



AUTOMATIC SNOW MELTING ROADS

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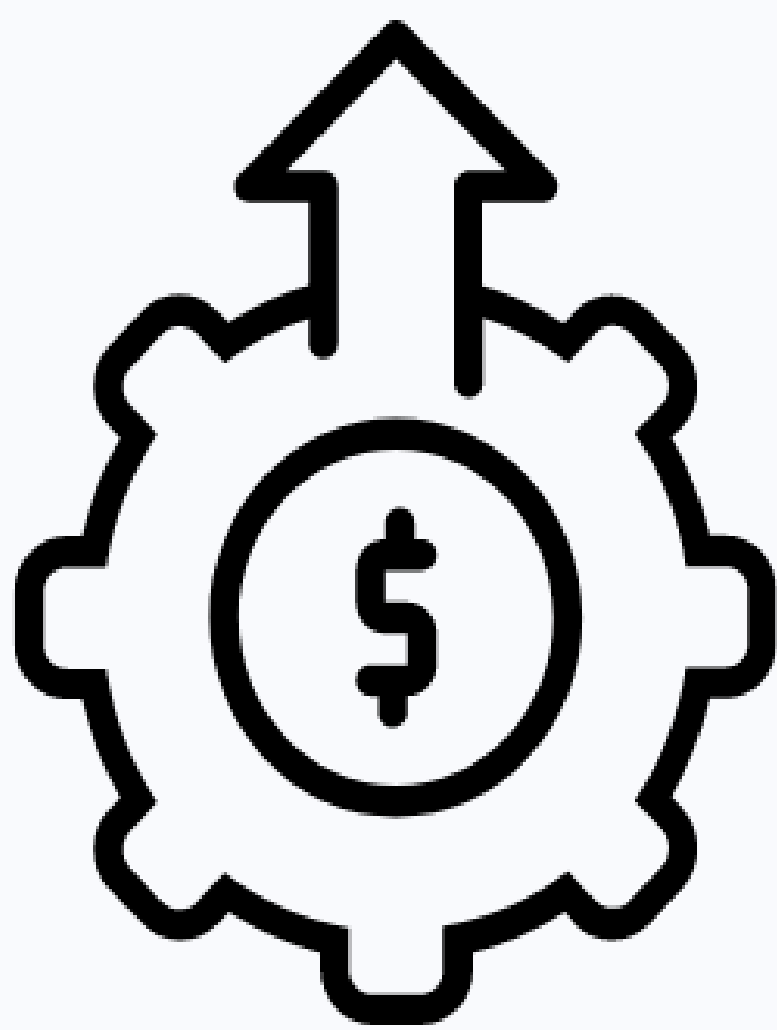
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Socio-Environment Impact of Geothermal Energy-based Hydronic Snow Melting Roads

Eco-Friendly



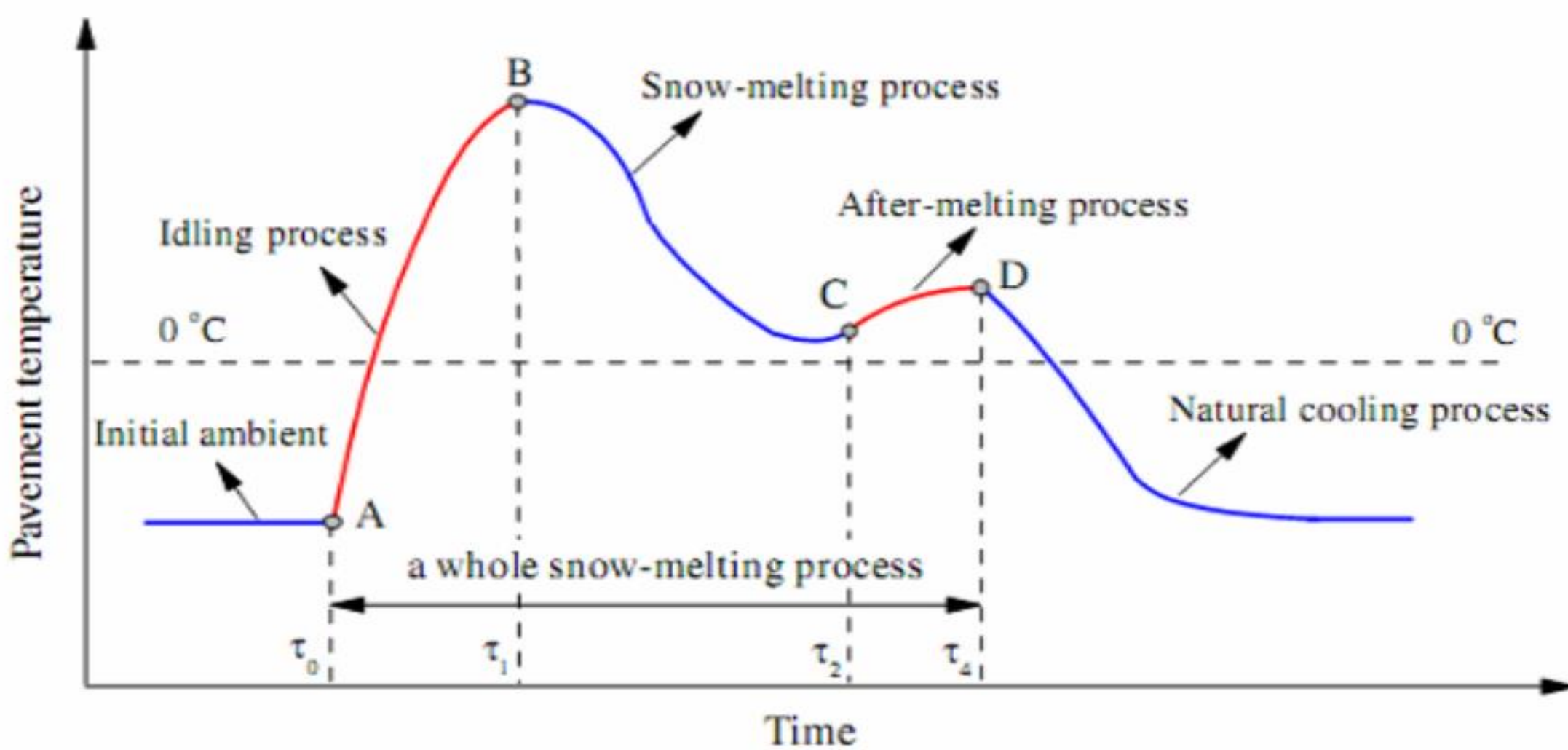
Economically Effective



Operational Efficiency



Discussion



- **Idling Process (A to B):**
System on standby, circulating heat transfer fluid through tubes to maintain melting temperature.
- **Snow Melting Process (B to C):**
Active melting of snow and ice using heat from circulating fluid.
- **After-Melting Process (C to D):**
Handling melted snow-water; can be evaporated or drained away.

Methods and Materials

1. Heat Source - Primary component responsible for providing the necessary heat energy to melt snow and ice. (Geothermal Energy)
2. Heat Exchanging Tubes – Embedded within the pavement, Facilitate the transfer of heat from the heat source to the surface.
3. Heat Transfer Fluid – Circulates through the heat exchanging tubes. Absorbs heat from the heat source and carry it to the surface for snow melting. (Water + Ethylene glycol mixture)
4. Sensors – Measure actual weather conditions. Provide data to system control to optimise the performance.
5. System Control - Receives input from sensors, monitors system parameters, and controls the operation of various components.

Results

1. Analysed Temperature Distribution profile through mathematical simulations for optimum temperature rise in working fluid.
2. Utilising geothermal energy for hydronic snow melting systems significantly increased efficiency compared to traditional heating methods.
3. While initial installation costs for geothermal hydronic snow melt systems may be higher than conventional methods, long-term operational costs were considerably lower.
4. Geothermal energy offers a sustainable and cost-effective solution for maintaining safe road conditions in cold climates.
5. Incorporating geothermal energy into snow melt systems reduces reliance on fossil fuels, resulting in lower greenhouse gas emissions and environmental impact.
6. We can minimise the negative environmental impacts due to the use of de-icing salt.

Conclusions

- Winter snow accumulation poses serious problems, impacting safety and causing property damage. It also leads to slower traffic, congestion, and time losses.
- Conventional snow removal methods, like manual labor and salt usage, are labor-intensive and environmentally harmful.
- Geothermal road heating offers an eco-friendly and efficient solution by utilizing renewable energy sources, reducing reliance on non-renewable resources.
- Automated operation decreases the need for nighttime maintenance shifts, improving efficiency.
- Despite higher initial costs, geothermal heating systems prove to be economically viable in the long term.

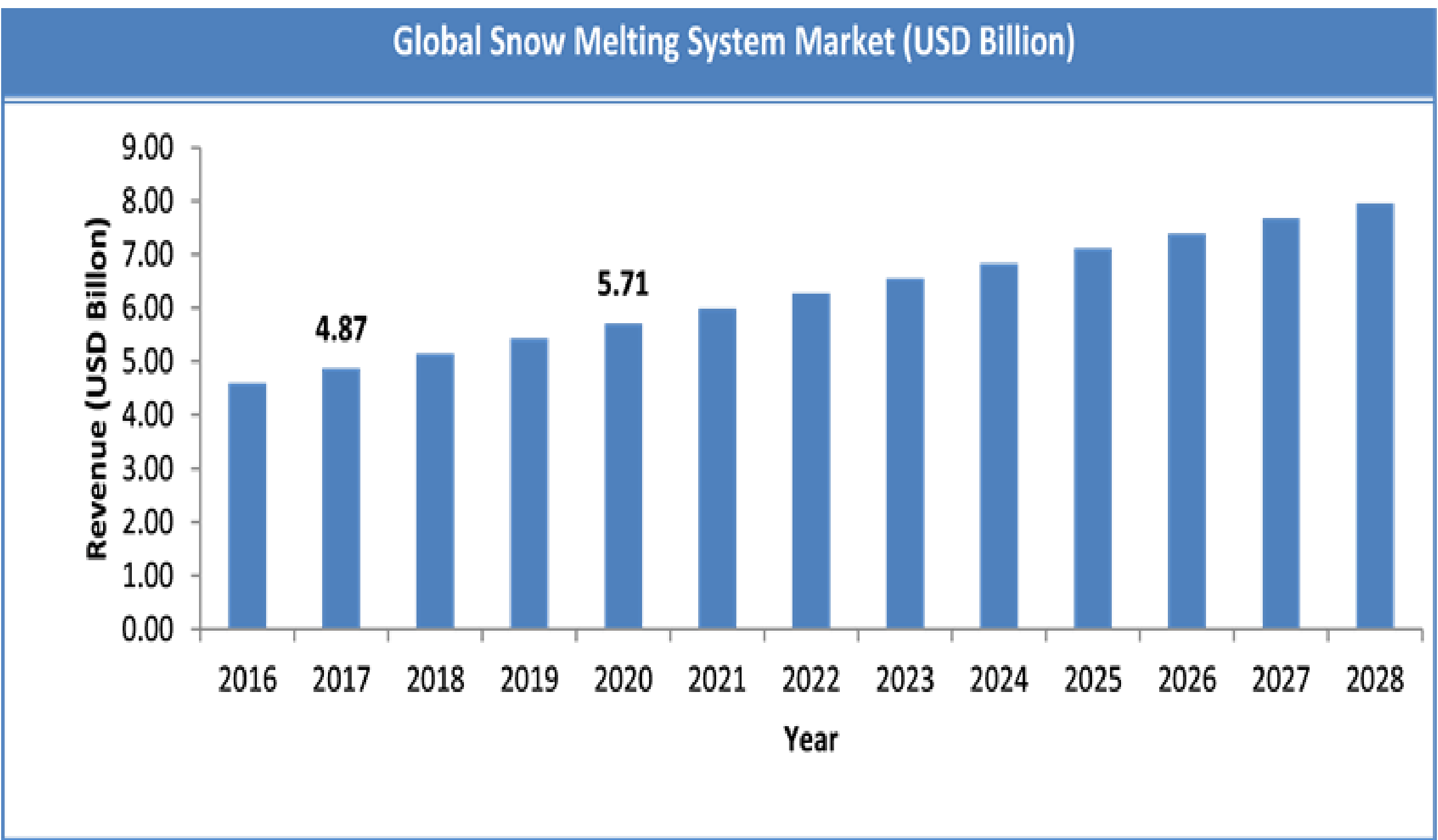


Figure 1: Global Snow Melting System Market

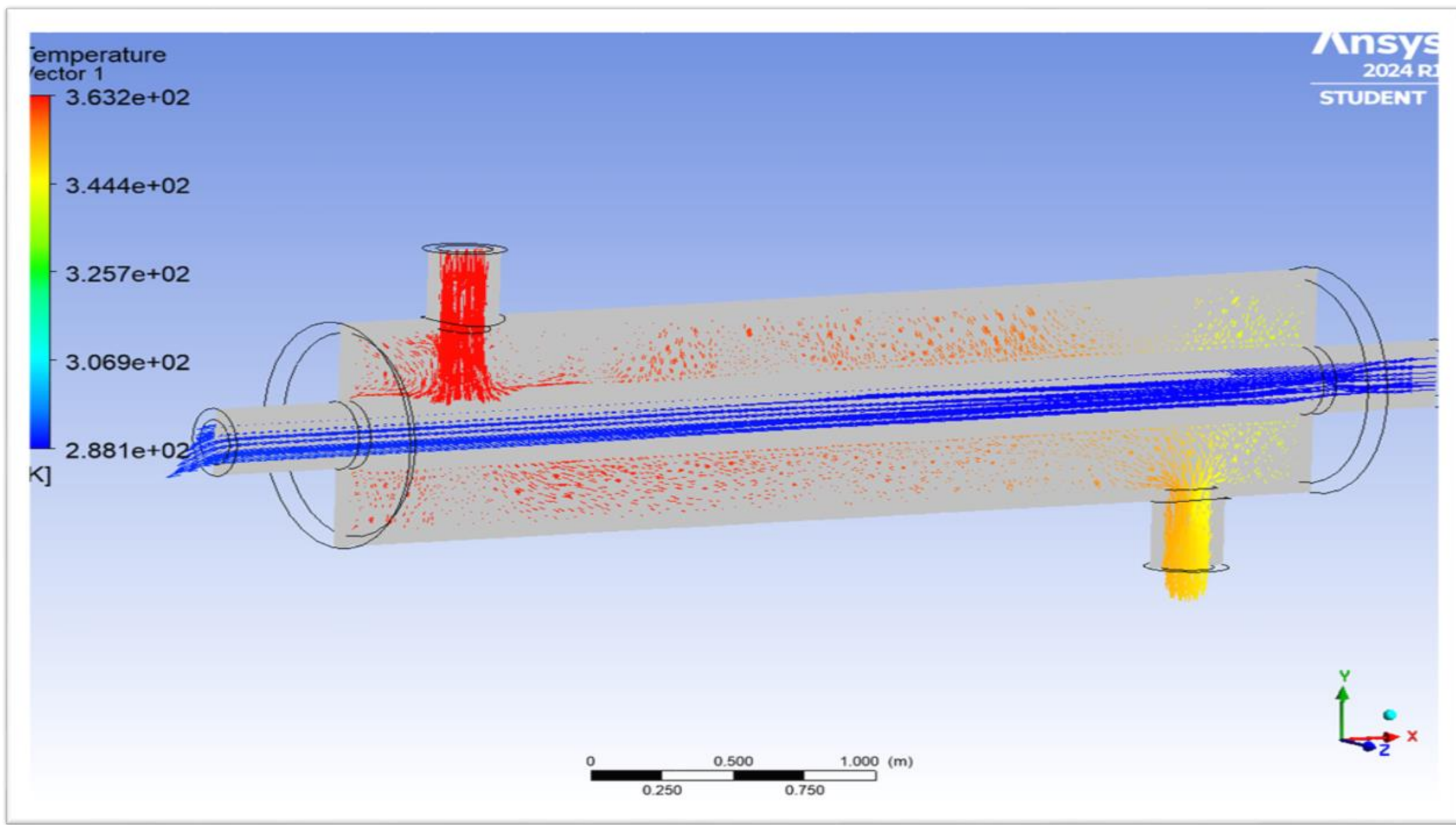


Figure 2: Temperature distribution inside heat exchanger



Figure 3: Heating Pipes Installation

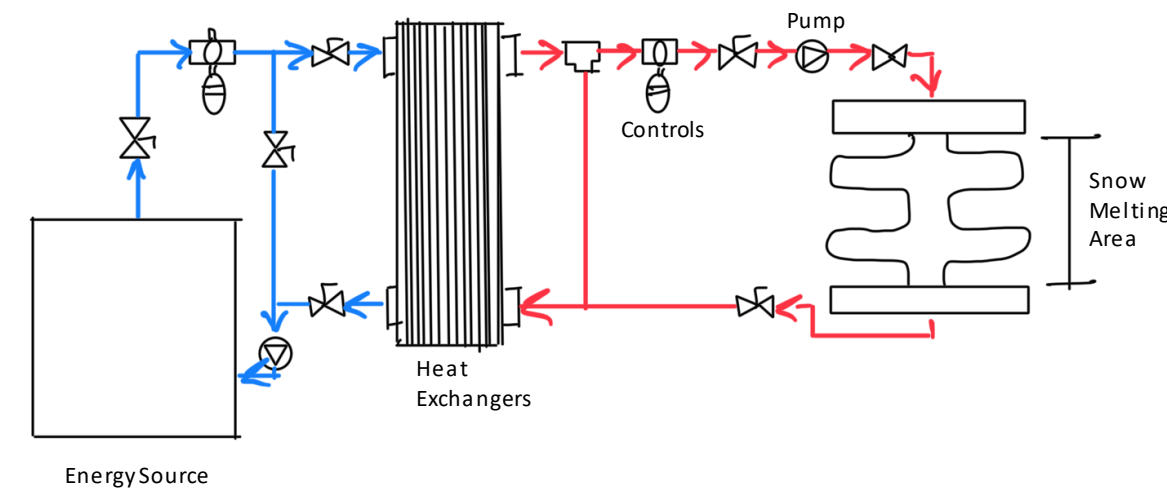


Figure 4: Hydronic Snow Melting System

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References

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