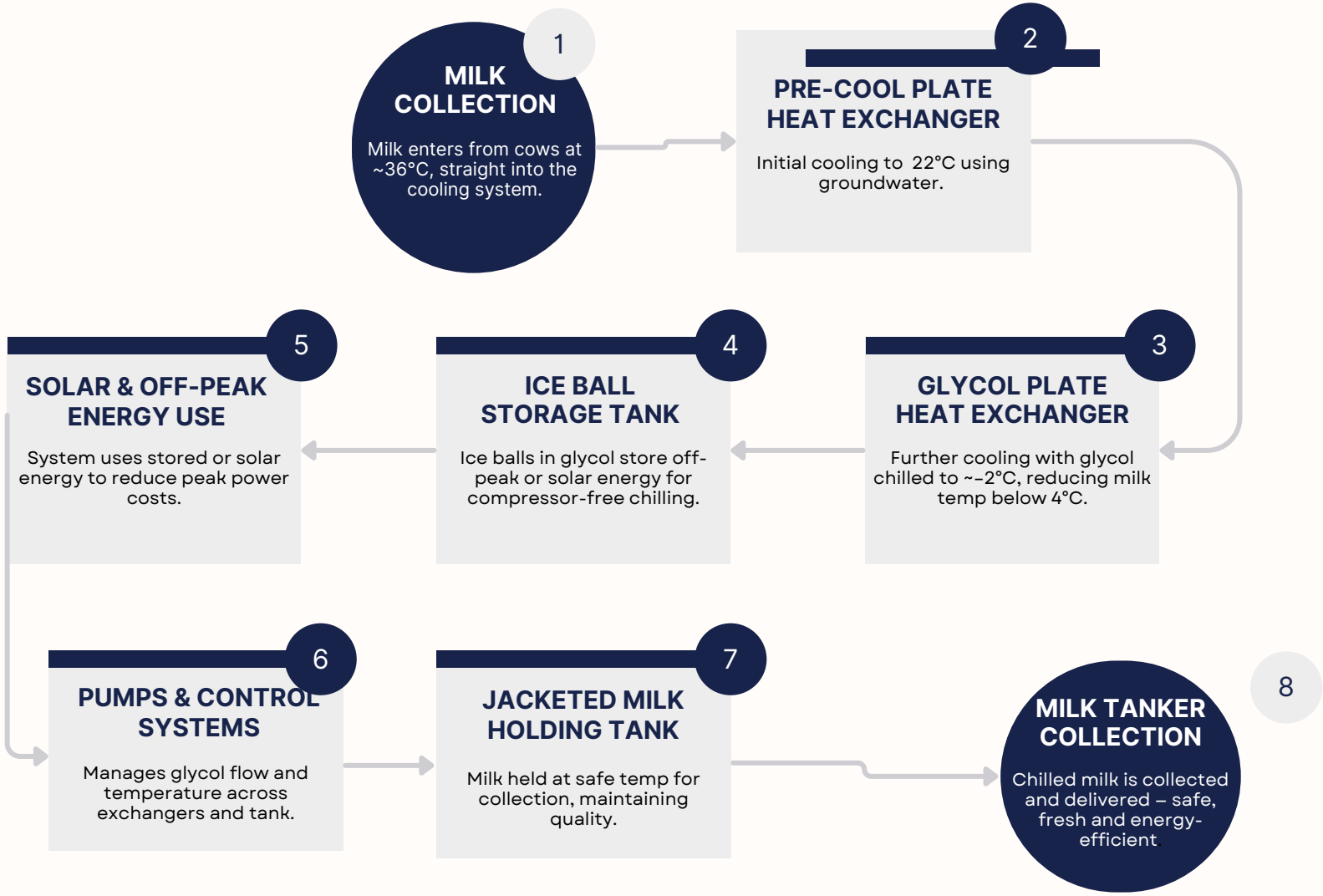
Thermal Energy Storage (TES)

Ice Ball Cooling Process

A step-by-step guide to how milk is rapidly cooled using ice ball technology and sustainable energy.



System Operation Narrative

– For Use with Diagram

This step-by-step process explains how Barry Brown & Sons' Thermal Energy Storage (TES) system cools milk efficiently, using ice ball technology, glycol and sustainable energy.

1. Milk enters the system
Milk is transferred directly from the milking line at approximately 36°C. It immediately enters a pre-cool plate heat exchanger, where it is cooled to around 22°C using groundwater. This first stage begins the cooling process and also recovers heat, which can be reused to pre-warm water for on-farm use systems — increasing overall energy efficiency.

2. Glycol Plate Heat Exchanger
After the initial stage, the milk continues through a glycol plate heat exchanger, where glycol chilled to approximately –2°C extracts even more heat. This rapidly brings the milk temperature down to just below 4°C, the critical threshold required for safe collection, storage and quality assurance.

3. Ice Ball Thermal Energy Storage
The glycol used in the system is chilled and recirculated from a specialised insulated storage tank filled with ice balls suspended in glycol. These ice balls are formed during off-peak electricity periods or using solar power. The stored energy is then discharged to cool the glycol during peak-demand windows — enabling milk chilling without the need for constant compressor use.
The ice balls act as a crystallisation agent, releasing stored energy (latent heat) as they melt, maintaining glycol temperatures around –2°C even when power demand is high.

4. Solar and Off-Peak Power Integration
The TES system is engineered to use low-cost off-peak grid power or on-site solar arrays to freeze the ice balls. This dramatically reduces reliance on fossil-fuel-powered electricity during peak hours, cutting costs and lowering emissions. It also enables farmers to participate in low-emission operations and peak load avoidance strategies.

5. Pumps and Control Systems
A series of automated pumps and control units manage glycol temperature and circulation through the plate heat exchangers and storage tank. The system monitors continuously in the background, ensuring precise temperature control without disrupting milking or refrigeration schedules. It is designed to integrate with both on-grid and off-grid (solar battery) installations.

6. Final Cooling and Storage
Once cooled, the milk is transferred to a jacketed holding tank, where it is safely stored at the required temperature until pickup. This holding stage ensures consistent temperature regulation, maintaining product quality and safety until the milk tanker arrives for collection.

Barry Brown & Sons' TES system combines thermal storage, intelligent controls and renewable energy integration to deliver high-performance milk chilling — reducing costs, improving efficiency and supporting sustainable dairy operations.