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Commentary
Hot in Here: Embracing Electrified Heating in Buildings

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Key Highlights

- Global CO_2 emissions reached a record high in 2022, with heat-related emissions accounting for 39%. Electrifying building heating with renewables is the key for future net-zero emissions.
- Electric heating is safer, provides significant public health benefits with zero emissions, and has a longer lifespan than gas heaters.
- The widespread adoption of electric heating poses challenges, including the potential strain on the electric grid, need for substantial expansion of non-carbon-emitting electricity, and required modifications to utility regulation. It also faces obstacles such as higher upfront costs and higher energy costs compared with fossil fuels.
- Electrified heating can support net-zero energy consumption for buildings, but prior to achieving widespread adoption, there are numerous efforts that need to be done.

Overview

Heating accounted for nearly half of the world's final energy consumption last year, making it the most prominent end use for energy. Industrial activities accounted for 53% of the final energy consumed for heat, while residential and commercial sectors contributed 44% for space and water heating, as well as for cooking.[1] Furthermore, 63% of global energy consumption for heating buildings was derived from fossil fuels, with natural gas accounting for 42% of the global heating energy demand.[2] In an endeavour to reduce the reliance on fossil fuels by the end of 2022, 20 states in the U.S. enacted legislation to prohibit direct gas usage in new construction. In addition, the European Union will push for a global pledge at the upcoming COP28 climate summit to phase out the consumption of fossil fuels well ahead of 2050.

Given governments' pressure to reduce carbon emissions, addressing how we heat buildings will be a crucial component in decarbonizing the economy. However, there are several challenges to electric heating that will not have carbon emissions during usage, including constraints within electricity grids, regulatory policies, substantial upfront investment, and higher usage costs. Given these challenges, the credit implications for utilities at this time are uncertain, as there is no timeline on when electrified heating will be widespread.

The Benefits of Electrified Heating

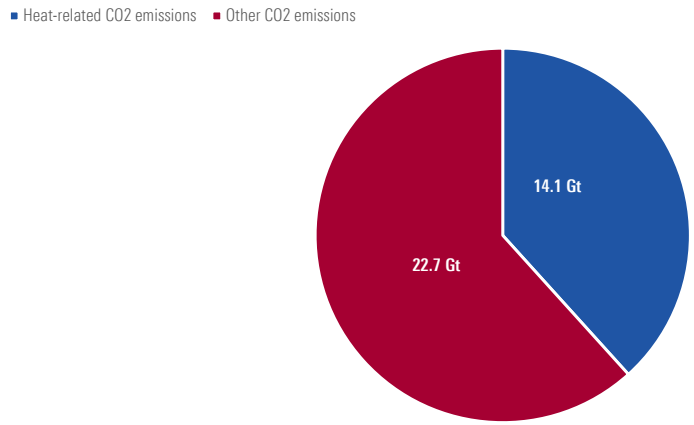
Reduced greenhouse gas (GHG) emissions

Global energy-related carbon dioxide (CO_2) emissions increased by 0.9%, or 321 metric tons, in 2022, reaching a record high of more than 36.8 gigatons (Gt).[3] Heat-related CO_2 emissions accounted for 14.1 Gt, equivalent or 39% of total global CO_2 emissions, as shown in Exhibit 1.[1] As such, electrified heating systems in buildings could materially help in achieving net-zero emissions in the future. This shift would displace carbon-emitting fuels with zero-carbon electricity generated from non-carbon-emitting sources such as solar, wind, hydro, and nuclear power. Improved energy efficiency could further reduce GHG emissions, as electric heating systems are almost 100% energy efficient, converting all incoming electric energy into heat. In comparison, the efficiency of a typical gas furnace ranges from 56% up to 98% with the residual portion of heat lost in ducts and emissions, according to the U.S. Department of Energy. Furthermore, zoned heating is more achievable for an electric heating system and enables greater

1 International Energy Agency, Renewables 2022: Analysis and forecast to 2027, 2022.
2 International Energy Agency, Buildings-related energy demand for heating and share by fuel in the Net Zero Scenario, 2022-2030, 2023.
3 International Energy Agency, CO2 Emissions in 2022, 2023.

flexibility in managing and scheduling heating in specific spaces, potentially improving energy efficiency and reducing energy waste within a heating system.

Exhibit 1 2022 Global Energy-Related CO_2 Emissions



Source: International Energy Agency.

Safety, health benefits, and easy installation with longer lifespan

Electric heating is generally safer than gas heaters as there is no combustion associated with the process, thus eliminating hazards such as carbon monoxide emissions and explosions. Without any emissions, there are also significant public health benefits, particularly for those with respiratory system diseases. In addition, since there are no gas pipelines, the risk of property damage from leaking or bursting pipework is eliminated. Furthermore, gas heaters, which can last between 10 and 20 years with proper maintenance, are typically large and complicated, requiring extensive ducting or gas pipes and professional installation. By comparison, electric heaters have a typical lifespan of 15 to 20 years and are relatively easier to install and maintain.

The Challenges of Electrified Heating

Electricity grid constraints and voltage regulations

The widespread adoption of electric heating will likely result in a substantial increase in electricity demand, particularly during peak hours. Consequently, this will necessitate a significant expansion of non-carbon-emitting electricity, which could exert a strain on the current electric grid. This constraint arises when electricity generation exceeds transmission capacity. As the current transmission infrastructure was not originally designed to accommodate this heightened load, substantial upgrades and build-outs will be required, including new substations and transformers, particularly if existing infrastructure has deteriorated because of age and insufficient investments in maintenance. Additionally, the electrification of other parts of the economy, such as the transportation sector, will further burden the power grid. It's challenging to forecast future electricity consumption as the grid transitions to green energy. Accurate predictions of demand are required to avoid excessive or inadequate upgrades. Moreover, the transition to electric heating poses additional complications in

regulating voltage on the grid. Heightened electricity demand will cause electric current levels in transmission wires and transformers to climb, resulting in potential voltage drops at the customer end. It will be essential to maintain voltages within a specific range to ensure the proper functioning of electronic equipment.

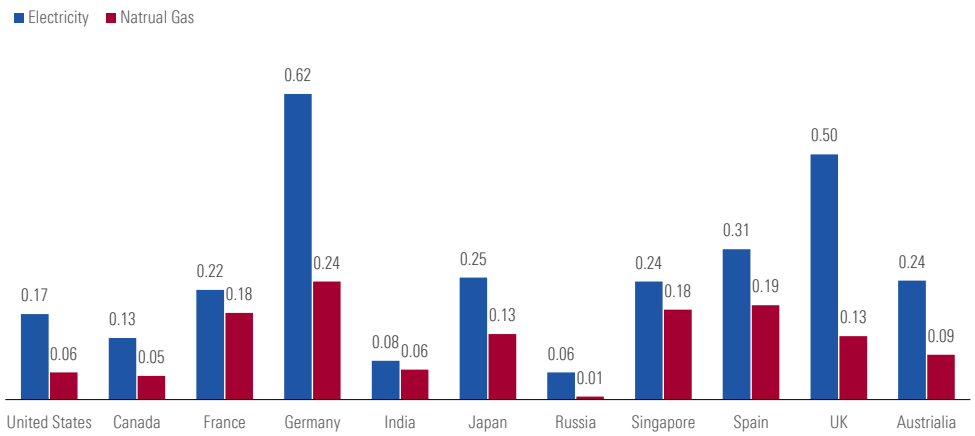
Regulatory challenges

The present utility regulation business model may need to be modified to better fit the electric future. For instance, the conventional cost-of-service regulation rewards utilities for investing in long-term capital projects, which necessitates continued investment for safe operations, maintenance, and eventual decommissioning. Currently, some frameworks use an inclining block rate structure, which charges a higher rate for each incremental block of electricity consumption. Under this structure, ratepayers will face much higher electricity bills as their rates increase—to fund infrastructure improvements—and their electricity usage steps up. It could be challenging for regulators to optimize electricity rate models to not only accommodate the increasing cost of infrastructure improvements, but also enable customers to economically benefit from electrification. Furthermore, changing the electric heating infrastructure necessitates permits and approvals from a diverse number of regulatory bodies, including municipal and state governments. Consequently, navigating the process can be long and complex.

Large upfront investment and higher energy cost for customers

An additional obstacle for heating electrification is the substantial initial capital expense when switching to electric heating systems from fossil fuel heating. Upfront costs include purchasing electric heating equipment such as heat pumps and electric furnaces, as well as the cost to upgrade an electric panel, wires, and outlets to accommodate increased appliance loads. These financial outlays may discourage homeowners from making the switch. Furthermore, the shift to electric heating may result in higher energy costs, as electricity prices often compare unfavourably in certain jurisdictions with fossil fuels such as natural gas, as shown in Exhibit 2.

Exhibit 2 Average Electricity Prices for Households, December 2022 (USD per kilowatt hour)



Source: GlobalPetrolPrices.com.

Dropping Fossil Fuels Like It's Hot

Adopting electric heating can help buildings reach net-zero energy consumption, particularly when the electricity is generated through renewable energy sources. The progress for electrified heating appears remarkable, such as the increasing adoption of heat pumps and electric water boilers. We have witnessed capital spending for electrification and policy efforts such as the U.S. Inflation Reduction Act of 2022, aimed at accelerating electrification by lowering the cost of renewable energy. Nonetheless, we believe it is premature to consider any significant credit impact on the utility sector at this stage since the current challenges associated with electric heating pose difficulties in achieving widespread adoption without further policy support. As the existing electric infrastructure undergoes upgrades to meet the expected growth in demand, consumers transition to electric heating, and policymakers implement regulations incentivizing electrification, it is just a matter of time before electric heating in buildings is more prominent, helping to mitigate CO_2 emissions and reaching a net-zero target.

Note:
All figures are in U.S. dollars unless otherwise noted.

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