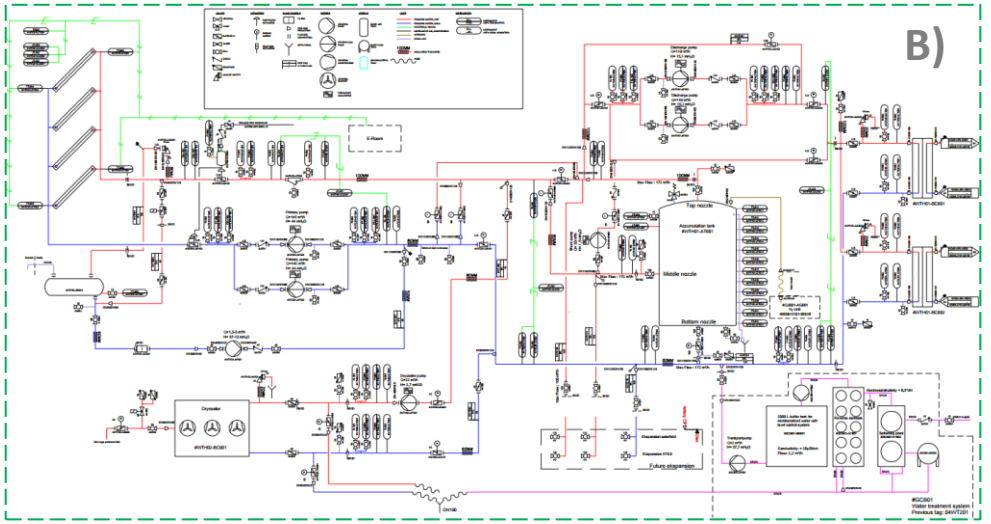

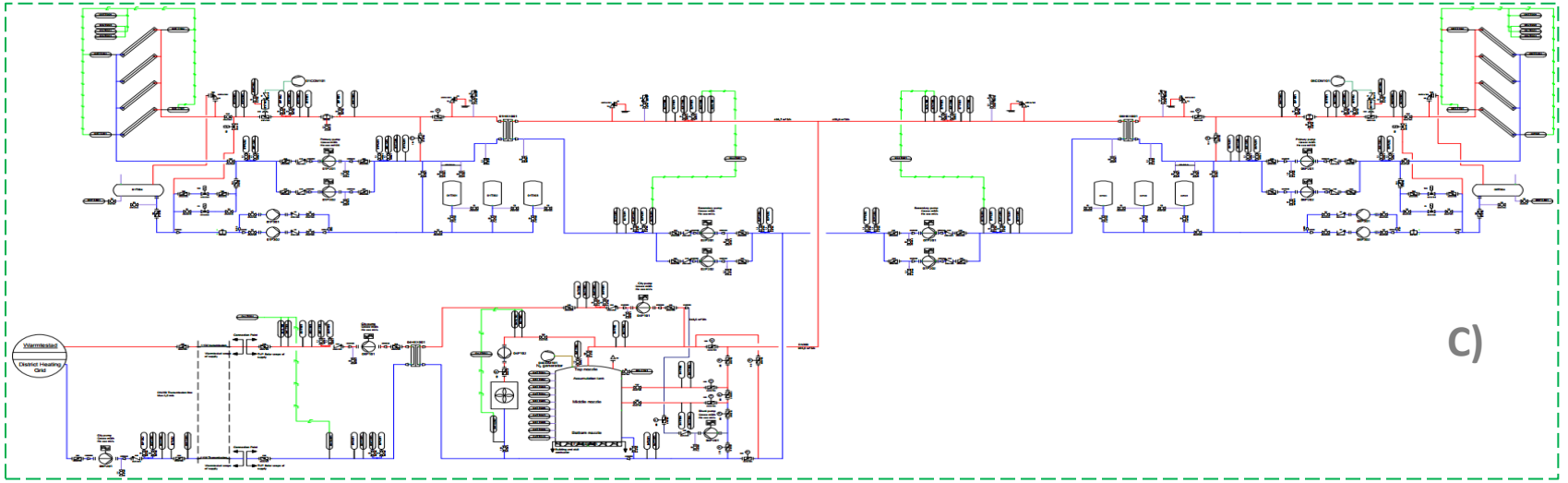

P&ID

Case A) No storage tank: the solar field is connected directly to the DHN through a heat exchanger (HX).

Case B) Storage tank on primary side: directly connected to the solar field.

Case C) Storage tank on secondary side: with one or more HX between the solar field and the tank (for large-scale fields). This configuration allows to divide the solar field into sections, which helps optimize pipes' sizing (with heat transfer fluid velocity values within acceptable limits) and pump units.

Solar District Heating (SDH) Systems

Main design steps and tools for SDH system

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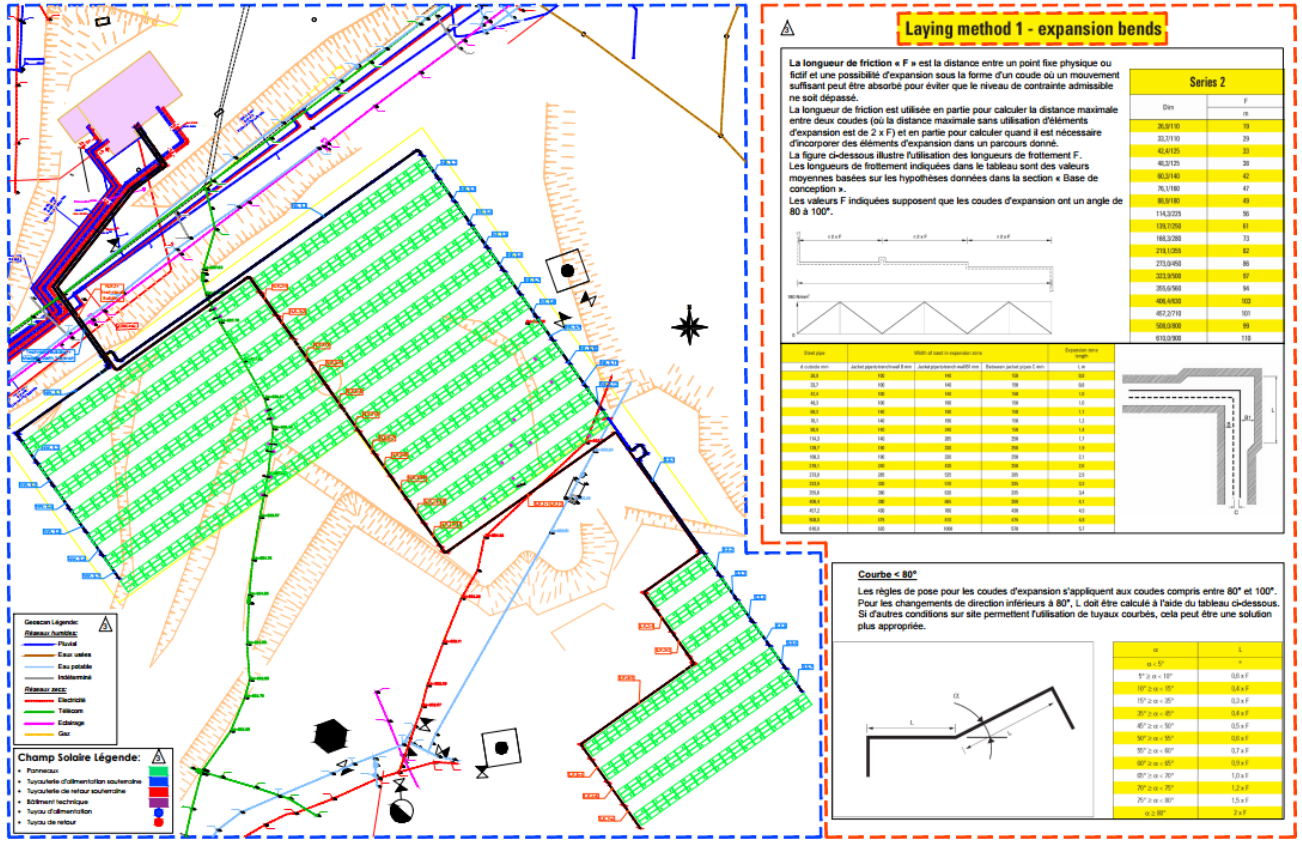
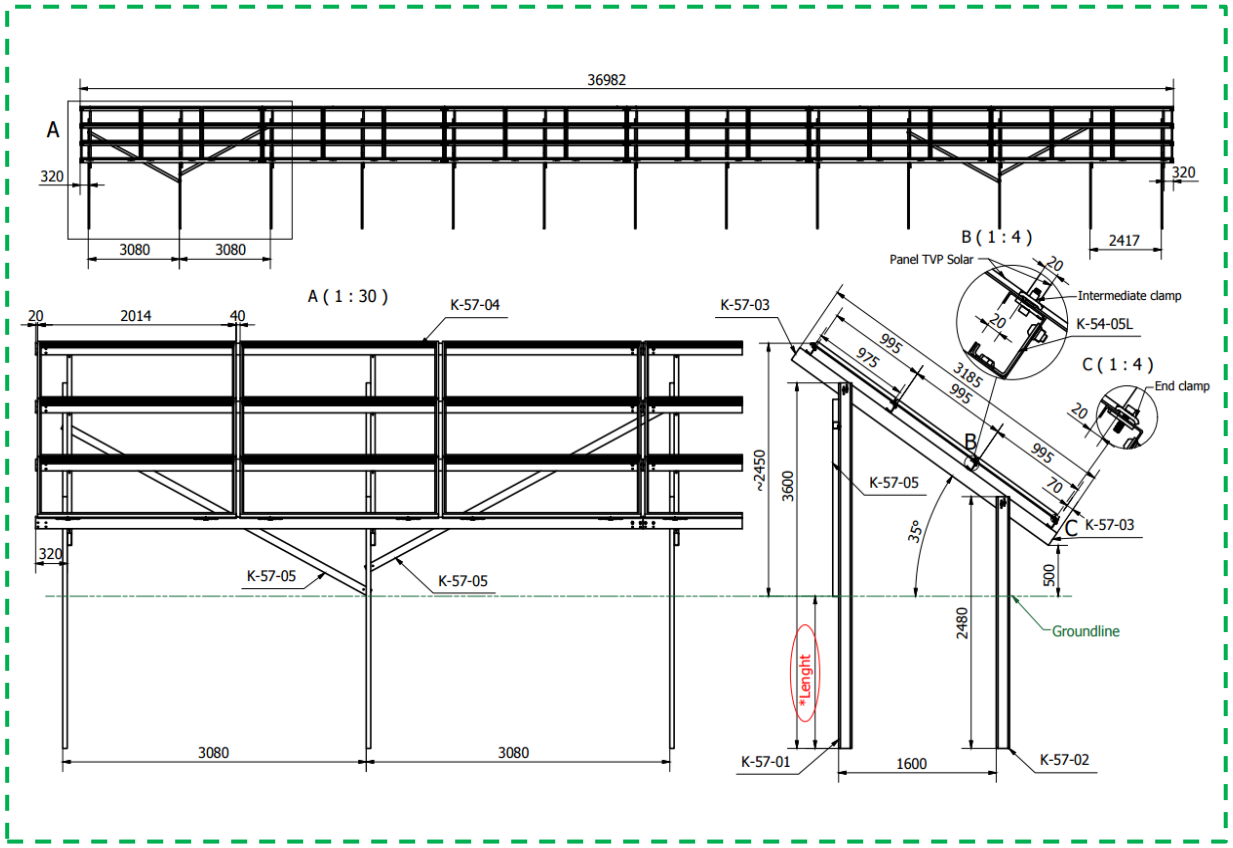


General layout and solar field pipe routing



Civil engineering

Solar District Heating (SDH) Systems

Main design steps and tools for SDH system

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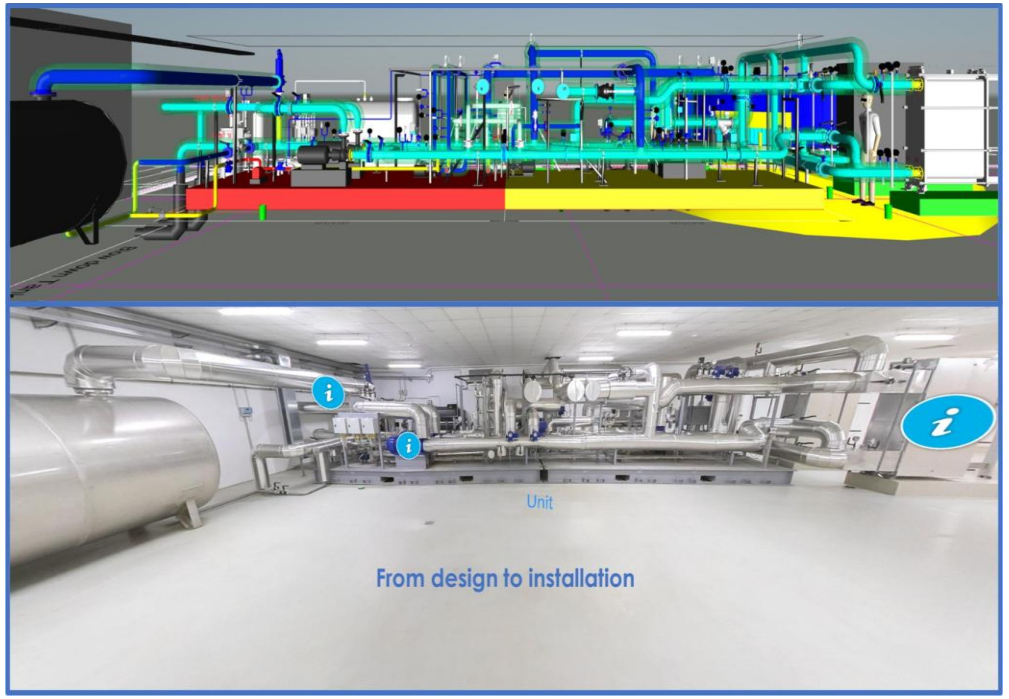
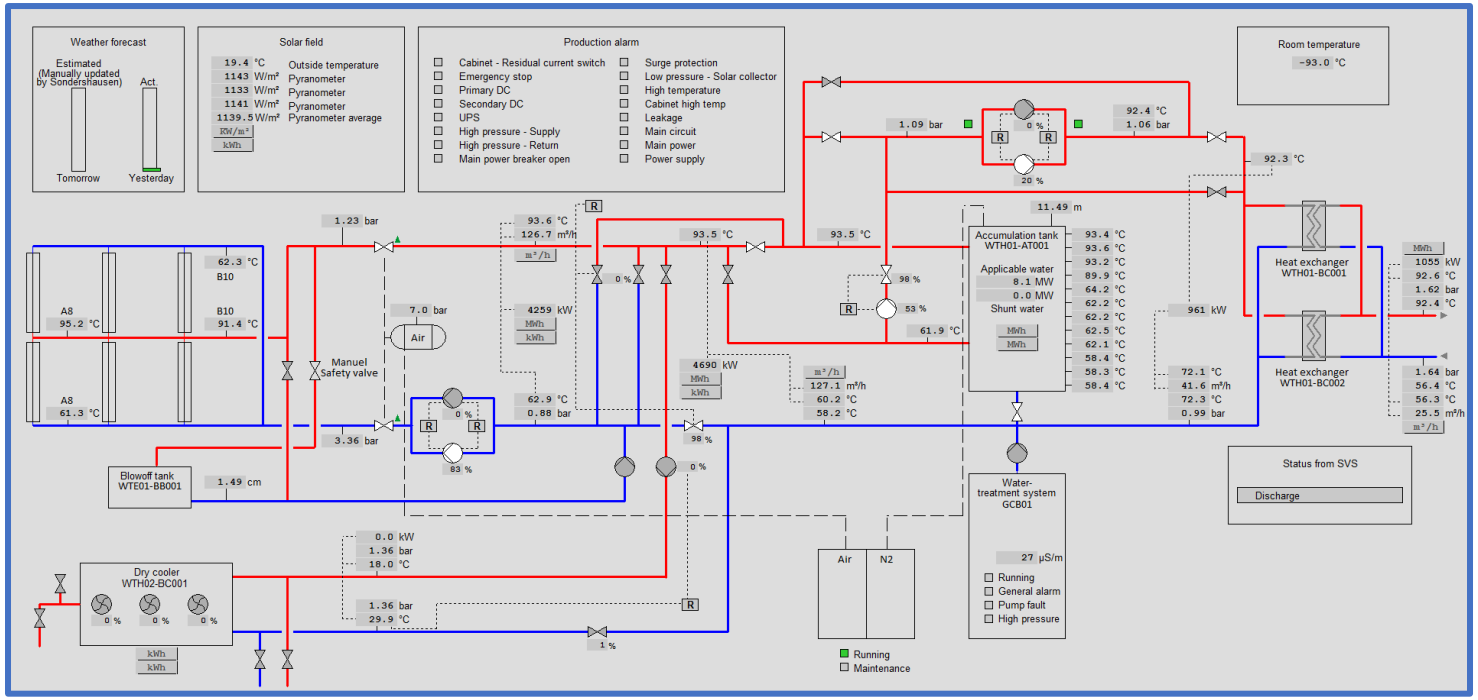


3D model
(Autodesk AutoCAD Plant 3D)



SCADA system
(Siemens or Rockwell Automation)

Solar District Heating (SDH) Systems

Main design steps and tools for SDH system

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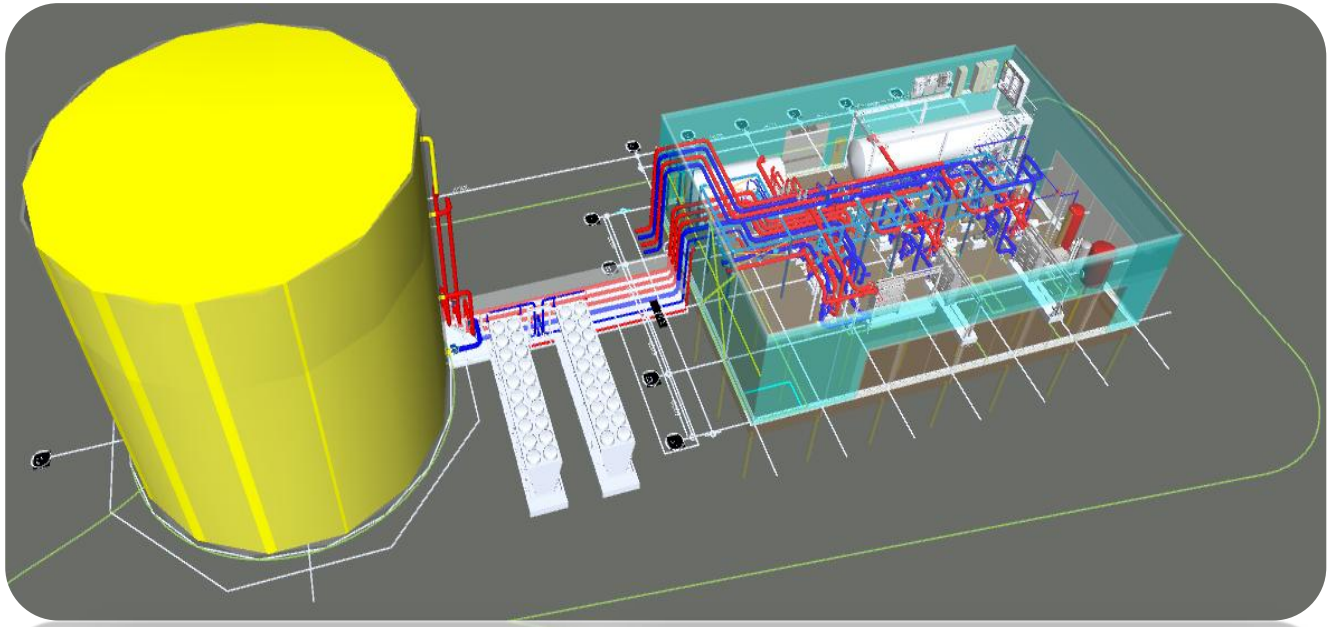
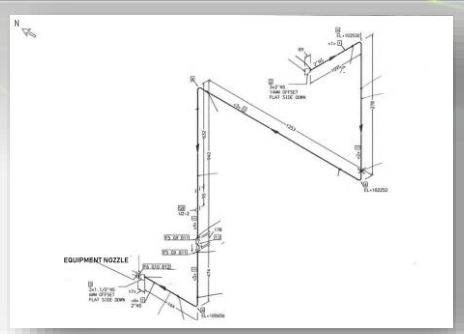
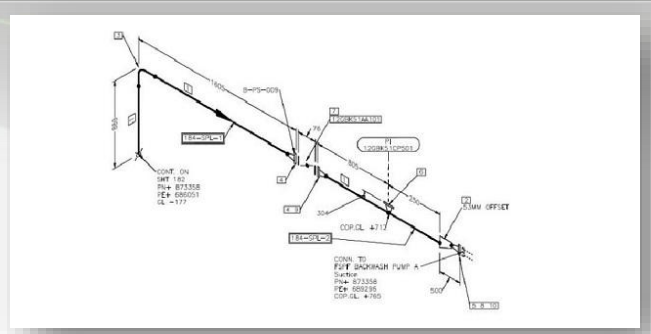
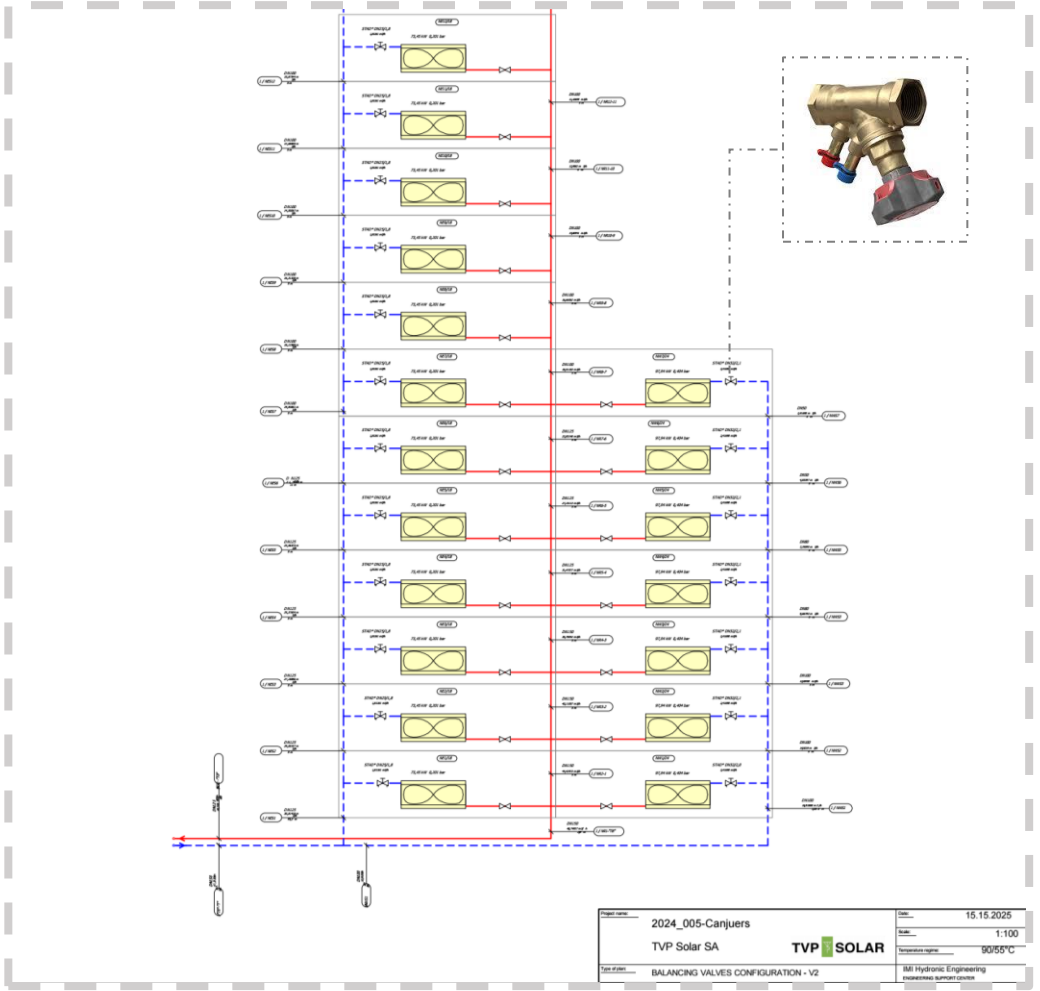






3D model and skid isometric drawings
(Autodesk AutoCAD Plant 3D)



Hydraulic sizing
(Hecos by TA Hydronics)

Solar District Heating and Cooling Systems

Theseus Project

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THESEUS
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The case of Ptolemaida's
Solar District Heating and Cooling Pilot
In Greece

Solar District Heating & Cooling (SDHC) Pilot

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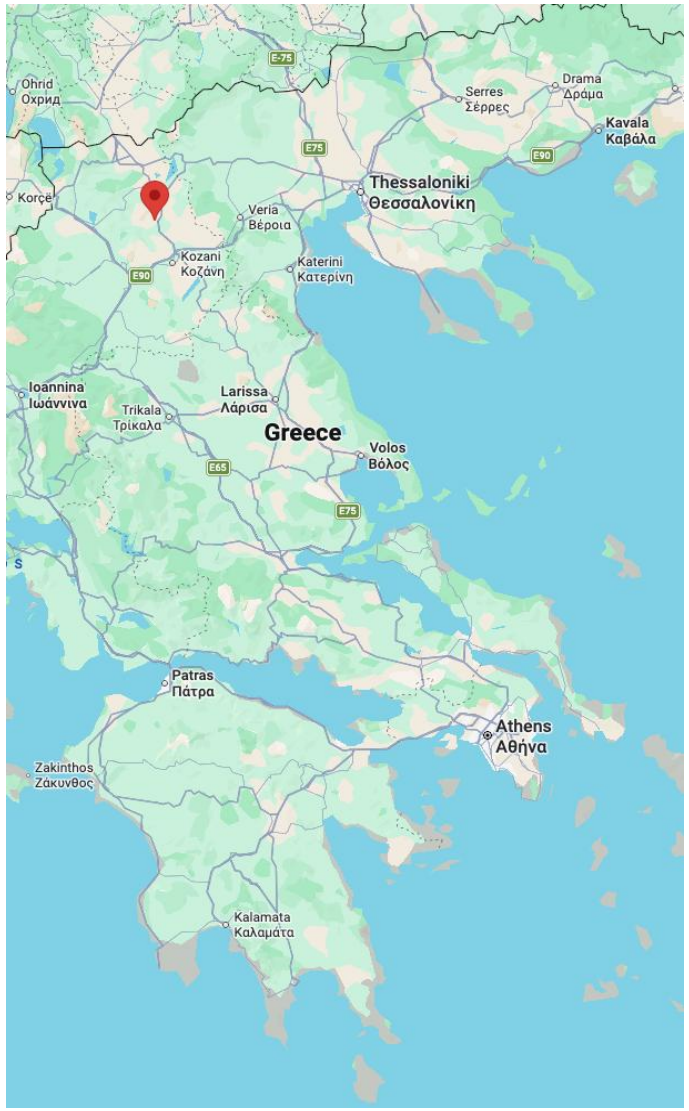

One of Europe's most carbon intensive regions

Long-term goal

Transition to 100% Renewable Heating & Cooling

Ptolemaida Pilot in Theseus

Leader: CERTH/CPERI

SDHC system:

- Solar thermal (TVP): 1 MWth or 1600 m^2 of panels (total footprint 3000m^2)
- Absorption chiller for cooling: 200kW
- TES tank: 40-50 m^3

Consumers:

- Building of CERTH/CPERI
- Mpodosakeio hospital

Connection:

- To the local DHN

Benefits:

- Solar heat: 1’500MWh/year
- Emission reduction: 355 $tnCO_2$

Solar District Heating & Cooling Demo

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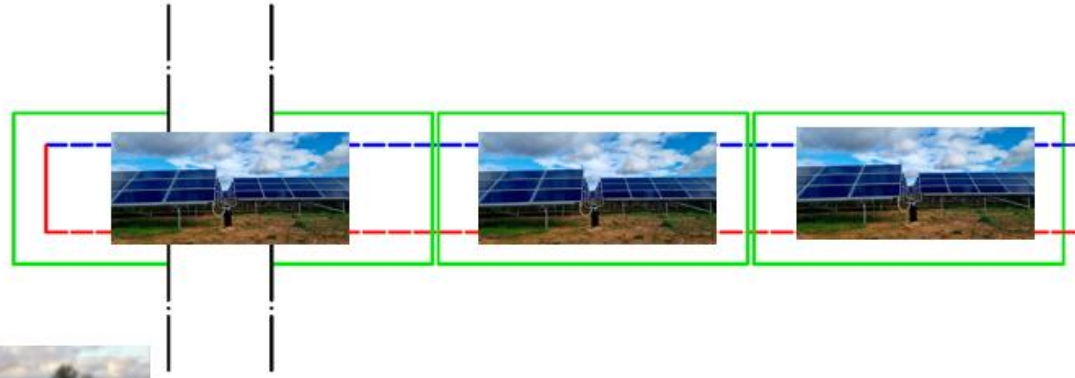
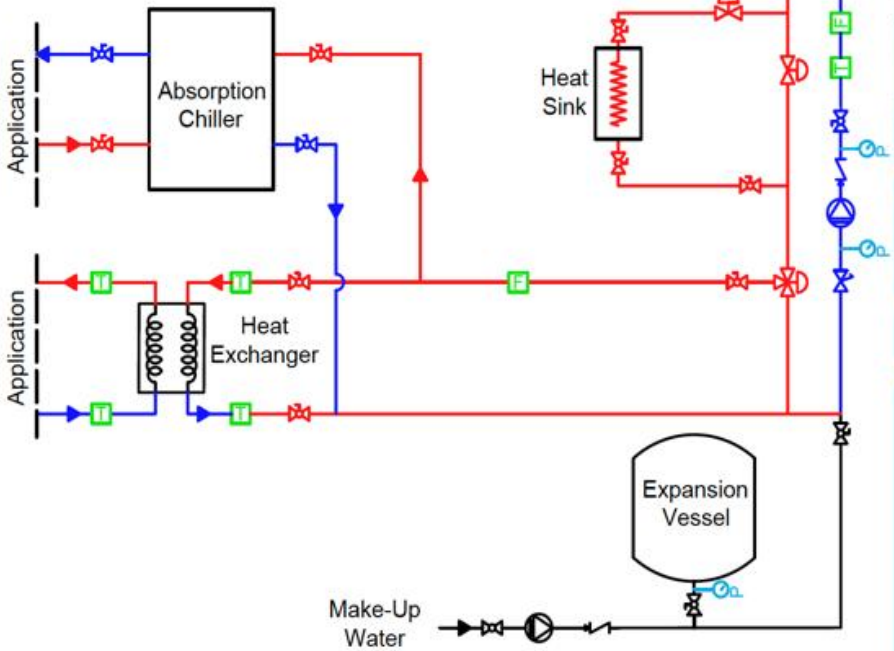
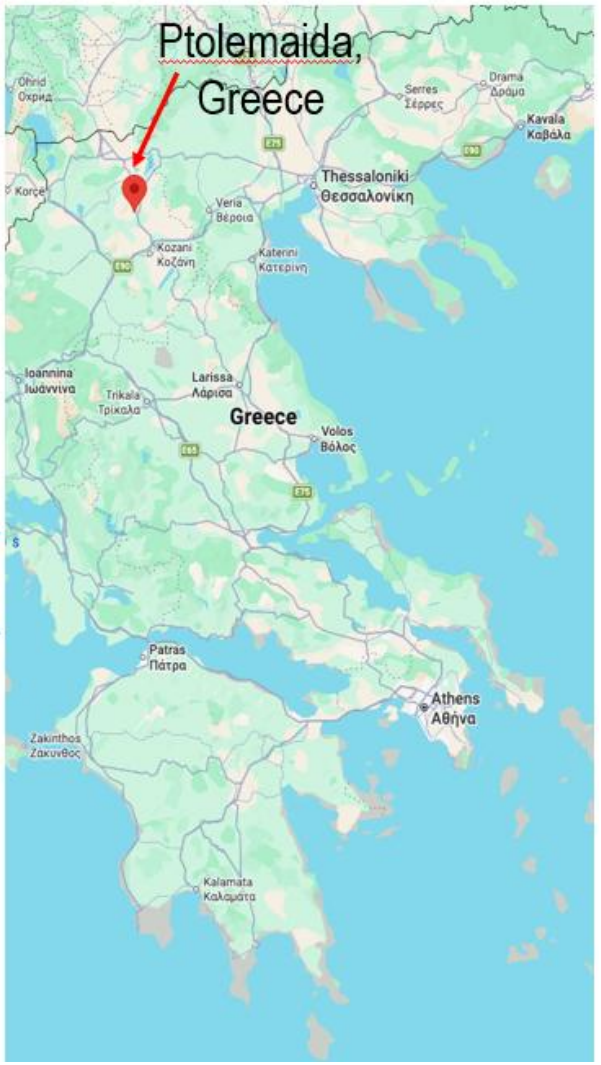


CERTH Building

Mpodosakeio Hospital

Ptolemaida's DHN





THESEUS Project: Snapshot

THESEUS
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HORIZON EUROPE

A First of a kind Hub for circularity demonstrator for Attica and peripheral regions

- Aim: to close resource loops with innovative urban solutions and achieve climate neutrality by 2050
- Activities: validate and develop water, energy and material technologies
- 47 partners and 5 associated entities from 9 European countries

https://www.theseus-h4c.eu/

Pilot 1 : Bio-based materials & Packaging

Pilot 2
Textiles Flow

Pilot 3
Construction & demolition waste & Glass Flow

Pilot 4
Energy Flow

Pilot 5
Water Flow

Project Information

Theseus
Grant agreement ID: 101178059

DOI
10.3030/101178059

EC signature date
20 September 2024

Start date
1 December 2024

End date
30 November 2029

Funded under
Digital, Industry and Space

Total cost
€ 21 777 067,50

EU contribution
€ 19 994 307,00

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EREVNITIKO PANEPISTIMIAKO INSTITOUTO SYSTIMATON EPIKOINONION KAI YPOLOGISTON
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THANK YOU

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