Air Source Heat Pumps: Ensuring Promise – Avoiding Perils

By Steven Wisbaum

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In buildings that are well insulated, ductless air-source heat pumps (aka "mini-splits") are becoming increasingly popular as a cost-effective and energy-saving alternative to heating systems that use oil and natural gas. And they can also be operated for both cooling and dehumidifying, often at a lower cost than conventional air conditioners and dehumidifiers.

However, while most people are aware of the importance of properly cleaning and maintaining wood stoves, dryer vents, and oil and gas boilers and furnaces, because mini-splits are relatively new, there's increased risk of improper operation and maintenance, which not only reduces efficiency, but increases the risk of expensive repairs, and the spread of mold.

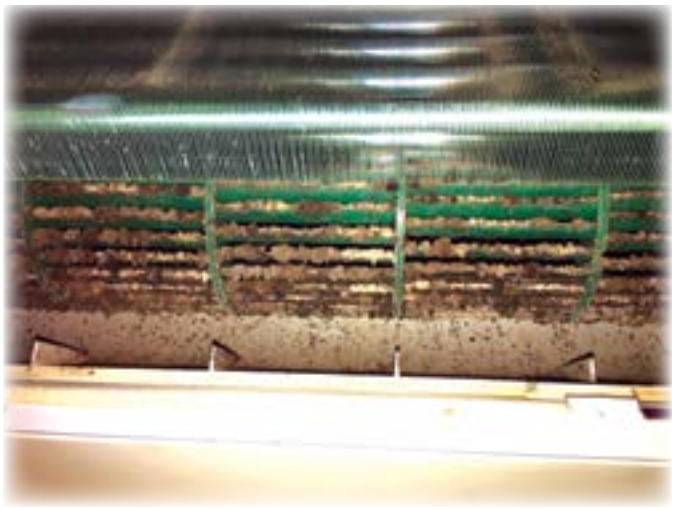
Mini-splits have two main components — an outdoor compressor-condenser and an indoor air-handling unit. A conduit containing the power cable, refrigerant tubing, and a condensate drain links the outdoor and indoor units. The air handler contains an air filter, and both the air handler and the outdoor unit contain a fan and heat exchanger coils. It is important to understand that mini-splits circulate indoor air, rather than heat or cool outdoor air that's then released into the building.

Cleaning for mold prevention and optimum operational efficiency

The fans push air through the coils, which means the coils and air filters collect the dust, pollen, pet dander, cooking grease, and other debris in the air. If not cleaned regularly, this debris reduces operating efficiency, which in turn increases energy consumption and operating costs. This also increases the likelihood of premature equipment failure. This debris can also hold moisture which can then grow and spread mold spores throughout a building.

Another way mold can be a problem is when a mini-split is left idle for multiple days (i.e., it is not used for either cooling, drying, or heating), and the moisture that condenses on the coils when operated in the 'cool' or 'dry' mode does not dry out. To dry out this moisture, operating manuals contain instructions to operate the system in a way that only the fan will be running without the system doing any heating, cooling or dehumidifying.

Depending on the use conditions, the air filters typically need to be cleaned every two to four months, which is relatively easy to do, assuming the air handler is within easy reach, but trickier if a tall ladder is needed. However, cleaning the fans, coils, and drain/base pan, flushing the drain line, and cleaning the outdoor unit requires a "deep clean" by a technician using a specialized pressure washer and a wash-water collection system. This deep cleaning should also include a service inspection to check internal components and wiring for damage or loose connections, testing the thermostat and controls, and inspecting the outdoor unit for mice nests. This deep clean and inspection process can cost between $200 and $300 for a system with one or two air handlers.



Dirty coils in an air-handler can cause the formation of mold. This also reduces operation efficiency. (Fresh Air Solutions)

There are several companies in *G.E.T.'s* distribution region that offer this service, including We Clean Heat Pumps; Fresh Air Solutions, ARC Mechanical, Energy Co-op of Vermont, Heat Pump Services, Mansfield Services, and Benoure Plumbing, Heating and Air Conditioning.

Proper installation

Because these appliances are still a relatively new technology in our region, and many builders and installers are still learning "best practices," it's critical that mini-splits are installed properly to avoid preventable repair issues, minimize the risk of mold growth in the air handlers, avoid creating rodent access points into a building, and to minimize the risk of damage to the outdoor unit from mice, snow and ice. Improper installation can also impede some important deep cleaning procedures. For example, air handlers should be installed perfectly level to ensure condensation drains properly into the drain pan and the condensate drain line. The condensate line also needs to be installed so that the exit end is accessible for vacuuming out any blockages. And if "hard plumbed," there should be a clean-out to facilitate this cleaning process. The holes drilled through perimeter walls also need to be properly sealed after installation of the refrigerant and condensate lines to prevent access to rodents. If a mini-split is to be used for heating, the outdoor unit should also be installed on a pedestal to avoid being impacted by snow, or the ice that forms

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Fertilizers Are Greenhouse Gas Emitters, but Their Impact Can Be Cut

Olivia Rosane

When we think of greenhouse gas emissions, we typically think of coal-burning power plants, vehicle exhaust or maybe forests being cleared to make way for methane-belching cows.

However, there is another important agricultural source of climate pollution: nitrogen-based fertilizers. A new study from University of Cambridge-based researchers has calculated these fertilizers' total contribution to the climate crisis for the first time, but also revealed how that contribution could be reduced to around a fifth of current levels by 2050.

Organic and synthetic fertilizers pollute more than global shipping and aviation combined, around 2.6 gigatonnes of carbon each year. (Bill Meir/Flickr)

"Our work gives us a good idea of what's technically possible, what's big, and where interventions would be meaningful — it's important that we aim interventions at what matters the most, in order to make fast and meaningful progress in reducing emissions," said study co-author Dr. André Cabrera Serrenho from Cambridge's Department of Engineering said in a press release. Nitrogen fertilizers can be either organic — coming largely from plant or animal waste — or synthetically made using chemical processes, according to Carbon Brief. Both have been important for boosting food production worldwide. Environmental scientist professor Vaclav Smil called them "the most important invention of the 20th century."

However, they are causing environmental problems in the 21st. When they are sprayed onto a field of crops, they can acidify the soil, run off into nearby waterways and feed deadly algal blooms or interact with soil microbes to form nitrous oxide (N2O), which is a greenhouse gas almost 300 times as potent as carbon dioxide.

Their production also burns emissions and, together with plastics, synthetic fertilizers make up as much as 74% of the products of the petrochemical industry, according to the press release. Despite this, a full life cycle assessment of fertilizer emissions had not been conducted before the new research published in Nature Food Thursday. What the study found was that nitrogen fertilizers contribute around five % of global greenhouse gas emissions. Organic and synthetic fertilizers emit more than global shipping and aviation put together at around 2.6 gigatons of carbon each year, according to the press release.

The researchers further discovered that around two-thirds of these emissions occurred after the fertilizers had been spread over crops.

"It was surprising that this was the major source of emissions," Serrenho said in the press release. "But only after quantifying all emissions, at every point of the lifecycle, can we then start looking at different mitigation methods to reduce emissions without a loss of productivity."

The researchers assessed what would happen if various already-available methods to reduce fertilizer emissions were put in place. For example, fertilizer production could be powered with renewable or nuclear energy. Nitrification inhibitors could also be added to block the formation of nitrous oxide. However, the most important intervention would be to prevent fertilizers from being over-applied.

"Increasing nitrogen-use efficiency is the single most effective strategy to reduce emissions," the study authors wrote in their abstract.

Currently, only 42% of the nitrogen applied to a field is actually absorbed by the crops, Carbon Brief explained. If that were increased to 67%, demand for fertilizers could fall by 48% by 2050. If farmers worldwide applied all of the strategies outlined in the report, nitrogen emissions could fall by 84%.

Professor Mark Sutton, an environmental physicist at the UK Centre for Ecology and Hydrology, applauded the study for showing a way forward. He also said it came at an opportune time, because the participants at the COP15 biodiversity summit in Montreal in December of 2022 agreed to cut nutrient loss in half by 2030.

"I think what is really new [in the study] is this very high level of saying 'we can do it,' and that's why it's a challenge to the community, for people who say we can't go quite as far as this," he told Carbon Brief. "I've not seen the whole set of emissions from all sources combined showing that level of ambition."

Olivia Rosane is a freelance writer and reporter with a decade's experience. She has been contributing to EcoWatch daily since 2018 and has also covered environmental themes for Treehugger, The Trouble, YES! Magazine and Real Life. *She holds a Ph.D. in English literature from the University of Cambridge and a master's in art and politics from Goldsmiths, University of London.*

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DIY Weatherization Tips

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from renewable energy). This is the first step to a fossil-fuel free future. We are in transition and change can be difficult, but the IRA provides some encouragement (Approximately $14,000 per house hold, see https://bit.ly/IRA-calculator. An electric service panel can also be upgraded to accept an EV home charging station. The IRA will provide up to $4000 for such an upgrade.)

Our training sessions are fun, we meet the nicest people, and, we hope, they pass their knowledge and enthusiasm on to friends. Don't wait! Buddy-up with a friend and DIY, start small and save big.

Joanne Coons is an adjunct professor at Hudson Valley Community College, TEC-SMART facility teaching photovoltaic theory and design, maintenance and installation. She is an active member for SolarFest in Brandon VT, advocates for sustainability, building science and is a member of the Town of Clifton Park's GREEN (Government Re-Thinking Energy & Environment Now) and is a NY-GEO advisory board member. Prior to her current endeavors, she taught high school biology, earth science and environmental science for 28 years. Her husband Paul is the silent partner but the brains and brawn of the team. ♻

ASHP: Avoiding Perils

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from condensation dripping off the coils. A pedestal also reduces the potential for access by mice, and for leaves and other debris being pulled in by the fan. A roof or cover may also be needed to protect the outdoor unit from falling icicles and snow dumps.

Protecting outdoor units from mice damage

Preventative strategies should be employed to help reduce the likelihood for expensive repairs due to mice nesting in the outdoor compressor/condenser and damaging its wiring and circuitry. These strategies include placing the unit on a pedestal, using steel wool to fill any access points in the protective metal casing, such as cut-outs for extra refrigerant lines (but NOT anywhere close to the circuit board), inspecting the interior of the unit during the yearly maintenance check, and if needed, using a rodent deterrent product.

Considering the need for a back-up heating source

Although cold climate heat pumps are designed to produce heat in cold temperatures, their efficiency decreases as the temperature decreases. Some newer models can generate heat at temperatures of -200 F and contain an internal back-up heating element, but this is not always the case. Therefore, proper consideration should be given for the installation of a back-up heating source to ensure occupant safety and protect plumbing infrastructure for deep freeze events, and when a mini-split becomes temporarily inoperable.

To summarize, installing air source heat pumps in buildings that are properly weatherized/insulated is critical to reduce greenhouse gas emissions associated with fossil-fueled heating systems, and to save consumers money. However, to ensure these goals are achieved, and to avoid the serious health problems associated with mold, these systems need to be properly installed, maintained and cleaned. Proper consideration should be given for the need for, and type of back-up heating source to install.

Steven Wisbaum has been advocating for and working to reduce fossil fuel use for almost fifty years. In 2016, he founded the Mow Electric! *Campaign (www.mowelectric.org) to advocate for and support the transition to electric lawn equipment within both the private and public sectors.* ♻