



Business Recommendations Template



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Executive Summary

This document provides a comprehensive guide to improving **energy efficiency for businesses** in the food and beverage industry, particularly within the cold chain sector. It incorporates insights from European initiatives such as TEBD-STEEP and ICCEE, offering a structured framework to assist businesses in enhancing their energy management. Supported by data from energy audits conducted across several countries, this document highlights specific areas for improvement and provides actionable **recommendations** to optimise energy use.

Key Recommendations by Technologies

HVAC: Strategies to optimize heating, ventilation, and air conditioning systems for better energy efficiency.

Lighting: Guidance on deploying energy-efficient lighting technologies and control systems.

Electrical & Mechanical Systems: Best practices for maintaining and upgrading electrical and mechanical installations to reduce energy consumption.

Transport & Fleet Management: Recommendations for enhancing the efficiency of transportation operations and fleet management.

Renewable Systems: Insights on implementing solar energy solutions to decrease reliance on non-renewable energy sources.

Compressed Air: Tips for optimising compressed air systems, crucial for industrial applications.

Monitoring & Management System: Techniques for implementing advanced monitoring systems to manage and reduce energy usage actively.

Refrigeration: Energy-saving practices specifically for refrigeration systems, critical in sectors such as food storage and retail.

Building & Infrastructure: Structural recommendations for improving the energy efficiency of buildings and other infrastructure.

Purpose of the Document

The primary purpose of this document is to equip businesses with actionable insights and recommendations to improve energy efficiency across key operational areas. It consolidates data from energy audits, offering a roadmap for reducing energy consumption, lowering operational costs, and enhancing sustainability. By implementing the guidance in each section, businesses can make informed, strategic decisions toward long-term energy savings and environmental responsibility.



Disclaimer

This document consolidates findings derived from energy audits conducted in a broad variety of contexts and is intended solely for information purposes. The aggregated data, recommendations and potential energy savings outlined herein may be specific to, and reflective of, the circumstances and operational contexts of the entities effectively audited and are thus provided as general guidance. For this reason, this report does not endorse or recommend any specific technologies mentioned within.

The report should therefore not be construed as a valid substitute for conducting a dedicated comprehensive energy audit tailored to specific circumstances, as actual energy savings and associated financial savings may vary significantly depending on unique operational conditions, processes, and requirements.

Whilst reasonable efforts have been made to ensure the accuracy of the information in this report, the authors offer no guarantees and accepts no liability for decisions or actions taken based on its content. Consulting suitably qualified professionals or carrying out a bespoke energy audit is strongly recommended in order to evaluate the applicability and potential outcomes of any measures referenced in this report.

Key Abbreviations & Terminology

- TEBD:** Thematic Energy Benchmarks and Continuous Energy Efficiency
- STEEEP:** Support and Training for an Excellent Energy Efficiency Performance
- EIW:** European Initiative Workgroup
- SMEs:** Small and Medium-sized Enterprises
- HVAC:** Heating, Ventilation, and Air Conditioning
- BMS:** Building Management System
- BAS:** Building Automation System
- ICCEE:** Improving Cold Chain Energy Efficiency
- EnPIs:** Energy Performance Indicators
- PV:** Photovoltaic
- ST:** Solar Thermal
- HP:** Heat Pump
- EMS:** Energy Management System
- LTL:** Less-than-Truckload
- RO:** Reverse Osmosis
- IE1/IE3/IE4:** International Efficiency Classes for Motors
- TPMS:** Tyre Pressure Monitoring System

About Thematic Energy Benchmarks and Continuous Energy Efficiency (TEBD) - STEEP

The **HORIZON Support and Training for an Excellent Energy Efficiency Performance (STEEP)** project developed training sessions and consultancy sessions as well as directives for effective energy management tools, developed by 34 chambers of commerce in 10 different European countries together with the EIW. This support enabled SMEs to control and measure their energy consumption more effectively and thereby lower energy costs.

The project prepared a checklist of measures for each energy thematic, that businesses could use to identify opportunities for improvement.



The **Türkiye-EU Business Dialogue (TEBD)** is a project co-funded by the European Union under its IPA II programme with Turkey that aims to strengthen mutual understanding and cooperation between the Turkish and the European private sectors. Activities are implemented by the European and Turkish Chambers of Commerce and Industry. The energy efficiency component of the TEBD project updated these checklists (2021).

Website: <https://tebd.eu/>

TEBD - Actions

A) Energy Management

Action code	Action to be done
A 1.1	Knowledge - Assess the internal consumption or consult a specialist for the realisation of a energy check.
A 1.2	Knowledge - Raise awareness among the staff about the internal energy costs.
A 1.3	Energy manager - Appoint a responsible for energy who will be in charge of the energy management and the monitoring of costs. He/she will construct a database for this purpose.
A 1.4	Energy manager - Plan the training of en employee appointed for Monitoring the Energy consumption.
A 1.5	Energy manager - Ensure that a person is in charge of verifying the energy bills.
A 1.6	Energy contracts - Follow the evolution of the consumption thresholds in force and of the adopted tariffs.
A 1.7	Energy contracts - Put into competition suppliers in order to obtain better contractual conditions.
A 1.8	Energy contracts - Ensure that the contract adequately encourages the two parties to work on the reduction of energy consumption.
A 1.9	Energy contracts - In case of hourly tariffs use your equipment during off-peak hours (up to 40% cheaper).
A 1.10	Energy contracts - Check your tariffs annually as your consumption patterns may change due to individual changes in your organisation (3x8 shifts, ...).
A 1.11	Energy contracts - Ask for advise to your energy supplier to adjust your tariff (take into account the power factor, if too weak or too high, it could penalise your invoices).
A 1.12	Consumption profile - Verify the production processes.
A 1.13	Consumption profile - Verify that the control equipment works properly (valves, thermostats, ...).
A 1.14	Consumption profile - Verify that the consequences and energy implications of any modification in the production process have correctly been analysed and integrated in the process itself.

Action code	Action to be done
A 1.15	Consumption profile - if necessary, plan acascade start of the equipment so that to avoid power demand.
A 1.16	Indicators - Outline a procedure to define indicators of energy performance (ex: kWh/tonnes...).
A 1.17	Indicators - Follow these indicators on the basis of an IT dataset.
A 1.18	Indicators - Monitor the evolution/development of the selected ratios for each consumption item.
A 1.19	Benchmarking - Ask your technical center or Professional Union to obtain a benchmark.
A 1.20	EE criteria - Consider the energy specifications of the equipment (high-efficiency motors, "EnergyStar" label, energy labels,...).
A 1.21	EE criteria - Raise awareness among employee responsible of purchases of energy saving opportunities/energy conservation.
A 1.22	EE criteria - Think in terms of global cost (purchase, consumption, end of life).
A 2.1	Meters/sub-meters - Identify item and equipment: if their consumption is higher than 150 MWh, install then a sub-meter.
A 2.2	Meters-sub-meters - Read the meters regularly and compare them with the level of production by recording them on a database.
A 2.3	Staff training - Organise trainings for staff who participates directly to the energy objectives.
A 2.4	Stafftraining - Make regular reminders on the topic (posters, internal notes, games/competition, procedures,...).
A 2.5	Staff training - Evaluate the spin-offs on the energy performance
A 2.6	Staff training - Intervene during staff meetings to explain good practices (turn off lights, close doors, ...).
A 2.7	Staff training - Show internally the results on a board dedicated to the topic, and discuss about it during staff meetings.
A 2.8	Maintenance contracts - Go for maintenance contract for all the equipment consuming energy (or have plans for internal maintenance).
A 3.1	BMS/ BAS - Put in place a Building Management System (BMS) /Building Automation System (BAS) on compressed air, space heatings, electric meters, lighting, steam, etc.
A 3.2	BMS/ BAS - Consult an energy expert for a feasibility study.
A 3.3	Audit - Make an energy audit every 5 years to check at least the inventory of consumption and production.



B) Heating/Boilers

Action code	Action to be done
B 1.1	Test - Put in place a monitoring/testing procedure of the boilers with a maintenance schedule and report including; monitoring and testing operations; any highlights (smell, noise..); control elements (consumption, length of use...).
B 1.2	Settings - Turn off useless boilers during the mid-seasons.
B 1.3	Settings - Lock the thermostats (or limit the access).
B 1.4	Settings - Ensure that thermostat and the timer are linked to the boiler and to the pumps.
B 1.5	Settings - Use the smallest boiler in summer.
B 1.6	Settings - Appoint a staff member for turning off and switching on the boilers.
B 2.1	Maintenance record - Ask a professional (manufacturer, supplier, etc.) to make you a list of the most important points to be analysed and draft a maintenance report once per year: checking the correct ventilation; checking possible water leakages.
B 2.2	Operating costs and performance - Establish an estimation of actual operating costs.
B 2.3	Operating costs and performance - Compare these results with the potential savings by installing high energy performance equipment.
B 2.4	Annual review - Call an expert once per year to: maintains the burners; optimise the combustion and the performance of the boilers.
B 3.3	Regulating system - Adjust thermostats of different boilers gradually (for ex. From 60°C to 85°C).
B 3.4	Regulating system - Install a cascade control.
B 3.5	Control devices - Draft an estimate (financial cost and returns) to equip your boilers with a control equipment if they work regularly.
B 3.6	Separate heating and hot water in order to cut the heating during summer.
B 3.7	Control - Evaluate your needs for an automatic system which allows to save energy during startup time, changes in needs and in monitoring.
B 3.8	Insulation - Contact a professional for insulating your equipment.
B 3.9	Contact an professional to study the potential of your boiler.

C) Steam

Action code	Action to be done
C 1.1	Annual consumption - Remind to the staff the cost of steam production and steam waste.
C 1.2	Leakages - Verify regularly your network.
C 1.3	Leakages - Repair any leakage as soon as there is an alert.
C 1.4	Steam traps - Maintain and monitor the steam traps.
C 1.5	Steam traps - Choose automatic steam traps.
C 2.1	Boiler room, ventilation - Verify regularly the good condition of the ventilation.
C 2.2	Boiler room, ventilation - Ask for the advise of an expert.
C 2.3	Maintenance - Set up a procedure to follow the heaters functioning and verify any eventual leakage, gas smell, unusual noises.
C 2.4	Maintenance - Keep updated a maintenance report
C 2.5	Maintenance - Verify there is no erosion in the pipes or tubes.
C 2.6	Water Quality - Set up a procedure to check the well functioning of the water treatment.
C 2.7	Insulation of pipes distribution - Verify regularly the good condition of the heat insulator.
C 2.8	Insulation of pipes distribution - Plan the reconstruction of parts of the circuit which are badly heat-insulated.
C 2.9	Dysfunctions - Check your steam system.
C 2.10	Dysfunctions - Indentify the leakages and repair them as soon as possible.
C 2.11	Dysfuctions - Compare the maximum return of the heater with those of the manufacturer.
C 2.12	Dysfunctions - Plan to change the burner of the boiler.
C 3.1	Management system - Install a steam meter to follow the ratio of production (ratio < 820kwh PCI/T of steam).
C 3.2	Management system - Invest in a cascade regulator if your thermal need varies often.
C 3.3	Dimension - Verify the consonance between the steam installation and steam needs.
C 3.4	Condensation - Install a revaporisation tank to your devices.
C 3.5	Condensation - Recover the condensates.

Action code Action to be done

C 3.6	Heat recovery - Analyse the process by adding a pre-heating phase for the make-up water, for the combustion air and for the liquid fuels.
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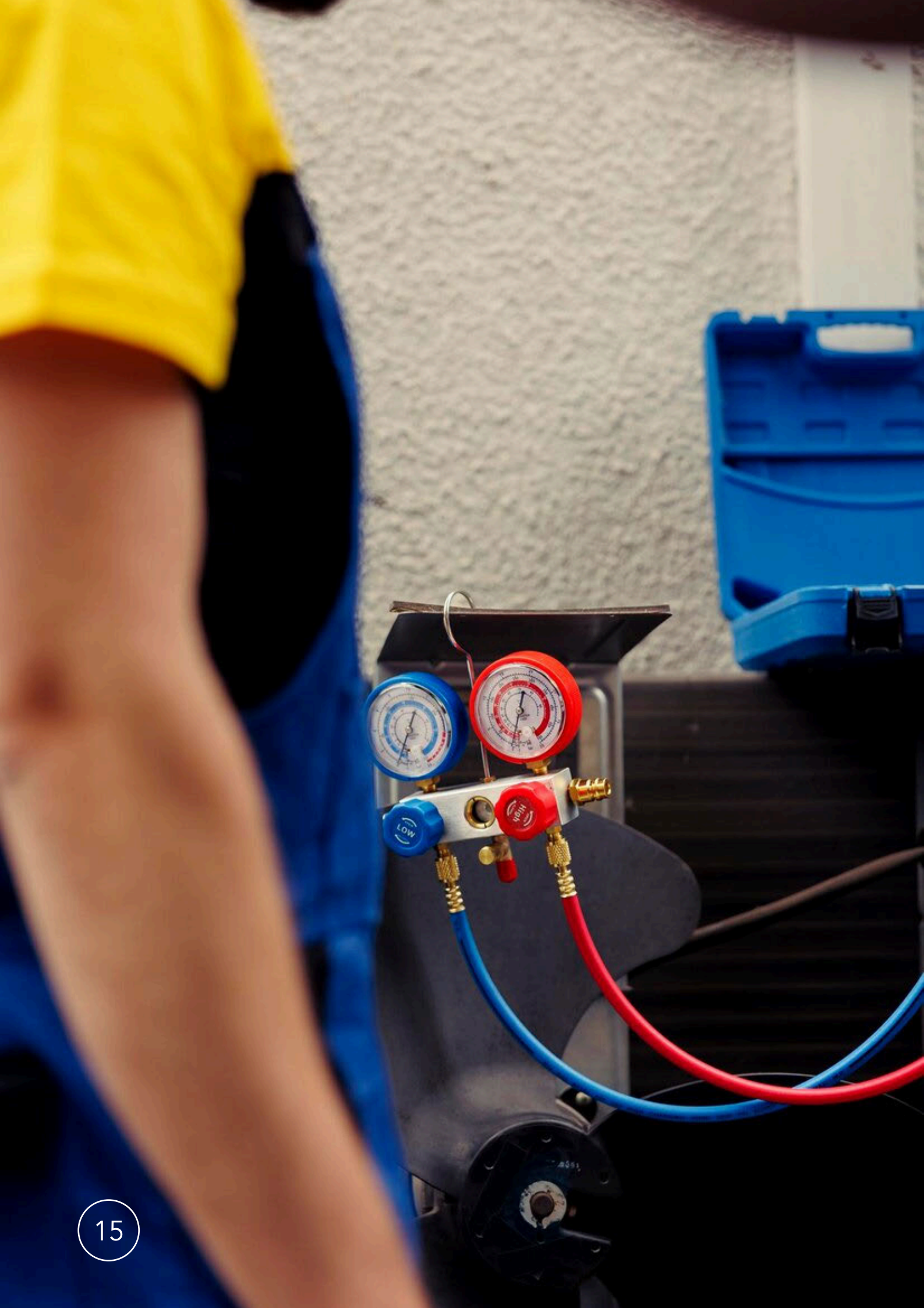
D) Heating, Ventilation and Air Conditioning

Action code	Action to be done
D 1.1	Staff awareness - Remind the staff the heating costs.
D 1.2	Staff awareness - Appoint a person responsible of the conditioning and heating systems (freeze protection included).
D 1.3	Staff awareness - Recall the best practices: lower the heating, turn off the air conditioning.
D 1.4	Temperature - Adapt the heating zone by zone.
D 1.5	Temperature - Consult an expert to study possibilities of heat recovery.
D 1.6	Temperature - Verify on/off status according to room occupancy.
D 1.7	Heating losses - Bring fresh and new air close to the extraction ventilation openings of the machinaries.
D 1.8	Heating and Air Conditioning system - Set the same mode for both systems (19°C heating system, 24°C air conditioning).
D 2.1	Thermostats - Choose the location of regulators.
D 2.2	Temperature control system - Provide your installation with automatic regulation system.
B 3.1	Maintenance - Call a service company for maintenance (or in-house training).
D 3.2	Tariffs - Adapt your heating and conditioning system in order to maximise your consumption during off-peak hours.
D 3.3	Difference of temperature between floor and ceilings - Put ceiling fans to homogenise the heating within the workplace.
D 3.4	Extractions - Install timers for extractions according to the daily needs .
D 3.5	Pollutants - Install local extractions as close as possible to the emission source.
D 3.6	Regulation of temperature - Set up a system of heat recovery from bad air before the rejection. Set up a system to recirculate the air in the ventilation system.
D 3.7	Purchases - Perform a feasibility study for different options (high energetic performance equipment, heat pump, ...).

E) Compressed Air

Action code	Action to be done
E 1.1	Consumption - Make an energy diagnosis (with measures).
E 1.2	Lower the needs - Raise awareness and inform the staff on the costs linked to the compressed air system.
E 1.3	Lower the needs - Use Venturi nozzles (less noisy and less energy-consuming).
E 1.4	Lower the needs - Indicate/ write the pressure required on the nozzles (with regulation of max 2 bars).
E 1.5	Lower the needs - Check the required pressure according to the zones.
E 1.6	Lower the needs - Replace manual traps with automatic steam traps.
E 1.7	Lower the needs - Determine the required level of air quality (filtration, drying).
E 1.8	Lower the needs - Identify whether pneumatic tools could be replaced by electric tools.
E 1.9	Lower the needs - Install isolation valves (manual or electricvalves) in areas of low frequency of activity.
E 1.10	Lower the needs - Check if all equipments require the same air quality level.
E 1.11	Lower the needs - Perform air treatment adapted to the demand.
E 1.12	Lower the needs - Check the pressure used by the blow guns (pressure <4b).
E 1.13	Compressed air leaks - Identify compressed air leaks during periods of inactivity.
E 1.14	Compressed air leaks - Check that the compressors are turned off during periods of inactivity (night, weekend, bank holidays).
E 1.15	Compressed air leaks - Repair as soon as possible detected leaks (if possible internally).
E 1.16	Compressed air leaks - Use and check the programming of turn off timers.
E 2.1	Outside vent - Adjust the air intake to the outside of buildings to increase efficiency (over the air is cold better performance) OPEN AIR INTAKE.
E 2.2	Regular maintenance - Establish a periodic verification of the seal systems/networks (fittings, joints, valves, vents, filters, air intake).
E 2.3	Regular maintenance - Remove or block the unused parts of the system/ network (depending on the time of use) .

Action code	Action to be done
E 2.4	Regular maintenance - Clean regularly filters.
E 2.5	Regular maintenance - Regularly clean the heat exchangers
E 2.6	Regular maintenance - Check the efficiency, performance and regulation of dryers.
E 2.7	Regular maintenance - Check traps (should not be by-passed), draining traps (unobstructed).
E 2.8	Regular maintenance - Favour vacuum systems rather than compressed air (blow guns ...).
E 3.1	Sizing/Design - Verify proper sizing the system.
E 3.2	Sizing/Design - Check losses (undersizing: 0,5bar maximum acceptable end to end i.e.: 1 mbar/m).
E 3.3	Sizing/Design - Check the size of the buffer tank (reservoir volume = volume of compressed air in 1 minute by compressors) .
E 3.4	Sizing/Design - Identify areas needed (flow, pressure, frequency) (use of booster valve or as needed) and remove unused areas.
E 3.5	Sizing/Design - Implement the equipments according to the zones need.
E 3.6	Regulation/Control - Use electronic speed control.
E 3.7	Regulation/Control - Study the implementation of in cascade compressors.
E 3.8	Heat recovery - Consider the installation of air pipes heated by the compressor to heat a close zone.
E 3.9	Purchases - Take into account the effectiveness of traps.
E 3.10	Purchases - Integrate the consumption criterion when buying.



F) Refrigeration

Action code	Action to be done
F 1.1	Closed door - Remind staff of the cost of production of cold and waste.
F 1.2	Seasonal temperature - Achieve a balance of refrigeration needs based on periods.
F 1.3	Seasonal temperature - Lower condensing temperature.
F 2.1	Defrosting - Install a system of defrosting cycles.
F 2.2	Defrosting - Centralise control of temperature sensors (T ° C display, setting the low and high thresholds).
F 2.3	Defrosting - Check that the condensers are well supplied with outside air.
F 2.4	Condensers - Clean condenser if the condensing temperature drift.
F 2.5	Maintenance of the cooling plant - Get quote from specialised companies (or internal training) for the maintenance of the cooling plant.
F 2.6	Maintenance of the cooling plant - Monitor performance during each maintenance (to be mentioned if service contract).
F 2.7	Maintenance programme - Adjust the frequency of inspections based on the manufacturer's recommendations and problems.
F 2.8	Insulation - Check the condition of the insulation and restore degraded areas.
F 2.9	Sealing - Check that the door thickness is sufficient.
F 2.10	Sealing - Check the condition of the sealing gaskets and door locking mechanisms.
F 2.11	Sealing - Install automatic doors.
F 2.12	Sealing - Search and limit the presence of thermal bridges.
F 3.1	Simultaneous need of hot and cold - Install a heat pump operating for simultaneous heating and cooling (HPS) (fridge + combination boiler group).
F 3.2	Centralised management system - Change the process by adding a phase of pre-cooling.
F 3.3	Centralised managemet system - Implement load control by cascading compressors.
F 3.4	Centralised management system - Follow daily the parameters: evolution of high pressure over the T ° C outside; evolution of the low pressure; rate of load compressors; daily electricity consumption.

G) Lighting

Action code	Action to be done
G 1.1	Awareness - Display saving instructions and achieved results.
G 1.2	Lighting level - Check lighting levels required with respect to activities carried out in each area.
G 1.3	Lighting level - Dim the lights in non-sensitive areas.
G 1.4	Lighting level - Encourage staff to turn off unnecessary lights.
G 1.5	Lighting level - Use extra lighting for specific tasks.
G 1.6	Switches - Avoid the all or nothing functioning in all areas of activities.
G 2.1	Maintenance - Clean light when changing the tubes.
G 2.2	Maintenance - Clean windows and translucent walls.
G 2.3	Fluorescent tubes - Replace standard bulbs with energy efficiency lamps (CFLs or AML or High performance Tubes (T5 or T8).
G 2.4	Fluorescent tubes - Install long life lamps, lightbulbs (high performance tube).
G 2.5	Fluorescent tubes - Set a preventive maintenance program after 8000 hours of functioning (10,000 hours with high performance tubes and conventional ballast or 15,000 hours with electronic ballast).
G 3.1	Programming - Install timers but keep manual switch control for staff (Changing the programming if needs change).
G 3.2	Programming - Install dimmer switches.
G 3.3	Programming - Install occupancy sensors in common areas and passage.
G 3.4	Lighting equipment - Change the equipment that cannot host low energy consumption lamps.
G 3.5	Discharge lamps - Install discharge lamps in workshops and high ceiling areas (> 8m) (high pressure sodium light for their efficiency and long life of approximately 18,000 hours metal halide, for better color rendering or lamps induction with a lifetime of 60 000 hours).
G 3.6	Electronic ballast - Choose electronic ballasts during renovations or new buildings.

H) Electrical and IT Equipment

Action code	Action to be done
H 1.1	Inventory - Make an inventory of electrical equipment: Useful powers uptime (and standby use).
H 1.2	Temperature - Compare the selected temperature [by the company] and the recommended operating manuals on computing devices.
H 1.3	Temperature - Adjust room temperature - Optionally display a document with the set temperature to follow.
H 1.4	Office equipment - Turn off equipment at the end of day or weekend. Raise awareness among staff.
H 2.1	Energy Star label - Prefer "Energy Star" labelled equipment.
H 2.2	Electricity use - Draft a record of the supply facilities on the entire site (inventory of equipment, power).
H 2.3	Electricity use - Install sub-meters.
H 2.4	Electricity use - Perform an energy audit by a specialised consulting firm.
H 2.5	Welders - Change the work procedure of welding stations. Ask welders cut power when welding work is completed.
H 2.6	Materials - Check that additional devices are off when they are not useful.
H 2.7	Materials - Indicate on each machine, which associated equipment must be stopped along with the machine.
H 2.8	Materials - Perform a servo between the machine which stops the process and those annexed (take account of technical security constraints).
H 3.1	Automatic control system - Determine compatible devices such regulators and those for which a power off automatically is adapted.
H 3.2	High efficiency motors - Study the opportunity of installing engines with electronic speed variation.
H 3.3	High efficiency motors - Specify in the procurement process the energy performance of appliances (selection criterion).
H 3.4	High efficiency motors - Compare yield curves for each type of engine.



I) Buildings

Action code	Action to be done
I 1.1	Technical evaluation - Check the condition of windows and doors.
I 1.2	Technical evaluation - Check the condition of the roof and gutters.
I 1.3	Technical evaluation - Remove unnecessary pipes and chimneys.
I 1.4	Technical evaluation - Repair if necessary.
I 2.1	Heating - Perform a thermographic analysis.
I 2.2	Heating - Properly insulate areas to be heated from those not heated.
I 2.3	Heating - Install adequate separation (swinging doors, buffer space ...) between areas requiring different temperatures.
I 2.4	Insulation - Insulate the outside walls.
I 2.5	Insulate - Install a metal double skin cladding with insulation incorporated.
I 3.1	Natural daylight - Increase natural lighting in the roof.
I 3.2	Ceilings - Study the opportunity to install false ceilings.
I 3.3	Roof insulation - take advantage of the need to repair the roof to insulate it effectively.
I 3.4	Solar protection - Favour the installation of movable guards placed outside the glass (windshield sun with adjustable blade).
I 3.5	Solar protection - Install reflective glass south.
I 3.6	Solar protection - Install solar control film.
I 3.7	Windows - Installing double glazing (or triple) windows.

K) Renewable Energy Sources

Action code	Action to be done
K 2.1	Green energy - Contact and revise your contract with energy suppliers including a % of green energy.
K 3.1	Expansion, modification, move - Identify funds, incentives for the installation of renewable energy.
K 3.2	Expansion, modification, move - Study the technical and economic feasibility of the development of renewable energy.



About Improving Cold Chain Energy Efficiency (ICCEE)

Improving Cold Chain Energy Efficiency (ICCEE) is a Horizon 2020 project aimed at supporting the food and beverage sector in implementing energy efficiency measures across cold chains. This project focuses on conducting energy assessments and audits, accelerating the adoption of energy-saving practices, and promoting investments in energy efficiency. It has a special emphasis on small and medium-sized enterprises (SMEs) within European supply chains.

Website: <https://iccee.eu>

Funding: this project is funded by the European Union's Horizon 2020 research and innovation programme under a grant agreement.

The outcomes of the ICCEE project provide valuable insights for policymakers to develop tailored energy efficiency policies in the food and beverage sector's cold chains. As part of its technical contributions, ICCEE produced *Deliverable D2.1: Main Report on Supply Chain Energy Impact Analysis and Best Practices*, which promotes a holistic approach to energy efficiency by expanding the focus from individual companies to entire supply chains. This shift enables a broader assessment, revealing greater opportunities for energy-saving measures across the sector.

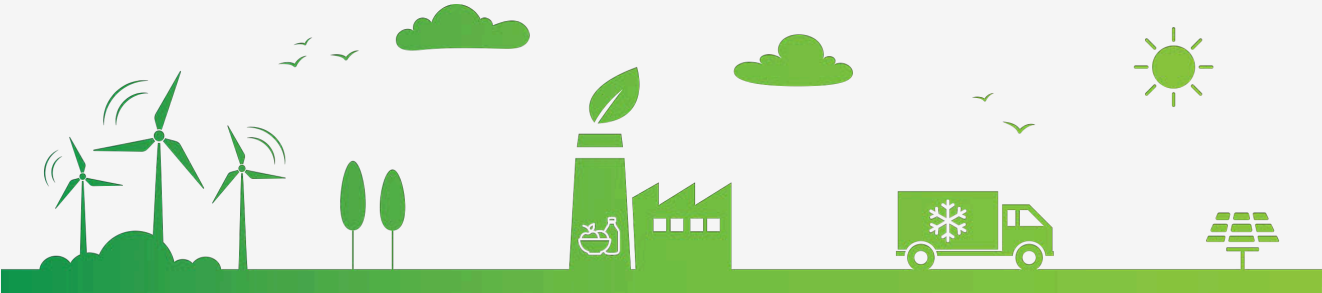
Additionally, ICCEE developed a comprehensive toolbox consisting of six tools and a guide, which cover critical aspects of: energy flows; benchmarking; and life cycle impacts. This toolbox integrates the unique characteristics of cold chains in the food and beverage sector into an analytical decision support tool. It offers customised analyses of energy performance across various stages, such as raw material preparation, logistics, warehousing, production, processing, and packaging.

To further support energy efficiency improvements, ICCEE also designed a dedicated tool to help companies assess their energy-saving potential and make informed decisions on implementing energy efficiency measures.

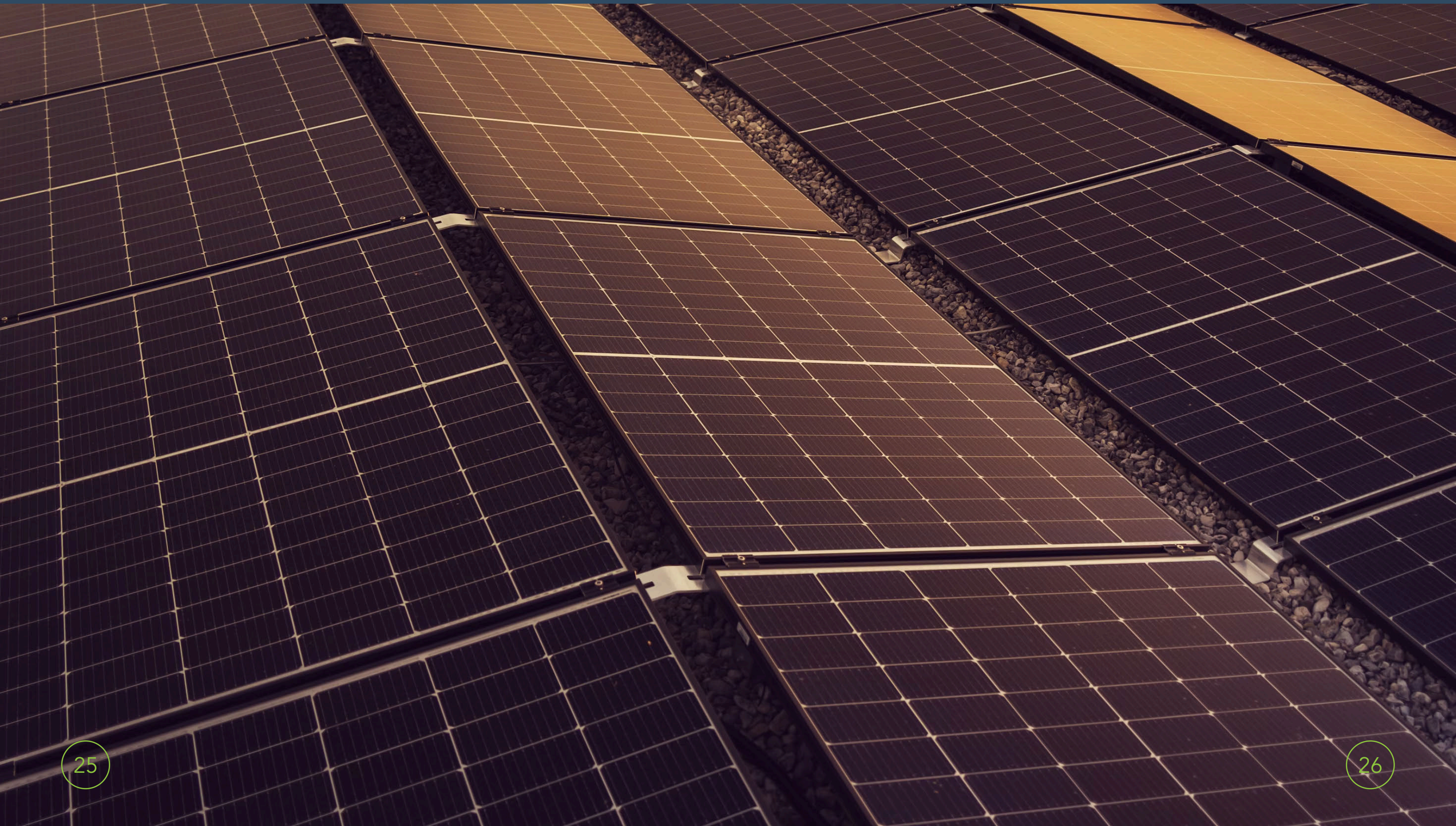
ICCEE - Actions

Category	Type of EE-measure	No of Best Practices
Auxiliary Technology (+ Lighting, Electrical and Mechanical Systems)	More efficient ventilation system for cold warehouses.	-
	More efficient lighting system (e.g. LEDs for cold warehouses).	2
	Efficient motors/filter/pumps/drive systems/steam generator with the appropriate sizing.	3
	Efficient inside refrigerant cycle: compressor, heat, exchanger: evaporator, condenser, throttle valves.	4
Building	Improved insulation (e.g., replacement of old windows, removal of thermal bridges, insulation of walls/ceilings/roofs/pipework, reduction of air infiltration of rooms and/or display area, repairing door deals and curtains, ensuring that door can be closed, air curtains on doors).	5
	Warehouse with separated compartments, with automated glide racks.	6
Energy generation/ Recovery	Waste heat recovery (e.g., absorption chiller).	1,22
	Renewable energy for electrical and thermal energy (e.g., PV, ST, HP, solar cooling)	19
	Energy storage system	9
Employee	Improved employees' awareness, active engagement, training and education of operators and drivers	10
Maintenance	Regular cleaning of condensers and evaporator coils.	11
	Minimisation of compressed air leakages.	12
	Review/optimisation of the cooling distribution system.	13.15
Management	EMS, energy audit, exploitation of energy benchmarks.	10.14
	Set temperature range for cooling to upper limit, adjustment of cooling temperatures.	-

Category	Type of EE-measure	No of Best Practices
Monitoring and Control	Visualisation of EnPis, real-time monitoring system, automated tracing.	16.17
	Use of smart heating systems/automatic/intelligent control system.	-
Refrigeration System	Less oversized cooling systems.	18
	Alternative refrigeration technology, design and refrigerant, retrofitting refrigeration display systems, closed display cabinets.	-
	Refrigerant cycle (e.g., one, two stage, intercooler etc.).	20
	Design and usage of free cooling.	21
Transport	Improved insulation of trucks (e.g., air curtain).	24
	Fuel monitoring for drivers and training drivers for fuel consumption reduction.	25
	Optimised travel routes (e.g., reduction of empty return trips), modal shift	26
	Alternate means of transport (e.g. portable refrigerated units for LTL).	27
Industrial symbiosis	By-product exchanges.	28
	Sharing of infrastructures, utilities or access to services (e.g., energy or waste treatment, biogas).	29
	Cooperation on issues of common interest (e.g., emergency planning, training or sustainability planning).	30



About Energy Audit Recommendations



Data collection is a fundamental aspect of energy management, enabling businesses to gain insights into their energy usage patterns, identify areas for improvement, and implement strategies to enhance efficiency and sustainability. In the context of collaborative efforts among partners, data from energy audits was collected from Malta, Bulgaria, Finland, Greece, Ireland, Italy, and Portugal using a comprehensive template. This template captured essential information about each company's operations, energy consumption, key performance indicators (KPIs), energy efficiency measures, and renewable energy initiatives.

This document presents a structured and comprehensive overview of recommendations derived from these energy audits, aimed at optimizing energy efficiency in business environments. Beginning with foundational information on energy audits and detailed notes, it guides businesses through evaluating and improving multiple energy-consuming systems and components. Each area, including HVAC, lighting, electrical and mechanical systems, transport and fleet management, solar energy, compressed air systems, monitoring and management systems, refrigeration, and building infrastructure, is analyzed individually to pinpoint potential energy savings. The recommendations highlight targeted actions that businesses can implement, from adopting energy-efficient technologies and best practices to exploring renewable energy sources, thus driving long-term cost savings and sustainability.

Parameters used in classifying energy audit recommendations

For the Investment Level

The costs were divided into four categories: No cost, Low (less than €6,500), Medium (between €6,500 and €120,000), and High (above €120,000).

Energy Savings

The energy savings values were divided into three categories: Category 1: Represents interventions resulting in savings of less than or equal to 500,000kWh, Category 2: Represents interventions resulting in savings greater than 500,000kWh but less than 5,000,000kWh and Category 3: Represents interventions resulting in savings greater than 5,000,000kWh.

For the Payback Period

The payback periods were categorised into Immediate, Short (up to 2 years), Medium (2 to 5 years), and Long (more than 5 years).

Financial Savings

The ranges used for categorising financial savings are as follows: Savings Present but Not Quantified" for actions resulting in savings that cannot be accurately calculated; "Low Savings" for amounts between €1 and €10,000; "Medium Savings" for amounts between €10,001 and €50,000; and "High Savings" for amounts above €50,000.





Category: Heating - Ventilation and Air Conditioning (HVAC)

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
Switch off AC unit when closed.	No cost	-	Savings Present but Not Quantified	Immediate
Increasing AC temp from 23 deg to 26 deg for winter months.	No cost	1	Savings Present but Not Quantified	Immediate
Cleaning and maintenance of filters.	No cost	1	Low	Immediate
Offices and heating: get efficiency at next service. Ensure radiators are set to 3 max and thermostats to 19 DegC.	No cost	1	Low	Immediate
Installation of Air curtains including night curtains on open cases.	Low	-	Savings Present but Not Quantified	Short / Medium
To install VRF Units at the end of life of current split-airconditioning units.	Low /Med.	-	Savings Present but Not Quantified	Short / Medium / Long
HVAC Implementing Occupancy Sensors.	Low	-	Savings Present but Not Quantified	Medium / Long
Replacement of upright curtain chillers with new more efficient ones.	Low	1	Low	Short
Install motion sensors for AC units.	Low	1	Low	Long
Ventilation system, heat-recovery.	Low	-	Savings Present but Not Quantified	Short
Installation of inverter on ventilation fans.	Low	1	Low	Short
Installation of air curtain at supermarket entrance.	Low	1	Low	Long
Installation of PVC curtains at doorways.	Low	1	Low	Medium
Installation of inverter for Central Air Handing Unit.	Low	1	Low	Medium
Insulation of uninsulated steam pipes, valves and boiler surfaces.	Low/Med.	-	Savings Present but Not Quantified	Short
Cleaning of chiller condensor heat exchange surfaces.	Low	1	Low	Short
Replacement of ventilation fans with new VSD fans.	Low	1	Low	Medium
HVAC upgrade - Replacement of non-inverter type units with high efficiency inverter units.	Med.	1	Low	Long

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
Installation of heat recovery Units.	Med.	1	Savings Present but Not Quantified	-
Replacing AC Split Units with Variabe Speed Type.	Med.	1	Low	Long
Glass Doors / Night Curtains on open Spaces.	Med.	-	Low	Long
HVAC - Changing from a fixed speed pump to a variable speed pump.	Med.	3	Low	Long
Upgrading of ACs.	Med.	-	Low	Medium
Other measures, heat-recovery from ovens.	Med.	2	Medium	Short
Pneumatic system, heat-recovery.	Med.	1	Low	Medium
Replacement of the heavy oil burners of the steam boilers with natural gas burners.	Med.	2	Medium	Medium
Replacement of ventilation fans with new, VSD fans and the simultaneous installation of indoor temperature sensors.	Med.	1	Low	Short
Replacement of the compressors of the ammonia chillers with new, inverter-type compressors.	Med.	1	Low	Medium
Installation of flue gas waste recovery heat exchanger.	Med.	1	Medium	Medium/ Long
Replacement of old chiller with new chillers with inverters.	Med.	-	Medium	Medium
Replacement of A/C units with new A/C units with inverter motors.	Med.	2	Low	Long
Waste heat recovery from ammonia chiller condensers.	Med.	2	High	Short
Retrofit ventilation system drive: new transmission and magnetic reluctance motors.	Med.	1	Medium	Medium
Replacement of the bottling chiller with a more efficient one.	Med.	-	Savings Present but Not Quantified	Medium
Installation of a heat pump to heat hot water for the process.	Med.	-	Savings Present but Not Quantified	Long
Reducing thermal energy consumption in the fermentation and stabilisation vats by improving the thermal insulation of the surroundings (roof and walls).	Med.	1	Low	Long

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
Retrofitting of Two stage evaporative cooling.	High	1	High	Medium
New chiller.	High	1	Medium	Long
New boiler.	High	2	Medium	Long
Cooling systems, heat-recovery.	High	-	Savings Present but Not Quantified	Long
Other measures, heat-recovery from ovens.	High	2	High	Medium
Ventilation system, heat-recovery.	High	-	Low	Medium
Ventilation system, heat-recovery.	High	2	Medium	Long
1. Flue gas waste heat recovery from steam and thermal oil boilers; 2. Waste heat recovery from rejected steam; 3. Waste heat recovery from chiller condensers.	High	-	High	Medium
Activity Energy Efficiency on Screw Compressors. N11 and n6.	High	1	High	Medium



Category: Lighting

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
Installation of a lighting control system with presence and natural lighting detectors.	Low	1	Low	Short
Switch lighting to LED.	Low/ Med.	-	High	Short/ Medium/ Long
Lighting replacement using light tubes and LED fittings.	Med.	-	High	Long
Daylighting using light tubes in main hall.	Med.	-	Low	Long
VPC lighting upgrade to LED and Lux reduction.	Med.	1	Medium	Medium



Category: Electrical and Mechanical Systems

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
To switch off equipment when not in use.	No cost	-	Savings Present but Not Quantified	Immediate
Installation of presence detectors in storage areas.	Low	1	Low	Medium
Installation of PFC unit.	Low/ Med.	-	Savings Present but Not Quantified	Short / Medium
Installation of harmonic filters.	Med.	-	Savings Present but Not Quantified	Medium
Ancillaries - Small Power - Replacement of old appliances and installation of RO.	Med.	3	Low	Medium
Installation of eight (8) electrical metering points.	Med.	1	Low	Medium
Retrofit Ventilation drive: new transmission and magnetic reluctance motors.	Med.	1	Medium	Medium
Retrofit of electric motors with at least 3000hrs/year.	Med.	1	Medium	Medium
VSD on all pumps.	Med.	-	Medium	Long
Replace motors <6kW with and IE1 rating with new motors with an IE3 rating.	Med.	1	Low	Long
Replacement of old motors with new motors (inverters) or upgrade of existing ones.	Med.	1	Low	Long
Replacement of old motors with new motors with a rating of IE4.	High	1	Medium	Medium
High-efficiency tri-generation 305kW.	High	2	High	Medium



Category: Transportation and Fleet Management

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
Keeping tyres of vehicles properly inflated.	No cost	3	Low	Immediate
Eco-driving training.	No cost	-	Savings Present but Not Quantified	Immediate
Improvement of vehicle maintenance protocol.	No cost	-	Savings Present but Not Quantified	Immediate
Improvement of vehicle routes.	No cost	-	Savings Present but Not Quantified	Immediate
Tighter fuel reporting: get more organised to save Km and fuel; use existing tools (apps, expense reporting, salesforce, fuel cards to automate processes and simplify).	No cost	1	Medium	Immediate
Ensure TPMS - Tyre Pressure Monitoring Systems - are calibrated and used (weekly).	No cost	1	Low	Immediate
Specify A rated tyres for fuel performance in maintenance contracts.	No cost	1	Low	Immediate
Not all work can be done by cargo bikes etc, but some can.	No cost	-	-	Immediate
Maintain correct tyre pressures 1-3% saving 1% assumed.	No cost	1	Savings Present but Not Quantified	-
Specify Low Rolling Resistance tyres 3-5% saving 3% assumed.	No cost	1	Savings Present but Not Quantified	-
Introduce no-idling policy (base savings on 0.5/Hr).	No cost	-	Savings Present but Not Quantified	-
Slow down - adhere to speed limits - use cruise control.	No cost	-	Savings Present but Not Quantified	-
Adjust aerodynamic aids to reduce parasitic drag.	No cost	-	Savings Present but Not Quantified	-
Remove roof mounted racks & spots wherever possible.	No cost	-	Savings Present but Not Quantified	-
Ensure vehicle spec. meets business need.	No cost	-	Savings Present but Not Quantified	-
Use existing tools - Telematics, Fuel Card, Smart Meters (c.5%).	No cost	1	Savings Present but Not Quantified	Immediate

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
Modifying gasoline powered vehicles to work on lpg.	Low	3	Low	Medium
Eco-driving training.	Low	1	Low	Short
ECO driving training / awareness raising can deliver 3-5% savings per annum.	Low	1	Medium	Short
Specify new vehicles with semi-auto transmissions, cruise control and speed limited to 100kph or less.	Low	1	Savings Present but Not Quantified	-
Replacement of leased vehicles with new leased electrical vehicles.	Med.	1	Medium	Short
Choose car club or similar hourly hire instead (€10/hr vs avg €10,000/year for owed.	Med.	-	High	Short
Replacement of two LPG forklifts with electric ones.	Med.	-	Low	Long
Replacing vehicles (light goods vehicles) with combustion engines with electric ones.	Med.	-	Low	Long
Energy Recovery Brakes.	Med.	2	High	Short
Driver training.	Med.	3	High	Short
Maintenance.	Med.	2	High	Short
Throttle Management.	Med.	2	High	Short
Train Handling Techniques.	Med.	2	High	Short
Idling Controls.	Med.	2	High	Short
Ranked performance.	Med.	1	Low	Medium
Choose electric - all vehicles look suitable.	High	2	High	Medium
Capture odometer readings at point of fuel purchase.	High	1	Savings Present but Not Quantified	-
Identify most fuel thirsty vehicles and duty cycles.	High	1	Savings Present but Not Quantified	-
Key operator (drivers) training - ECOdrive c.5% saving with weekly feedback.	High	1	Savings Present but Not Quantified	-
Consider alternate PTO e.g., electric powered chargers for drones and other equipment.	High	-	Savings Present but Not Quantified	-

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
Get control of base load use and MIC excesses first; then look to install and use solar pv to charge cars (exports will be at wholesale prices, sales to customer at retail prices i.e. exports = losses.	High	1	High	Long
Fuel Additive.	High	2	High	Short
Notch 8 Limiters.	High	3	High	Short



Category: Renewable Systems

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
PV Cleaning -Regular cleaning is also very important since dust accumulation can decrease the system's output by up to 30%.	No cost	-	Savings Present but Not Quantified	Immediate
Installation of a photovoltaic system.	Med. / High	-	Savings Present but Not Quantified	Medium / Long



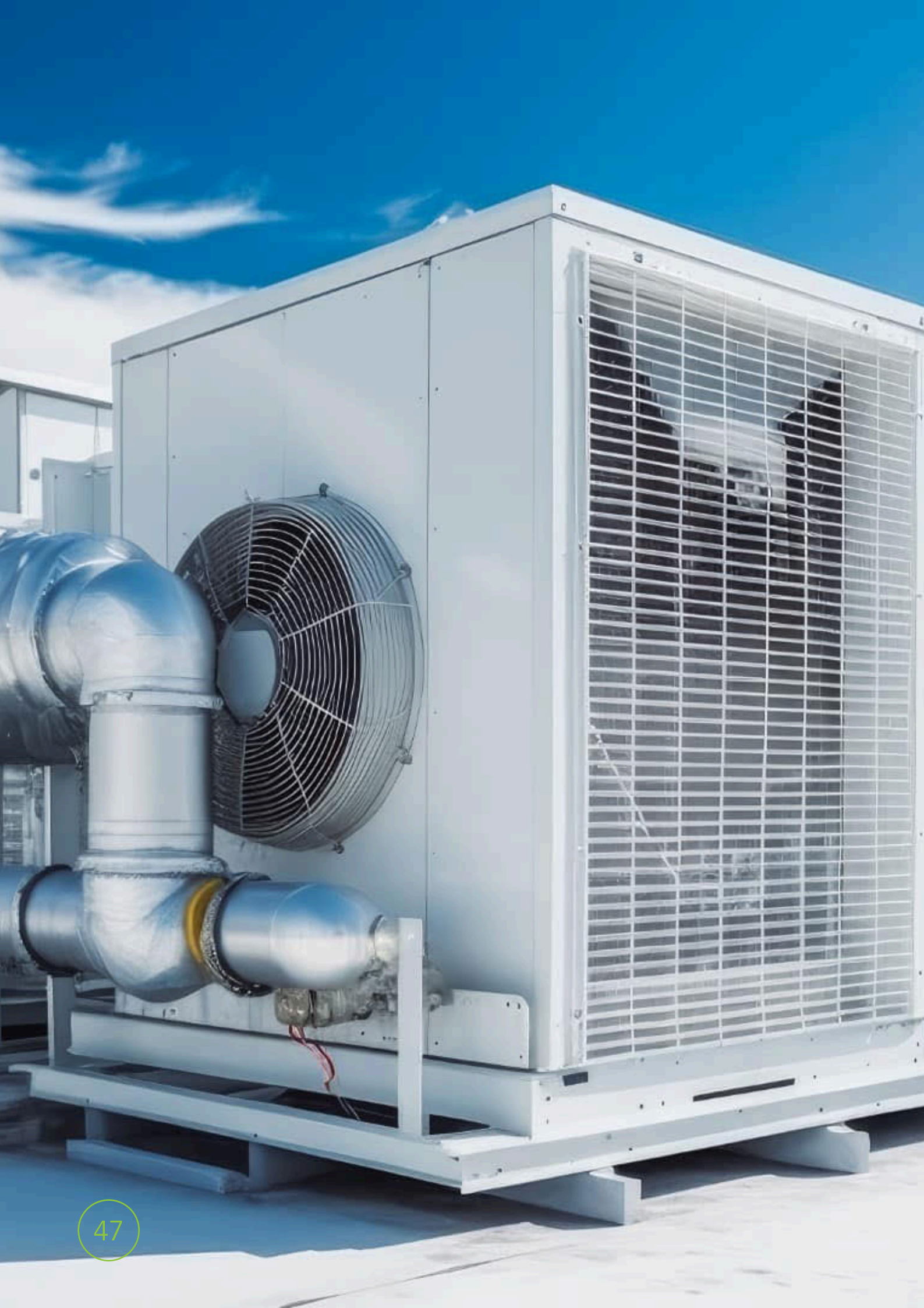
Category: Compressed Air

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
Improvements in Compressed Air system (reduce: waste due to improper control and unload energy; waste due to efficiency at higher pressure; waste due to leaks reduction at lower pressure).	No cost	1	Medium	Immediate
Compressed air system reducing pressure by 0.5bar.	No cost	-	Savings Present but Not Quantified	Immediate
Compressed air pipework to be checked for leaks and timers to be used for on/off	No cost	-	Savings Present but Not Quantified	Immediate
Pressure reduction of compressed air system and detection of leaks.	Low	1	Low	Short
Reducing air inlet temperature of compressor.	Low	1	Low	Medium
Energy recovery for compressor.	Low / Med.	-	Savings Present but Not Quantified	Short / Medium
Reduction of compressed air system leaks.	Low / Med.	-	Savings Present but Not Quantified	Medium / Long
Optimisation of air compressor settings and operation.	Med.	-	Savings Present but Not Quantified	Short / Medium
Upgrading to a variable speed drive compressor.	Med.	1	Low	Medium
Compressed air system optimisation with compressor replacement.	Med.	1	Medium	Medium
Replacement of air compressor with new variable speed compressor.	Med.	-	Savings Present but Not Quantified	Long
Replacement of air compressors with new inverter-type compressors.	Med.	1	Low	Long



Category: Monitoring and Management Systems

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
Awareness raising campaign.	No cost	-	Savings Present but Not Quantified	Immediate
Implement energy awareness campaign (5% of buildings surveyed).	Low	1	Savings Present but Not Quantified	Immediate
Installation of energy monitoring system.	Low	-	Savings Present but Not Quantified	Short / Medium
Installation of IoT energy management system.	Low	1	Low	Medium
Consider ISO50001 (with or without certification) Sum 1+3.	Med.	1	Savings Present but Not Quantified	Immediate
Installation of an IoT energy monitoring and management system.	Low / Med. / Long	-	Savings Present but Not Quantified	Short / Medium / Long
Introduction of an automated system for managing the operation of steam boilers	Med.	3	High	Short
Monitoring and sub-metering.	Med.	-	High	Short
Introducing an energy management system.	Med.	-	Savings Present but Not Quantified	Short / Medium / Long
Improve Industrial Control.	High	-	High	Short



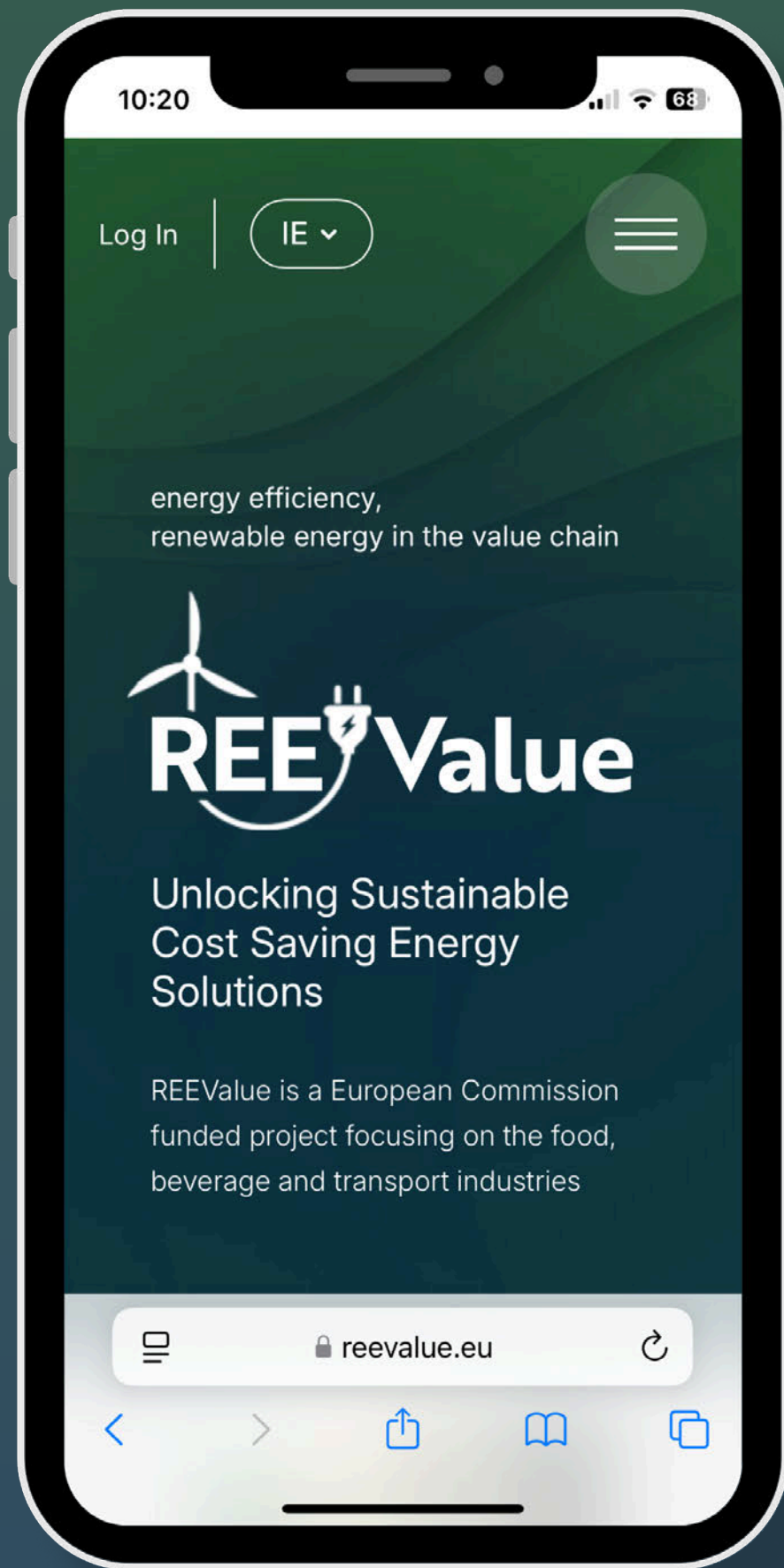
Category: Refrigeration

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
To reduce volume of refrigeration.	No cost	-	Savings Present but Not Quantified	Immediate
Replacement of refrigeration units (Cost & savings quoted is for one unit).	Low	1	Low	Short
Installation of doors at industrial refrigerators.	Low	1	Low	Medium
Insulation of uninsulated refrigeration and cooling piping.	Low	1	Low	Short
Replacement of refrigerator and freezer doors.	Med.	1	Medium	Short
Shading and Ventilation of Condensors of Refrigeration Compressor Systems.	Med.	1	Low	Long
Refrigeration - Change from R404 based system to a CO2 based system (R744).	High	-	Medium	Long
Optimisation on refrigeration.	High	3	High	Short
Retrofit of 3 compressors refrigerators by motor replacement and inverter installation.	High	3	High	Short
Refrigeration plant: transformation from single stage to bi-stage.	High	2	High	Short



Category: Building and Infrastructure Improvements

Description of energy efficiency recommendation	Investment Level	Energy savings categories	Financial savings	Payback period level
Storage heating to be reset and all shown how to use controls.	Low	-	Savings Present but Not Quantified	Immediate
Technical system insulations.	Low	1	Low	Medium
RO System upgrade.	Med.	-	High	Short
Building automation.	Med.	-	Savings Present but Not Quantified	Short / Medium
Introduction of Skylights.	Med.	1	Low	Long
Roof reflective white coating	Med. / High	-	Savings Present but Not Quantified	Medium / Long



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