PHONONIC + Halton

The Time is Now... for a New Way to Live

September 2023



Together, we have Created the World's First Solid State, Sustainable HVAC Solution



July 2023 was the Hottest month on Earth...Ever

PHONONIC + Halton | TTAP TECHNOLOGY

COOLNG Next Sustainability Battleground



CO₂ Emissions Intensifying

Left unchecked, by 2050 global AC will produce 2.3bn tons of CO_2^3

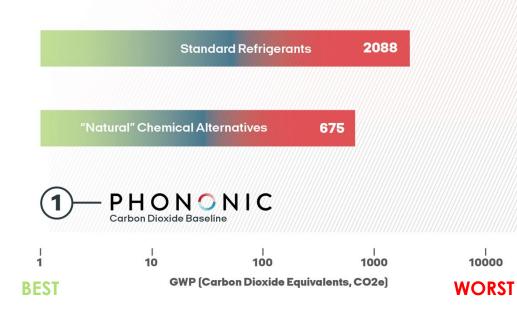
Refrigerant Impact is Catastrophic

Global Warming Potential 'GWP' of common refrigerants 2000X worse than CO₂⁵

appliances

Refrigerants: Catastrophic Global Warming Contributor

GLOBAL WARMING POTENTIAL OF REFRIGERANTS COMPARED TO CO₂





Phononic Solid State Solution Uses Only CO₂ & Water – Eliminating HFCs & Toxic & Flammable Refrigerants

Refrigerants in HVAC: **Environmental Impact Demands Action**

CLIMATE CHANG

WORLD ECONOMIC FORUM Air conditioning is threatening our ability to tackle climate change. Here's what we need to do





US to Ban Refrigerants With High Global Warming Potential The EPA proposed a ban on refrigerants with high global warming potential by 2025.



Indoor Air Quality is Critical to Health and Sustainability in the Office of the Future

Technology can help buildings achieve greater IAQ without using more energy





The Economist

How supermarket freezers are heating the planet, and how they could change

f)(🔰)(🔤)(🍯)(in)

Grocery chains under pressure to switch from HFCs to natural refrigerants to curb climate change

Emily Chung · CBC News · Posted: Jan 29, 2023 4:00 AM EST | Last Updated: February 27









PHONONIC + Halton TTAP TECHNOLOGY

A Big Roadblock in the Drive to Bring Down Emissions? BUILDINGS

Commercial buildings are responsible for nearly

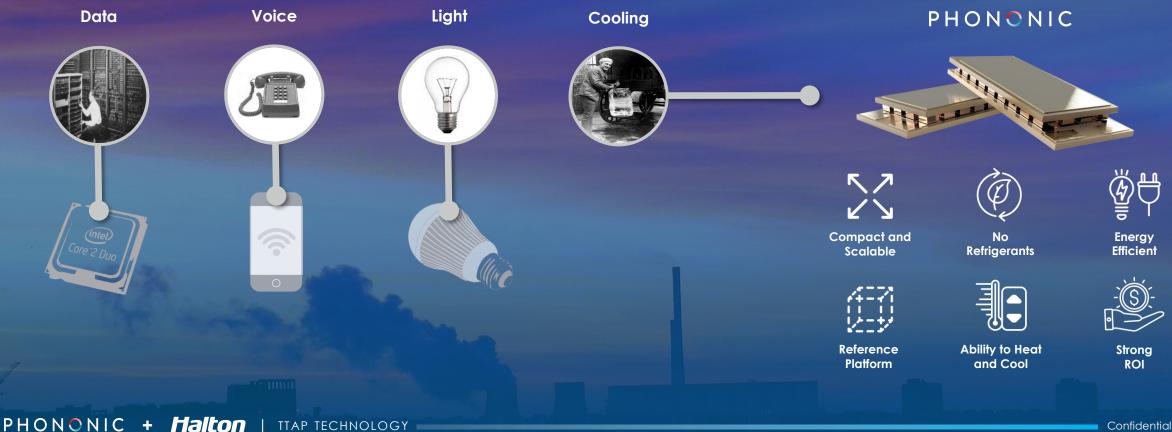
40% & 36%

of energy consumption

of greenhouse gas emissions

TRANSFORMATIONAL

Semiconductor Innovation Legacy



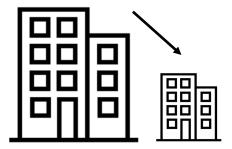
8

Halton: Rethink HVAC

Reconsider Existing Building HVAC TTAP Concept: Hybrid Integration

Thermal Module: Flexible Output Comfort & Sustainability

Building Chiller No Longer does all the Work Uses Partially Treated Fresh Air & Flexible Integration Solid State Cooling & Heating w/Flexible Scale Fresh Air w/Comfort & Lower CO₂e & TCO









Significant CO₂ Mitigation and Impact Potential Phononic + Halton TTAP Technology



PHONONIC + Fallo

We reimagined HVAC with a landmark installation in Paris

sustainable future

PHONONIC + Halton | TTAP TECHNOLOGY

Phononic + Halton

1st & Largest Solid State Cooling Installation

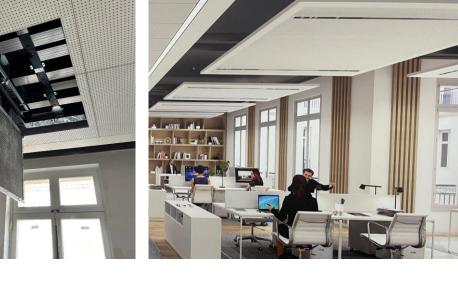


- 8,500 m² office
- 2 adjoined buildings, 5 floors each
- 100M€ /10 year lease signed



'TTAP' Thermal Module

- Eliminates HFCs
- Reduces energy use
- Saves on maintenance



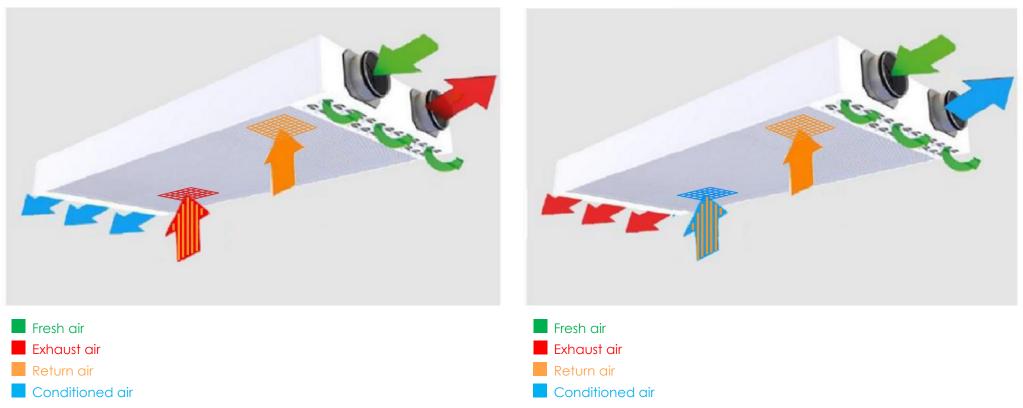
>150kW Installed Heating & Cooling Capacity

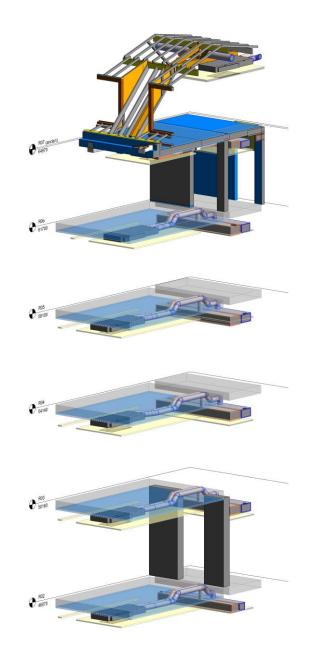
TTAP Platform

Low Voltage & Fast Transient Response Preferred!

HEATING MODE

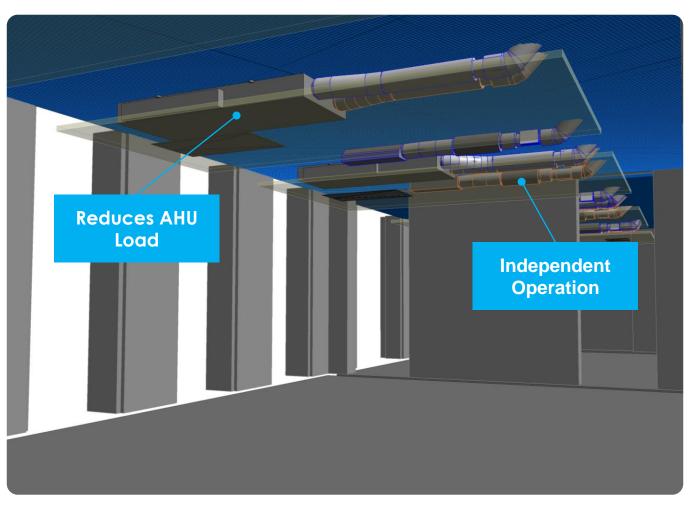
COOLING MODE





TTAP Platform

Flexible Integration



Superior CO₂e Footprint and Total Cost of Ownership

TTAP Analysis vs. Legacy Incumbents

TTAP Production and Installation

>20% less CO₂e



TTAP Operation >13% less CO₂e



Total Cost of Ownership

Solid State Cooling

>100 tonnes CO₂e saved

>18% savings





3rd Party Validated

It's change that could **change the world.** And it's just beginning.

In Paris alone, there are ~350 buildings a year that could be upfitted with TTAP technology

PHONONIC + Halton | TTAP TECHNOLOGY

TTAP – A Global Solution

S I T

SITES

SITES

For More Information

Anu Saxén

Director, SBA Halton Halton Oy Firdonkatu 2 T 146 00520 Helsinki, Finland +358 40 5016209 anu.saxen@halton.com www.halton.com

Emmanuel Bizien

Sales Region Director, Western Europe Halton 94-96 rue Victor Hugo 94200 Ivry sur Seine +33 6 03 40 59 17 <u>emmanuel.bizien@halton.com</u> www.halton.fr

Tony Atti, Ph.D

CEO & Co-Founder Phononic, Inc. 801 Capitola Dr., Bay 3 Durham, NC 27713 +1-917-679-6350 tony.atti@Phononic.com www.phononic.com Twitter: @anthonyatti

PHONONIC + Halton

Thank you!

September 2023