

## BEST PRACTICES – REFRIGERATION SYSTEM FACTSHEET



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### Electricity costs and emissions savings

A small German village shop has proven that it is possible for small and medium-sized enterprises to be a climate pioneer: in 2010, it installed 100 m<sup>2</sup> of photovoltaic modules on its roof, which has already saved 46 tonnes of CO<sub>2</sub> emissions since. In 2017, the shop's management, voluntarily run by inhabitants from the village, decided to do more: after a comprehensive consultation with an energy consultant, they found further efficiency potentials for the store.

In spring 2018, the new refrigeration system and deep-freeze technology with a modern CO<sub>2</sub> compound, which replaced four old refrigerators, was installed. Using CO<sub>2</sub> as a natural refrigerant, it is more energy efficient, functions as a more environmentally friendly alternative to CFC and HCFC fluids, and gives CO<sub>2</sub> a second life. Thus, electricity could be saved, and the use of environmentally harmful substances was reduced. A new refrigerated service counter and a refrigerated and deep-freeze shelf were put into operation for this purpose. Now cheese, sausage, meat and frozen products are kept fresh and presented in an attractive way.

#### Description

Climate-friendliness is not just a goal for the big corporations: a small village shop in Germany has proven that it is possible to enable citizen participation and climate protection as a small business. In 2010, the shop's

200-year old building was renovated and comprehensively insulated, reducing the need for heating and cooling energy in the winter and summer months. Additionally, over 100 square metres of solar PV panels were installed on the shop's rooftop, producing environmentally friendly

### 'Double saving'

Germany  
Retail

#### Investment

57,800 €

#### Savings

3,500 €/year

17,000 kWh/year

#### Main NEBs (other benefits)

Reducing greenhouse  
gas emissions

Product quality  
improvement

Environmentally friendly

electricity for the shop's own consumption. This measure alone has already resulted in a reduction of 46 tonnes of CO<sub>2</sub> emissions.

In 2017, the shop's chairman, applied for a nation-wide energy efficiency project. This project supports small

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and medium-sized enterprises in becoming more energy efficient, by providing funding and support in the planning phase.

After consultation with an energy expert, the village shop found further energy efficiency potential. In spring 2018, four old refrigerators were replaced with a new refrigeration and deep-freeze technology with a modern CO<sub>2</sub> compound refrigeration system.

### What is the improvement focus?

Using CO<sub>2</sub> as a refrigerant means a natural and environmentally friendly alternative to the traditional HCFC/CFC refrigerants that damage the ozone layer. Additionally, its volumetric cooling capacity is significantly higher than that of

conventional refrigerants, and could be considered safer due to lower toxicity levels and non-flammability. It has to be noted that CO<sub>2</sub> as a refrigerant, leads to higher pressure, and associated hazards can present additional challenges. Due to the higher pressure, CO<sub>2</sub> is also not suitable as a retrofit refrigerant.

### Benefits

Nine months after the installation of the new refrigeration system, the shop has used 12,000 kWh less than it would have otherwise. Thanks to this latest energy efficiency measure, the shop's energy consumption has dropped by an additional 30%, contributing to climate goals and shielding the shop from rising electricity prices.

Combined with the existing PV installation, the shop's total electricity consumption has dropped with over 31,000 kWh, or 58%, saving the shop around €6,500 per year.

Another important benefit is the improved presentation of the shop's cooled goods in the new refrigerated service counter, which is more attractive than it was in the four old refrigerators.

Using PV panels, energy efficient refrigeration systems and natural refrigerants, such as CO<sub>2</sub> is a cross-sectional possibility for businesses of different sizes to decrease electricity consumption, greenhouse gas emissions, the use of harmful substances and related costs.

### Opportunities and barriers to implementation

<i>Opportunities</i>	<i>Barriers</i>
Lower electricity consumption and related cost	investment costs for PV panels and new refrigeration technology
Environmentally friendly technology (Reducing greenhouse gas emissions)	
Cross-business technology also for small businesses	

### 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. For transparency's sake, the initial situation is directly compared with the final situation and a table of differences is shown broken down into the different key points of savings, using an average price of electricity and emissions taking into account their expected evolution.

	Initial situation	Final situation
Annual energy consumption [kWh/year]	56,476	39,359
Annual energy cooling consumption [kWh/year]	<i>No data</i>	
Annual economic energy expenditure [€/year]	12,424	8,625

Total investment (€)	57,800 <sup>1</sup>
Energy savings [kWh/year]	17,117
Average electricity price [€/kWh]	0.3147 <sup>2</sup>

<sup>1</sup> The village shop received financial support in the height of €45,121, making their own investment costs €12,679.

<sup>2</sup> This is the average retail electricity price in Germany in 2018.

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Average emission price [€/tCO <sub>2</sub> ]	25 <sup>3</sup>
Emission reduction [tCO <sub>2</sub> /year]	9.7 <sup>4</sup>
Energy economic saving (€)	3,799
Emission economic saving (€)	242.50
Total economic savings (€)	4,041.50
Return period (years)	14.3 <sup>5</sup>

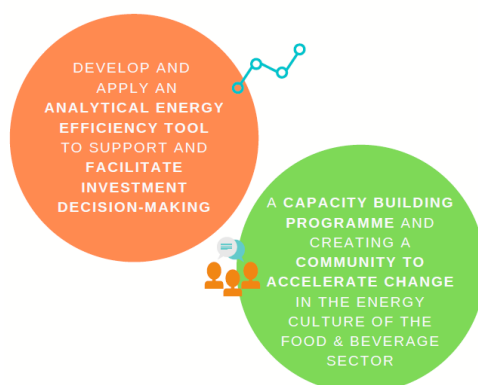
### References

[1] Handelsverband Deutschland: Klimaschutzoffensive des Handels: Erfolgsgeschichten: Dorfladen & AllerCafé Otersen, Potsdam. Zuletzt eingesehen am 23.06.2020 unter: <https://www.hde-klimaschutzoffensive.de/de/kampagne/erfolgsgeschichten/dorfladen-otersen>

### About ICCEE

The project ICCEE, [www.iccee.eu](http://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.

<sup>3</sup> This will be the German carbon price in 2021.

<sup>4</sup> The carbon intensity of Germany's electricity is 567g/kWh.

<sup>5</sup> This is the return period for the entire investment. The return period for the shop's own investment (€12,679) is 3.1 years.