SAM.SSA

Sugar Alcohol based Materials for Seasonal Storage Applications

The SAM.SSA project

Sugar Alcohol based Materials for Seasonal Storage Applications

6th Progress Meeting –17~18 March 2015
Avala, SPAIN

SEVENTH FRAMEWORK PROGRAMME

SAMSSA

Sugar Alcohol based Materials for Seasonal Storage Applications

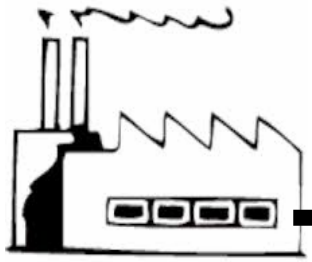
COVENTIONAL THERMAL ENERGY STORAGE APPLICATIONS

SEVENTH FRAMEWORK PROGRAMME

DIRECT
HEATING STORAGE

Domestic

Commercial



Industrial

TES

Solar

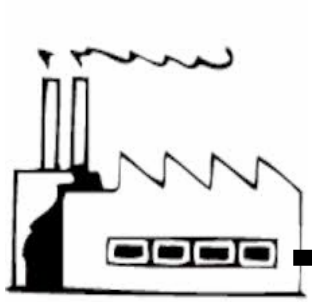
Boiler

Heat Pumps

INDIRECT
HEATING STORAGE

Domestic

Commercia



Industrial

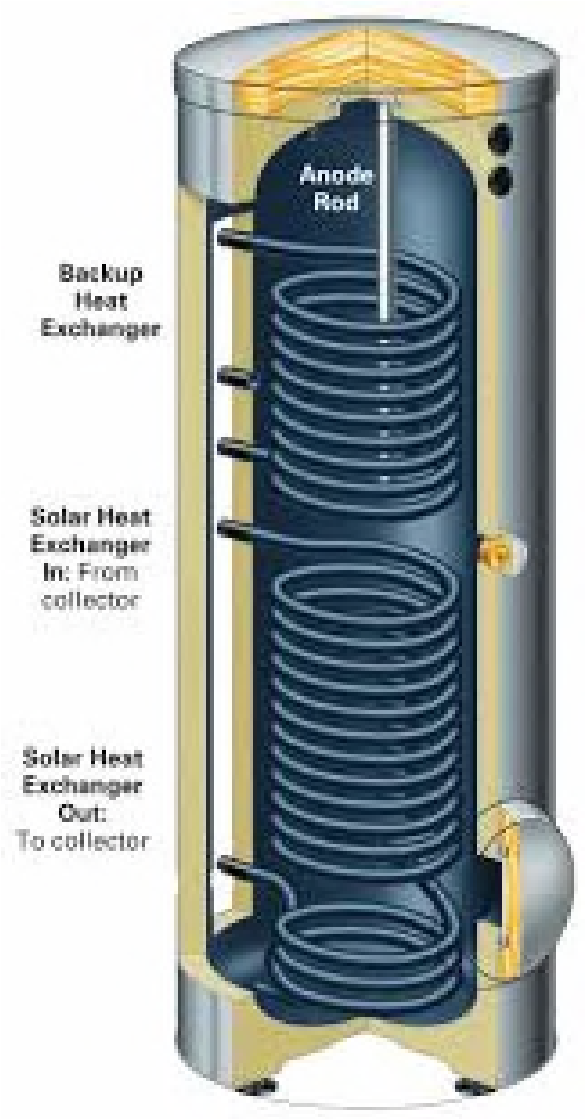
TES

Solar

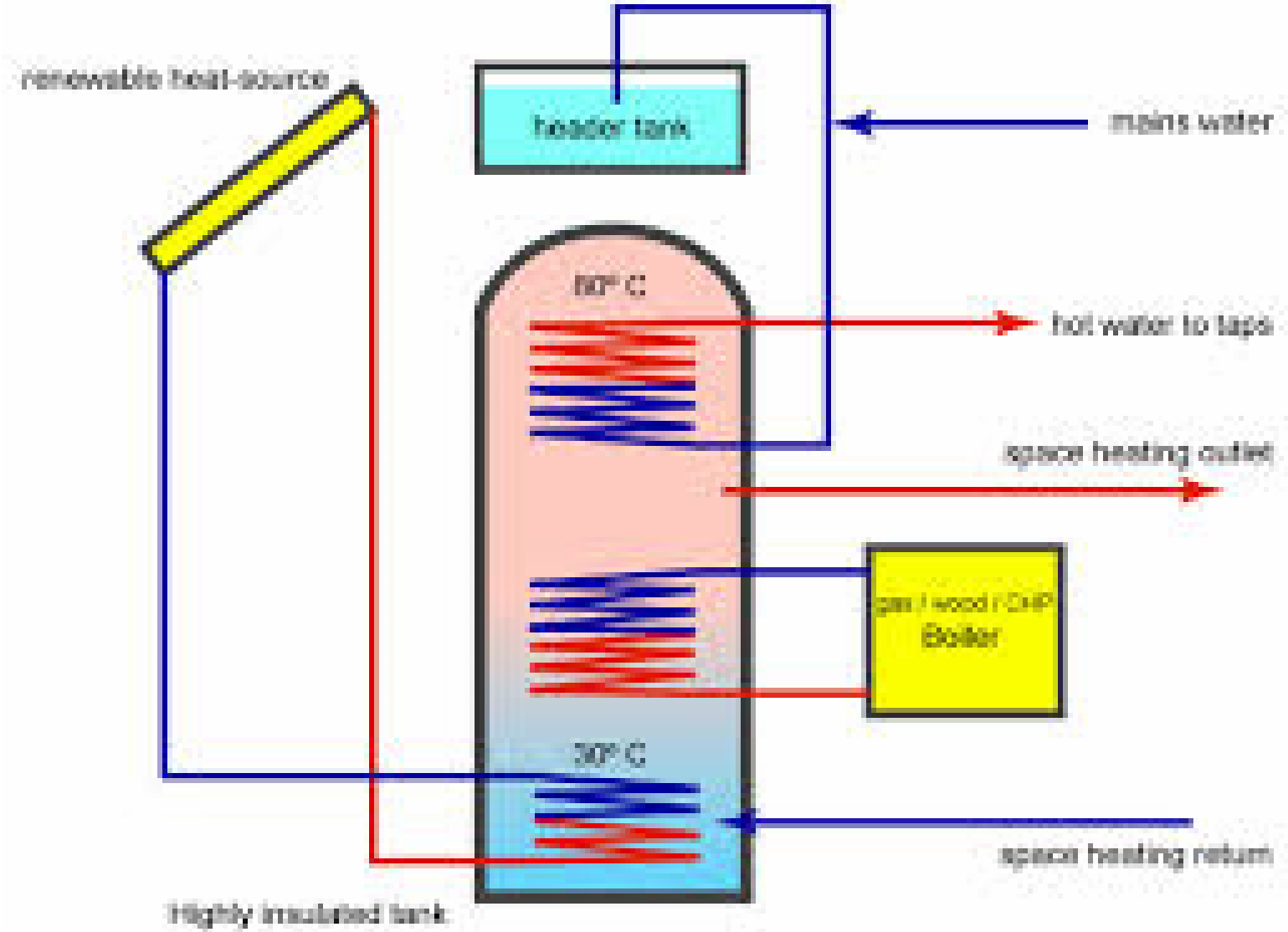
Boiler

Heat Pumps

EXISTING HOT WATER STORAGE TANKS



COVENTIONAL STORAGE CONCEPT



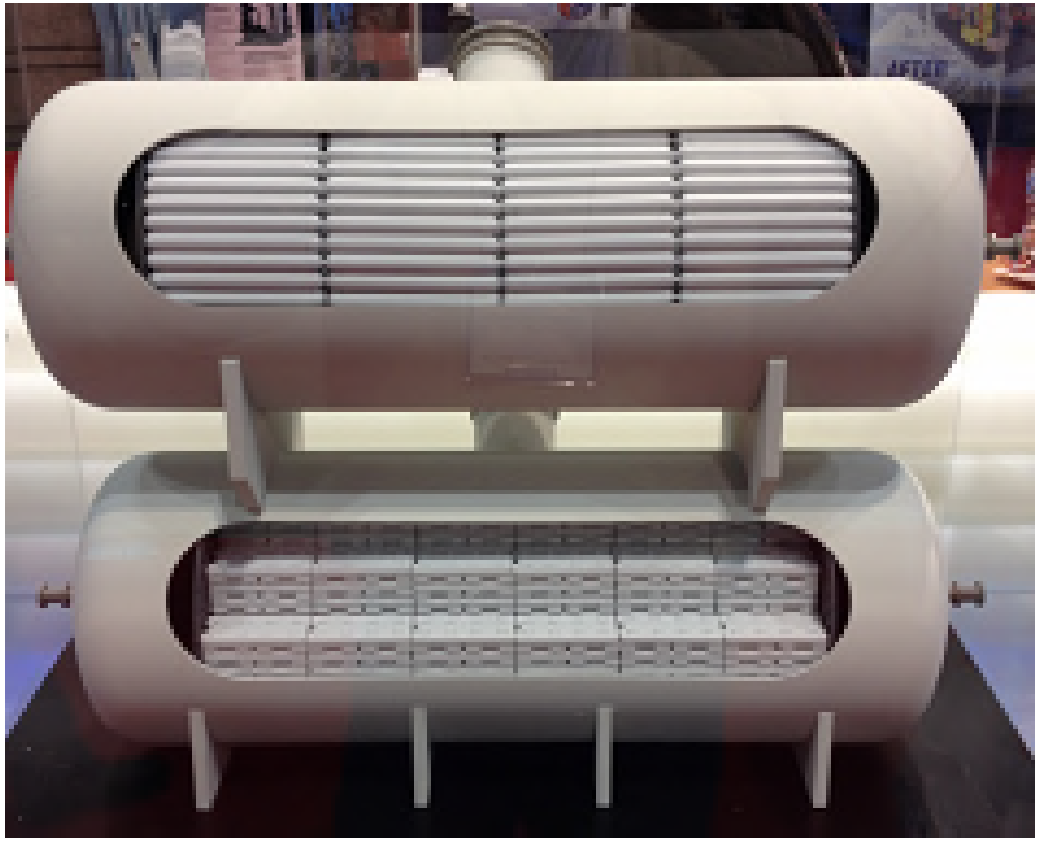
SAMSSA

Sugar Alcohol based Materials for Seasonal Storage Applications

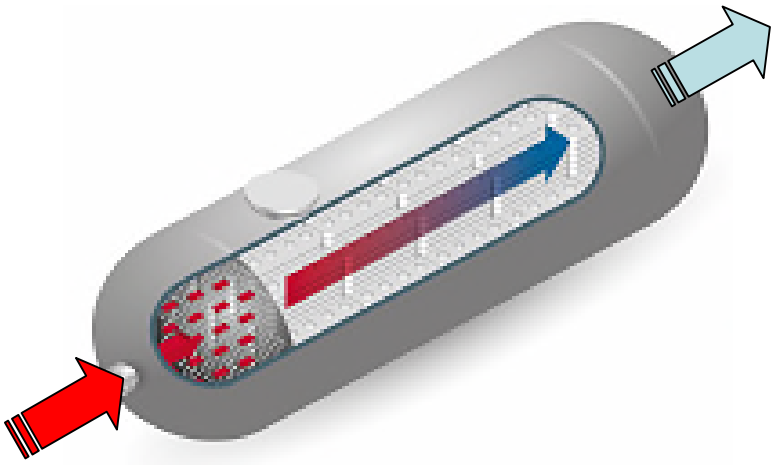
PCM BASED THERMAL ENERGY STORAGE APPLICATIONS

SEVENTH FRAMEWORK PROGRAMME

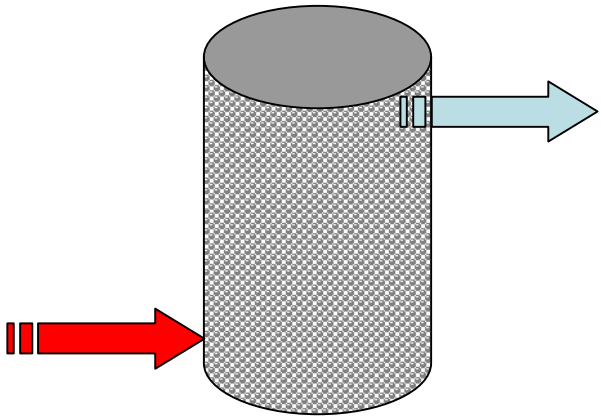
CURRENT PCM BASED THERMAL ENERGY STORAGE PRODUCTS



PCM ENERGY STORAGE OEPARATION



CHARGING



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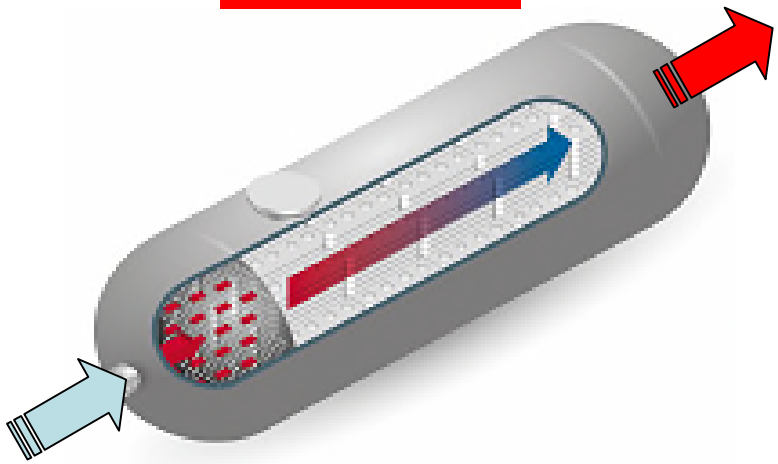

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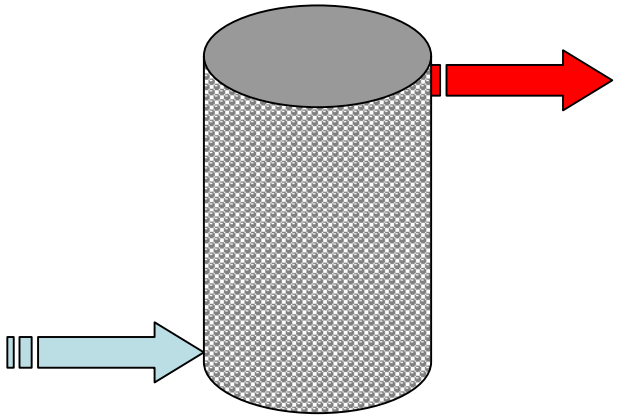


CHARGING

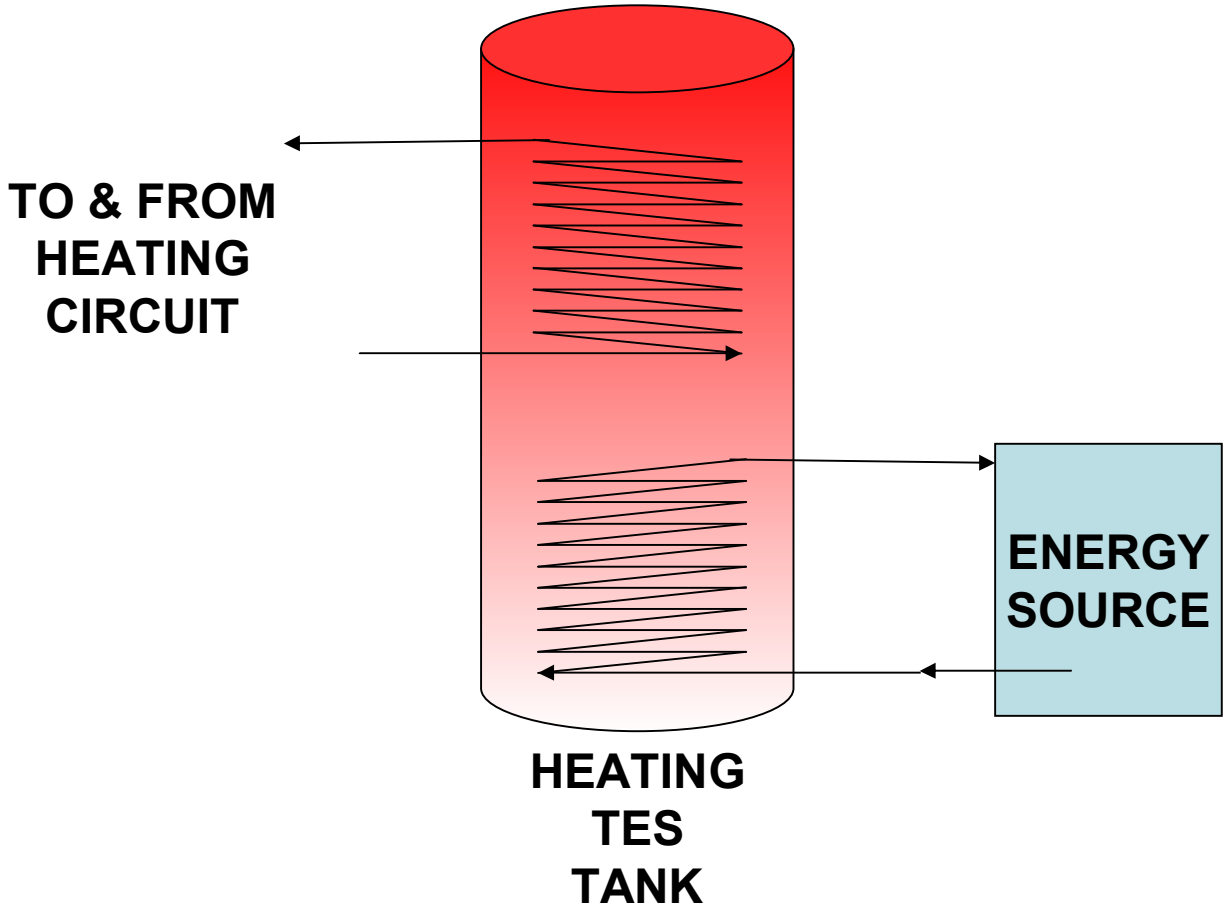
SAMSSA

Sugar Alcohol based Materials for Seasonal Storage Applications

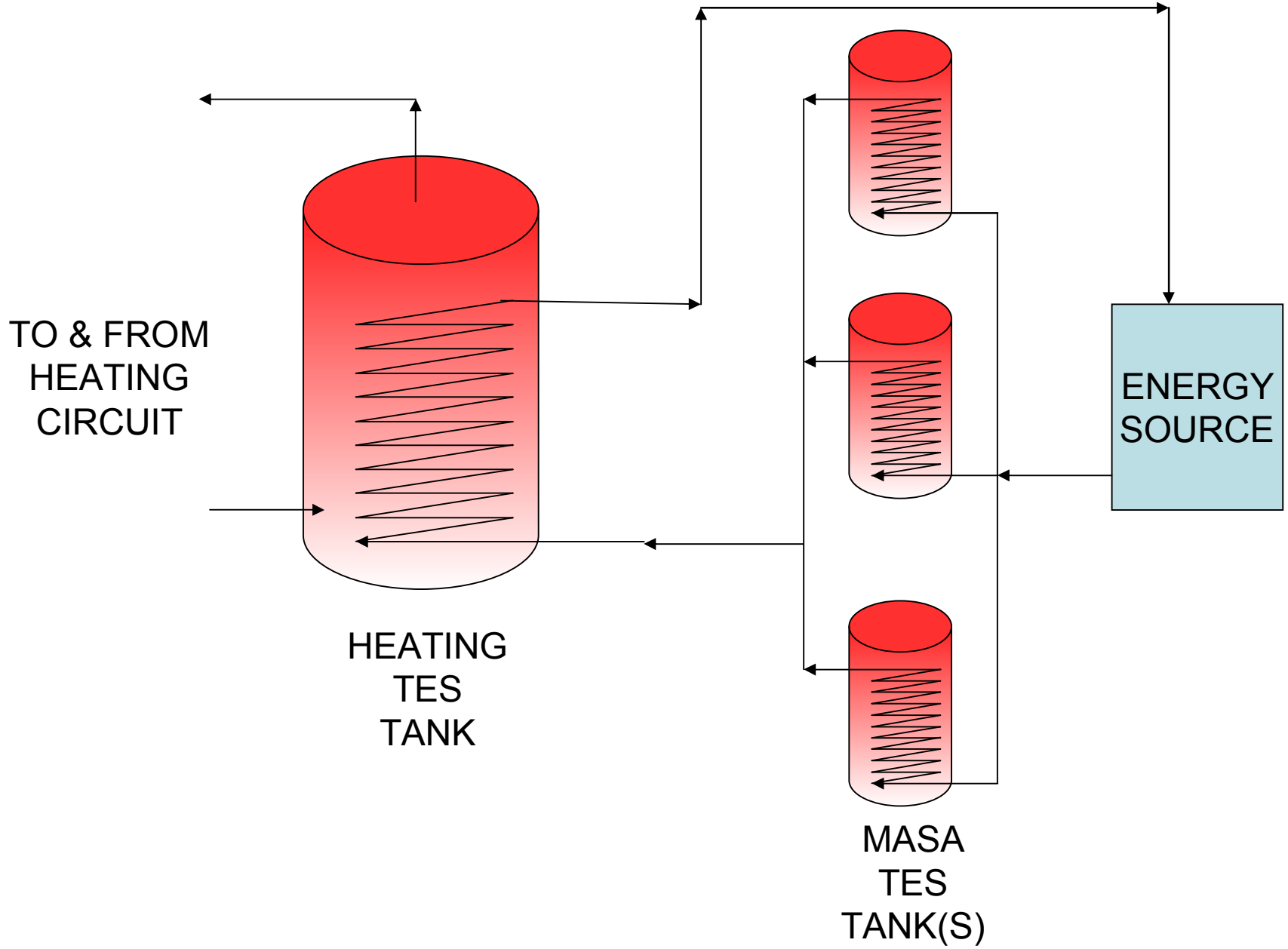
MASA
THERMAL ENERGY STORAGE APPLICATIONS

SEVENTH FRAMEWORK PROGRAMME

CENTERALISED MASA ENERGY STORAGE



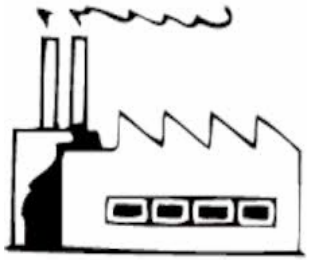
DISTRIBUTED MASA ENERGY STORAGE



SEASONAL LOCAL SOLAR MASA ENERGY STORAGE

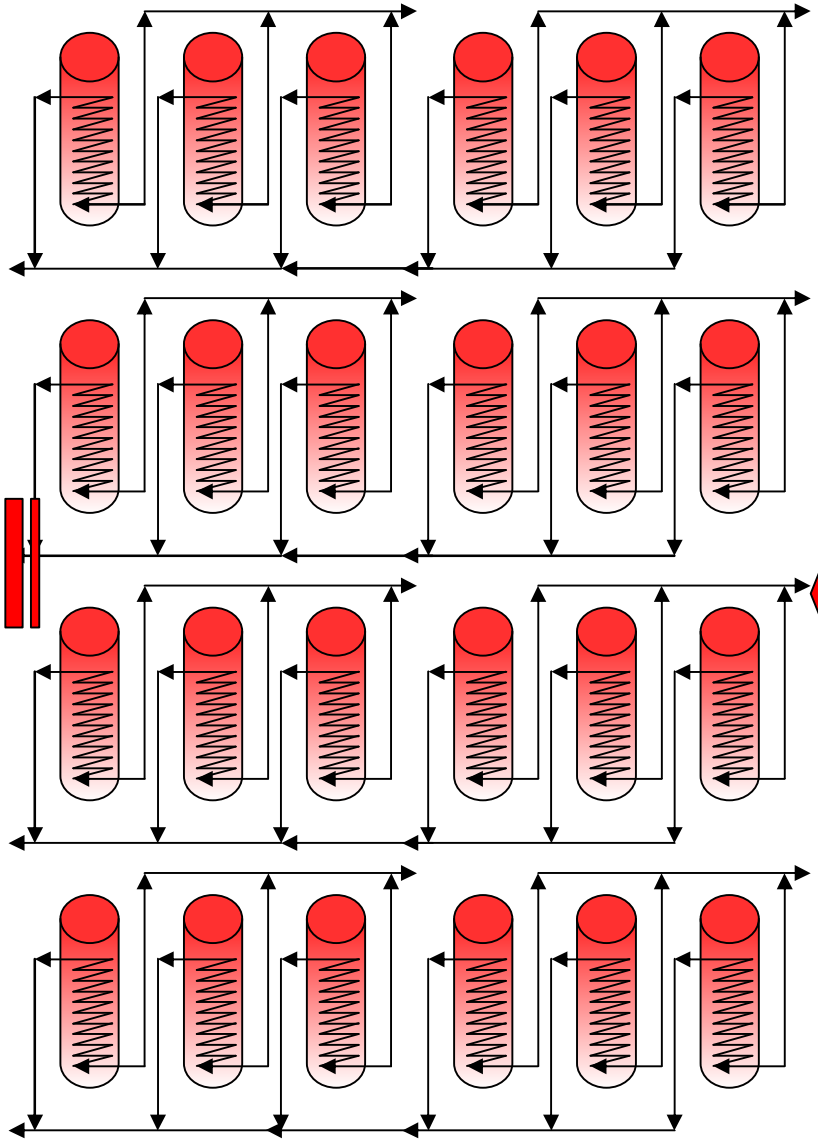
Domestic

Commercial



Industrial

USAGE



ENERGY STORAGE

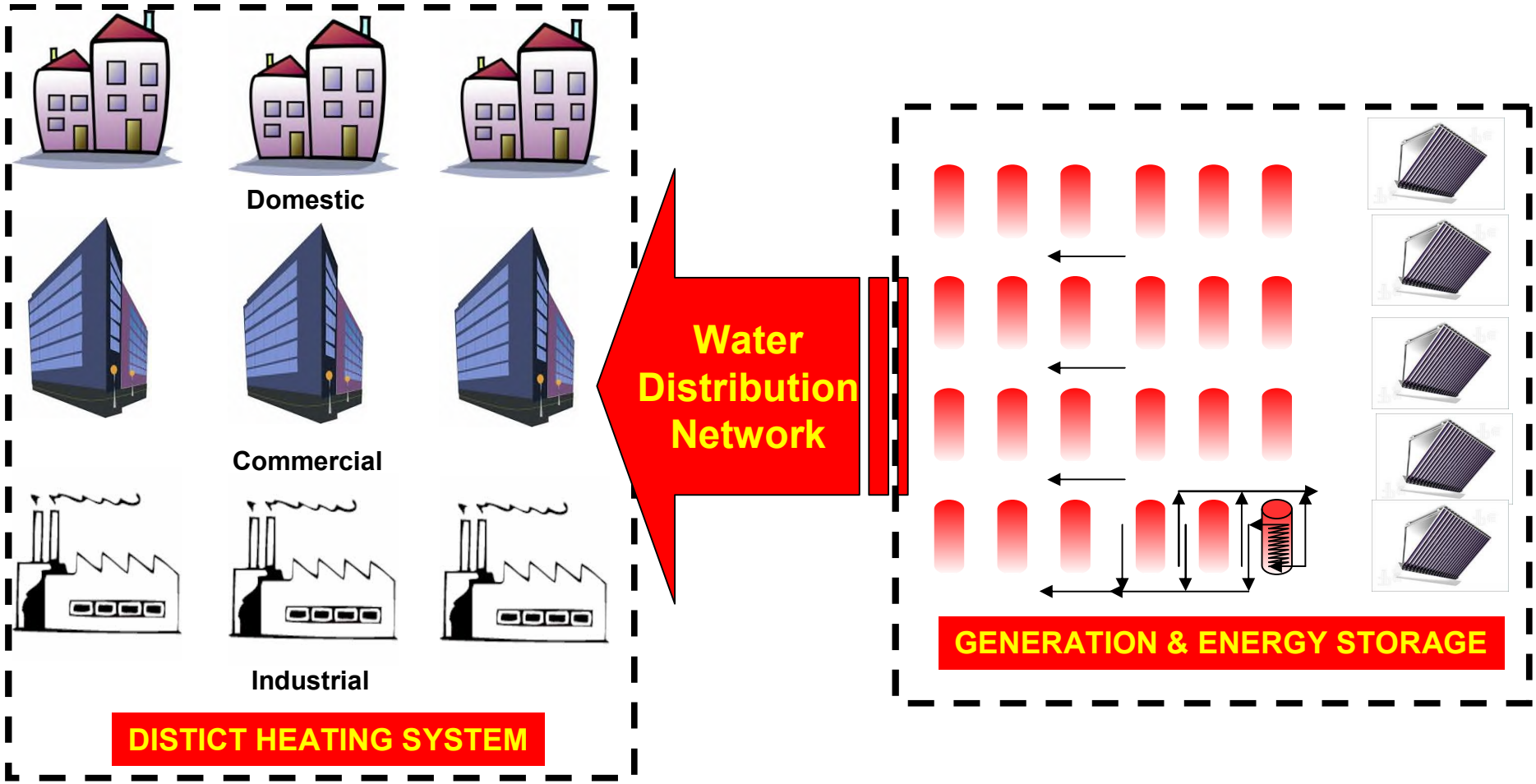
SOLAR

WASTE HEAT

PROCESS

GENERATION

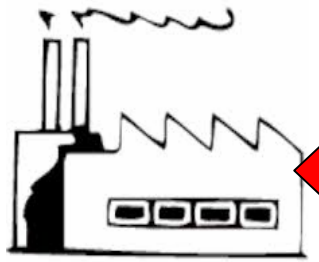
SEASONAL DISTRICT SOLAR MASA ENERGY STORAGE



SEASONAL DISTRIBUTED SOLAR MASA ENERGY STORAGE

Domestic

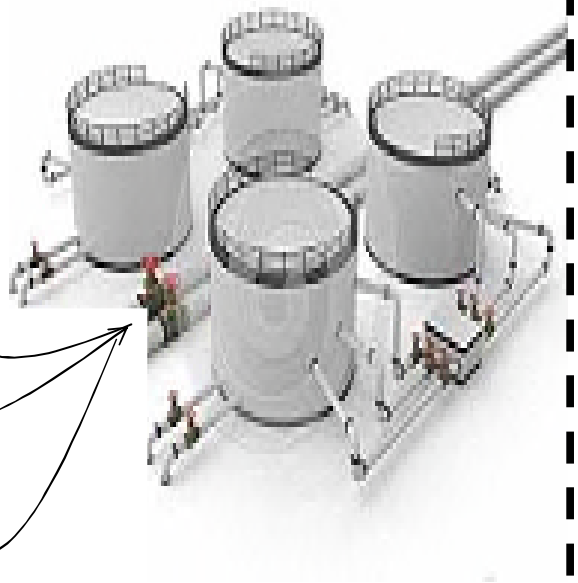
Commercial



Industrial

USAGE

TRANSPORT



CENTRALISED ENERGY STORAGE CENTER

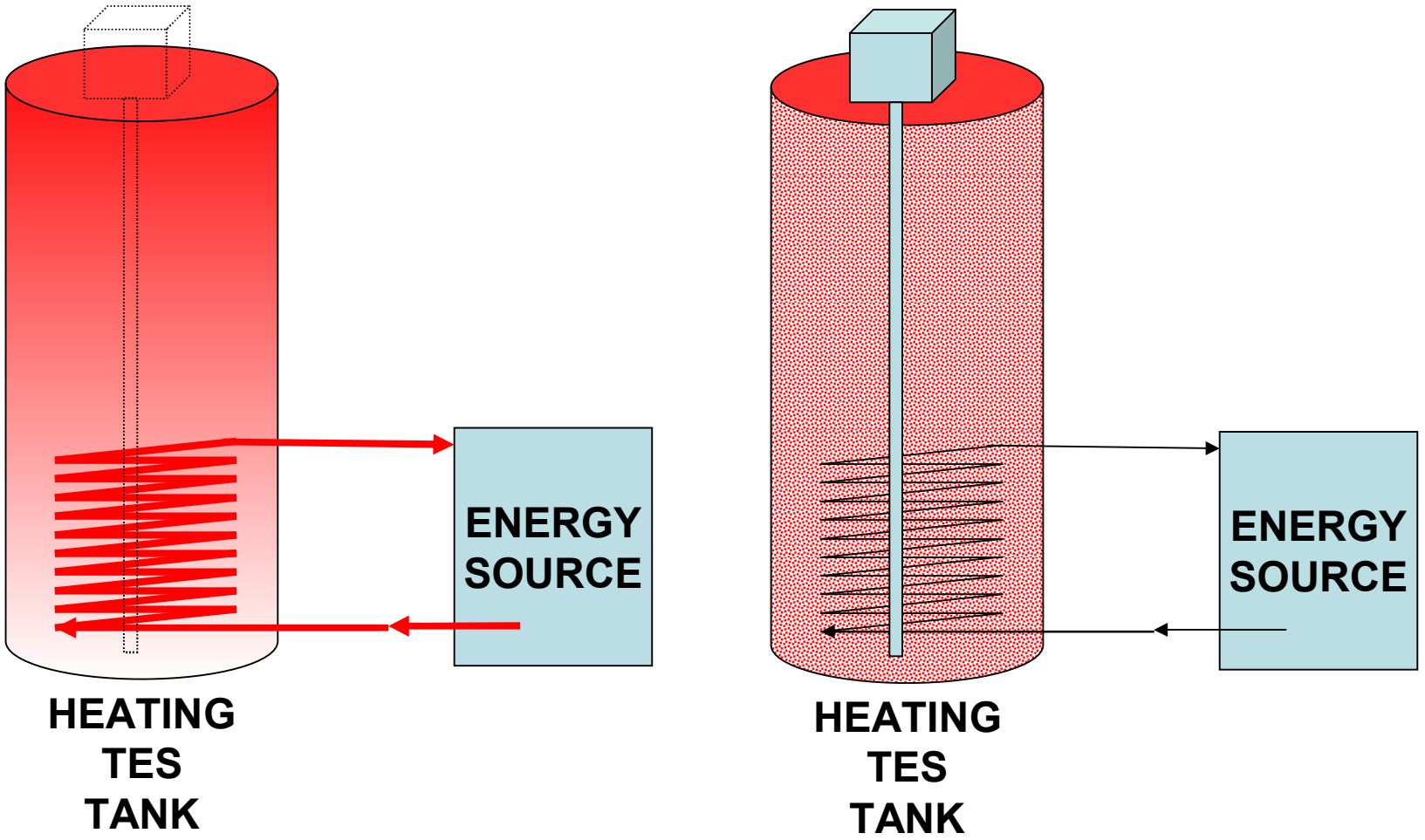
SOLAR

WASTE HEAT

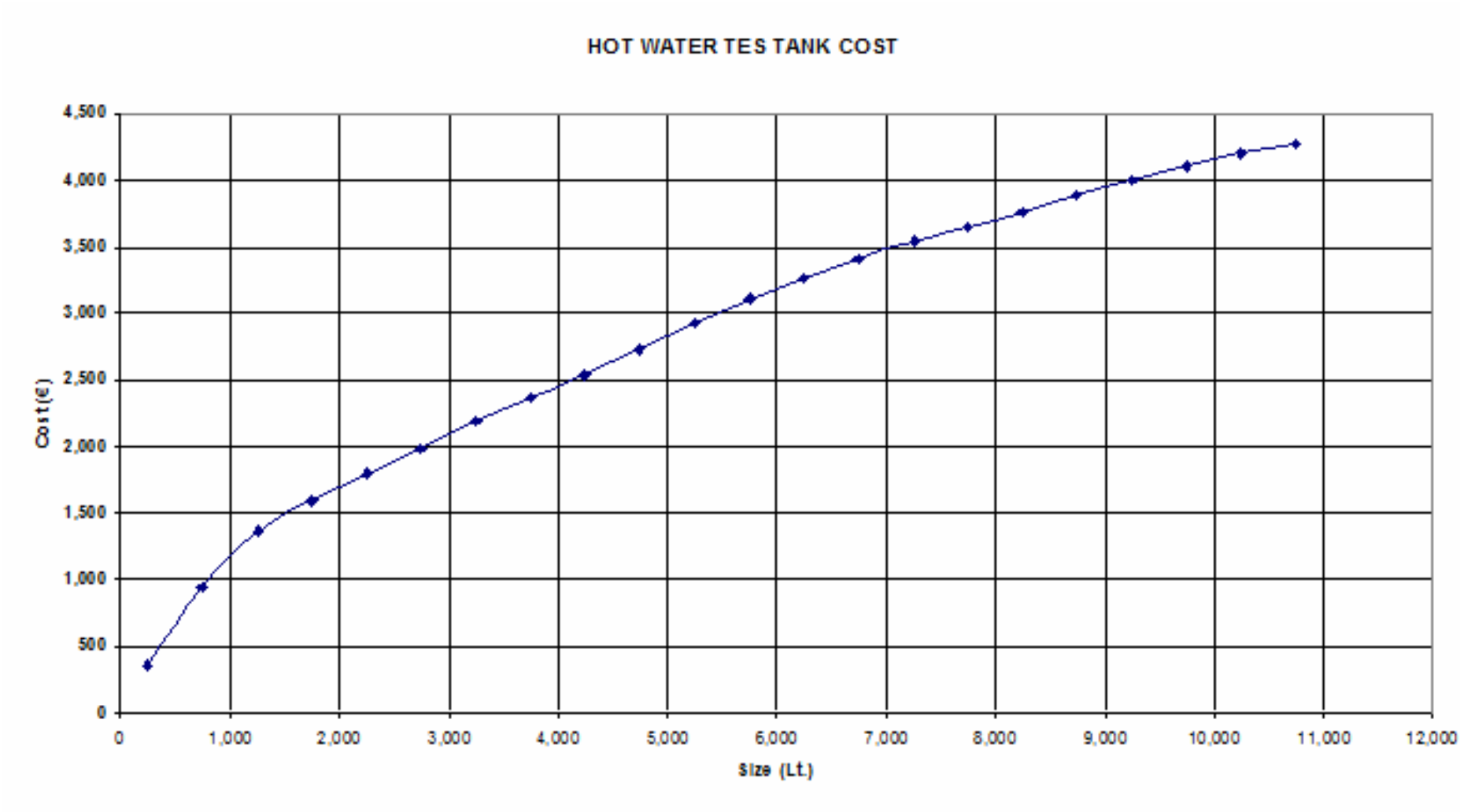
PROCESS

GENERATION

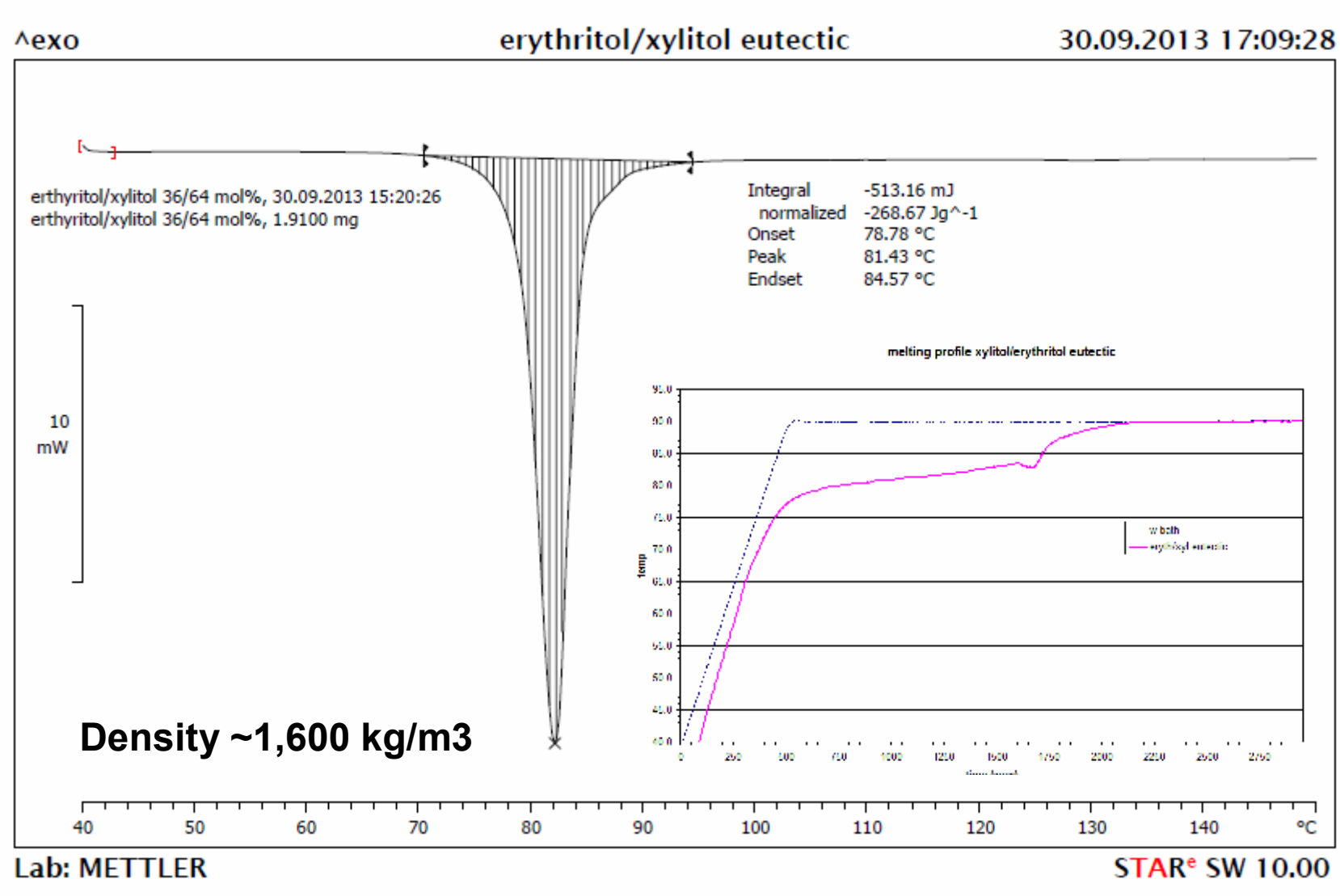
MASA ENERGY STORAGE



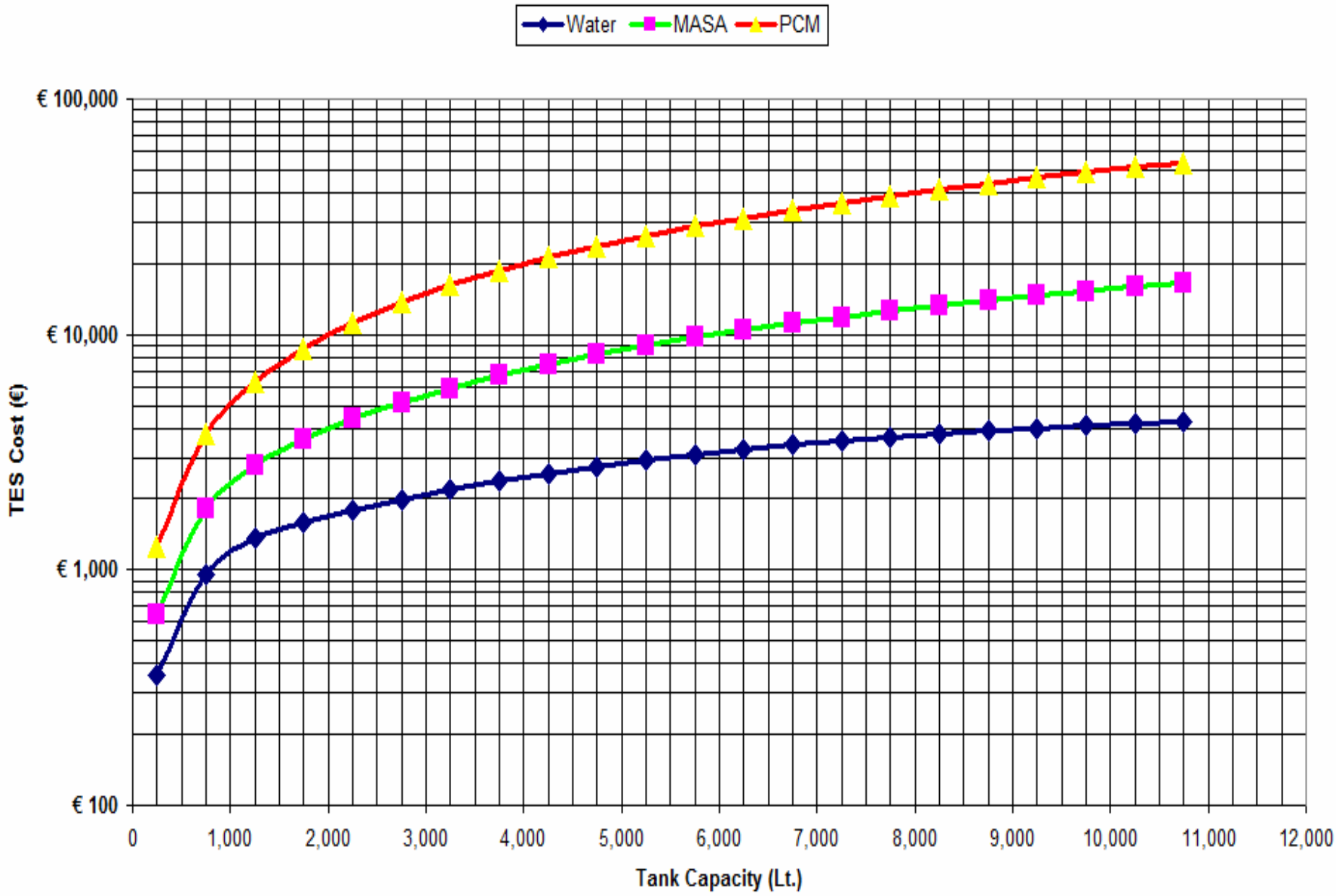
CHARGING **DISCHARGING**


HOT WATER TES TANK COST
Cost(€)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
Size (Lt.)

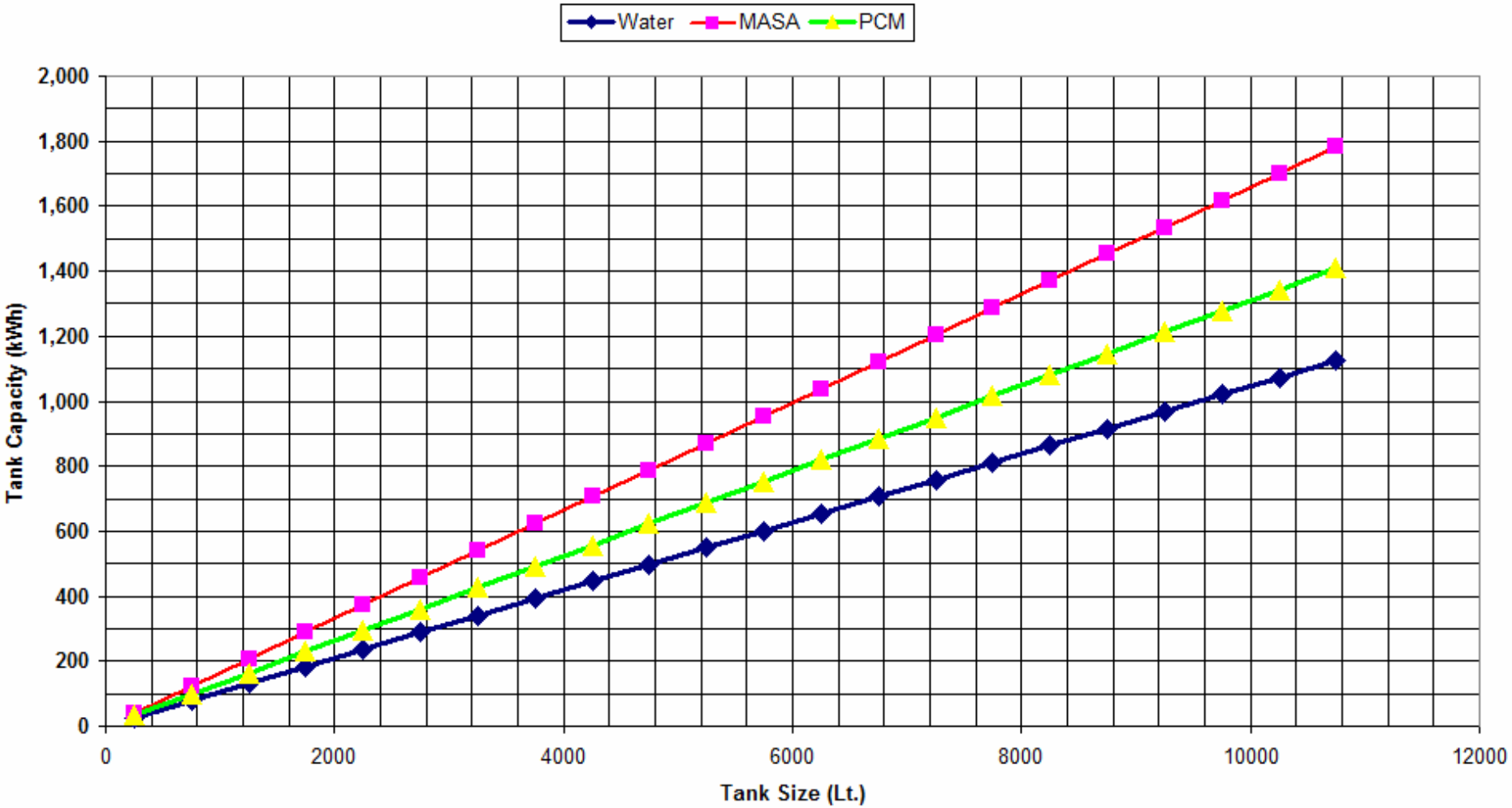
OPTIMUM MASA-82 COMBINATION



HEAT ENERGY STORAGE COST STUDY



TES CAPACITY

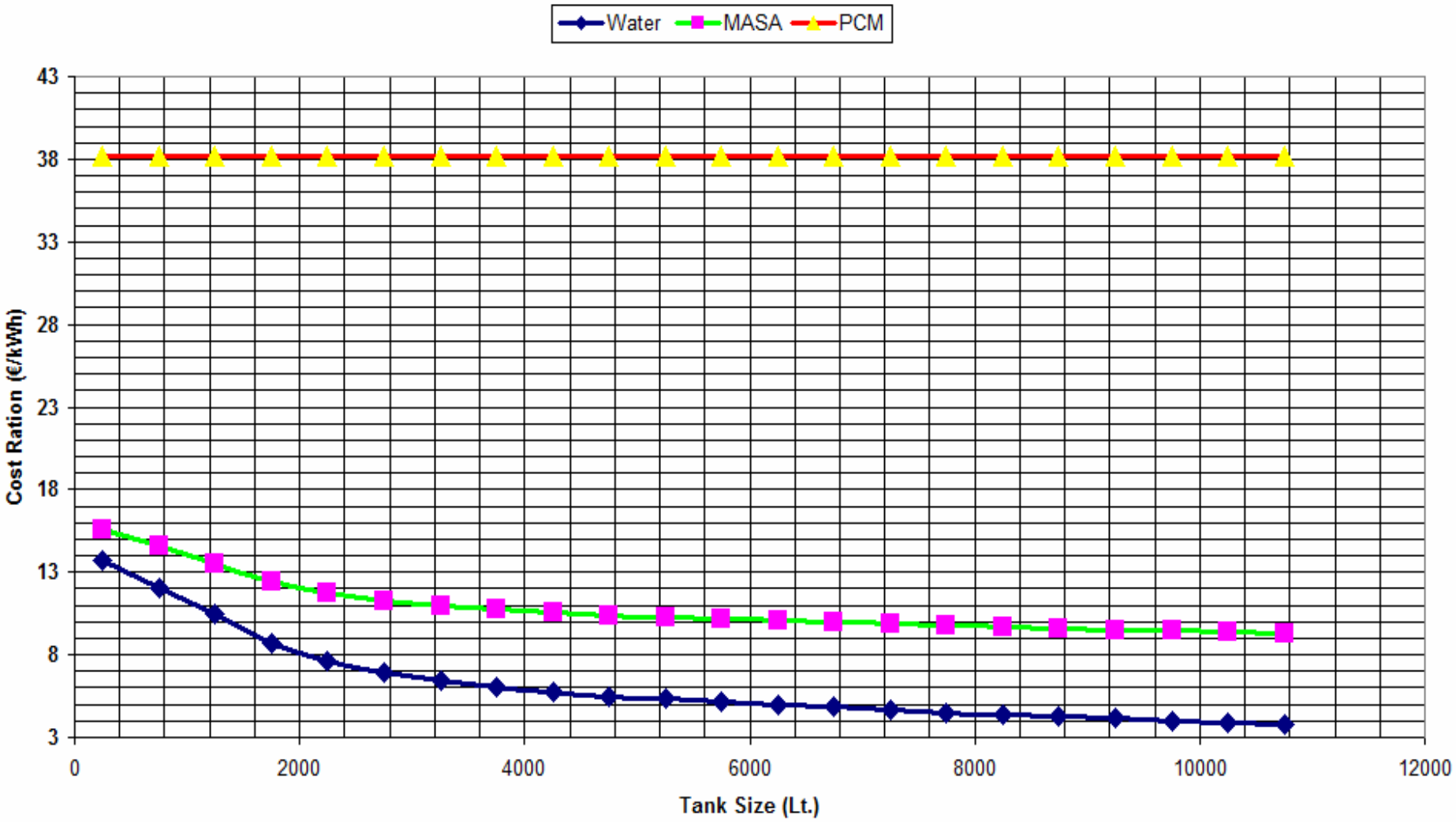


-Hot water tank temperature rise based on 25K (65C down to 40C)

****-PCM temperature rise based on 25K sensible heat capacity (65C down to 40C)***

*****-MASA temperature rise based on 25K sensible heat capacity (65C down to 40C)***

TES CAPACITY RATIOS

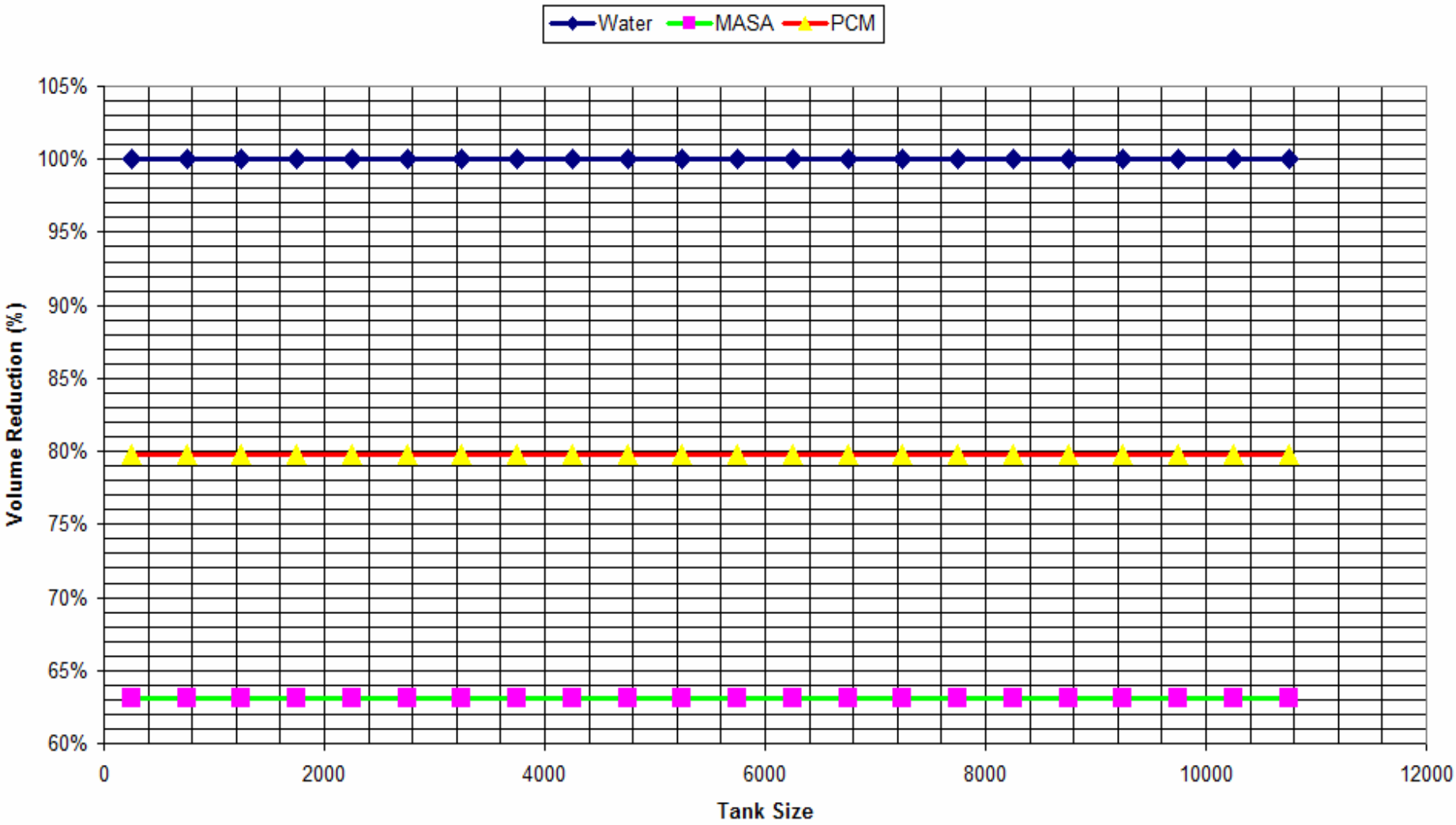


**-Hot water tank temperature rise based on 25K (65C down to 40C)*

***-PCM temperature rise based on 25K sensible heat capacity (65C down to 40C)*

****-MASA temperature rise based on 25K sensible heat capacity (65C down to 40C)*

VOLUME REDUCTION STUDY

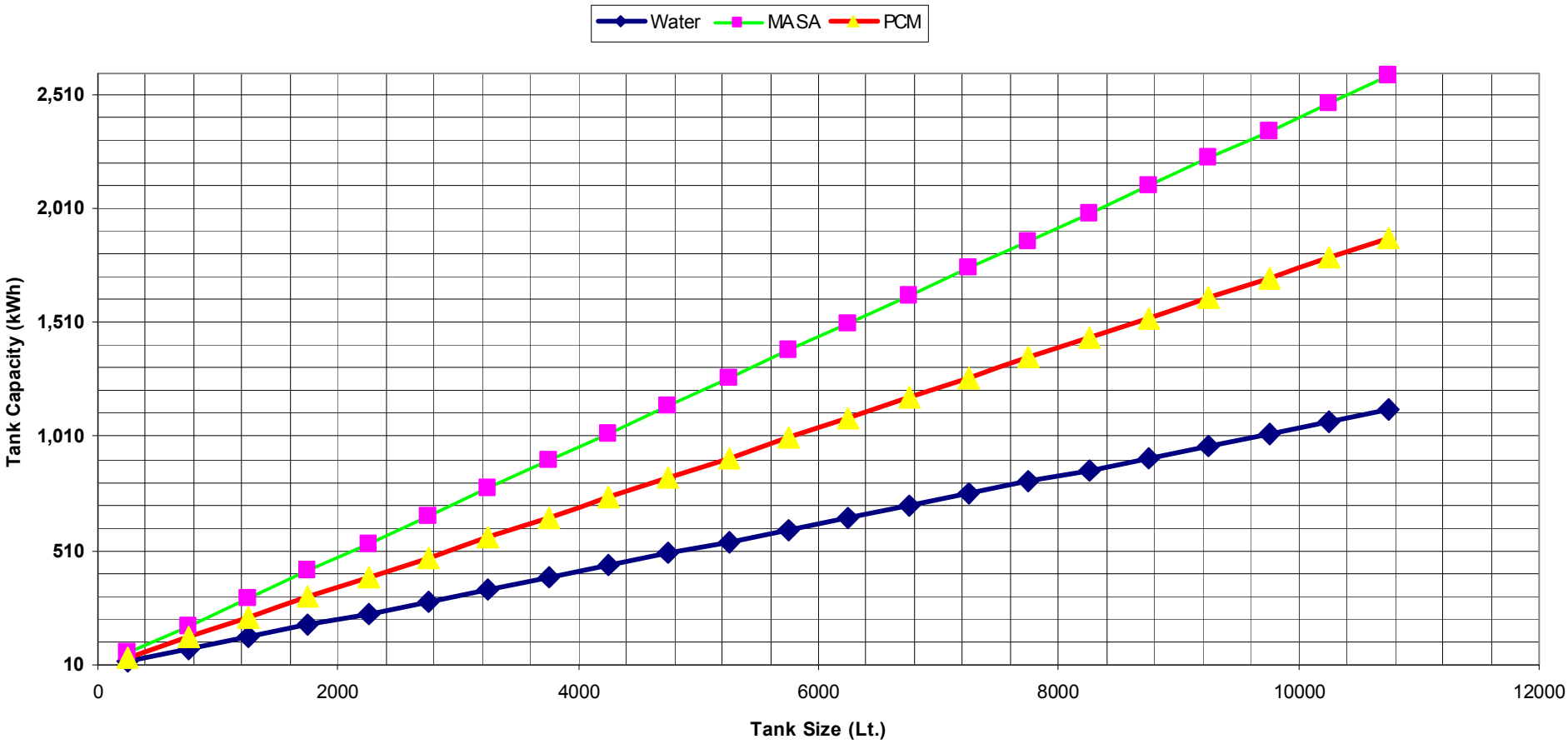


-Hot water tank temperature rise based on 25K (65C down to 40C)

****-PCM temperature rise based on 25K sensible heat capacity (65C down to 40C)***

*****-MASA temperature rise based on 25K sensible heat capacity (65C down to 40C)***

High Temperature MASA TES CAPACITY STUDY

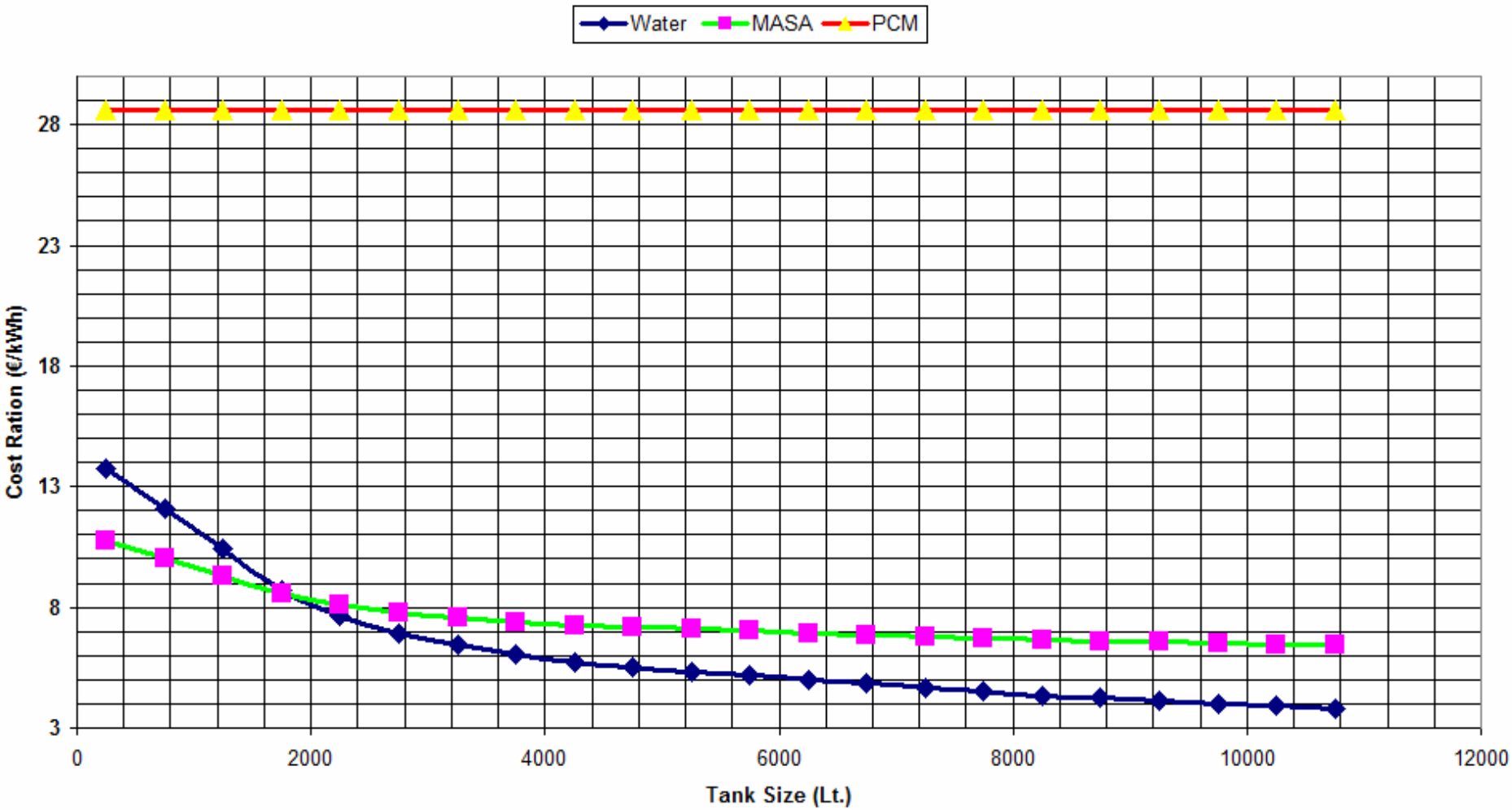


-Hot water tank temperature rise based on 25K (65C down to 40C)

****-PCM temperature rise based on 124K sensible heat capacity (164C down to 40C)***

*****-MASA temperature rise based on 124K sensible heat capacity (164C down to 40C)***

High Temperature TES COST RATIOS

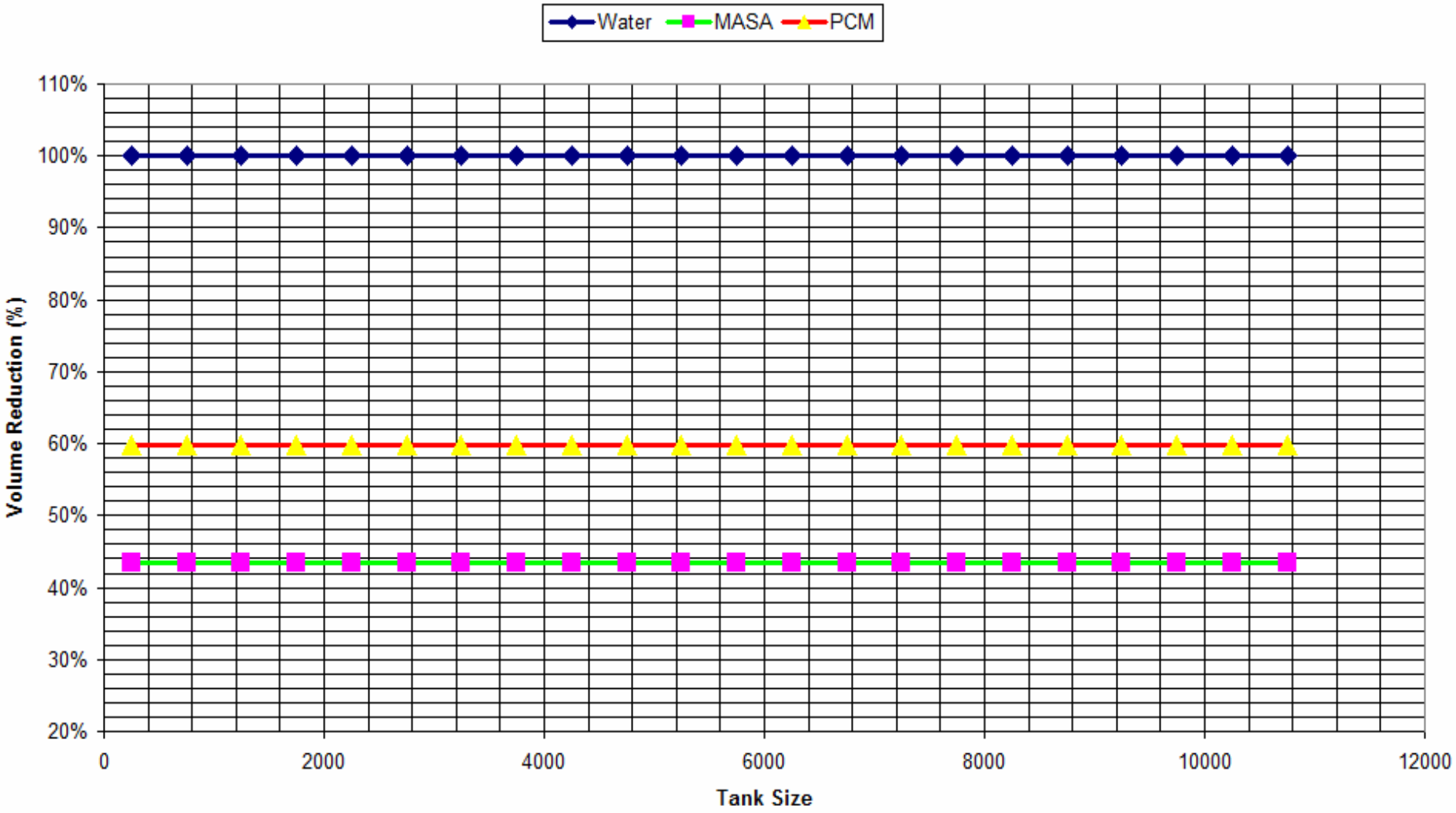


-Hot water tank temperature rise based on 25K (65C down to 40C)

****-PCM temperature rise based on 124K sensible heat capacity (164C down to 40C)***

*****-MASA temperature rise based on 124K sensible heat capacity (164C down to 40C)***

High Temperature MASA & PCM VOLUME REDUCTION STUDY

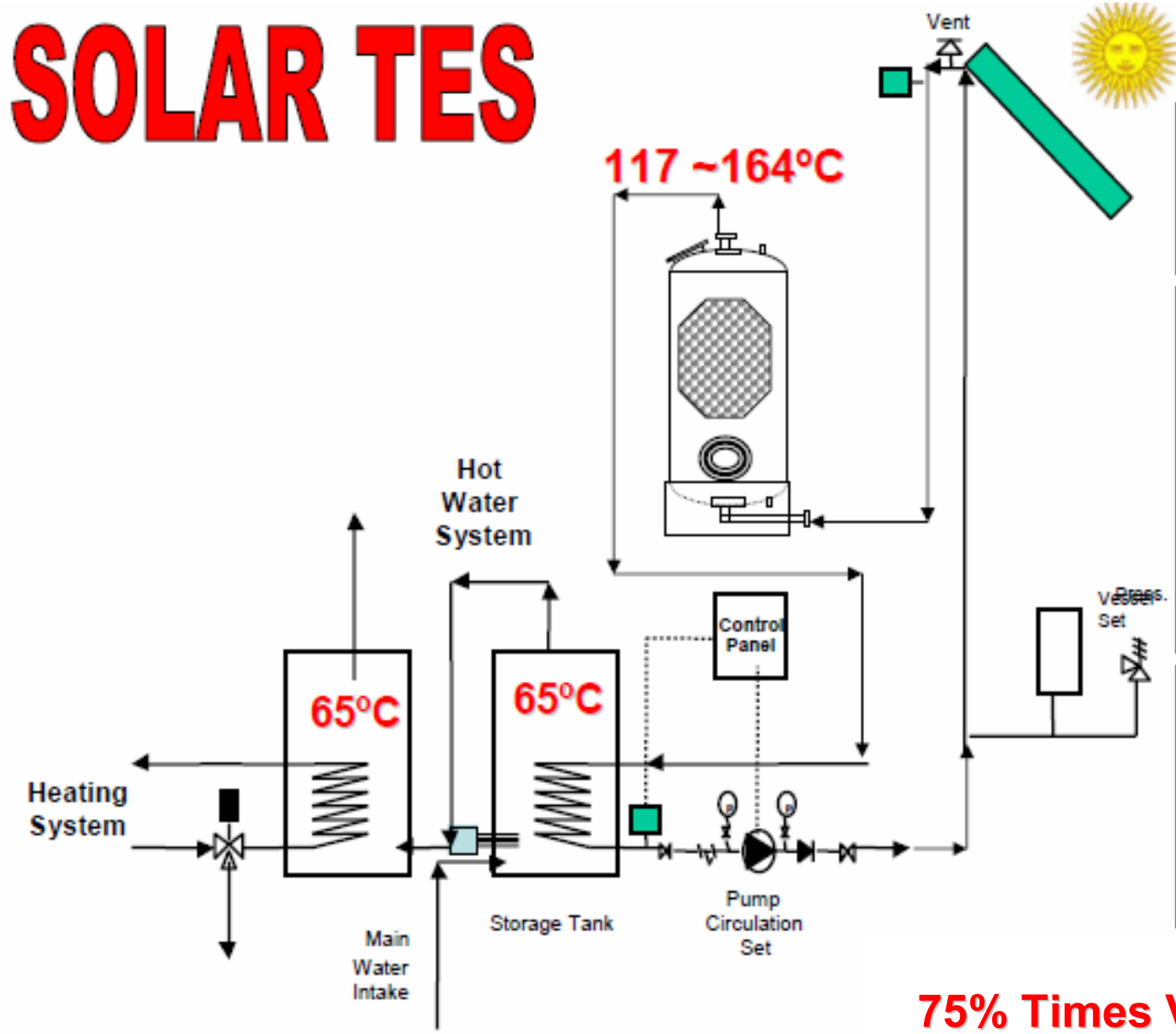


-Hot water tank temperature rise based on 25K (65C down to 40C)

****-PCM temperature rise based on 124K sensible heat capacity (164C down to 40C)***

*****-MASA temperature rise based on 124K sensible heat capacity (164C down to 40C)***

SOLAR TES



Q= m x Cp x ΔT
1m3 Tank

Conventional
ΔT = 65-15 = 50°C
Q=(1000x4.186x50)/3600
58 kWh

PCM TES
ΔT = 65-15 = 50°C
Q1=29kWh
+
PCM LATENT HEAT
Q2= (750kg x 200 Kj/kg)/3600
Q2= 42 kWh
Q= Q1 + Q2
71 kWh

HT-PCM TES
ΔT = 164-65 = 99°C
Q3=(1000x4.186x99)/3600
Q3 = 115 kWh
Q=Q1+Q2+Q3
244 kWh

75% Times Volume Reduction

CONCLUSION

- Major issues regarding charging & discharging the MASA
- Nucleation Issues
- Volume reduction is less than original target
- Custom-made tank design required
- Distributed TES is promising
- Small scale domestic application are promising options