National Agency for New Technologies, Energy and Sustainable Economic Development

SH&C – Performances influence of tank technologies, facility installation site and size

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Overview

- *CASE STUDY: SH&C system at ENEA CASACCIA Research Centre (ROME);*
- *Facility's numerical **MODEL** and its **VALIDATION**;*
- *Estimated influences on PERFORMANCES of facility's **SITE** and **SIZE**;*
- *Economical support (**incentives**).*

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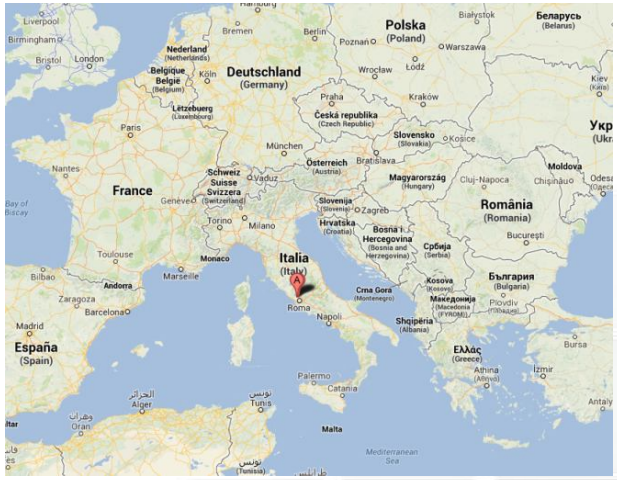
CASE STUDY: SH&C system at ENEA CASACCIA Research Centre

CASE STUDY: Solar heating and cooling system, building F-92 at ENEA CASACCIA Research Centre (ROME)

F-92 BUILDING FEATURES	
Latitude	42 ° 03 ' N
Longitude	12 ° 18 ' Est
Climatic Zone (Italy)	D
Area	381 m^2



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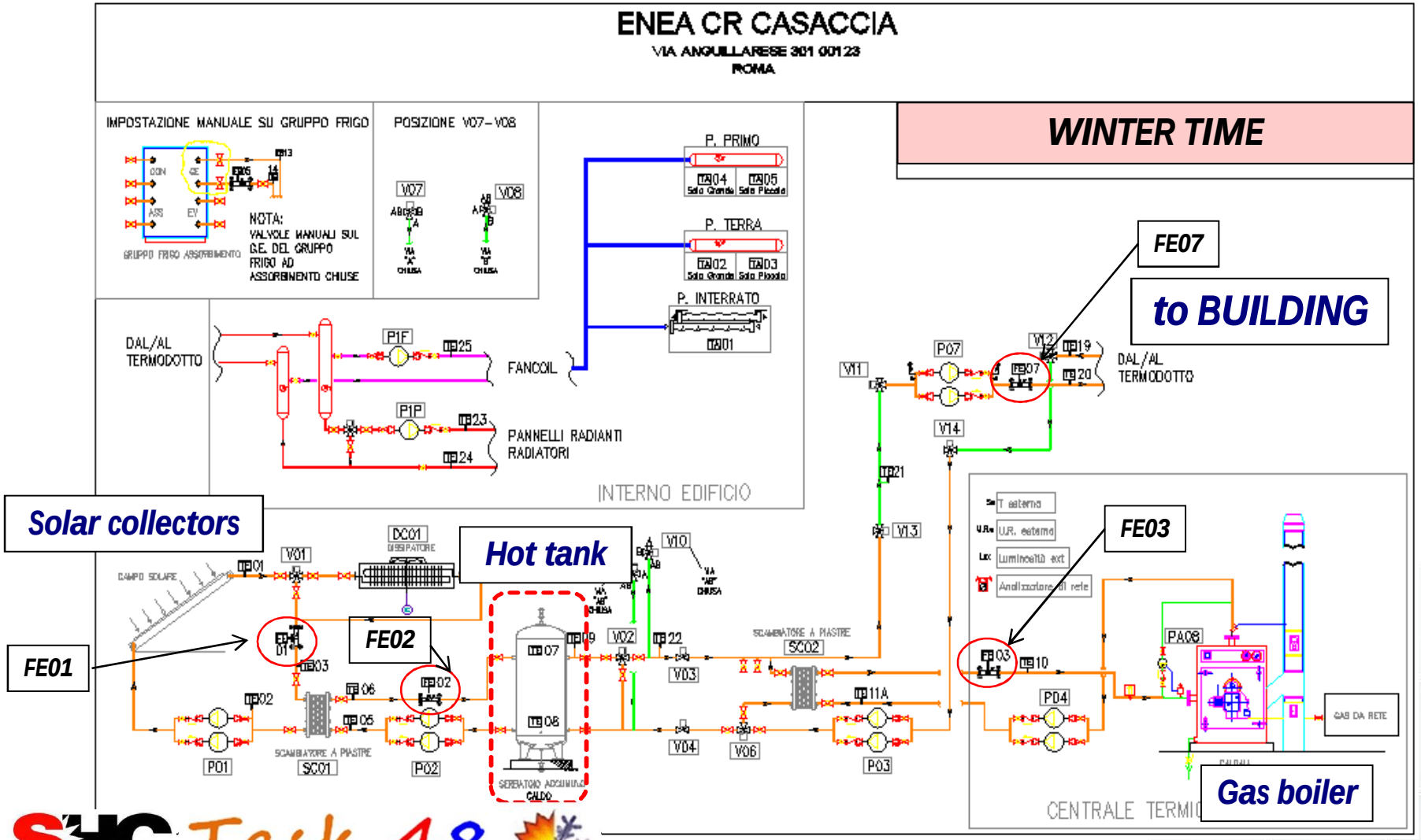
CASE STUDY: SH&C system at ENEA CASACCIA Research Centre

A) Solar Heating: Facility LAYOUT – highlights on different energy contributions



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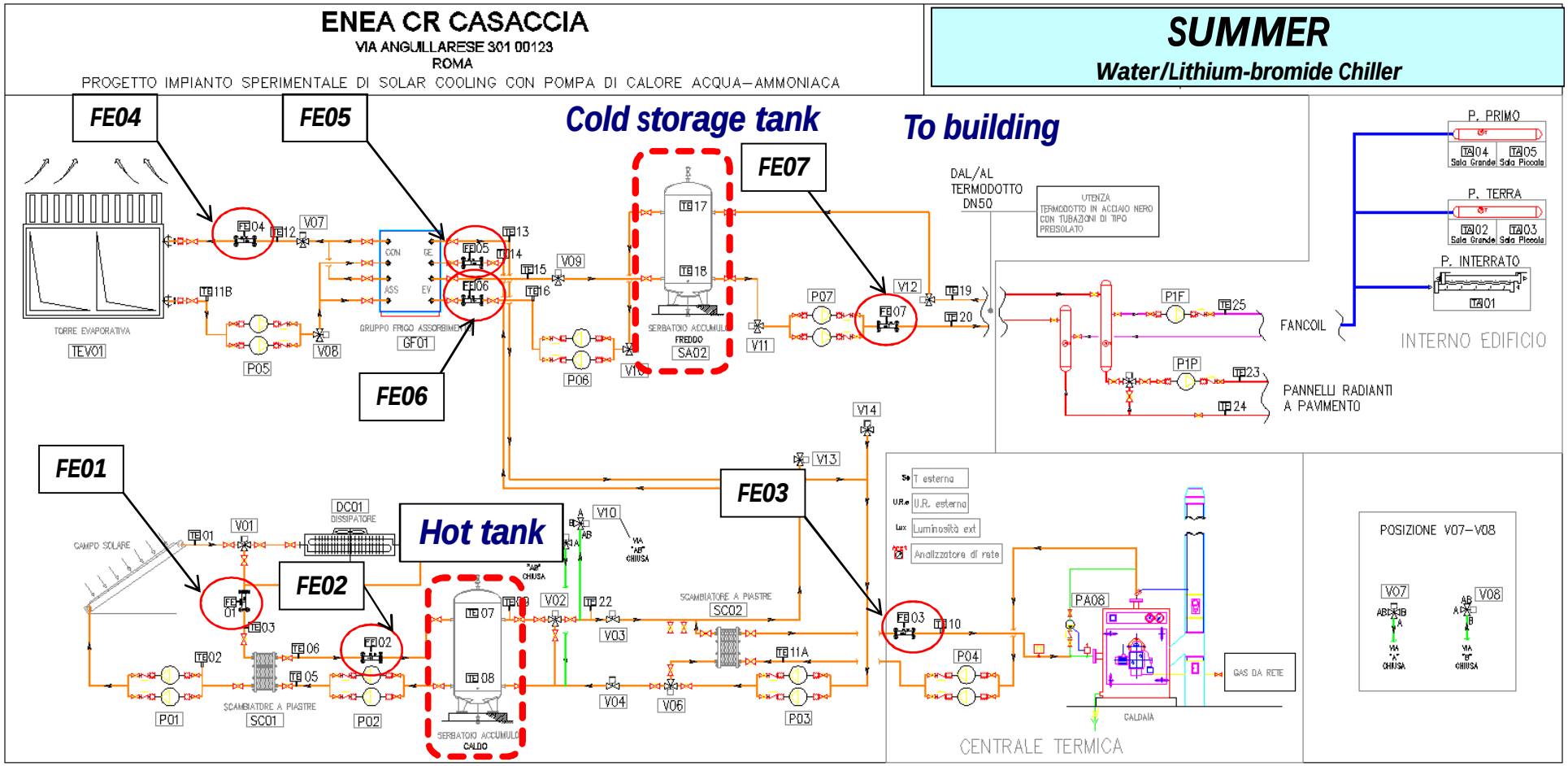
CASE STUDY: SH&C system at ENEA CASACCIA Research Centre

A) Solar Cooling: Facility LAYOUT – highlights on different energy contributions



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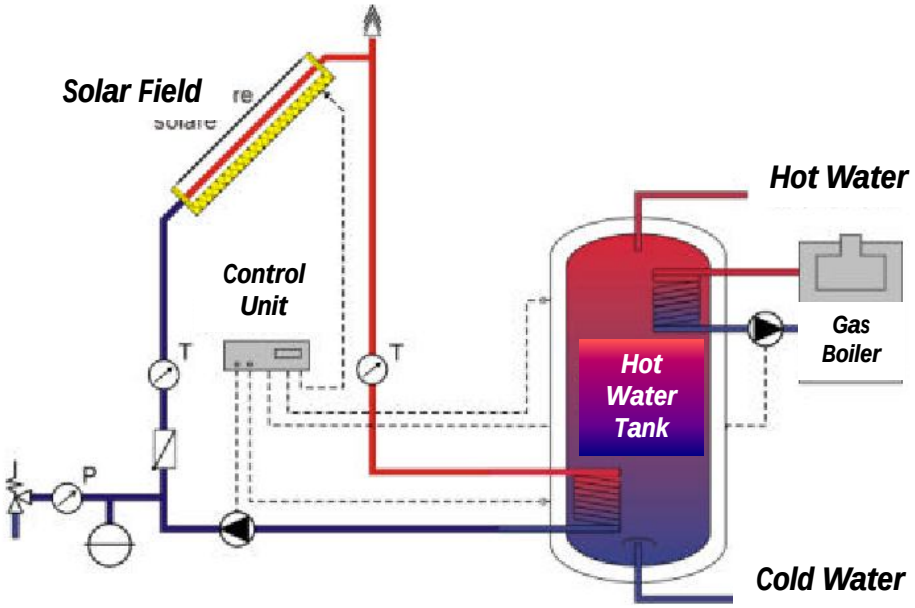
Standard VS PCM Storage Tank

PCM (Phase Change Material) Storage tank to minimize energy loss:

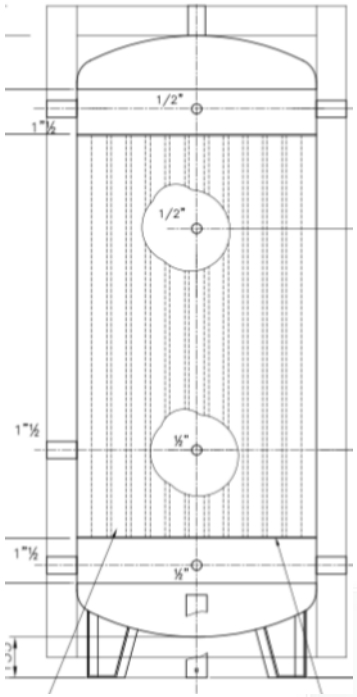
YEAR 2012



- *Volume* 1500 litre

YEAR 2013

HYDRATED SALTS OF S46-S7 SERIES *placed in sealed tubes*



- *Phase change temperature* 46 ºC
- *Volume* 1000 litre

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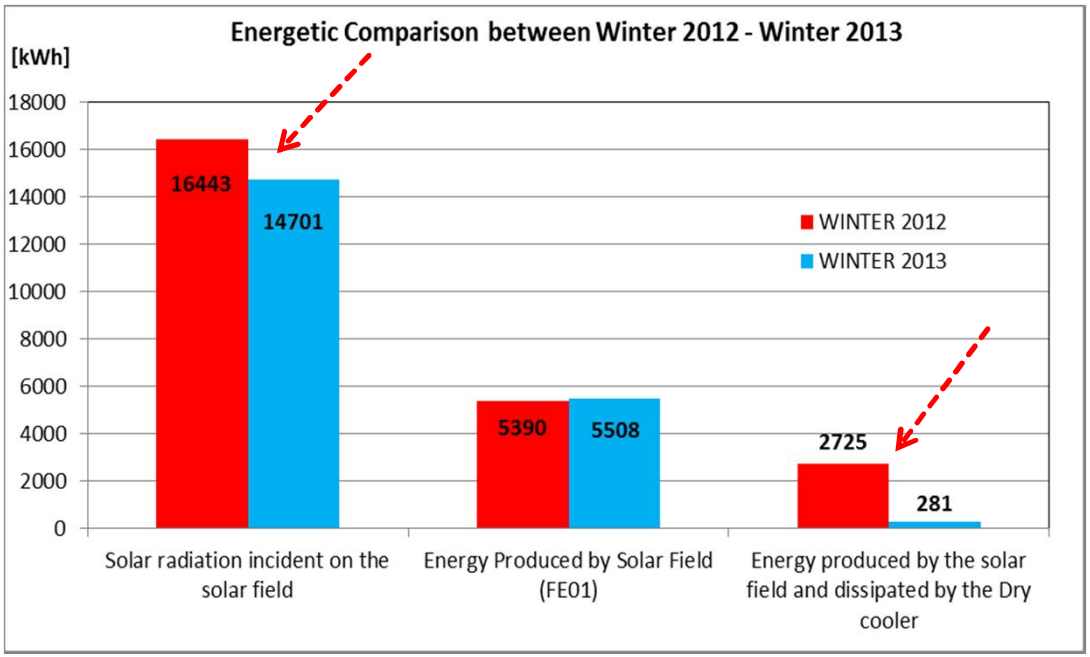
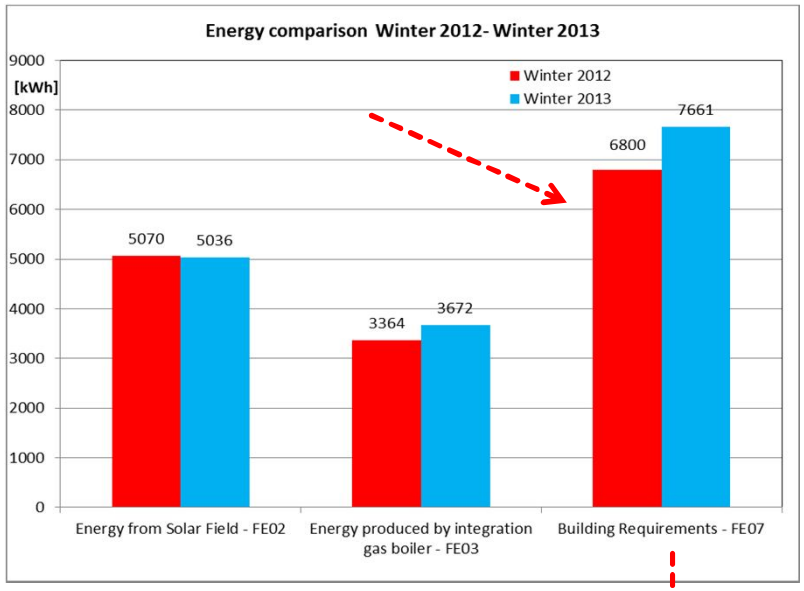
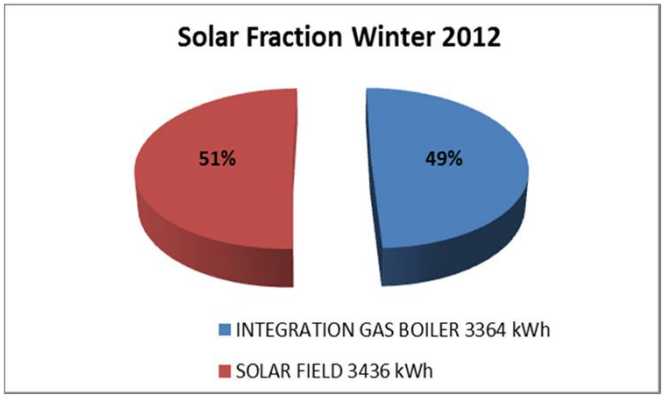
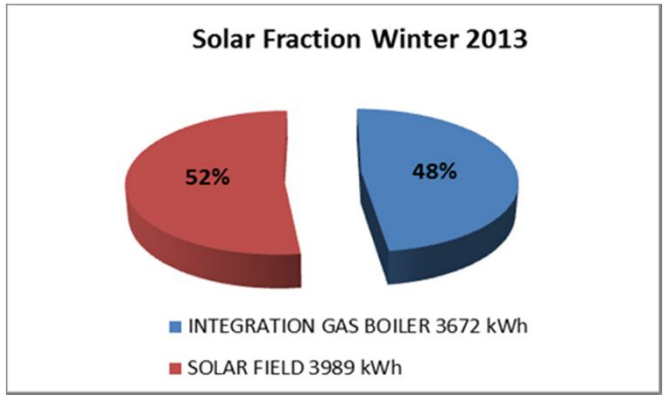
Standard VS PCM Storage Tank



WINTER TIME



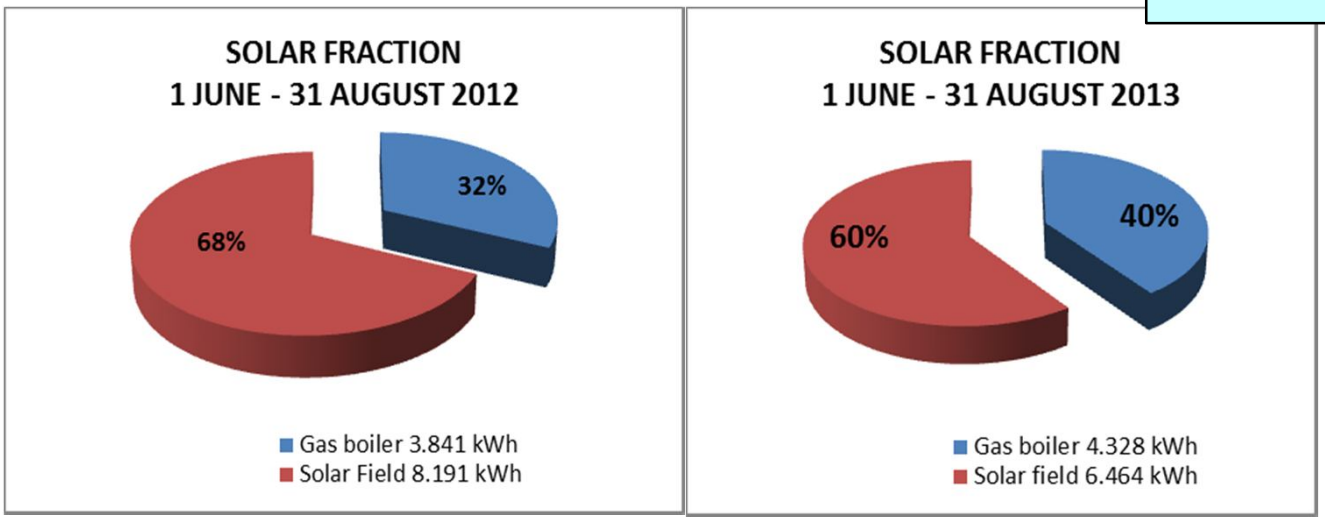




- *Ambient temperature setting from 20 to 22 ºC*
- *Different weather conditions*

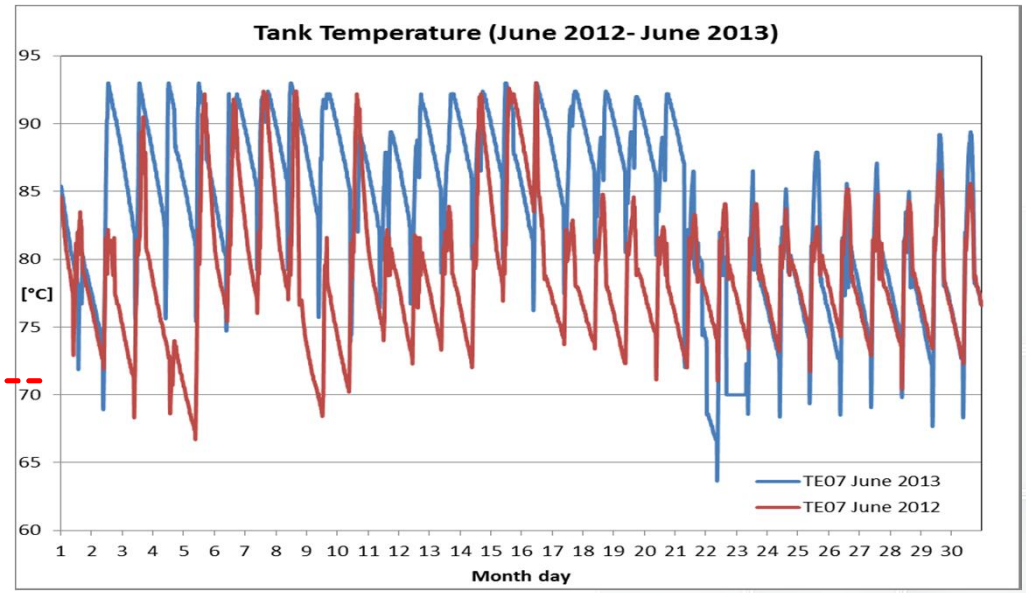
Standard VS PCM Storage Tank

SUMMER



- *Ambient temperature setting from 26 to 24 ºC;*
- *Different weather conditions;*
- *Different time schedule;*
- ***No phase change***

Tank Volume 2012: 1.500 liter
Tank Volume 2013: 1.000 liter



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How size and installation site influence facility's performances

Collaboration between **ENEA** and **UNIVERSITY OF PALERMO**: *Comparison of standard and SH&C systems in order to estimate how size and installation site influence facility's performances and the economical feasibility.*

Location	Climatic Zone	Winter	Summer
Milan	E	15 October – 15 April *7:00 – 17:00*	1 June – 15 September *9:00 – 19.00*
Rome	D	1 November – 15 April *7:00 – 17:00*	1 June – 15 September *9:00 – 19.00*
Naples	C	15 November – 31 March *7:00 – 17:00*	1 June – 15 September *9:00 – 19.00*
Palermo	B	1 Dicember – 31 March *7:00 – 17:00*	1 June – 15 September *9:00 – 19.00*

Winter outside design temperature:

Milan: -5 [°C]
Rome: 0 [°C]
Naples: 2 [°C]
Palermo: 5 [°C]

Facility Size [kWf]
18
35
65
100
160
280
400
620

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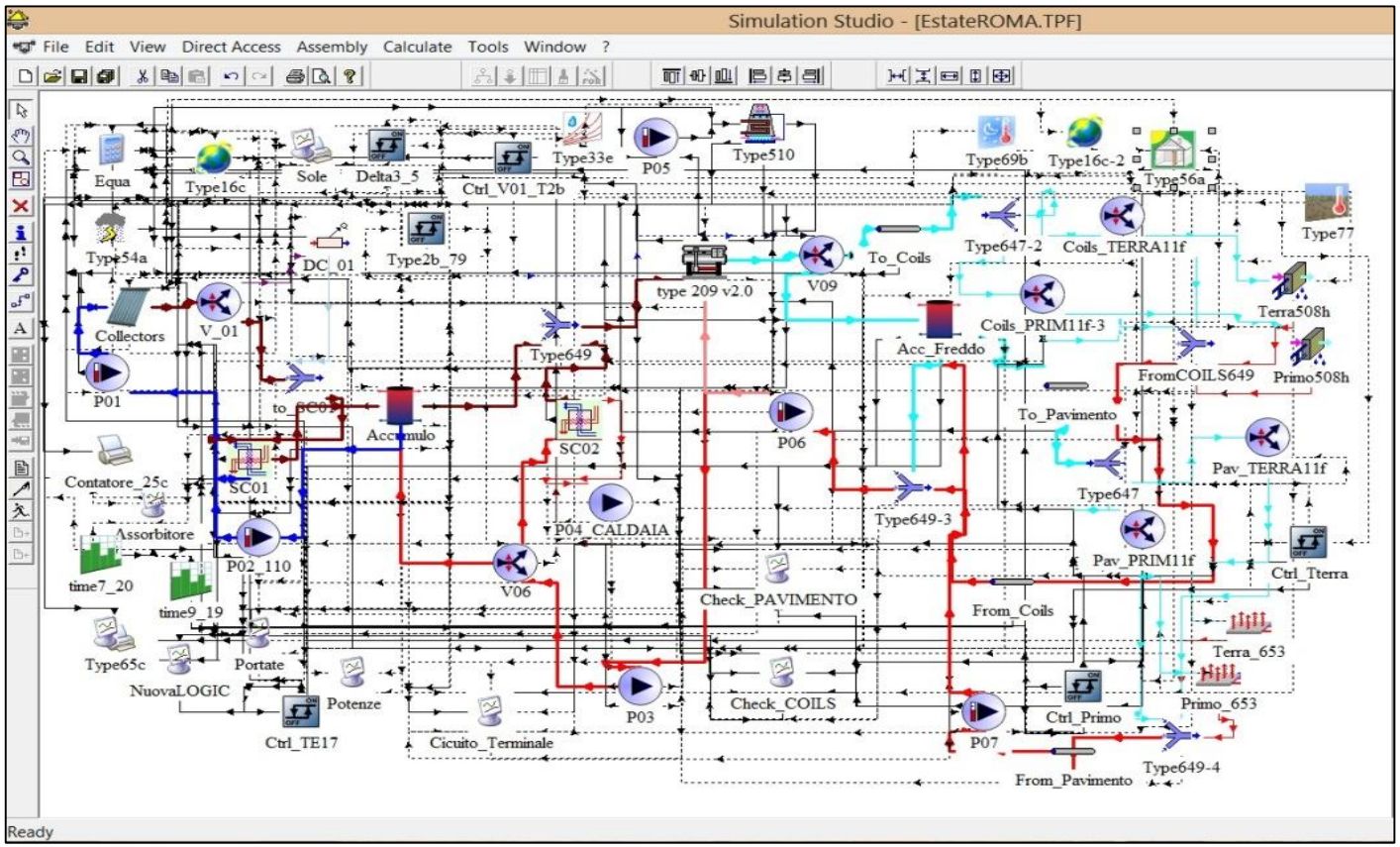
How size and installation site influence facility's performances

*1- **TRNSYS** Facility **MODEL**;*
*2- **Validation** through direct comparison with experimental datas;*
*3- Model used to **estimate** facility performances for different **Sites** and **Sizes**;*



	Fossil Fuel	Sun	Tot	Renewable fraction
Measured Energy Demand [kWh]	8.285	13.443	21.728	0.62
Calculated Energy Demand [kWh]	7.342	12.873	20.215	0.64

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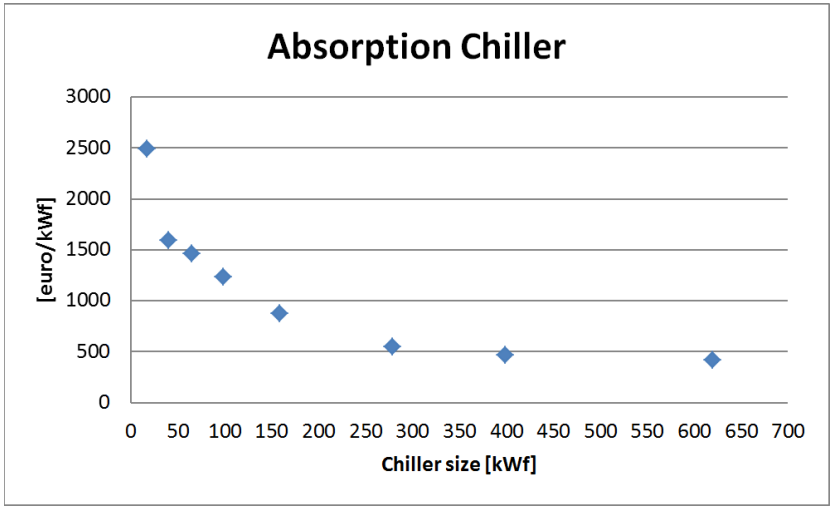
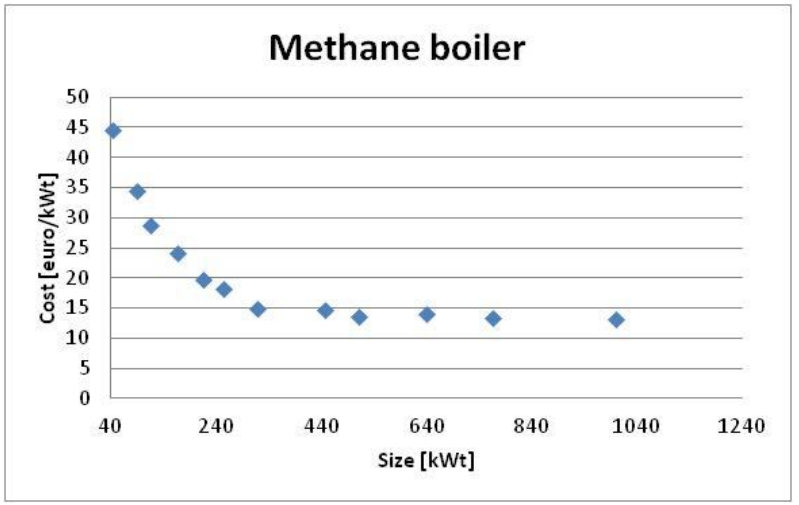
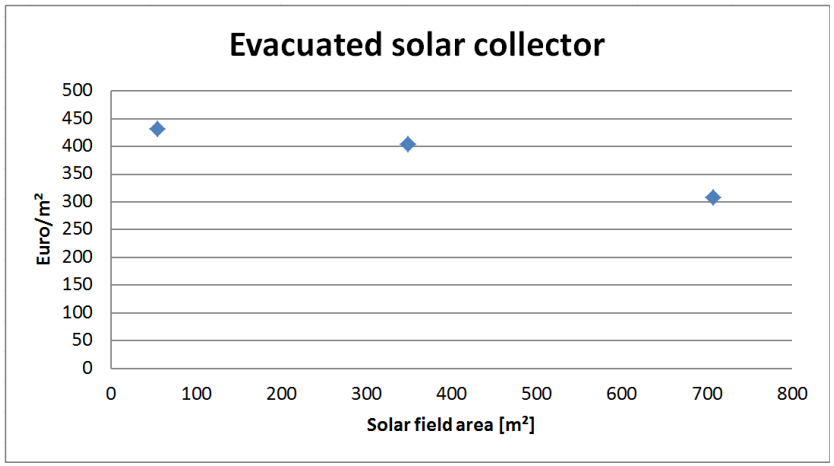
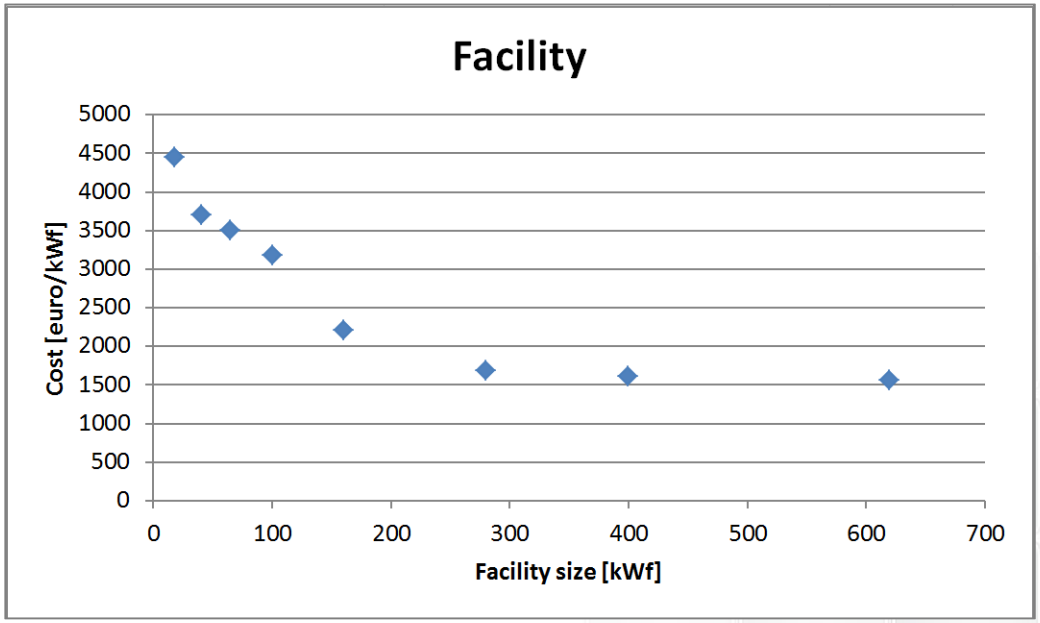
How size and installation site influence COSTS









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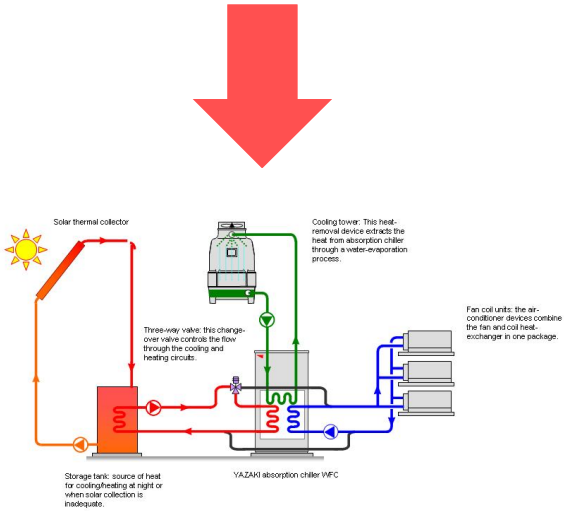
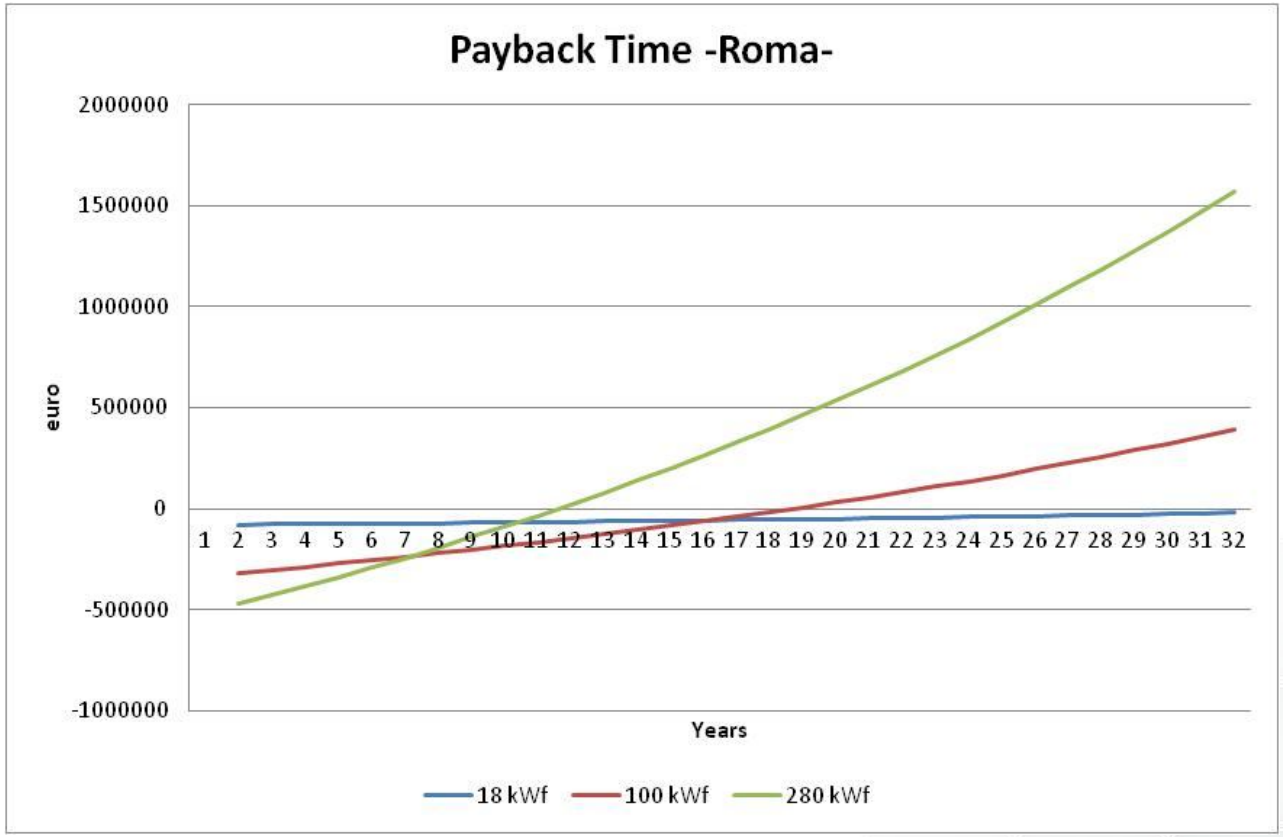
How size and installation site influence payback period

Annual Energy Inflation	*3%*
Methane Gas Cost	*0.093 €/kWh*
Electricity Cost	*0.2414 €/kWh*
Split System EER Average Value	*3.3*





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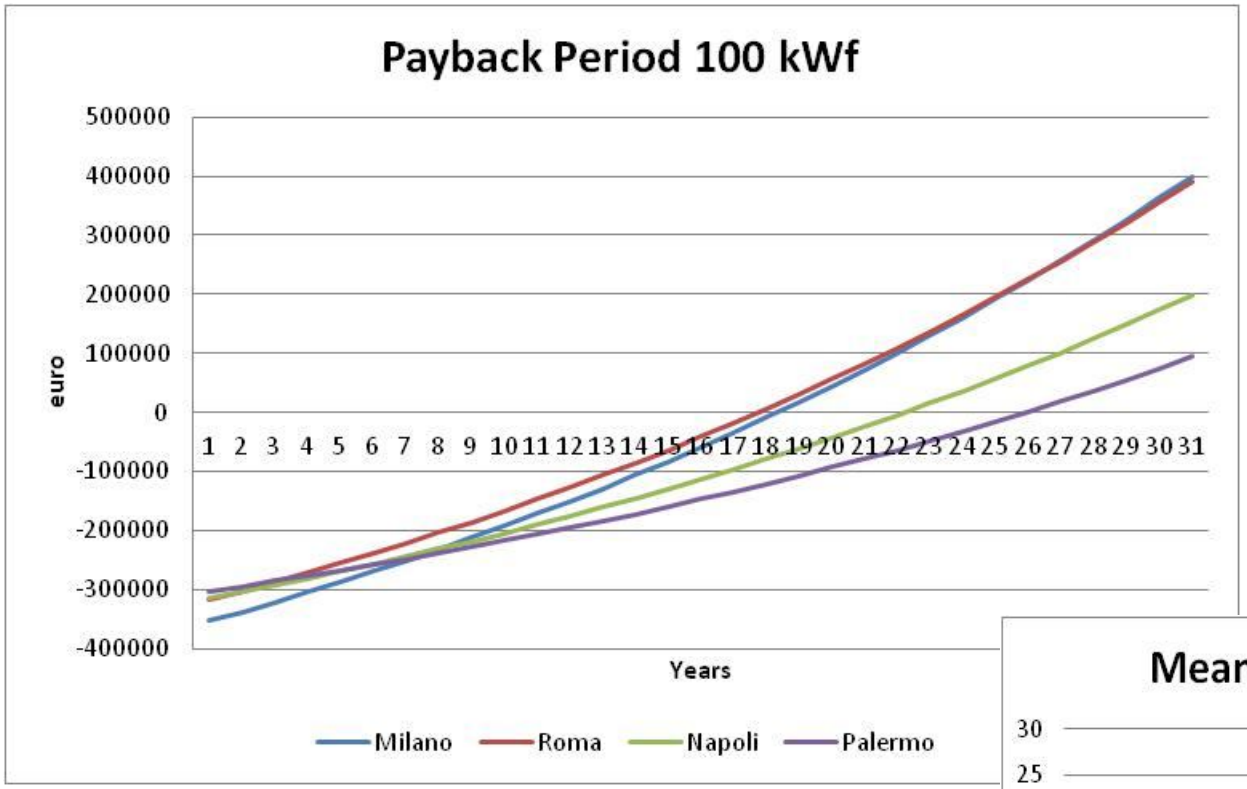
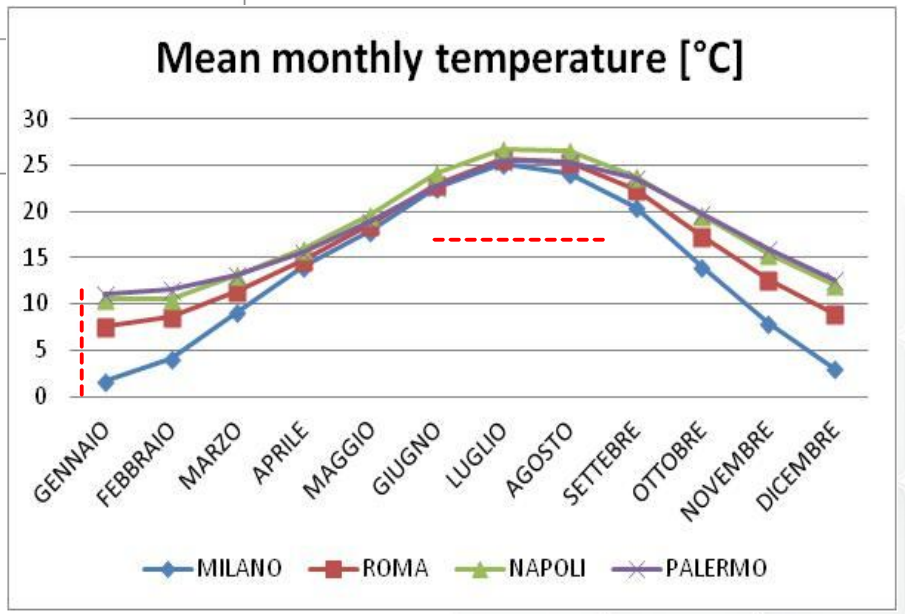
How size and installation site influence payback period





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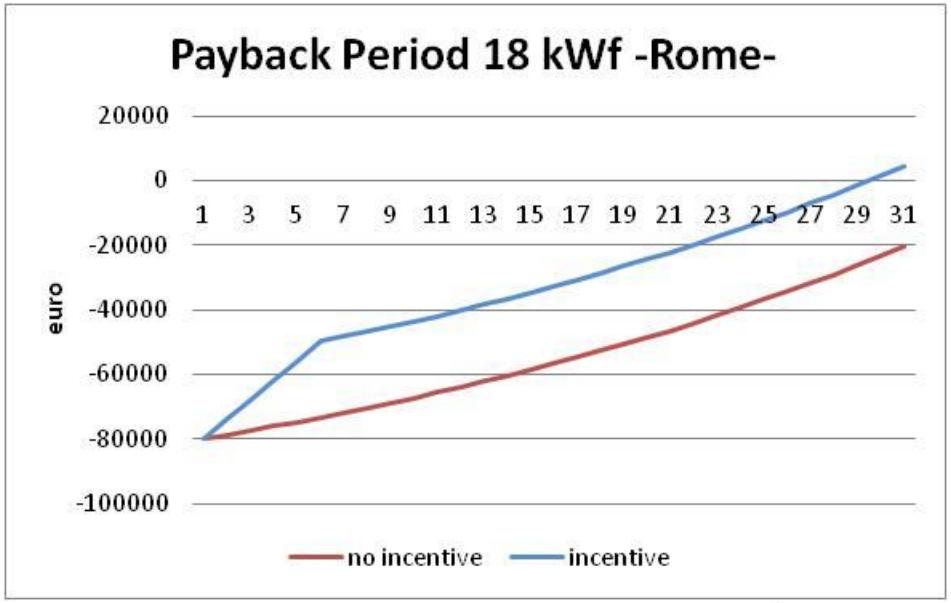
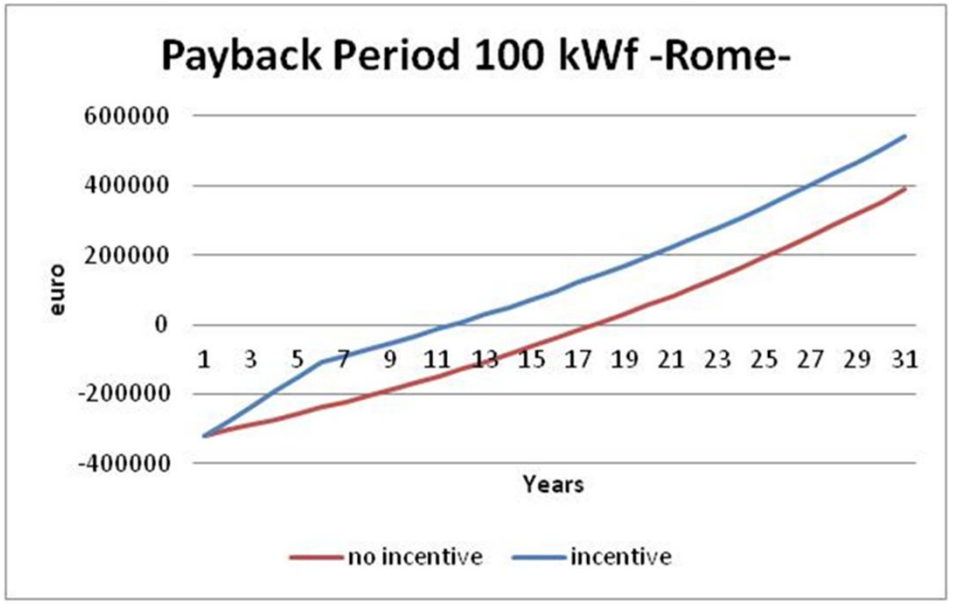
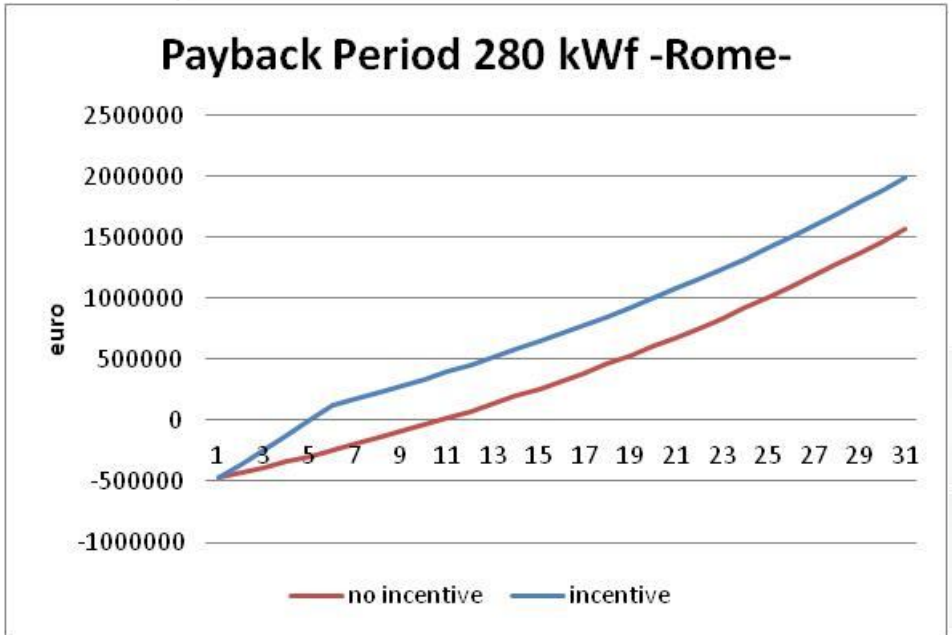
How size and installation site influence payback period







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SH&C: Incentive system in Italy

Technology	C_i if solar field is ≤ 50 mq	C_i if solar field is > 50* mq
Solar heating	170 (€/mq)	55 (€/mq)
Solar heating & cooling	255 (€/mq)	83 (€/mq)
Solar heating (concentrated solar panels)	221 (€/mq)	72 (€/mq)
Solar heating & cooling (concentrated solar panels)	306 (€/mq)	100 (€/mq)
INCENTIVE Period	**2 years**	**5 years**

$$I_{y,tot} = C_i \times S_i$$

** Up to 1000 m²*

Es. SH&C:
P_f = 18 kW
Solar field = 56 m² (gross area)

$$I_{tot} = C_i \times S_i \times n^o years = 83 \times 56 \times 5 = \mathbf{23{,}240.0\ €}$$

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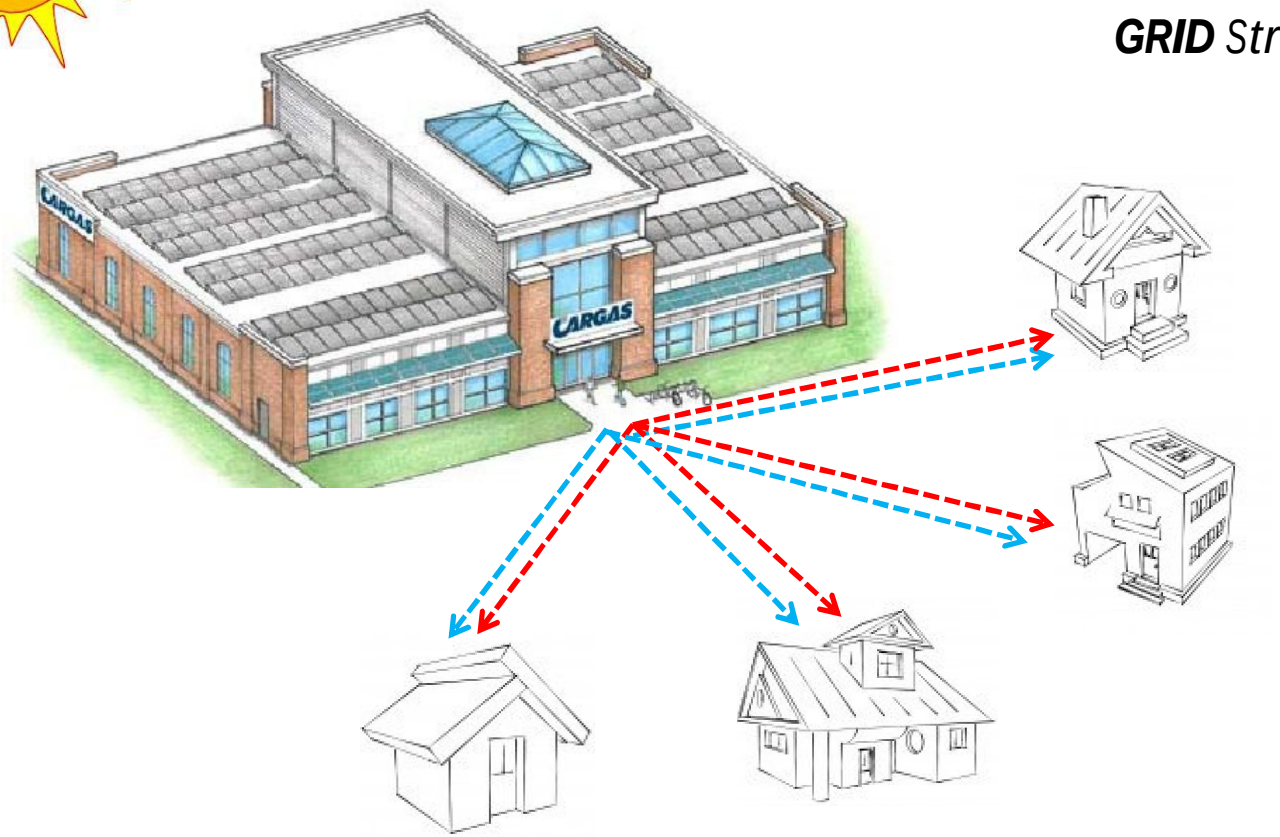
How size and installation site influence facility's performances

Economical Convenience for big sizes...

***GRID** Structure!*



Conclusions

- *SH&C very dependent on **location** & facility's **size**;*
- ***Incentives**;*
- ***Grid** structure*

Contacts

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