SPECIFIC HEAT & LATENT HEAT OF FUSION Unit20

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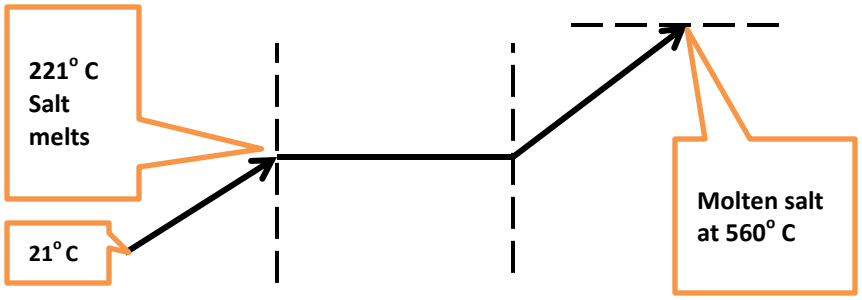
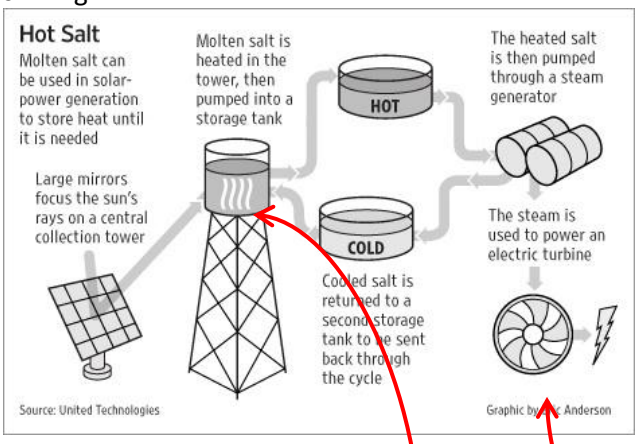
& NYTimes January 3,2012 by Matthew L Ward , Please send Dr Cise an e-mail on how you used this NYTimes physics application.

STOREHOUSES FOR SOLAR ENERGY: MOLTON SALT



A completed solar power tower at the SolarReserve Crescent Dunes Solar Energy Plant, Tonopah, Nev., expected to be in service in 2013.

If solar energy is eventually going to matter — that is, generate a significant portion of the nation's electricity — the industry must overcome a major stumbling block, experts say: finding a way to store it for use when the sun isn't shining.



INTRODUCTION: The storage tank of molten salt heated by the sun is 9.1 m high and 12 m in radius. Density of salt is 2170 kg/m^3, specific heat of solid salt = 0.88 KJ/Kg^{o}C , specific heat of molten salt = 1.6 KJ/Kg^{o}C, Salt Latent heat of fusion=260 KJ/Kg . Q = c m (delta)t , Q = L m , density = m/V
QUESTIONS: (a) **Find volume of tank in m^3? (b)Find the mass of salt in tank? (c) Find heat from sun needed to raise temperature of salt from 21^{o}C to 221^{o}C? (d) Find solar heat needed to melt salt in tank? (e) Find solar heat needed to raise molten salt from 221^{o}C to 560^{o}C(1051^{o}F)?**

ANSWERS: (a) 4117 m^3 , (b) 8.934 X 10^6 kg , (c)1.383 X 10^9 KJ (d) 2.323 X 10^9 KJ , (e) 4.846 X 10^9 KJ

That challenge seems to be creating an opening for a different form of power, solar thermal, which makes electricity by using the sun's heat to boil water. Two California companies are planning to deploy the storage technology: SolarReserve, which is building a plant in the Nevada desert scheduled to start up next year, and BrightSource, which plans three plants in California that would begin operating in 2016 and 2017. One crucial role of the plants will be complementing solar panels, which produce electricity directly from sunlight. When the panels ramp down at dusk or on cloudy days, the plants will crank up, drawing on the stored thermal energy. The Energy Department seems to agree: in September it gave SolarReserve a $737 million loan guarantee for its project in Nevada. **The plant will generate 110 megawatts at peak and store enough heat to run for eight to 10 hours when the sun is not shining.** Technical details of the SolarReserve and BrightSource plants vary slightly, but **both will use thousands of computer-operated poster-size mirrors aiming sunlight at a tower that absorbs it as heat. (((SolarReserve absorbs the heat in molten salt))), *which can be used immediately to boil water, generating steam that turns a conventional turbine and generator.*** Hot salt can also be used to retain the heat for many hours for later use. BrightSource heats water that can be used immediately as steam or to heat salt for storage. The plants rely on salt because it can store far more heat than water can. But once molten, it must be kept that way or it will freeze to a solid in part of the plant where it will be difficult to melt again. Storage could **cut costs by 4 cents a kilowatt-hour,** Mr. Denholm calculates **— a considerable benefit for a commodity that retails for an average of 11 cents.** A big part of the savings is not having to build the gas-fired generators for backup.