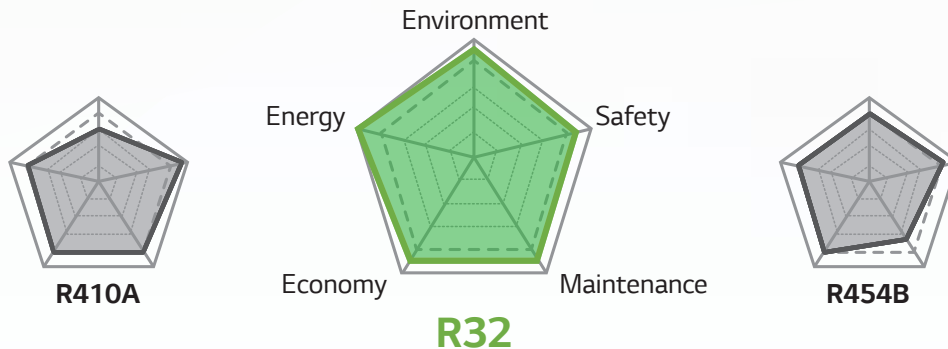




WHY



Why R32



LG chose R32 as the new refrigerant for its split systems. There are various advantages of using R32 and R454B in different applications. This paper shows why LG chose R32 as the future refrigerant from environment, efficiency, economy, and safety points of view. This paper also shows a comparison table demonstrating how R32 and R454B stack up against R410A.

Environment

Zero Ozone Depletion

R32 is a chlorine-free lower Global Warming Potential (GWP) fluorocarbon with an Ozone Depletion Potential (ODP) of zero. When comparing GWP of R32 (GWP 675) to that of R410A (GWP 2088), it comes in just under 1/3, which complies with new and coming refrigerant regulations. [1]

No PFAS

In Europe, R32 is not under regulation of per- and polyfluoroalkyl substance (PFAS) while R454B and R410A are. A restriction of PFAS use was proposed to the European Chemicals Agency (ECHA) in early 2023, and this proposal is currently under a six-month open consultation period. [2] HFO1234yf is one of around 10,000 PFAS chemicals included in this proposed restriction which makes up 31.1% of R454B. R32 is 100% composed of HFC32 and is not included in this proposal.

Life Cycle Climate Performance

Life Cycle Climate Performance (LCCP) is an indicator that calculates the CO₂ emissions generated throughout the entire process from production to disposal. LCCP is comprised of direct and indirect emissions. Direct emissions include the refrigerant leakage and atmospheric degradation of refrigerants, and indirect emissions include the energy consumption, material/refrigerant manufacturing, and material/refrigerant recycling. [3] As shown in the graph (Fig 1) for the LCCP calculation based on test results in a light commercial heat pump system, the direct emissions (grey) from R454B were lower but the indirect (black) and total emissions from R32 were lower. Less LCCP means less CO₂ emissions in kg CO₂ eq., which has less impact on the environment.

LCCP calculation based on test results in a light commercial heat pump system

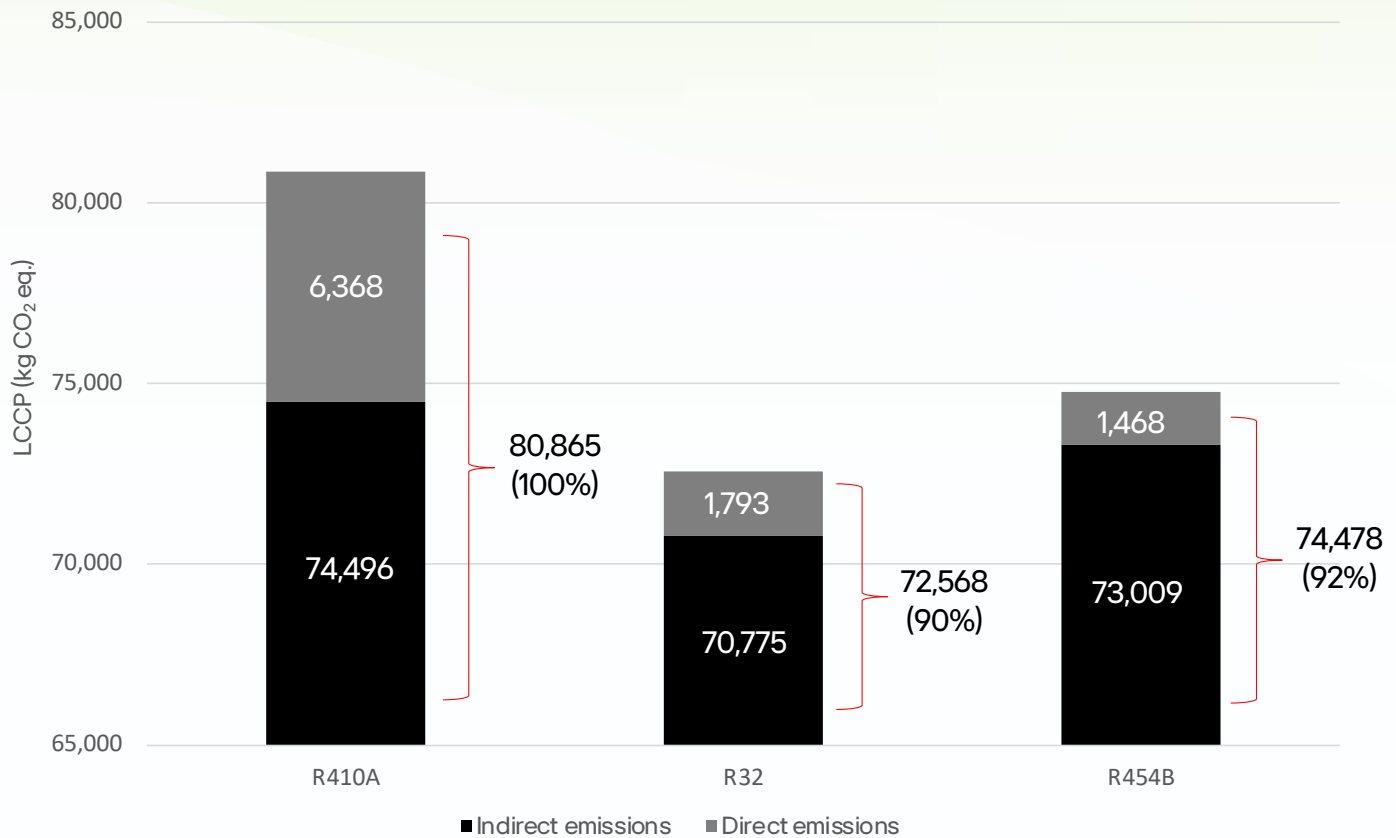


Fig 1. LCCP calculation based on test results in a light commercial heat pump system [4]

Energy (Efficiency)

Higher capacity/efficiency

As a result of evaluating the performance of the refrigerant in the low-pressure scroll compressor, R32 increased the capacity by 4-8%, and efficiency by 0-5% compared to R410A systems. Compared to R410A, a system with R454B resulted in a decreased capacity by 5-7% and efficiency by 2-4%. [5]

Smaller charge volume

As a result of comparing the optimal refrigerant charging amount and cooling/heating performance evaluation with a Single Split Ceiling Cassette type product, R32 and R454B systems only required 75% and 92% respectively of the refrigerant charge amount compared to R410A.

Economy

As a single component refrigerant, R32 is likely to remain most cost effective compared to the blend refrigerants R410A and R454B. With R410A being phased out from new equipment use, R32 is likely to be less expensive than R410A. As a blend of more than just R32, R454B is likely to be more expensive than R32. Also, as a component of many blends, the volume of R32 production is likely to help hold the cost down. As discussed earlier, R32 requires less charge volume due to its larger amount of energy per unit volume so the larger the system, the larger the cost difference. This likely makes R32 the most economical choice.

Maintenance

Mixed refrigerants such as R410A and R454B may have different mixing ratios depending on the temperature, possibly affecting charging. As a single component refrigerant, R32 can be charged in either liquid or gas phase.

Safety

LG has a successful history using R32 with VRF products in other parts of the world, including Europe. LG has also applied R32 to North American window air conditioners since 2015. Per ASHRAE Standard 34, LG's current refrigerant, R410A is in the refrigerant class of A1 and LG's future refrigerant, R32, is in the class of A2L. The refrigerant classified in class A1 are non-toxic and non-flammable and the ones classified in class A2L are non-toxic and have lower flammability. Even with their lower flammability, A2L refrigerants are safe and relatively easy to use provided the basic precautions are followed. Compared to most A3 class refrigerants, A2L refrigerants need at least 1,000 times more energy to ignite. [6] In practice, the guidance keeps refrigerant concentration well below the lower flammability limit (LFL), preventing risk of ignition. Additionally, ASHRAE 15 has been updated to support application of A2L refrigerants providing guidance to help apply systems safely.

	R410A	R32	R454B	R32...
Global Warming Potential	2088	675	466	
Composition	R32 50% / R125 50%	R32 100%	R32 68.9% / R1234yf 31.1%	✓ Liquid or gas phase charging is possible
Refrigerant classification	A1	A2L	A2L	
Direct emissions (kg CO2 eq.)	6,368	1,793 (↓72%)	1,468 (↓77%)	✓ Even with a slightly higher GWP, performs better with indirect CO2 eq. emissions making the LCCP (total emissions) lower
Indirect emissions (kg CO2 eq.)	74,496	70,775 (↓5%)	73,009 (↓2%)	
Total emissions [LCCP] (kg CO2 eq.) 4 Ton Single Split Ceiling Cassette	80,865	72,568 (↓10%)	74,478 (↓8%)	
Compressor Capacity (%)	100	110	95	✓ Higher efficiency ✓ Less energy consumption
Charge amount (%) Single Split Ceiling Cassette	100	75	92	✓ Smallest charge amount required leading to more flexible application and lower refrigerant cost for a similar size systems
Discharge Temperature (%)	100	110 - 119	105 - 107	✓ Higher discharge temperature can be managed through LG's sophisticated controls and inverter technology
Cost	-	Lower	Similar	✓ As R410A becomes less available, R32 is not likely to be more expensive than R410A ✓ As a blend that is predominantly R32, R454B is not likely to be less expensive than R32 ✓ As a component of many blends, the volume of R32 production should help hold the cost down ✓ R32 has a lower charge volume than both R410A and R454B
Lower Flammability Limit (lb/1000 ft3)	-	19.1	18.5	✓ Can have larger allowable charge in a room

Conclusion

Where it is true that the discharge temperature of R32 is 10-19% higher than that of R410A, there are also many benefits of using R32. [5] Where some in the market have indicated that R454B is a better choice due to the higher discharge temperature of R32 creating challenges in equipment design, LG's variable speed technology effectively manages the higher discharge temperatures. With LG's sophisticated controls and inverter compressor design, higher discharge temperatures are effectively managed, meaning that LG can take advantage of the many benefits of R32 where other technologies may be more challenged.

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Life's Good.