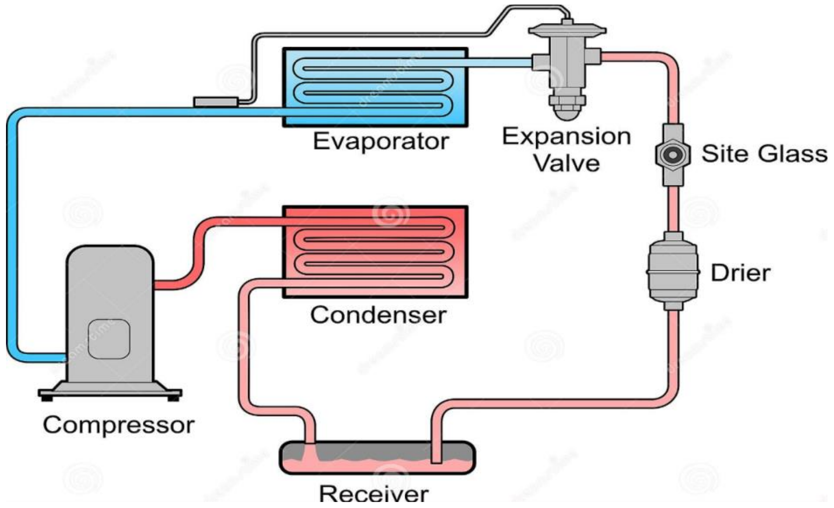
This project has received funding from the European Union's H2020 Coordination Support Action under Grant Agreement No. 894356.

Best Practice	COMPRESSOR CONTROL	COOL-02
Application	Cooling systems	
SME sector	Industrial	
SME Sub-sector	Breweries, industrial pastry, refrigeration, etc.	
Technical description	Cooling systems are designed to meet a maximum cooling load that normally occurs for less than 5% per year. The most frequent case concerns load that stand at 50% compared to the maximum design load with an ambient temperature 20 degrees lower than the design ones. For these reasons, a compressor regulation system should always be installed. For systems consisting of several compressors, the optimal solution could be to combine a fixed-speed compressor covering the base load with variable speed compressors for peak loads.	
Recommendation for optimisation	The greatest potential for energy savings due to the installation of a compressor regulation system comes from the adaptation of the condensing temperature to the ambient temperature. Before considering the installation of a frequency converter it is necessary to check the compatibility of oil transport and the design of the expansion and control valves to verify compatibility with fluid speed variations.	
Relevant technical considerations	The main parameters of the cooling system are measured power, operating hours, COP, ambient and load temperatures. Other factors that need to be considered are production capacity, uptime, main equipment, and processes provided by the cooling system.	
Schemes and diagrams	 Assembly diagram of control valves in a cooling system.	

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Economics	100-1,000 EUR indicatively per industrial frequency converter.
Energy savings	Compared to other compressor control modes, the value of evaporation temperature during partial loads: 6-12% Up to 20% compared to systems without regulation.
Economic savings	The economic savings are closely linked to the reduction of electricity used to power the cooling system.
Average Payback Time	Less than 3 years If you change the condensation temperature of the fluid the recovery time is shorter. Payback Time increases if a frequency regulator is used.
Emissions	Emissions depend on the characteristics of the refrigerant gas: in fact, GWP and ODP emissions vary depending on the refrigerant gas.
Environmental benefits	Reduction of CO_2 emissions due to a reduction in electricity needs for cooling
Main NEBs (Multiple benefits)	☒ Environmental benefits ☐ Increased productivity ☐ Work environment/ Health/Safety ☐ Increased competitiveness ☐ Maintenance Environmental benefits through the reduction of CO_2 emissions.
Replicability	Medium
Related measures	• COOL-01: Cooling load reduction and free cooling • COOL-03: Increase and decrease in evaporation and condensation temperature • COOL-04: Efficient fans and regulation • COOL-05: Loss reduction • COOL-06: Heat recovery
Case study	Installation of a new chiller with use of free-cooling company "Rudolf Ölz Meisterbäcker GmbH" (Austria, 2011) • Initial Situation: the need for thermal energy for cooling before the intervention was 1,403 MWh/y • Description of the optimisation: thanks to multiple optimization interventions, the need for cooling has increased from 1403 MWh/year to 1,347 MWh/year, this can now be covered with 578 MWh of electricity. Optimizations include better control of two compressors leading to a 2°C increase in the primary temperature. The cooling demand has been reduced thanks to continuous insulation and reduced

	friction losses. By shifting loads to larger machines, resulting in more hours at full load, their COP can now be increased from 2.1 to 3.26 • Implementation costs: 209,300 EUR • Payback Time: 7.5 years
References	Kulterer, K., Mair, O., Horvath, C.: Leitfaden für Energieaudits in Kältesystemen, klimaaktiv energieeffiziente betriebe, Vienna 2017

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