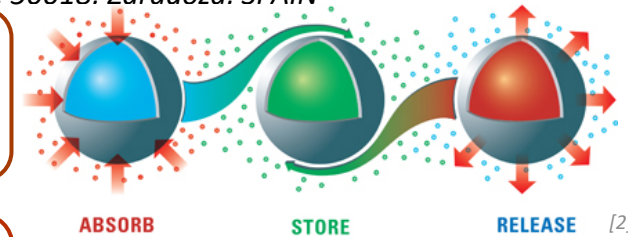


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INTRODUCTION

Agro-industry and food industry accounts almost for 30% of the global energy consumption and 20% of greenhouse gases emissions [1] → Great improvement potential by means of solar heat in industrial processes (SHIP) applicable in low-temperature processes (below 200 °C). Conventional sensible heat storage tank based on water can be enhanced in energy efficiency and savings by latent heat storage coupling with phase change materials (PCMs), mitigating the mismatch between solar energy supply and industrial processes demand.



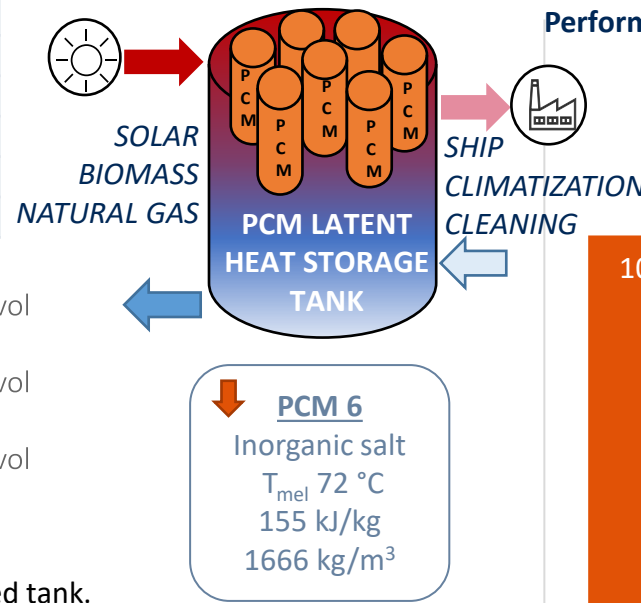
METHODOLOGY

Assessment of key parameters of innovative PCM storage by a parametric analysis in comparison to a water-based tank (90°C storage, 5 m³) to find a suitable and technically viable solution: Type (inorganic, organic, eutectic); Melting point (52-72 °C), Latent heat capacity H_{fus} (145-240 kJ/kg), Integrated volume (10, 20, 30%). In a second stage, the stored energy, solar fraction and system savings will be evaluated using an in-house dynamic simulation model developed in TRNSYS coupled to a Java application (JEPlus).

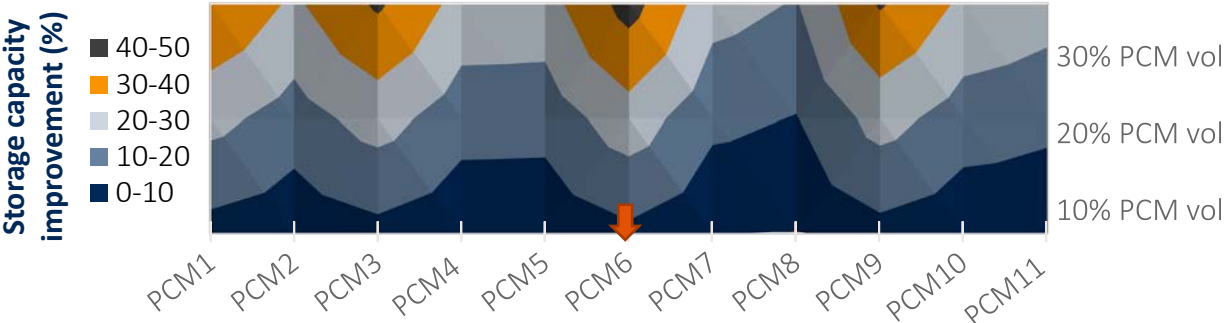
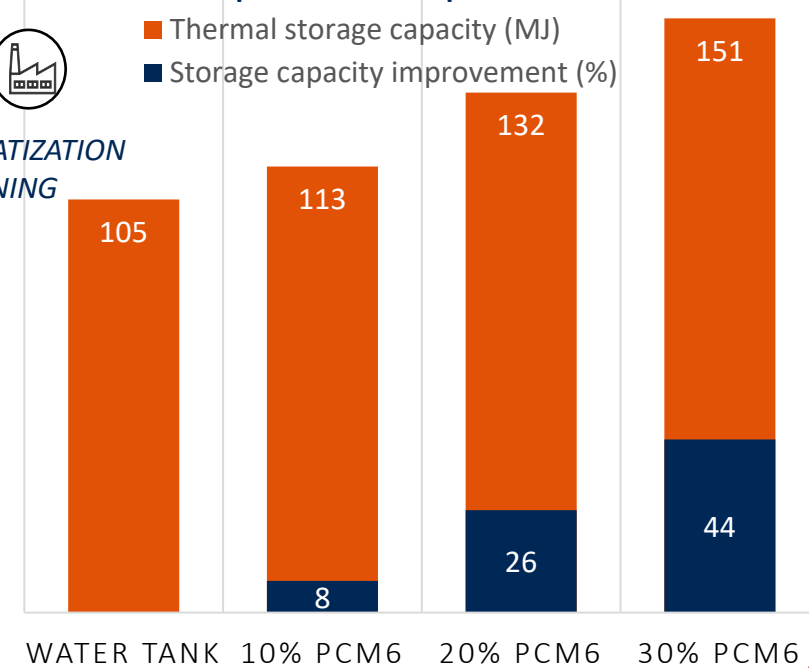
A system design based on PCMs is analysed as potential alternative to be integrated in industrial and agro-industrial sectors

RESULTS AND CONCLUSIONS

PCM vol	PCM1	PCM2	PCM3	PCM4	PCM5	PCM6	PCM7	PCM8	PCM9	PCM10	PCM11
10 %	7	3	7	2	2	8	1	-0.2	7	3	2
20 %	23	16	24	14	14	26	13	10	24	15	13
30 %	40	28	42	27	26	44	24	19	41	28	24
T_{mel} (°C)	58	58	58	61	70	72	68	82	52	57	67
H_{fus} (kJ/kg)	200	240	145	220	225	155	213	170	215	210	183



Performance improvement compared to a 5 m³ water tank



- Storage capacity is enhanced up to 44% for the same volume as conventional water-based tank.
- The more PCM volume, the more storage capacity; but the water volume available is reduced → a compromise must be found.
- PCM parameters strongly influence the stored energy, the solar fraction and the overall system savings.
- A proper selection evaluation must be done according to the application to avoid loss of performance.