



# ***APPLICATIONS OF TRANSCRITICAL***

***CO<sub>2</sub>***

***Part 2***

***Chapter 1***





# ***An overview***

Transcritical CO<sub>2</sub> technology has been deployed in a variety of applications across the world for many years. From traditional supermarket applications to convenience stores and industrial cold storage applications; even on cruise ships and for ice rinks – there are hundreds of examples of successful installations globally.

The following pages showcase examples of a multitude of different transcritical CO<sub>2</sub> installations, varying in size and location, categorized by type of application. Whether in a small, convenience store type of installation, or the more conventional commercial retail one; even industrial projects – transcritical CO<sub>2</sub> is worth considering when designing an HVAC&R installation. Here is how others have done it...



# SMALL STORE APPLICATIONS



## CONVENIENCE STORES

**<sup>1</sup>Europe:** European retailer Carrefour has installed a full-CO<sub>2</sub> transcritical remote unit at a Carrefour City store in Vannes, Brittany. Opened in October 2017 and located in the city center of Vannes, the store has a commercial surface of 293m<sup>2</sup> [3154ft<sup>2</sup>]. To save space for the refrigeration plant, Carrefour installed the refrigeration systems in the store's yard.

The transcritical CO<sub>2</sub> refrigeration system is a two-stage central unit with 22kW [6.3TR] of medium-temperature (MT) cooling and 2.2 kW [0.6TR] of low-temperature (LT) cooling. All refrigerated display cabinets are equipped with doors except the snacking segment. Carrefour has also installed doors on all refrigerated cabinets of the store, as well as LED lighting to increase the energy performance of the store.

**<sup>2</sup>Europe:** A Delhaize convenience store in the heart of Belgian capital Brussels uses two CO<sub>2</sub> condensing units. The two new CO<sub>2</sub> condensing units were installed in a franchised Shop & Go store on Boulevard Adolphe Max. The supermarket has a footprint of 250m<sup>2</sup> [2,691ft<sup>2</sup>] and opened at the end of June 2018.

One of the units serves the medium-temperature cabinets, and other serves the frozen food cabinets. They were commissioned in late June.

**<sup>3</sup>Japan:** In the framework of the convenience store (CVS) concept, Lawson has opened a CVS store that has 263m<sup>2</sup> [2,831ft<sup>2</sup>] and provides around 3,000 kinds of products. The CO<sub>2</sub> refrigeration system for this

store helps reduce the energy consumption by 20% in comparison to 2010's standard HFC system.

Half of the 20% energy savings is thanks to the CO<sub>2</sub> system and the other half due to energy saving features of new CO<sub>2</sub> showcases (i.e. sliding glass doors). LED lighting, improved thermal insulation, energy management system and electricity generated with installed solar panels contribute to planned total 50% energy saving of this store opened in February 2014. The system features one 10HP [7.5kW; 2.1TR] unit to provide MT cooling, two 2HP [1.5kW; 0.4TR] units to provide LT cooling and a bottle cooler with built-in CO<sub>2</sub> refrigeration system.





# ***REFERENCES***





## Chapter two: 'Applications of transcritical CO<sub>2</sub>

1. Battesti, M. (2018). *Carrefour's first CO<sub>2</sub> transcritical convenience store*. Available online at: [http://www.r744.com/articles/8184/carrefourandrsquo\\_s\\_first\\_co2\\_transcritical\\_convenience\\_store](http://www.r744.com/articles/8184/carrefourandrsquo_s_first_co2_transcritical_convenience_store)

2. Williams, A. (2018). *CO<sub>2</sub> at heart of new Delhaize convenience store*. Available online at: [http://www.r744.com/articles/8422/co2\\_at\\_heart\\_of\\_new\\_delhaize\\_convenience\\_store](http://www.r744.com/articles/8422/co2_at_heart_of_new_delhaize_convenience_store)

3. Dusek, J. (2014). *Lawson's green flagship convenience store opens in Osaka, promises 50% energy reductions*  
at: [http://www.r744.com/articles/5044/lawson\\_s\\_green\\_flagship\\_convenience\\_store\\_opens\\_in\\_osaka\\_promises\\_50\\_energy\\_reductions](http://www.r744.com/articles/5044/lawson_s_green_flagship_convenience_store_opens_in_osaka_promises_50_energy_reductions)

4. Garry, M. (2020). *Transcritical CO<sub>2</sub> in Warm, Muggy Florida*. Available online at: [http://r744.com/articles/9384/transcritical\\_co2\\_in\\_warm\\_muggy\\_florida](http://r744.com/articles/9384/transcritical_co2_in_warm_muggy_florida)

5. Garry, M. (2019). *Weis Markets reports dramatic energy savings with transcritical CO<sub>2</sub>*. Available online at: [http://www.r744.com/articles/9096/weir\\_markets\\_reports\\_dramatic\\_energy\\_savings\\_with\\_transcritical\\_andnbsp\\_co2](http://www.r744.com/articles/9096/weir_markets_reports_dramatic_energy_savings_with_transcritical_andnbsp_co2)

6. Stausholm, T. (2020). *Italian Supermarket Increases Efficiency of Transcritical CO<sub>2</sub> system with Groundwater*. Available online at: [http://r744.com/articles/9349/italian\\_supermarket\\_increases\\_efficiency\\_of\\_transcritical\\_co2\\_system\\_with\\_groundwater](http://r744.com/articles/9349/italian_supermarket_increases_efficiency_of_transcritical_co2_system_with_groundwater)

7. Stausholm, T. (2019). *Migros Ticino installs its first integrated CO<sub>2</sub> system*. Available online at: [http://r744.com/articles/9090/migros\\_ticino\\_installs\\_its\\_first\\_integrated\\_co2\\_system](http://r744.com/articles/9090/migros_ticino_installs_its_first_integrated_co2_system)

8. Koegelenberg, I. (2019). *Bulgarian Metro Store Installs Transcritical CO<sub>2</sub> system with Zero Downtime*. Available at: [http://r744.com/articles/9187/bulgarian\\_metro\\_store\\_replaces\\_20\\_year\\_old\\_hfc\\_system\\_with\\_zero\\_downtime](http://r744.com/articles/9187/bulgarian_metro_store_replaces_20_year_old_hfc_system_with_zero_downtime)

9. Koegelenberg, I. (2020). *1.9MW of CO<sub>2</sub> for South African Produce Market*. Accelerate Corporate Edition 2020. Available online at: [https://issuu.com/shecco/docs/acorp\\_sphere](https://issuu.com/shecco/docs/acorp_sphere)

10. Koegelenberg, I. (2019). *Centre Point PnP minimizes environmental impact*. Available online at: <https://www.coldlinkafrica.co.za/index.php/projects/412-centre-point-pnp-mini-mises-environmental-impact>

11. Koegelenberg, I. (2019). *Prioritizing Sustainability, IGA Store Chooses CO<sub>2</sub>*. Available online at: [http://www.r744.com/articles/9162/prioritizing\\_sustainability\\_iga\\_store\\_chooses\\_co2](http://www.r744.com/articles/9162/prioritizing_sustainability_iga_store_chooses_co2)

12. Koegelenberg, I. (2020). *Meeting the "Living Building Challenge"*. Available online at: <https://accelerate24.news/regions/australia/meeting-the-living-building-challenge/2020/>

13. Koegelenberg, I. (2019). *Quick Adopting New Zealanders Boast Two New CO<sub>2</sub> Retail Installations*. Available online at: [http://r744.com/articles/9236/\\_quick\\_adopting\\_new\\_zealanders\\_boast\\_two\\_new\\_co2\\_retail\\_installations](http://r744.com/articles/9236/_quick_adopting_new_zealanders_boast_two_new_co2_retail_installations)

14. Aleu, P. (2019). *Makro Continues CO<sub>2</sub> Installations in Latin America*. Available at: [http://r744.com/articles/9267/makro\\_continues\\_co2\\_installations\\_in\\_latina\\_merica](http://r744.com/articles/9267/makro_continues_co2_installations_in_latina_merica)

15. Yoshimoto, D. (2019). *Satisfying Results Observed in China's Second Transcritical CO<sub>2</sub> System*. Available online at: [http://r744.com/articles/9245/satisfying\\_results\\_observed\\_in\\_china\\_s\\_second\\_transcritical\\_co2andnbsp\\_system](http://r744.com/articles/9245/satisfying_results_observed_in_china_s_second_transcritical_co2andnbsp_system)

16. Garry, M. (2020). *Hannaford Pioneers Transcritical CO<sub>2</sub>*. Available online at: [http://r744.com/articles/9328/hannaford\\_pioneers\\_transcritical\\_co2\\_andndash\\_again](http://r744.com/articles/9328/hannaford_pioneers_transcritical_co2_andndash_again)
17. Yoshimoto, D. (2020). *Japanese Cold Storage Operator Cuts Energy by 35% with CO<sub>2</sub>*. Available online at: [http://r744.com/articles/9392/japanese\\_cold\\_storage\\_operator\\_cuts\\_energy\\_by\\_35\\_with\\_co2](http://r744.com/articles/9392/japanese_cold_storage_operator_cuts_energy_by_35_with_co2)
18. Yoshimoto, D. (2019). *Yoshio Ice goes with transcritical CO<sub>2</sub> in warm climate*. Available online at: [http://r744.com/articles/9048/yoshio\\_ice\\_goes\\_with\\_transcritical\\_co2\\_in\\_warm\\_climate](http://r744.com/articles/9048/yoshio_ice_goes_with_transcritical_co2_in_warm_climate)
19. Koegelenberg, I. (2020). *Australian Wholesaler Chooses CO<sub>2</sub> Over Ammonia and HFCs for Cold Storage*. Available online at: <https://accelerate24.news/regions/australia/australian-wholesaler-chooses-co2-over-ammonia-and-hfcs-for-cold-storage/2020/>
20. Yoshimoto, D. (2019). *Japanese margarine, beer, ice makers adopting transcritical CO<sub>2</sub>*. Available online at: [http://r744.com/articles/9110/japan\\_margarine\\_beer\\_ice\\_makers\\_adopting\\_transcritical\\_co2](http://r744.com/articles/9110/japan_margarine_beer_ice_makers_adopting_transcritical_co2)
21. Williams, A. (2018). *Sipping CO<sub>2</sub>cooled wine*. Available online at: [http://r744.com/articles/8168/sipping\\_co2\\_cooled\\_wine](http://r744.com/articles/8168/sipping_co2_cooled_wine)
22. SCM Frigo s.p.A (2020). Available online at: [https://www.linkedin.com/posts/scm-frigo-s.p.a.\\_scmfri-go-beijref-co2leader-activity-6626143937620918272-Er2y/](https://www.linkedin.com/posts/scm-frigo-s.p.a._scmfri-go-beijref-co2leader-activity-6626143937620918272-Er2y/)
23. Ackermann, J. (2018). *CO<sub>2</sub> transcritical installation- a processing plant first*. Available online at: <https://www.coldlinkafrica.co.za/index.php/projects/317-co2-trans-critical-installation-a-processing-plant-first>
24. Yoshimoto, D. (2019). *World's largest transcritical CO<sub>2</sub> system commissioned in California*. Available online at: [http://r744.com/articles/9042/world\\_s\\_largest\\_transcritical\\_co2\\_system\\_commissioned\\_in\\_california](http://r744.com/articles/9042/world_s_largest_transcritical_co2_system_commissioned_in_california)
25. Jooste, J. (2019). *Transcritical CO<sub>2</sub> system pushing boundaries for Meat World*. Available online at: <http://www.coldlinkafrica.co.za/index.php/projects/550-trans-critical-co2-system-pushing-boundaries-for-meat-world>
26. Aleu, P. (2019). *Hillphoenix supplies 4th transcritical CO<sub>2</sub> industrial system in Latin America*. Available online at: [http://r744.com/articles/9064/hillphoenix\\_supplies\\_4th\\_transcritical\\_co2\\_industrial\\_system\\_in\\_latin\\_america](http://r744.com/articles/9064/hillphoenix_supplies_4th_transcritical_co2_industrial_system_in_latin_america)
27. Yoshimoto, D. (2019). *DFDS Logistics Switches to CO<sub>2</sub>Containers for Coastal Shipping Service*. Available online at: [http://r744.com/articles/9204/dfds\\_logistics\\_switches\\_to\\_co2\\_containers\\_for\\_coastal\\_shipping\\_service](http://r744.com/articles/9204/dfds_logistics_switches_to_co2_containers_for_coastal_shipping_service)
28. Stausholm, T. (2019). *Fishing Trawler Installs Compact CO System to Chill Catch*. Available online at: [http://r744.com/articles/9313/u\\_s\\_fishing\\_trawler\\_installs\\_compact\\_co2\\_system\\_to\\_chill\\_pollock](http://r744.com/articles/9313/u_s_fishing_trawler_installs_compact_co2_system_to_chill_pollock)
29. Garry, M. (2020). *Toronto's CO System for Outdoor Ice Trail Said to be World's First*. Available online at: [https://accelerate24.news/regions/torontos-co2-system-for-outdoor-ice-trail-said-to-be-worlds-first/2020/?mc\\_cid=8c87020895&mc\\_eid=f3c3851c70](https://accelerate24.news/regions/torontos-co2-system-for-outdoor-ice-trail-said-to-be-worlds-first/2020/?mc_cid=8c87020895&mc_eid=f3c3851c70)
30. Yoshimoto, D. (2019). *Beijing 2022 Winter Olympics officially announces use of CO<sub>2</sub> systems for ice venues*. Available online at: [http://r744.com/articles/9053/beijing\\_2022\\_winter\\_olympics\\_officially\\_announces\\_use\\_of\\_co2\\_systems\\_for\\_ice\\_venues](http://r744.com/articles/9053/beijing_2022_winter_olympics_officially_announces_use_of_co2_systems_for_ice_venues)
31. Williams, A. (2019). *Norway's first year-round indoor ski arena to use CO<sub>2</sub> transcritical*. Available online at: [http://r744.com/articles/9050/norwayandrsquo\\_s\\_first\\_year\\_round\\_indoor\\_ski\\_arena\\_to\\_use\\_co2\\_transcritical](http://r744.com/articles/9050/norwayandrsquo_s_first_year_round_indoor_ski_arena_to_use_co2_transcritical)
32. Garry, M. (2019). *GEA to equip two Chinese cruise ships with transcritical CO<sub>2</sub>*. Available online at: [http://r744.com/articles/9128/gea\\_to\\_equip\\_two\\_chinese\\_cruise\\_ships\\_with\\_transcritical\\_co2](http://r744.com/articles/9128/gea_to_equip_two_chinese_cruise_ships_with_transcritical_co2)
33. Koegelenberg, I. (2019). *Burger King Starts Roll Out of CO<sub>2</sub> Condensing Units in Spain*. Available online at: [http://r744.com/articles/9203/burger\\_king\\_starts\\_roll\\_out\\_of\\_co2\\_condensing\\_units\\_in\\_spain](http://r744.com/articles/9203/burger_king_starts_roll_out_of_co2_condensing_units_in_spain)
34. Williams, A. (2019). *The Natural Refrigerant Treatment*. Accelerate Europe Spring 2019. Available online at: [https://issuu.com/shecco/docs/ae\\_1903\\_33d31f1e897942/22](https://issuu.com/shecco/docs/ae_1903_33d31f1e897942/22)
35. Garry, M. (2019). *Versatile CO<sub>2</sub> Contractor Installs Transcritical at a Supermarket, a Processing Facility and an Ice Rink*. Available online at: <https://accelerate24.news/regions/versatile-co2-contractor-installs-transcritical-at-a-supermarket-a-processing-facility-and-an-ice-rink/2019/>