HOW STRATITROPIC HEAT PUMP TECHNOLOGY COULD SOLVE GERMANY'S ENERGY PROBLEM

A new thermodynamic cycle may be the global catalyst for rapid greenhouse gas reduction

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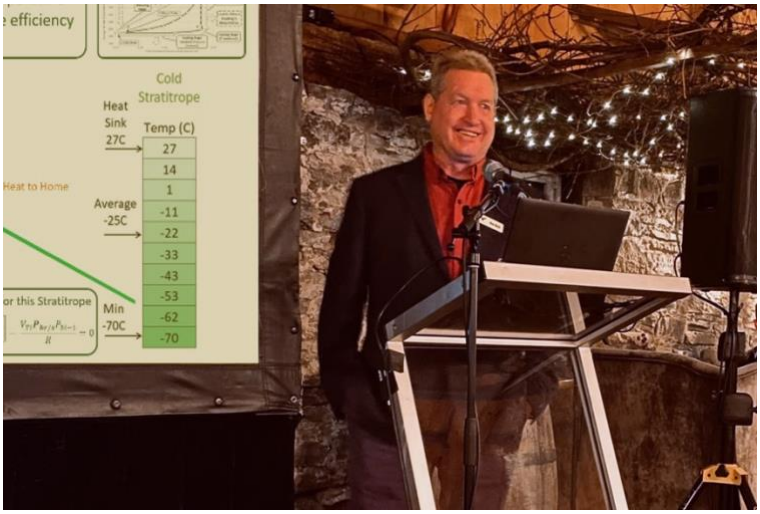
"Reaching Net Zero requires solving some very difficult problems, but solutions will bring opportunities for investors" Ron Hurst



The President of Stratitrope Inc. and inventor of the Stratitropic Heat Pump, Ron Hurst P.Eng., speaks at a recent angel investor event.

WHAT A TIME IT WAS

It seems like yesterday that natural gas was considered a reliable transitional technology. A welcome bridge in the government's climate strategy to move away from coal and nuclear power toward renewable energies.

Just last year, more than half of Germany's gas supply originated from Russia, while Germany accounted for more than 50% of Russia's exports to the European Union (EU). The flow of natural gas had been increasing for the last half a century, reaching an all-time monthly high of more than 5 billion m^3 in January of 2021.

But that was then…

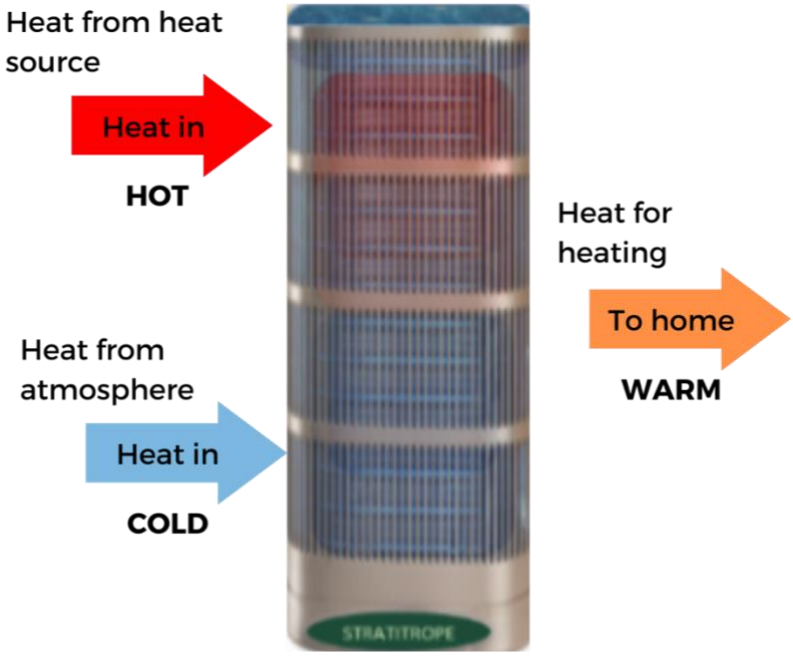
By August of 2022, gas imports from Russia fell to record lows. Russia's invasion of Ukraine had changed the dynamics of the EU's energy market abruptly, adding new and complex challenges to its already difficult energy strategy. How would this new struggle for energy independence, impact the rising pressure to reach its commitments on greenhouse gas emissions?

Even as Germany renewed its commitment to Energiewende, a move toward climate neutrality by 2045, it recently reactivated coal fired plants to help get through this winter without Russian gas. According to Jennifer Morgan, a climate activist and Special Envoy for International Climate Action, the decision to burn more coal is "a hard pill to swallow" but acknowledged in her interview at the United Nations (AP) "we need to assure that our citizens have enough heat for the winter."

HOW CAN THE STRATITROPIC HEAT PUMP HELP?

By replacing traditional natural gas heating systems with stratitropic heat pumps (SHPs), the natural gas usage could be reduced by 50%. This is because the heat from the natural gas is used to produce a direct heat pump effect, pulling in nearly equal amounts of heat from the surrounding atmosphere. These two sources combine to provide the same space heating but using half the natural gas.

"Switching to SHPs would cut the Carbon Intensity for heating in half, based on its current design. With full scale commercialization, this would be improved even further" Ron Hurst



Space heating is the number one use of natural gas in Germany. Three in four homes continue to use fossil fuels to heat their homes. In 2015, more than 250 Terawatt hours (TWh) of natural gas was used to heat residential homes (Energy for Heating). This means that switching to a SHP would mean a savings of more than €10 billion per year for residential consumers, while reducing CO_2 emissions by 45 million tonnes per year.

When you include commercial and industrial space heating, natural gas consumption reaches 600 Twh per year with the savings from the SHP rising above €20 billion per year.

STRATITROPIC HEAT PUMP VS THE ELECTRIC HEAT PUMP

In a future world when reliable and affordable power generation is carbon free, converting all energy intensive human activities, including heating and transport, to electricity would be an excellent strategy to minimize our carbon footprint. However, getting there from where we are today is an enormous undertaking. Experts now know that the struggle to solve our planets CO_2 problem can be as elusive as it is essential.

With that in mind, since 2001, Germany has reduced its power sector carbon intensity by 39%. But in 2021, according to the Clean Energy Wire Fact Sheet , after two decades of concerted effort, there was still more power generated from fossil fuels than from renewables, with two thirds of that being coal. In fact, wind and solar combined, generate only 3% more than coal does. The enormous challenge of reducing its use will only get worse when new energy-hungry loads like vehicles, industrial and home heating are added to the grid. It is further exacerbated by Germany's desire to phase out nuclear power plants.

More importantly, since renewable sources like wind and solar are weather dependant, a stable source of alternative generation would need to be constructed along with large scale storage capacity for Dunkelfaute, those periods of Dark Calm when wind and solar fail to sufficiently generate.

The Stratitropic Heat Pump technology provides an opportunity, an interim step in the pathway to net-zero emissions. One that can accelerate the elimination of coal power while providing time to develop and construct reliable, affordable renewable energy sources. It overcomes the potentially insurmountable challenge of attempting to add new clean power while simultaneously adding new electrical energy loads.

The table below illustrates the difference in replacing an existing natural gas system with either a traditional electric powered heat pump (EHP) or a thermally powered Stratitropic heat pump (SHP).

ELECTRIC VERSUS STRATITROPIC HEAT PUMP

	EHP	SHP	Units
Energy Source	Electricity	Natural Gas	
Carbon Intensity[i]	116	113	g CO_2/KWh$_t$
Net Heat Demand[ii]	480	480	TWh/y
Fuel cost[iii]	51.5	24.2	Billion €/y
Fuel Cost Savings from Existing	-3.1	24.2	Billion €/y
Added Generation Capacity Required[iv]	68.8	0	GW
Cost of added generation[v]	84.6	0	Billion €

Both systems would have comparable installed costs and would reduce green house gas emissions significantly; about 50%. However, the consumer who switched to the SHP would immediately reduce their energy bill by 50%, whereas the user who switched to the electric heat pump would see an increase in their energy bill. An energy bill projected to rise significantly as new generation capacity is added to support these new loads.

On a system wide basis, consumers in Germany would save about €27 Billion per year by choosing the Stratitropic technology over the EHP.

"The Stratitropic heat pump could be the technology needed to bridge the crucial gap between the desire to reach climate neutrality and our ability to actually achieve it" Ron Hurst

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TECHNOLOGY COMPARISON

The Stratitropic heat pump is a recent technology, patented in 2022. It strategically combines multi-cell thermodynamic processes that interact synergistically with each other, creating a heat pump effect as it heats and cools.

Traditional electric heat pumps, however, still use the same closed vapor-compression cycle originally conceived by Oliver Evens in 1805. Hydrofluorocarbons, which are still used in EHPs and aren't expected to be phased out for another 25 years, have a global warming potential (GWP) over 1,000 times that of CO_2. Conversely, the SHP uses gases such as Argon, an abundant and harmless gas.

The Stratitropic heat pump *generator* is a related product referenced in the same patent. In addition to providing a heat pump effect, it generates highly efficient electricity using the same technology. It was not discussed in this article, but you can find more in the link (SHPG).

Find out more at www.stratitrope.com

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[i] Based on an average Coefficient of Performance of 3 for the EHP and 1.6 for the SHP
[ii] Based on 600 TWh total use, with an average current efficiency of 80%.
[iii] Based on current pricing- 0.806 €/KWh for NG (the average gas price in first half of 2022) and 0.321 €/KWh for electricity
[iv] Based on the current ratio of Total installed capacity to Total Annual Generated (211 GW/490.6 TWh/y=0.43 GW/TWh)
[v] Based on 1.23 M€/Mw for wind power – Does not include cost of storage or alternative for low wind periods