Introduction:

As we know, the nonrenewable sources of energy are depleting at a faster rate, because of which the future demands the advancement in the field of renewable energy. Out of which solar energy plays a major role. Even though it is renewable, the challenge which we face in this energy storage. Due to daily and seasonal variations in solar irradiation, the need for heat storage arises and it plays a crucial role in addressing fluctuations in energy demand, optimizing the use of fluctuating production sources like renewables, enhancing energy grid safety, and improving overall system efficiency. To address this energy storage challenge, we had come up with the idea of phase change materials.

Phase change materials are substances which releases/absorbs sufficient energy at phase transition to provide useful heat or cooling.

Now tell about the types.

In this we are dealing with salt hydrates. The list of salts are Sodium Chloride, Lithium Chloride, Calcium Chloride, Magnesium sulphate and Lithium sulphate.

The applications of PCM includes, → Tell about the applications.

The future market for PCM is given as CAGR of read ppt.

Literature Review:

- After reading that first point,
    - Calcium chloride is found to be one of the promising salt hydrates for thermochemical heat storage for common building applications.
- 3rd point:
    - In his study, he found that composite materials have more thermal stability than pure salts.
- BET (Brunauer–Emmett–Teller)

Various Model:

- The Debye Hückel equation accounts for the interactions between the different ions, which are the primary cause of differences between the properties of dilute electrolyte solutions and those of so-called ideal solutions. Solutions of Electrolytes are very dilute, on the order of 0.01 M.
- Davies equation is useful at ionic strengths up to 0.5M, making it a better choice than the Deybe-Huckel Model
- Pitzer equations are based on an ion interaction approach, where strong interactions are treated as ion pair formation, but weaker interactions are treated as ion-ion interactions that contribute to the respective ions' activity coefficients.
- BET method is also used for predicting phase change across a range of temperature and concentration.
- It is one of the most popular models for predicting behavior of mixed electrolytes. In the PSC model, the excess Gibbs energy is represented by summation of short-range and long-range interactions.

Research Gap:

- For first 2 point, read and then mention that our model is used for even high temperature.
- For third points, mention about MgSO. Saying that mgso4 has different phase in which we could able to capture all.
- For 4th point - Our model predicted liquid solid equilibria also.

Objective:

- For the salts which I mentioned previously, we have done the phase change analysis.
- With this phase change analysis, we can predict the energy storage capacity of the salt hydrates.
- With this application we can find… Tell all 3 points

Methodology:

- Pitzer`s form of the Debye- Huckle (PDH) function as the electrostatic contribution to the free energy. --> Long range
- Flory- Huggin's theory --> Short range

The term χ_{sw} is the generalized Flory-Huggins parameter and considered as the function of the volume fraction of the salt hydrate, ϕ_S, and temperature, T.

$$\chi_{sw}(T, \phi_S) = \sum_{i=0}^{n} b_i(T)\phi_S^i$$

$b_i(T)$ is temperature dependent coefficient and as expressed as:

$$b_i(T) = b_{i\alpha} + b_{i\beta}\left(\frac{1}{T} - \frac{1}{T_r}\right) + b_{i\gamma}\, ln\left(\frac{T}{T_r}\right)$$

$b_{i\alpha}, b_{i\beta}$ and $b_{i\gamma}$ are constants.

$b_i(T)$ is temperature dependent coefficient are calculated using nonlinear regression method.