

## Using inverter technology lowers CO<sub>2</sub> emissions.

CO<sub>2</sub> is the most produced greenhouse gas. It can lead to rising sea levels that pose a very real threat to some island nations and densely populated river delta areas. Contributes to a sustainable future in all regions.

## What are the benefits of inverters for laboratories?

### How inverters reduce CO<sub>2</sub> and save energy.

#### Scope of Applications:

Inverters are found in eco-friendly models of ACs, refrigerators, freezers and HVAC systems, but also in EV cars and other high-end products. For applications that make use of liquid (compressed) gas refrigerants in a cooling loop, the inverter regulates the input frequency to the compressor. In doing so, the input becomes realtime adjustable.



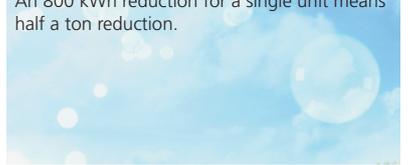
#### Save energy, save costs

A conventional laboratory uses up to 1000 kWh per m<sup>2</sup> per year. The biggest share of that is used for ventilation, temperature adjustment and cooling. In warm climates and R&D that requires 24/7 frozen storage, the power bill can have a significant impact on the available budget. Inverters enable energy consumption cuts of up to 60% per unit. For a laboratory with 10 refrigerators, running costs would be the same as for 4 conventional units.



#### Carbon Footprint

Inverters contribute to a large cut in CO<sub>2</sub> exhaust. The largest energy consumers in laboratories are HVAC, fume hoods and 24/7 cold storage solutions. In an effort to reduce CO<sub>2</sub> exhaust, A/C and cold storage each can make a large contribution by switching to models with inverter-controlled compressors. An 800 kWh reduction for a single unit means half a ton reduction.



Source: <https://energyfactbook.com/co2-equivalent/>

### LifeScience and biolabs

Fume hoods are refreshing air constantly, so supplying cooled air causes a large carbon footprint. The energy bill can be reduced 20-60% by using inverter controlled compressors in refrigerators and freezers.

■ **ULT freezer -80°C (8,000 kWh/y) 6.5 tons CO<sub>2</sub>**



■ **INVERTER ULT Freezer (3,000 kWh/y) 2.5 tons CO<sub>2</sub>**

■ **A/C (6230 kWh/y) 5.0 tons CO<sub>2</sub>**



■ **INVERTER A/C (3471 kWh/y) 3.0 tons CO<sub>2</sub>**

■ **Conventional Industrial 500L freezer -30°C (2,000 to 3,000 kWh/y) 1.6 to 2.4 tons CO<sub>2</sub>**



■ **INVERTER Industrial 500L freezer -30°C (1,000 kWh/y) 0.8 tons CO<sub>2</sub>**

Source: <https://link.springer.com/article/10.1007/s41825-020-00033-y>

#### OTHER benefits:

Non-inverter models run at a single speed, turn off, then turn on again. As the start-up of a compressor requires the most energy, repeated ON and OFF cycling causes noise, speeds up product wearout, and frequent energy consumption peaks.

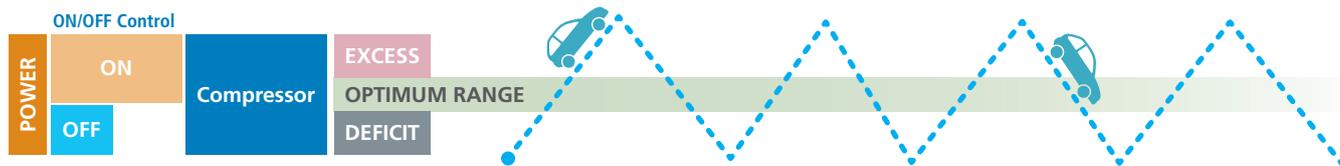
#### INVERTERS feature:

- less maintenance
- longer product life
- less noise
- flat energy consumption
- better accuracy

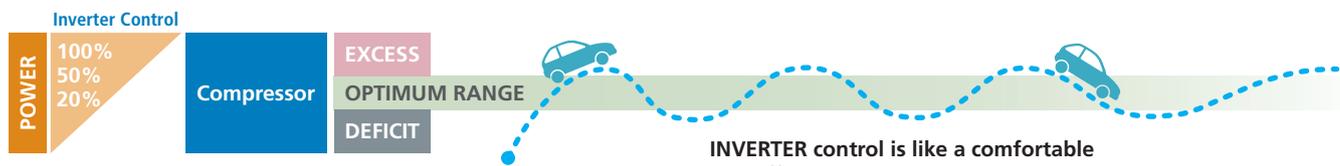


# How the inverter works

## NON-inverter



## Inverter



## Example of CO<sub>2</sub> reduction per country.

	 INDIA	 SINGAPORE	 JAPAN	 AUSTRALIA
CO <sub>2</sub> emissions in million ton	1,222.6 in 2005	40.9 in 2005	1,315.9 in 2013 (1,304.4 in 2005)	535.7 in 2013 (617.0 in 2005)
2030 Reduction target	33-35% (compared to 2005)	36% (compared to 2005)	26% compared to 2013 (25.4% compared to 2005)	26-28% (compared to 2005)
ADOPTED POLICY	Even though energy demand will triple, clean coal, renewable energy, smart grid implementation, clean technology funding and planting trees will be among the largest of India's CO <sub>2</sub> emission cuts.	Singapore is implementing clean technologies and increasing energy efficiency to meet the CO <sub>2</sub> target. The government sponsors buying household appliances with inverters, aiming at 357,000 ton less CO <sub>2</sub> emission by inverter refrigerators only.	By enhancing the use of inverter technology, Japan aims to save 5.33 TWh of energy per year. This directly translates into a 3.4 million ton reduction in CO <sub>2</sub> emissions, exactly 1% of planned 340 M ton reductions.	Australia works with the Emissions Reduction Fund, rewarding every ton of carbon reduction with carbon credits, which gives converted into money, so giving incentive to implement clean technologies.

### References and sources:

<https://www4.unfccc.int/sites/submissions/indc/Submission%20Pages/submissions.aspx>

JAPAN: <https://www.nedo.go.jp/content/100903678.pdf>

AUSTRALIA: [https://www.aph.gov.au/About\\_Parliament/Parliamentary\\_Departments/Parliamentary\\_Library/pubs/BriefingBook45p/EmissionsReduction](https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BriefingBook45p/EmissionsReduction)

INDIA: <https://www.macrotrends.net/countries/IND/india/carbon-co2-emissions>

**PHCbi INVERTER Technology Line-up**



Cut Down on Electricity.  
Reduce Power Consumption.  
Save Energy.




**Ultra-Low Temperature Freezer**  
MDF-DU502VH / MDF-DU502VHL  
MDF-DU702VH / MDF-DU702VHL  
MDF-DU901VHL

**Biomedical Freezer**  
MDF-MU339HL  
MDF-MU539HL  
MDF-MU549DH

**Vaccine Refrigerator**  
MPR-S150H / MPR-S300H  
MPR-N250FH / MPR-N250FSH  
MPR-N450FH / MPR-N450FSH  
MPR-S500H / MPR-S500RH



