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Insights into Refrigeration and Heat Pump Operations using Machine Learning

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ABSTRACT

Machine learning offers significant potential to enhance the performance of industrial refrigeration systems. At Beca, a machine-learning-based optimisation platform has been developed and deployed on ammonia refrigeration plants. When combined with a digital twin, the optimiser provides detailed insights into both system operation and asset health. These insights arise both from the optimiser driving the system to minimum overall power and from expert review by refrigeration specialists, who analyse data and develop operational heuristics based on observed behaviour. The increasing integration of heat pumps that recover waste heat from refrigeration systems, together with fluctuating demands for cooling and hot water, makes advanced dynamic control essential to minimise total electrical energy consumption.

KEY WORDS

Refrigeration, machine learning, energy efficiency, optimisation, heat pumps

BIOGRAPHY

Adrian Dickison, Technical Fellow at Beca, has over 35 years' experience in a diverse variety of industries providing process engineering and project management input. Adrian has experience in research and development, conceptual and detailed studies, process simulation, project and programme management, process refrigeration, energy efficiency and HAZOP facilitation in the food & beverage, pulp & paper, mining & metals and pharmaceuticals segments. Adrian is considered a Subject Matter Expert in industrial refrigeration and ammonia refrigeration process safety and is also the Founder of Beca's Maestro Refrigeration Optimiser.

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