

Heat Pumps Atmospheric Water Generator for Dried Grape Processing

A Practical Summary for Growers and Industry Operators

Drying grapes during unpredictable harvest weather has always been a challenge. Traditionally, growers supplement sun drying on trellis wires with LPG or diesel space heaters, drying the grapes to a shelf stable 11 - 12% moisture content. However, recent unseasonal weather conditions have caused crop damage, and rising fuel prices mean running traditional burners is increasingly expensive. Space heaters work by heating outside air to 75 - 90°C, lowering its relative humidity. This hot air is blown through trays of grapes drying the grapes as it passes and then exits into the atmosphere. This process is extremely effective at drying the grapes, but uses a lot of energy. A recent feasibility study evaluated an alternative solution, closed loop heat pump Atmospheric Water Generators (AWGs). Instead of dumping the high heat air into the atmosphere, the air is recirculated, the water is removed, and the air is reheated, before being blown across the grapes again. Operating at safe drying temperatures (40°C to 60°C), this approach creates a controlled microclimate that dries fruit evenly, preserves fruit color and quality, and slashes overall heating energy demand by up to 83 percent.

Financial modeling of a 15 year lifecycle shows that AWG heat pump dehydrators offer strong cost savings, but how you power them makes all the difference. For large commercial aggregators processing high volumes (around 8,000 tonnes per year), high utilisation results in a complete payback on equipment in about 4.1 years, or just 2.2 years when paired with solar energy and government efficiency rebates. For individual farm scale operations processing around 200 tonnes per year, running units purely on grid electricity leads to high power bills and longer payback periods. However, pairing a farm scale AWG heat pump with a 25 kW solar system and taking advantage of Victorian Energy Upgrades (VEU) rebates dramatically shifts the economics, cutting the payback period down to just 4.9 years while providing a permanent shield against diesel and electricity price increases.

While the economics are compelling, adopting AWG heat pumps involves operational changes on the ground. Unlike the tarp tunnels used with space heater drying, commercial AWG heat pumps feature equipment enclosures that are not rated for weather exposure (IPX4). They therefore must be installed undercover on a flat, solid pad. The increased complexity of the AWG heat pumps means they will need to be maintained more often and at a higher cost than the space heaters. Air filters and condensation coils will need to be inspected and cleaned routinely to keep air flowing freely and prevent efficiency losses. The condensation coils allow for the capture of free water as a byproduct of the drying process, but this moisture comes from warm beds of fruit that picks up airborne dust and wild yeasts. This captured water is a great resource, but it could require filtration or UV treatment before being reused.

Switching to enclosed AWG heat pumps also changes how fruit is handled. Instead of using the tarp tunnels, fruit is placed on trays or racks inside the unit. Getting the tray packing density right is critical, spreading grapes too thickly can block airflow and cause air to channel around the edges, leaving pockets of wet fruit. Before growers make purchasing decisions, the study recommends a few practical trials on the ground. Peak bodies and growers should conduct physical drying tests on local grape varieties to map late stage drying times down to the target 12 percent moisture mark, run airflow tests to determine the ideal tray setup, and carry out basic motion studies to see whether manual tray loading or semi-automated racking makes the most sense for farm labor.