

Cooling as a Service Case Study: South African Fruit Packing Company Upgrades Ammonia System

By outsourcing its cooling system, Afrupro could upgrade its unreliable, aging refrigeration system without any capital costs, improving efficiencies and lowering energy consumption by 20%.

Overview

The need: Afrupro, a South African fruit packing company, was experiencing consistent problems with its existing industrial ammonia plant. The cold rooms were operating above required temperature specifications and the glycol tanks were leaking. This resulted in rising maintenance and electricity costs compounded by expensive product losses. Their upfront request was to replace the problematic plant with a new higher-GWP R407F multiplex system due to the poor temperature stability.

The solution: Following a thorough evaluation, Energy Partners Refrigeration proposed an outsourced cooling solution (financed, owned and optimised by Energy Partners). This involved an upgraded ammonia plant to provide better, more reliable cost-efficient cooling. The upgrade involved the installation of a new liquid receiver (including valves and instrumentation) and new stainless-steel glycol tanks. Existing mechanical controls were replaced with a new computerised control system with remote monitoring capabilities and a full re-commissioning process commenced. This was all financed through a Cooling as a Service (CaaS) agreement, with no upfront cost to the client.

Benefits:

- CaaS contract structure saved Afrupro R3.7m (USD200,000) in additional capital expenditure.
- Total project CO₂ emissions avoidance of 425 tons annually or 4,250 tons over the contract period.
- Cold rooms running efficiently with 20% lower energy cost.
- Elimination of unnecessary maintenance costs.
- Stabilised temperature management and elimination of product losses or re-cooling costs.
- Guaranteed uptime with 24-hour monitoring.
- Improved business focus: Afrupro allowed to focus on packing and shipping fruit while EP guarantees the cooling.
- Ability to plan for the cost of the cooling required.

REGION

Northern Province, South Africa

YEAR OF IMPLEMENTATION:

2020

SECTOR

Agricultural

RETROFIT OR NEW

Retrofit

PROJECT SIZE (cooling equipment)

600kW (170.6 TR)

TECHNOLOGY

Central ammonia plant with secondary glycol system

REFRIGERANT

Ammonia



Background



Afrupro Packers does the marketing and packaging of all grades of locally grown avocados and litchis, both in South Africa and internationally. Afrupro's existing ammonia refrigeration installation was becoming unreliable. Their major concern was that their maintenance and electricity costs were out of control while their cold rooms were not maintaining temperature. This resulted in product loss.

They called in South African-based Energy Partners Refrigeration for help. Energy Partners Refrigeration, a division of Energy Partners, supplies consistent, clean and reliable cooling across a diverse range of environments: commercial cold storage, agriculture, retail and industrial process cooling. Energy Partners invests in, owns and operates refrigeration assets off balance sheet, enabling their clients to free up capital to grow their businesses.

Afrupro wanted the aging ammonia system removed and replaced with a R407F (GWP of 1,825) multiplex plant, which is a common solution in that area of South Africa. Energy Partners proposed an evaluation of the plant after which they presented Afrupro with a CaaS solution that allowed for the upgrade of the ammonia plant.

An additional problem of leaking glycol tanks arose in the 2019 season, incurring a cost of more than ZAR2,000 (USD110) per day. After investigation, it was found that plastic tanks were used and possibly cracked and needed to be replaced. With the litchi season approaching, the upgrade became a matter of urgency.



CaaS contract information

The agreement between Energy Partners and Afrupro determined that Energy Partners would provide the investment of R3.7m (USD200,000) for the required upgrade and take ownership of the operations of the existing plant for a contracted period of 10 years. This would include a comprehensive maintenance agreement with remote monitoring and management. A fixed availability fee and variable usage fee is billed monthly, based on the refrigeration required. All electricity used for refrigeration is also refunded to the client as part of the agreement.

Computer modelling (using an internationally recognised tool, PakCalc) of the proposed R407F plant shows additional electricity use of 9% compared to the upgraded ammonia plant. Using the current cooling consumption of the facility it equates to savings of 58,000kWh per annum or 61 tons of CO₂e emissions avoided annually.

Using a 20% gas leak rate, which is conservative in South Africa, the CO₂ emission avoidance due to gas leaks comes to 365 tons annually. This gives a total project CO₂ emissions avoidance of 425 tons annually or 4,250 tons over the contract period.

“This site once again taught us that you can only control what you measure and don’t assume anything,” said Henk McDonald, Sales Engineer Energy Partners.

Energy Partners has set up EP Investments (which they own 100%) as a vehicle for all its energy investments. The projects are financed through a combination of 70% bank funding and 30% own funding (equity).



Project description



The CaaS proposal was presented to the Afrupro board indicating the scope of work to include replacing the plastic tanks with stainless steel tanks to solve the glycol leak, a new control system, as well as the mechanical upgrades the plant required. A receiver will be installed close to the condensers and the refrigerant piping changed to suit the new design. The result would be a more efficient system with increased energy savings.

The existing mechanical control system was replaced with an HControl Solutions programmable control system. This included several PLC's allowing for human machine interfaces (HMI's) for plant and cold room management. A PC with Supervisory Control and Data Acquisition (SCADA) platform to record the temperature logs and allow remote assistance was also added. In order to better comply with export standards and reduce temperature variation in the product, additional temperature sensors were installed in the cold rooms to increase accuracy.

Energy Partners' cooling meter was installed to measure the energy and cooling consumption remotely. With the start of the avocado season so close after completion, there were some problems initially but with the effective measurement and monitoring in place, these were easily identified and corrected. The now improved plant and control allowed the room temperatures to stabilise on the required setpoints. Due to the redundancy built into the system design, no significant scheduled downtime was necessary.

Operations are continuing to run optimally and efficiently. Stock losses have been reduced due to monitored temperature control ensuring further food security supply in South Africa.

"We don't have any problems with the refrigeration and the cold rooms have never worked as well as they do now – not even when it was new," said Simon Tattersall, Managing Director – Afrupro.

The partnership between Energy Partners and Afrupro has been a huge success and plans for the next stage of the plant upgrade is currently being finalised with a further ZAR4m (USD226,300) investment planned.

