

BEST PRACTICES – TRANSPORT

FACTSHEET



Portable refrigerated units for LTL

Refrigerated transport is critical not only in terms of maintaining the temperature integrity of the products but also in terms of the environmental impact in terms of energy consumptions and greenhouse gas and particulate emissions.

Portable refrigerated units (PRU) represent a novel solution that can be used by logistic companies to offer their customers a refrigerated transport service for small and medium volumes (e.g., Less than Truck Load transport) of perishable goods on board of their standard vehicles, without the need for investment in special vehicles and infrastructures.

The use of this particular solution can lead to relevant economic and environmental benefits with respect to the traditional refrigerated transport which is usually belt-driven from the vehicle engine with diesel as the fuel source.

Description

Refrigerated transportation of foodstuffs presents several challenges and issues (e.g., harsh environment, wide range of cooling demand and constraints, substantial temperature differences inside the vehicle due to air distribution) which make critical keeping the

temperature of perishable goods in the desired range during the transportation activities. Furthermore, these issues are increased by the recent globalization which results in long distances travelled and higher duration of land transportation. In addition, the increasing quantity of transported

‘Portable cold’

Italy

Frozen foods

TRL 9

Investment (real or estimated)

€ 4,000

Pay Back Time

< 1 year

Main NEBs (other benefits)

Food quality

Lower fuel consumption

Lower leakages

Negligible maintenance

goods and of home deliveries, and the higher quality expectations of customers, bring to an increased use of refrigeration in order to reach lower temperatures, which result in tremendous amount of energy consumption [1]. There are many factors affecting design and performances of

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transportation units, such as extreme exterior weather conditions, desired interior conditions, insulation properties, infiltration of air and moisture, trade-offs between construction and operating costs and physical deterioration from shocks and vibrations. In addition, there are logistic activities that cause air infiltrations which lead to a remarkable increase of the cooling demand and, consequently, of the energy usage, and which may also affect the product temperature and quality. The most relevant are the frequent temporary opening of the vehicle doors for the delivery of the products, and the temporary interruptions of refrigeration function due to engine power off, mainly during loading and unloading of the products [2]. For instance, a food product can be subject to about 50 door-openings during a multi-drop delivery [3]. While, ground operations for loading and unloading products frequently report increases in temperature due to the length of time that pallets are kept at inappropriate ambient temperatures waiting for material handling activities. As a consequence, the stakeholders' awareness on these significant environmental impacts put an increasing demand for the definition of new solutions for more sustainable refrigerated transport activities. Recently, a portable refrigerated unit (PRU) has been proposed as a new solution for overcoming the previously defined issues [4]. The ColdTainer¹ solution is an active transportable insulated and

refrigerated unit designed and produced by the company Euroengel Srl.

What is the improvement focus?

Portable refrigerated units are made of polyethylene for food use with a rotational molding technology, which allows to obtain unique impact resistant cable bodies. Such containers can be easily sanitized in compliance with Directive 93/43/EEC (HACCP). The thermal insulation is made of expanded polyurethane, with thickness ranging from 65 to 130 mm. Furthermore, the larger models are tested in accordance with ATP regulations and have a technical dispersion coefficient "K" less than 0.40 Wm²/K.

The refrigeration units use Danfoss hermetic compressors (12-24Vdc), developed specifically for use on vehicles and therefore with low absorption and can function perfectly even in the presence of vibrations and angles up to 30°C. Coolant gas is R134a, non-flammable and compatible with environmental regulations, for + 4 °C solutions while R404a for – 20 °C solutions.

Benefits

The use of active refrigerated containers simplifies different phases of the cold chain with obvious reduction in direct and indirect costs, a significant improvement in delivery time, and also a reduction in the risk of food contamination and breaks in the chain itself. This entails environmental benefits in terms of reducing energy consumption and

CO₂ emissions. In particular, this technology simplifies transport and storage of refrigerated goods. From the storage point of view, containers can be placed in non-refrigerated traditional warehouses and used as a local refrigerated space by connecting them to the power supply. This allows you to not make specific refrigerated warehouses while avoiding investments. From the transport point of view, these containers can therefore be loaded directly with a forklift truck on an un-refrigerated truck (powered by 12V/24V batteries of the vehicle) for direct delivery to their final destination. This system therefore eliminates the need for specialized refrigerated vehicles. PRUs enable also the joint delivery and storage of refrigerated and non-refrigerated goods, since they allow to set different temperatures to each unit avoiding the deterioration of products. In particular, in the food supply chain where the temperature, relative humidity, hygienic conditions and possibly even air composition must be strictly controlled and monitored to accelerate or slow down the product aging process (controlled atmospheres). PRUs allow also to avoid the partitioning of the warehouse into smaller cells for the preservation of goods with similar characteristics.

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¹ <https://www.coldtainer.it>

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Opportunities and barriers to implementation

Opportunities	Barriers
Improved food quality	Additional cost for renovating fleet equipment
Lower fuel consumption and related cost	
Negligible maintenance	
Lower leakages	
Available worldwide and	

cheaper than other solution	
Simplified handling, storage and transport of products	

compared with the final situation and a table of differences is shown broken down into the different key points of savings.

Total investment (€)	4,000
Fuel unit price [€/l]	1.65
Refrigerant price [€/kg]	29
Emission reduction	- 37%
Savings	- 43%
Return period (years)	<1

Calculations

The calculations show a quick idea of the costs and returns of this practice, as well as the economic impact after the implementation of the new equipment. In order to be clear, the initial situation is directly

References

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About ICCEE

The project ICCEE, www.iccee.eu, funded by the EU programme Horizon 2020, aims at improving energy efficiency in the cold chain of the food & beverage sector and making it easier for the sector to undertake energy efficiency measures across the entire supply chain and accelerate the implementation of energy audit results.

ICCEE follows a holistic approach that moves from a single company perspective to the assessment of the entire cold supply chain. Existing financing schemes for SMEs will be assessed: the optimal ones will support the implementation of energy efficiency measures. ICCEE objectives build on 2 pillars:



The ICCEE project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement no. 847040.