

Smart Specialization in Toscana

incontri Tematici per la nuova Programmazione dei fondi Europei

2014-2020

ENERGIA
Laboratorio Green economy

21 Febbraio 2014

Palazzo dei Congressi e Palazzo degli Affari

9,30 -13,30

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**Università degli Studi di Firenze
Dipartimento Ingegneria Industriale**

Un OPERAIO europeo è oggi MOLTO più ricco in beni e servizi di quanto lo fosse un principe medievale, anche se possiede poche decine di metri quadrati di appartamento invece di un feudo

Da dove viene questa ricchezza? → dall'ENERGIA DISPONIBILE

Schiavo Energetico (60W) (Indurain 600W, Cipollini 1200W).
(SE) lavora senza sosta a per 10 ore può accumulare 0,6kWh (equivalenti a circa 12 c€)).

Ma questa energia quanto vale?

The use of a washing machine would require **16 "energy slaves"**



A 115 hp car at 100km/h require **1600 "energy slaves"**



The average TOTAL energy consumption of a European man amounts to ~150kWh/day approximately ~ **300 "energy slaves"** in 8 h/d.



~5000 Contadini

LA CARENZA DI ENERGIA IN PASSATO È STATA LA FONTE DI GUERRE E DISGREGAZIONE DI IMPERI INTERI.

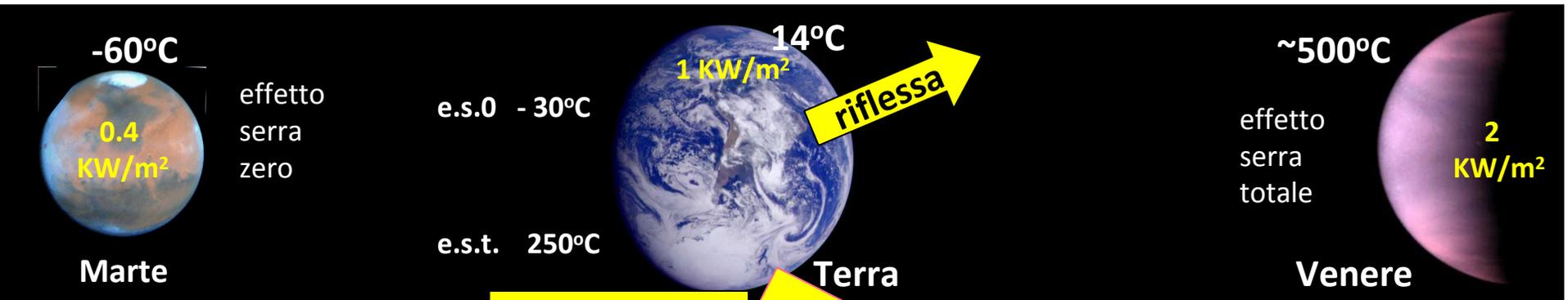
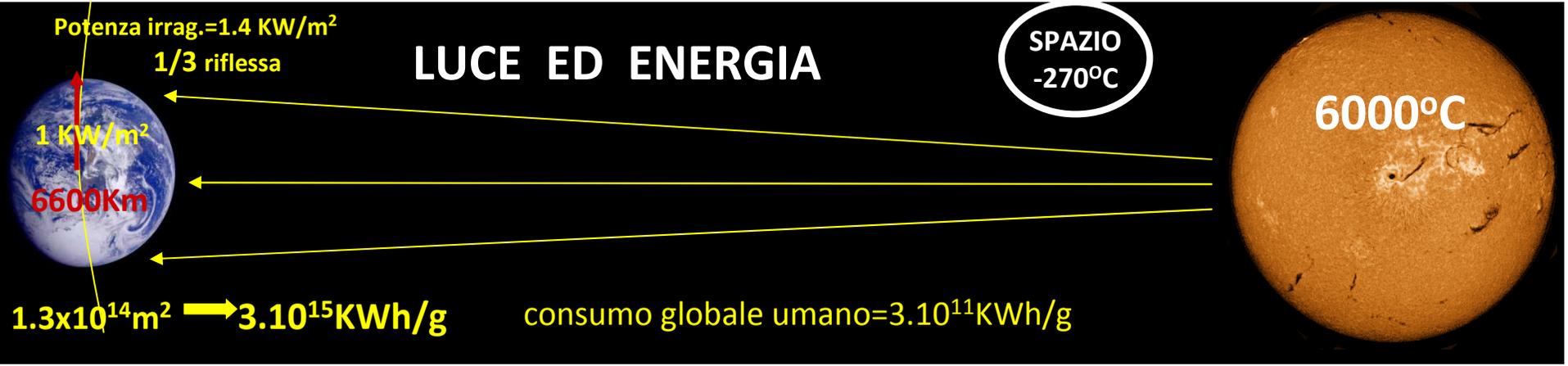


La Terra
fotografata da
6 miliardi di Km
di distanza:
(la distanza da Plutone)
una nicchia di
vita in
un'immensità di
materia
inanimata

*Siamo veramente molto isolati,
quanto un astronave nello spazio,*

*con 6.5 miliardi di passeggeri e
senza possibilità di rifornimenti.*

LUCE ED ENERGIA



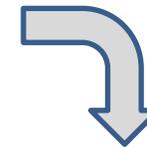
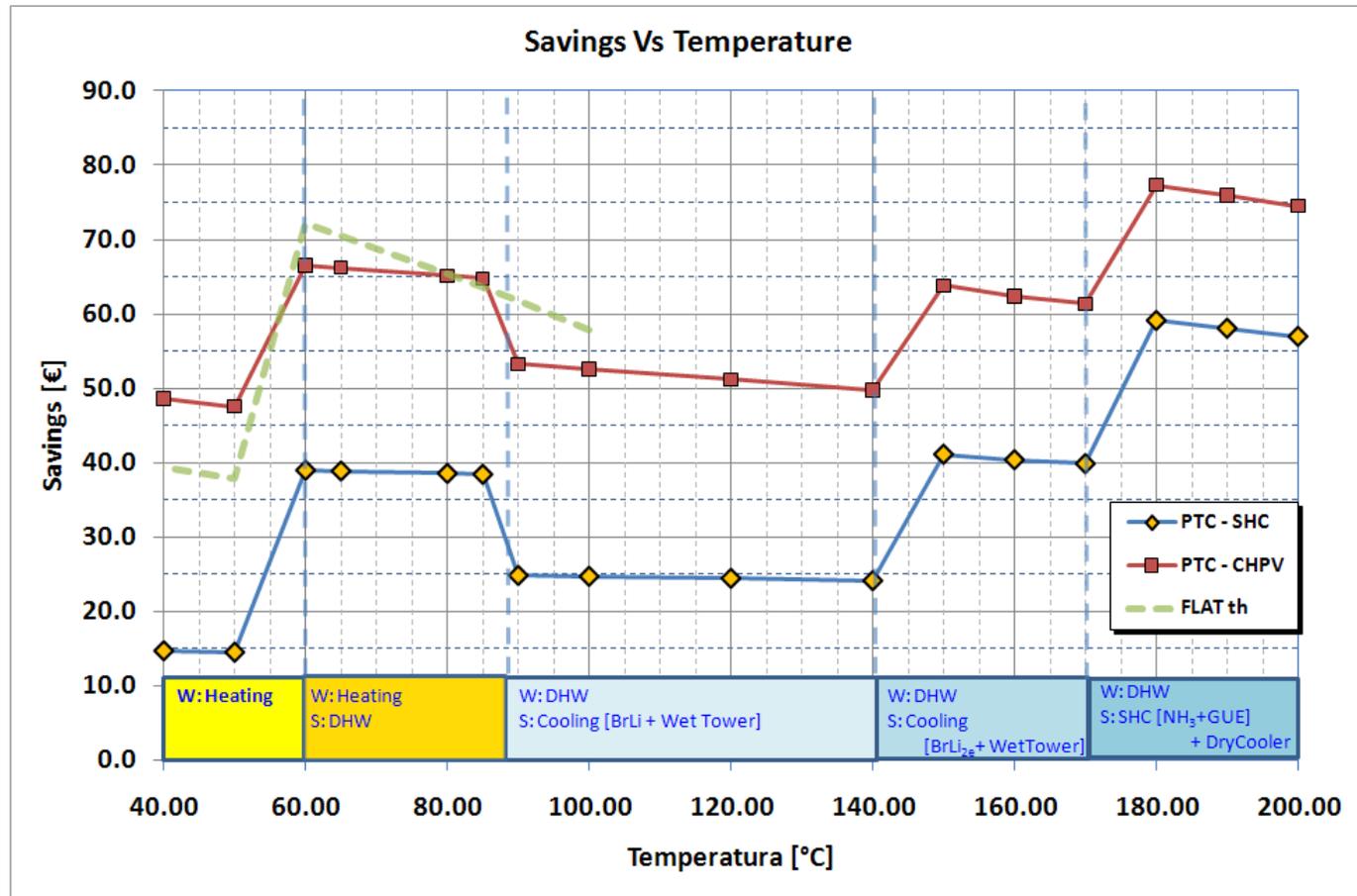
Efficienza ~ 10⁻⁶

**CALORE
VENTO
PIOGGIA
FULMINI
URAGANI**

VEGETALI PER FOTOSINTESI

Green economy
Fonte: Dalpiaz

Energia solare - Valorizzazione dell'energia al variare della temperatura



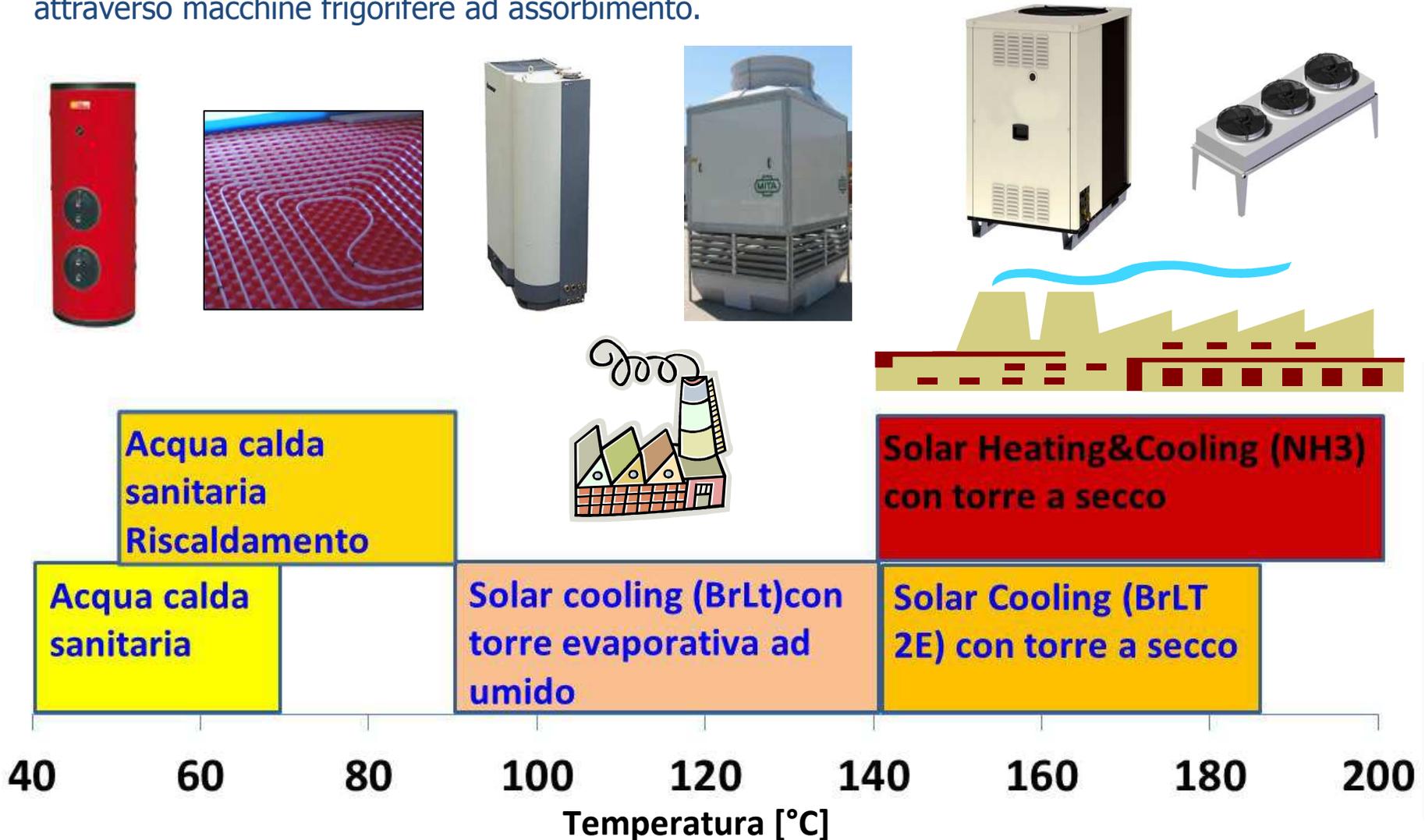
**Solare a
concentrazione a
media
temperatura**

*potenzialmente il
miglior compromesso
costo/efficienza di
conversione*

Saving per Campo solare PTC, Latitudine Firenze

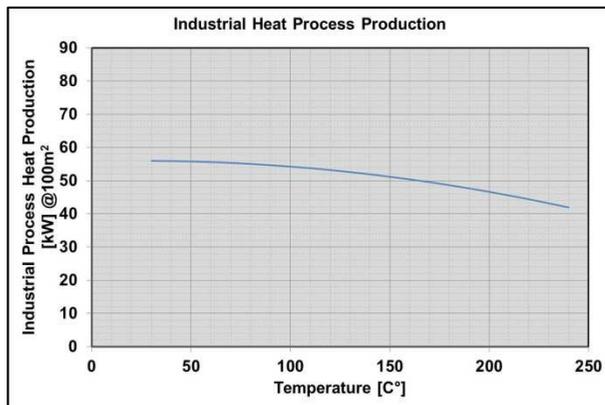
IL VALORE dell'ENERGIA

- ✓ Processi in cui è richiesta **Energia Termica fino a 250°C** ed oltre - Impianti solari termici per temperature comprese tra 80 e 250°C per applicazioni tecnologiche o di condizionamento attraverso macchine frigorifere ad assorbimento.

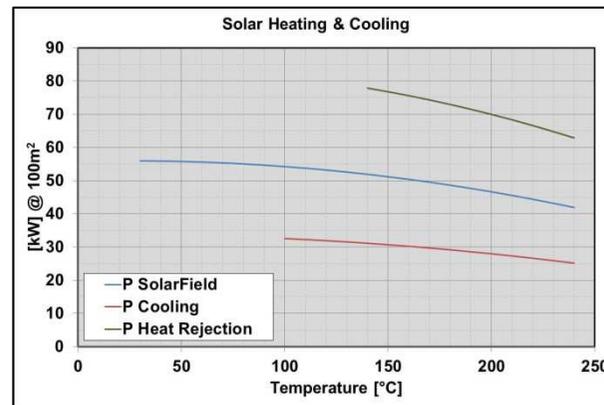


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- ✓ In funzione delle esigenze potranno essere realizzati sistemi più complessi per la **Cogenerazione e Trigenerazione**.
- ✓ Settori industriali, applicazioni in isola e soluzioni strategiche - Impianti di **Solar Cooling e Solar Heating&Cooling** parzialmente o interamente basati su energia rinnovabili.

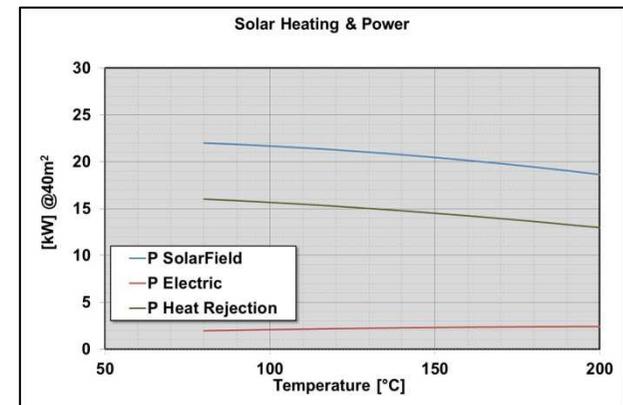
Energia Termica
(100 mq di concentratori)



Energia Frigorifera e Termica
(100 mq di concentratori)



Energia Elettrica e Termica
(40 mq di concentratori)



Valore del Mercato Industriale Italiano

Richiesta di calore
per usi industriali
(Fonte IEA task33)

EU 25 → 6881 PJ
ITA → 857 PJ

Range di temperatura 80-250°C
2,1% coperta da PTC 9000000 m²

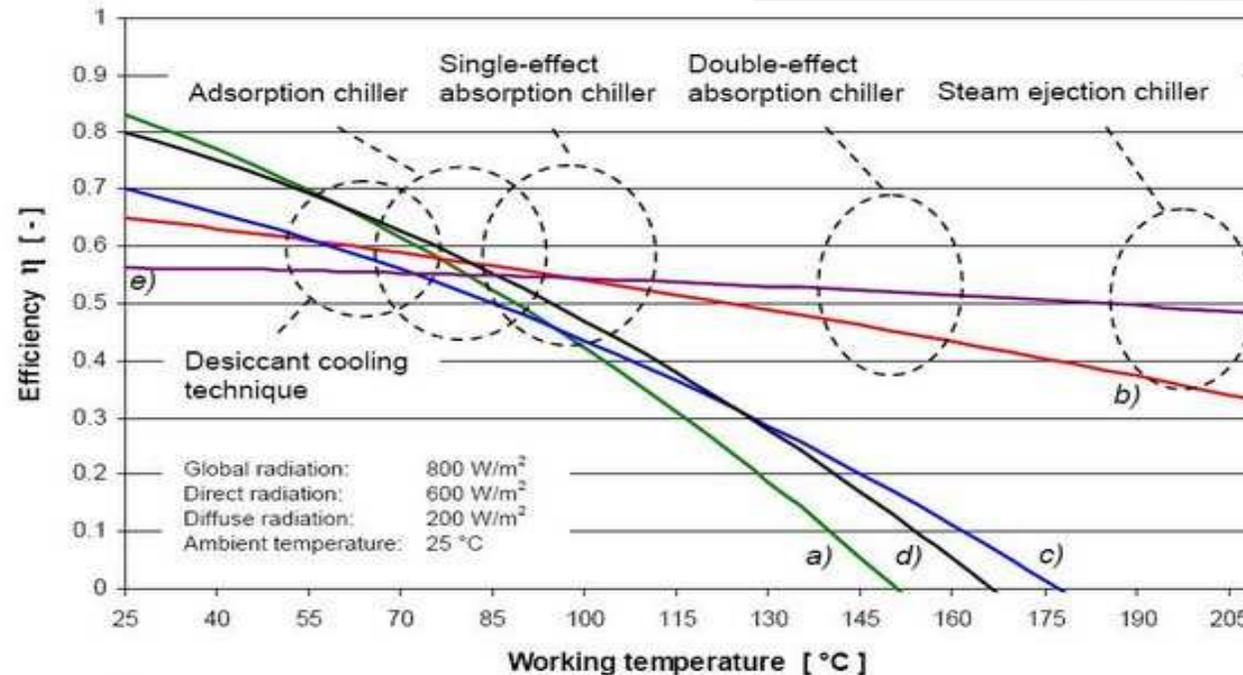
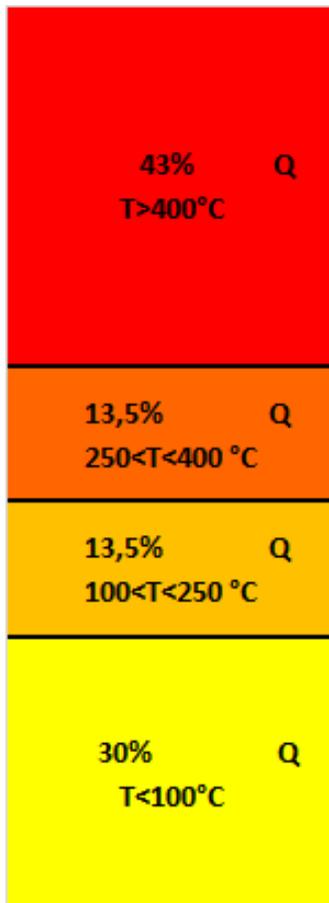
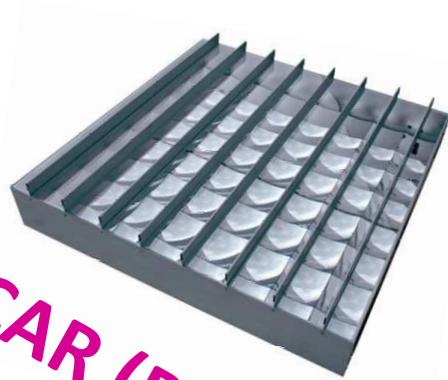


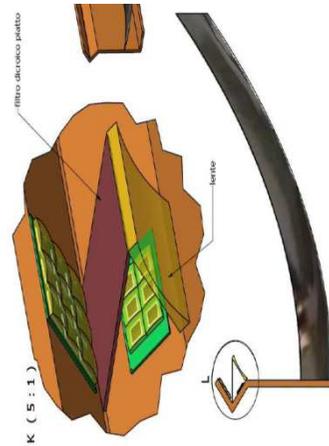
Fig. 6: Comparison of different collectors at 800 W/m². a) Single glazed flat-plate with AR, b) Evacuated tube collector of the Sydney type, c) CPC flat-plate with Teflon foil, d) Flat-plate with double AR-glazing and inert gas filling, e) Small parabolic trough (under development; only the fraction of direct radiation = 600 W/m² can be used). The values are for normal irradiance and refer to the aperture area.

I PRINCIPALI PLAYER ITALIANI



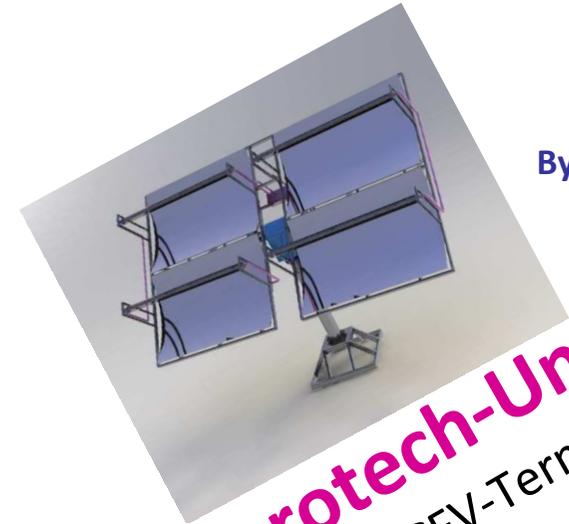
BECAR (Beghelli)
alta concentrazione

Sistemi CPV



STM

splitting della radiazione



By ENEA

Ferotech-UniFi
Ibrido CFV-Termico



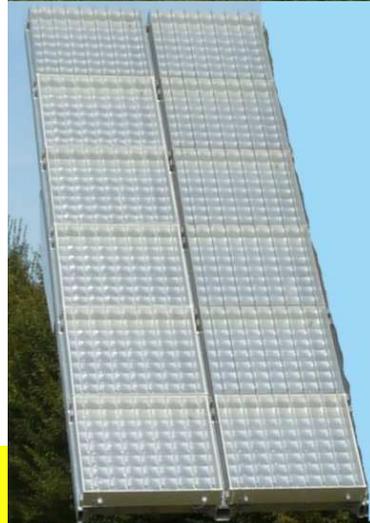
Angelantoni
alta concentrazione



Alitec
alta concentrazione

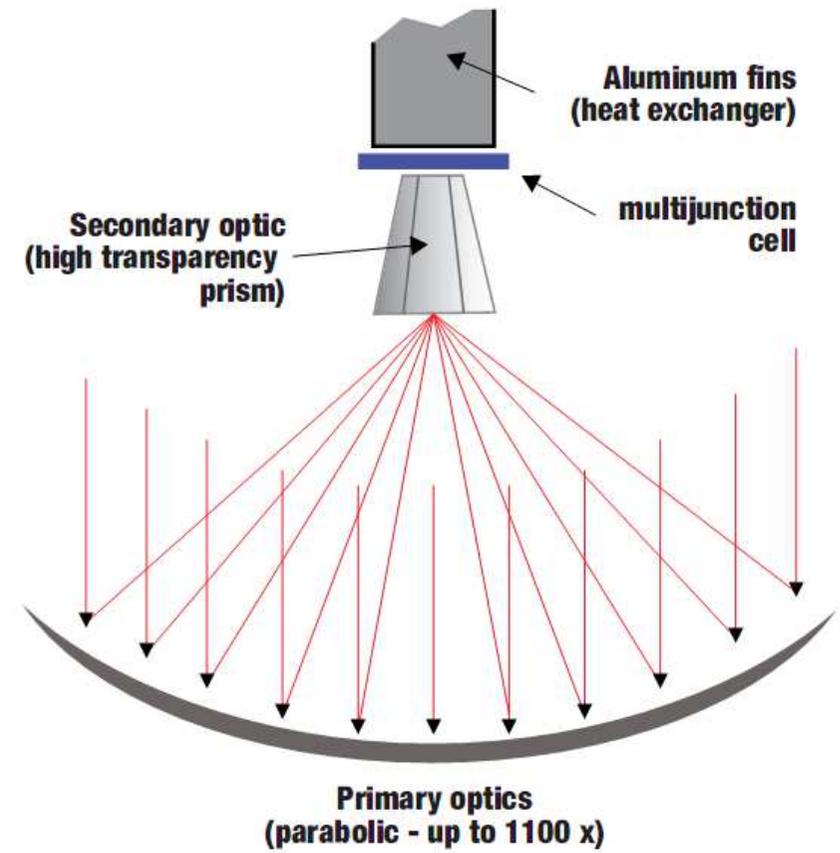
HCPV Beghelli's «Life tree» generator

- *Generator's peak power: 8160W @ 900 W/mq DNI*
- *48 HCPV modules*
- *Total weight 3900kg*
- *Size 7670x5560mm*
- *Modules are installed and lined up on the supporting structure (maximodule) in the manufacturing facility*



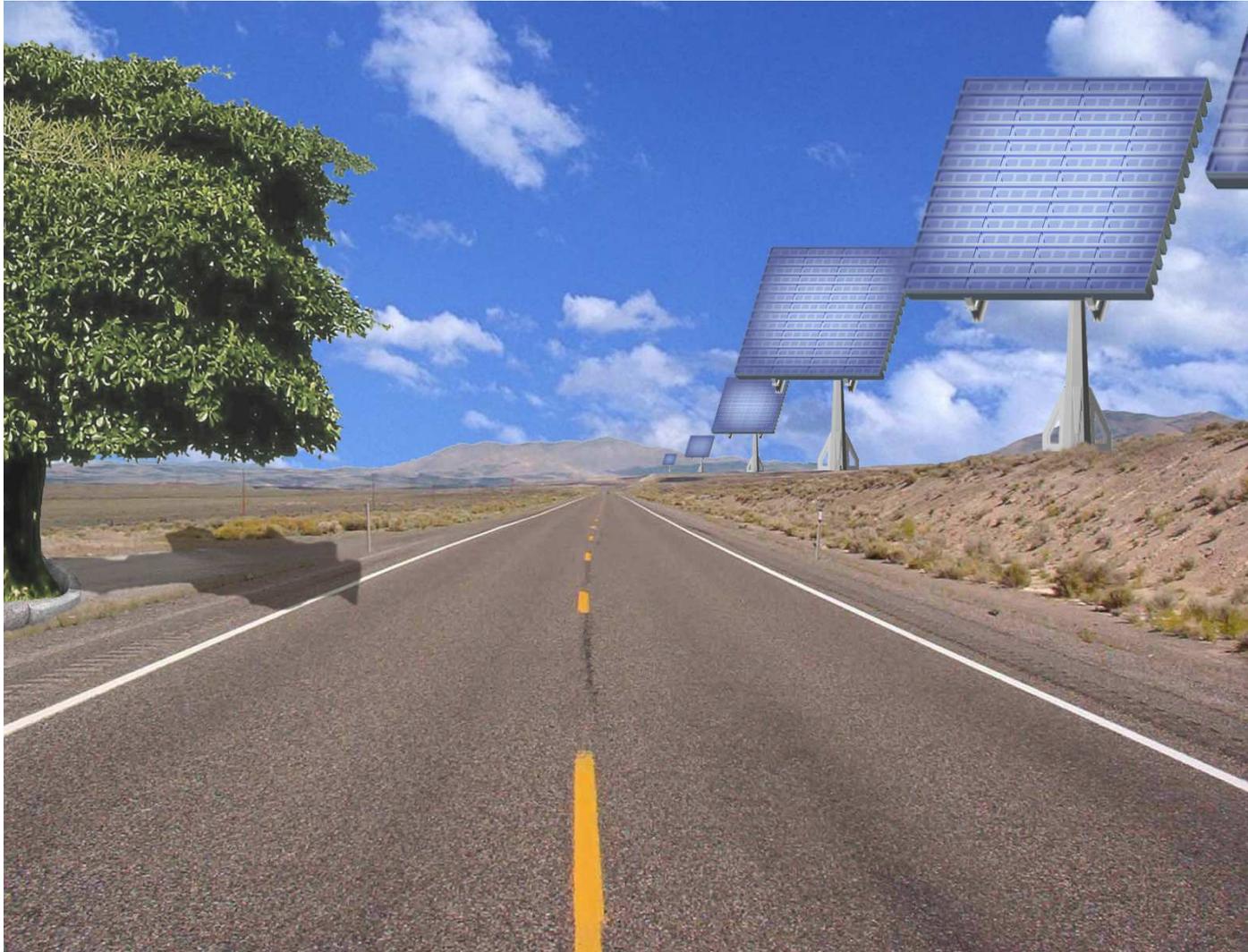
Beghelli's HCPV concentrator

- *Single reflection system*
- *AR front glass*
- *High reflectivity primary parabolic optics (85%-90%)*
- *Geometric concentration 1350x*
- *Quartz SOE*
- *Acceptance angle +/- 0.5°*
- *III-V triple junction cells, with 38%-40% efficiency @ 900 suns tested up to 1500 suns*
- *Front aluminum slim heatsinks (aluminum fins)*





ANGELANTONI





Renewable Energy Excellence in TUSCANY



PTC

SOLAR RESEARCH

- Solar concentrator research involve the develop of Parabolic Trough Collector (PTC) for Power (CSP) or Industrial application (DSG) and Solar Heating&Cooling (SHC or SC)
- Photovoltaic research means Concentrated system (point Focus and linear focus)



CPV



1.5 kg/h pilot pyrolyser

ADVANCED BIOFUELS

- Development of pyrolysing and torrefaction systems
- Pyrolysis of innovative (2^ogen) feedstocks: microalgae, lignin
- Torrefaction and Pyrolysis of lignocellulosic feedstocks, either dedicated or residual
- Small scale gasification systems



E-Mobility - Smart-City

- Development of Electric Vehicle (EV) 2 Weels and 3 Wells for Smart City
- smart solar roof
- distributor of batteries & battery sharing
- high capacity batteries (Zn-Air)

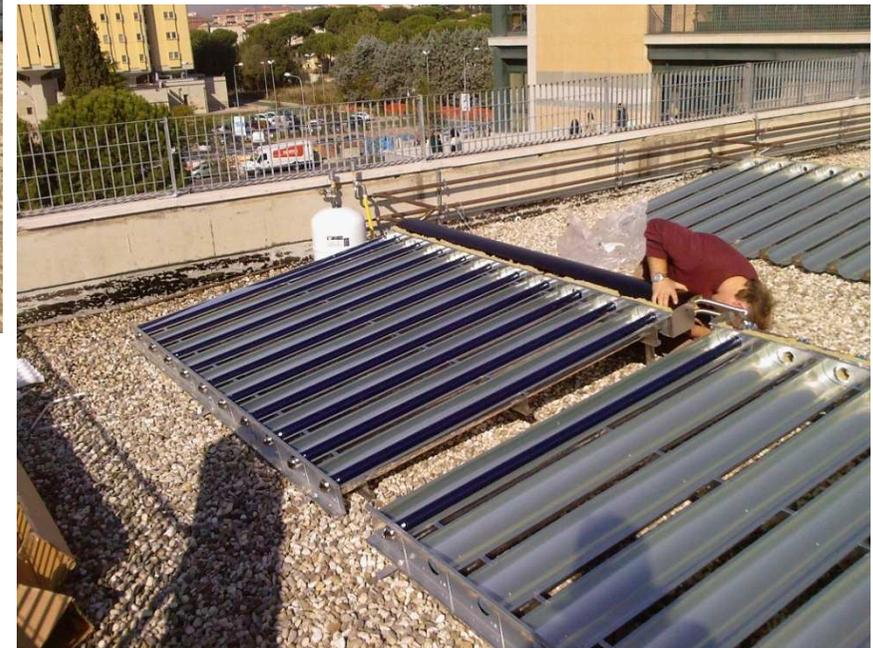


PIAGGIO Mp3 Hybrid



Laboratorio Green economy

INSTALLAZIONI - 01



Progetto SALVE-presso UNIFI
Min.Ambiente

Progetto SALTO

✓ Medium temperature PTC collector F-PTC2200

FERO-PTC2200	
Collector length	5,400 mm
Aperture	2,200 mm
Concentration factor	50-70
Temperature area	100°-250°C
kind of tracking	One axis
Tracking collector focusing precision	0.2°
Medium	Water/Steam/Thermo oil
Reflector	Coated alluminum



Realizzazioni Toscana

Progetto PIACE/SALTO

✓ Medium temperature PTC collector F-PTC1600

FERO-PTC1600	
Collector length	5,400 mm
Aperture	1,540 mm
Concentration factor	50-70
Temperature area	100°-250°C
kind of tracking	One axis
Tracking collector focusing precision	0.2°
Medium	Water/Steam/Thermo oil
Reflector	Coated aluminum



Realizzazioni Toscana

✓ Advanced Solar Heating& Cooling System

Alone Project: Misericordia's building-outpatience (Florence, Italy)	
Solar field surface	108 m ²
Cold Power	17 kW
Solar Field Thermal Output Power	40÷60kW@190°C&T _{amb} 40°C/50÷60kW@70°C&T _{amb} 10°C
Chiller Heat Rejection	35kW@60°C
Thermal Power	6÷7kW@60°C



Prog. ALONE (FP7)

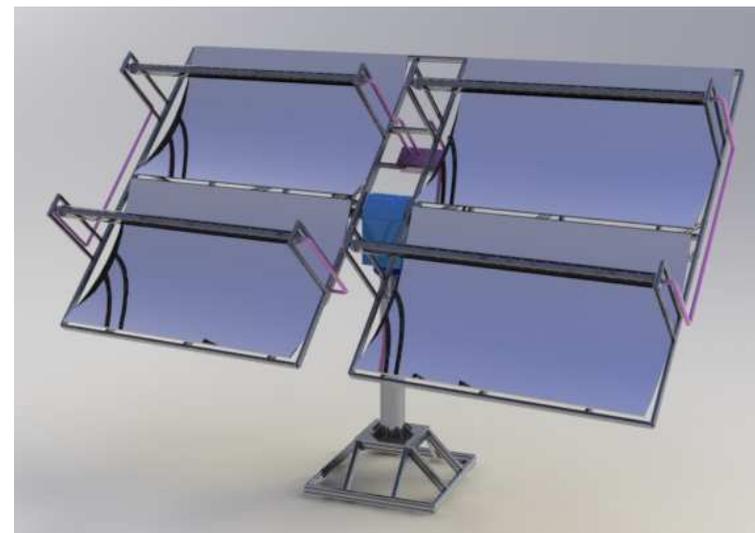
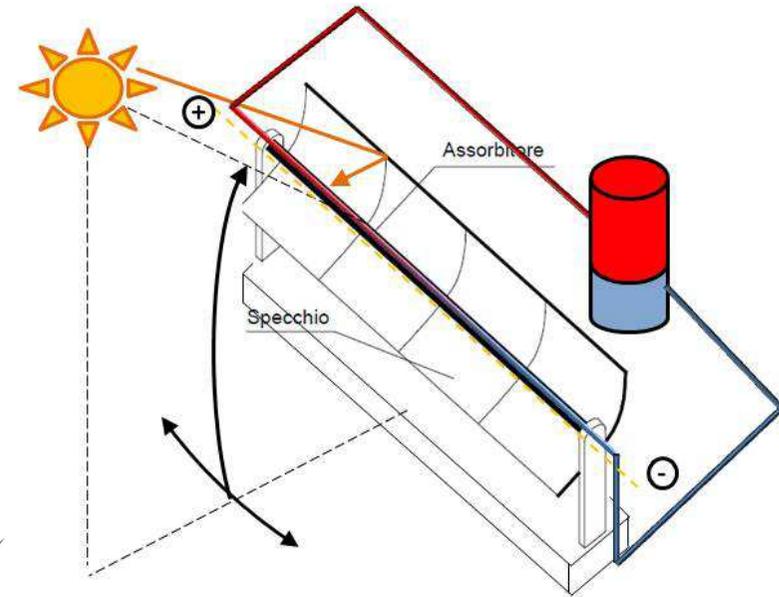
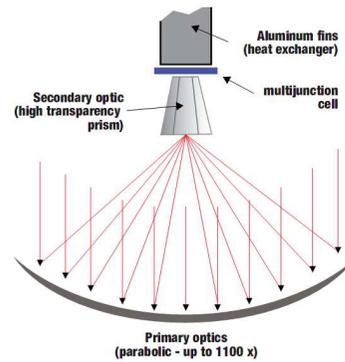
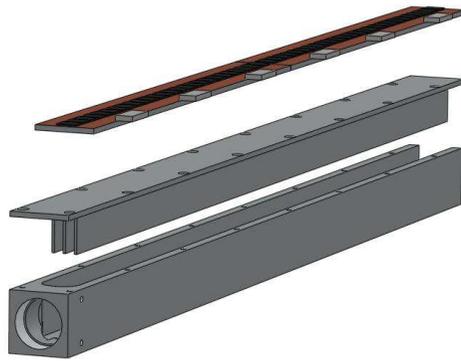
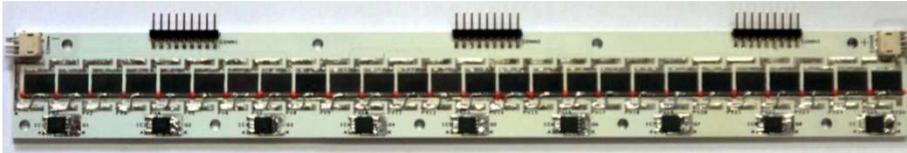
Progetto Cesare-SCOOP

✓ Concentrated Hybrid photovoltaic and thermal collector

FERO-CHPVdevelopment	
Collector surface	15 m ²
Geometrical Concentration factor	100-150
Electrical Power	2÷2.5kW
Thermal Power	6÷7kW@60-80°C
kind of tracking	Two axis
Photovoltaic Materials	Si-c(η_e 18%) / MJ(η_e 24-32%)
Medium	Water
Reflector	Coated alluminum

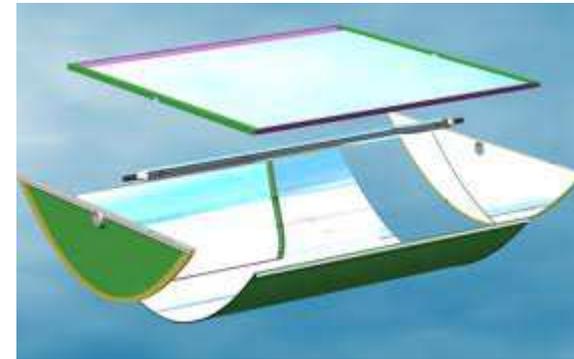


CPV-HYBRID (TERMO-ELECTRIC – LINEAR FOCUS)



Progetto residenziale (in corso)

- Applicazione della tecnologia dei PTC in ambito residenziale



Prossimo FUTURO

Installazione su tetto →



Installazione su modulo →





Smart renewable energy system for poli-generation in residential buildings using solar concentrating collectors

by CASA Spa and University of Florence
for the new building in
Via Torre degli Agli
Firenze



SOLAR COLLECTORS – TORRE AGLI



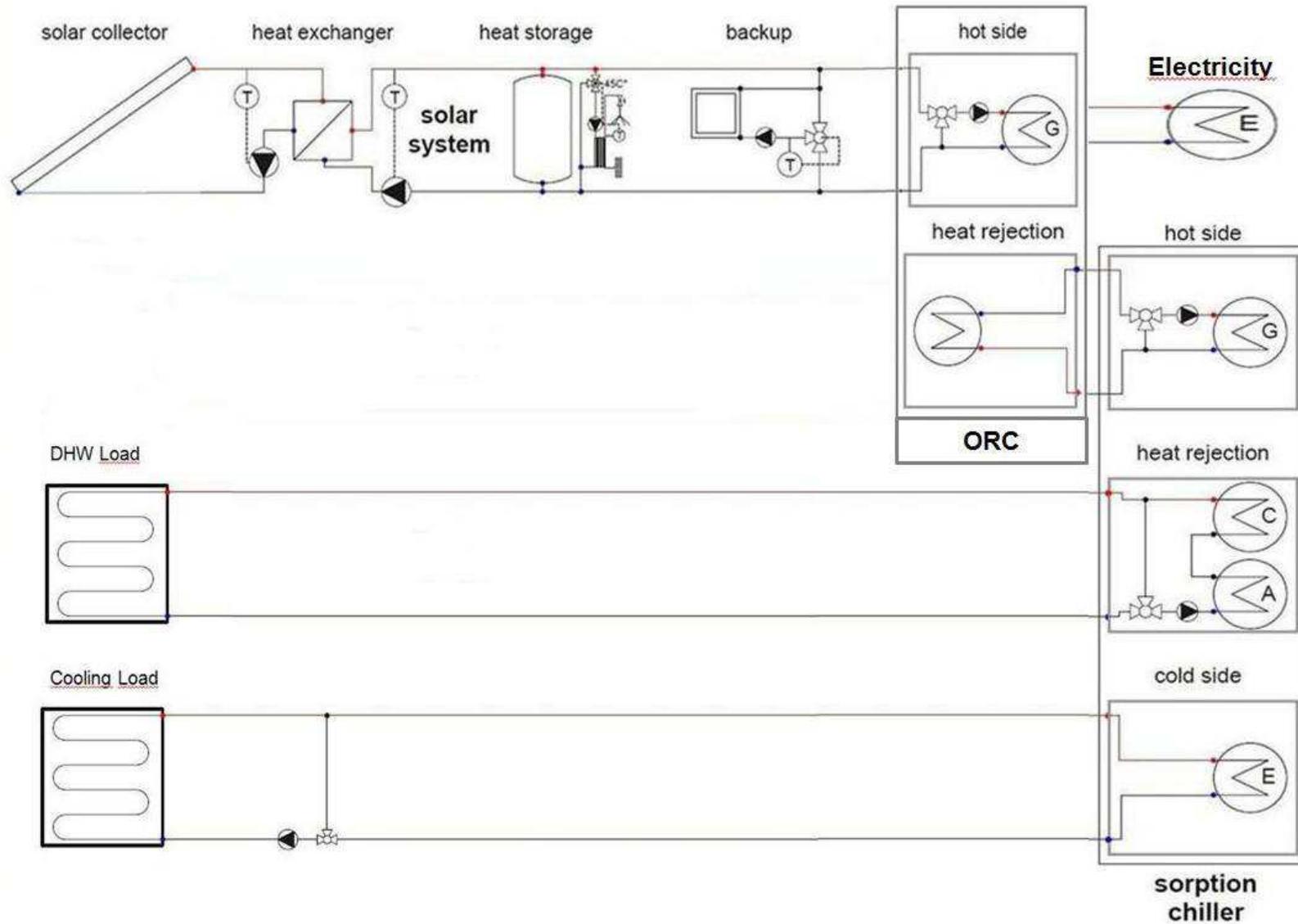
SOLAR COLLECTORS – M-PTC



Collector Area : 3.3 m²
Collector Weight < 100 kg
Number of Collectors : 54
Solar field area : 200 m²
Slope of the surface : 22°
Orientation : 39° N



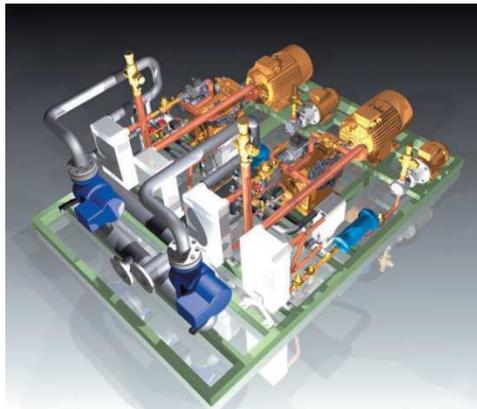
PLANT LAY-OUT - (Torre Agli)



ORC

- ORC machines exploit classic Rankine cycle
- Evolving fluid is organic (R245fa, n-pentane, etc...)
- Operating temperatures – Generator 150°C / Condenser 100-120°C

Newcomen



Turboden



Riello



Infinity

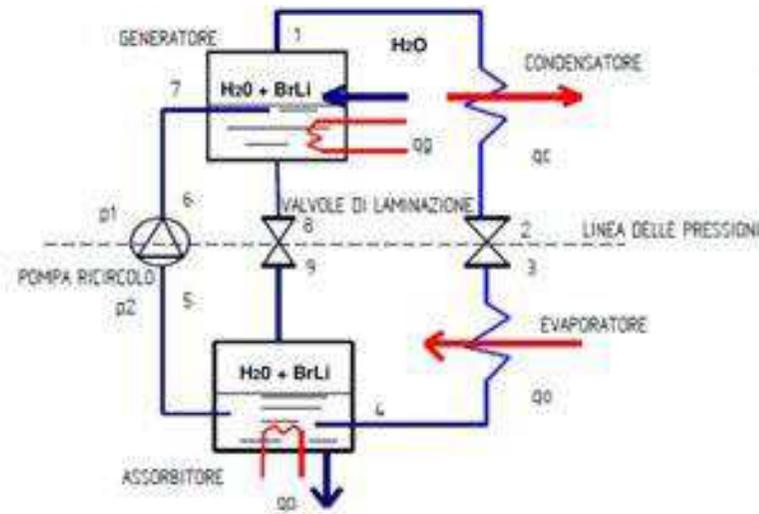
A lot of companies may provide technological solutions already available in the market

CHILLER

LiBr chiller

In this case the chiller supplied by the heat rejected at the ORC condenser (about 100-120°C)

Innovative solution

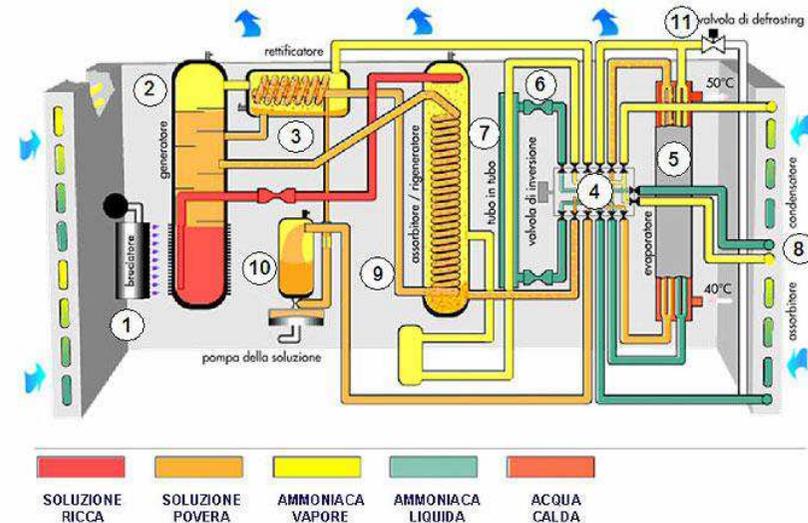


NH3 chiller – ROBUR GAHP-W

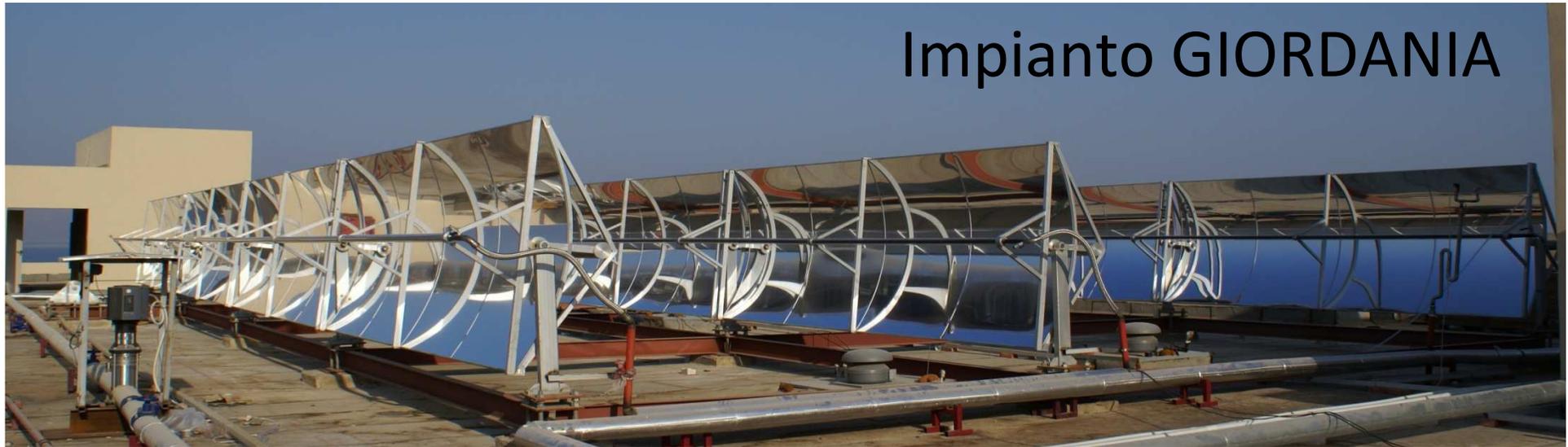
Chiller developed by University of Florence

Solution already tested at the Misericordia of Badia a Ripoli in Florence

In this case the chiller is supplied directly by the solar field operating at a temperature about 190°C (pressurized water)



Impianto GIORDANIA



REALIZZAZIONI e FACILITY

Campo solare Università di Firenze



Campo sperimentale Università di Firenze





Fine
grazie per l'attenzione