

TREND
ELECTRIFICATION

US Cities Embark on an Anti-Gas Battle to Electrify Buildings

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Fossil fuels are the preferred energy source for heating buildings, making them a major source of greenhouse gas emissions worldwide. However, in recent years, electricity has emerged as a serious rival, driven by the boom in renewables, which makes it an essential decarbonisation tool. For the past two years, this rivalry has been illustrated very concretely in the United States, where cities and states have been clashing over this climatic, but also economic and political issue.



DATA OVERVIEW

Heating buildings is still largely dependent on fossil fuels

Thermal energy^a consumption, which accounts for half of global final energy consumption ahead of transport (30%) and electricity production (20%), experienced a historic decline of 3.1% in 2020 because of the Covid-19 pandemic.¹ This decline is primarily due to many industrial activities coming to a halt, which are responsible for half of the total thermal energy consumption. To a lesser extent, buildings, which account for the bulk of the other half, were also responsible for this decrease, mainly due to the reduced use of non-residential buildings.

In total, thermal energy accounts for more than three quarters (77%) of global building energy consumption.² This consumption is still largely dependent on fossil fuels, which makes it responsible for almost 45% of greenhouse gas (GHG) emissions from buildings, or

almost 12% of global emissions.³ The share of renewables in the heat consumption of buildings is slowly increasing (from 7.8% in 2009 to 10.4% in 2019).² This increase is mainly driven by the electrification of heating systems, coupled with the rise of renewables in the global electricity mix (**see Energy sector**): 11.7% of building heat demand was met by electricity in 2019, up from 9.6% in 2009.² To achieve carbon neutrality, the International Energy Agency (IEA) recommends ramping up this trend: the share of buildings heated with natural gas would need to increase from 30% today to 0.5% in 2050, and that of buildings heated with electricity from 20% today to 55% in 2050.

This electrification can be achieved through the installation of electric radiators or heat pumps^b, depending in part on regulatory policies or incentives put in place by governments. However, the number of countries with targets for renewable heating and cooling has fallen considerably since last year, in particular because of targets not being renewed after the 2020 deadline: from 49 in 2020, there are only 19 in 2021 (compared to 165 for renewable electricity).²

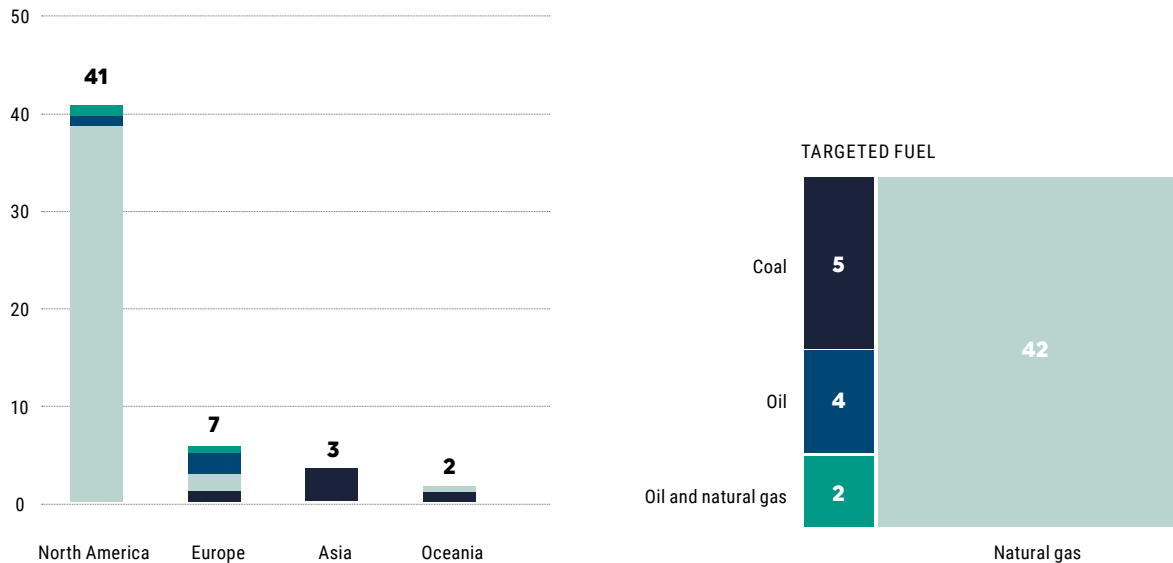
^a Thermal energy, or heat, refers to energy used for heating air and water, air conditioning, cooking, drying and industrial processes... In other words, thermal energy is any energy that is not used for electricity generation or transport.

^b Heat pumps are thermodynamic devices that use heat from a medium (air, water, soil) to release it into a space to be heated or cooled. They require auxiliary (electrical) energy to operate. When reversible, heat pumps can produce heat from a cold medium (heating function), or cold from a warm medium (cooling function). Under optimal conditions, the most efficient systems can produce up to five times more thermal heat than they consume in electricity (see [REN21, 2021](#)).

FIGURE 1

NUMBER OF CITIES IMPLEMENTING BANS OR RESTRICTIONS ON THE USE OF FOSSIL FUELS IN BUILDINGS IN 2020

Source: [REN21, 2021](#)



In contrast, heat pumps have received strong public support in recent years: they now meet 5% of the world’s demand for space heating,⁴ and have benefited from a higher increase in investment in 2020 than in the previous five years, from \$45 billion to \$51 billion.⁵ In Europe, nearly 14.8 million heat pumps were heating buildings in 2020,⁶ and 1.6 million units were sold in 2020, nearly half of which in France (394,000 units), Italy (233,000 units) and Germany (140,000 units), three countries that have introduced purchase subsidy schemes.² In Germany, the installation of heating systems based on renewable energy (solar heating, electric heating powered by renewables, etc.) has even been compulsory for new buildings since 2016, as it has been for its Danish neighbour since 2013.² However, these two countries are not included in the list of seven European countries that have stopped subsidising fossil fuel heating systems (mainly to help replace oil boilers with gas boilers): Croatia, Estonia, Ireland, Lithuania, Luxembourg, Malta and the Netherlands.⁷ Similarly, the subsidies introduced by the Chinese government under the Electric Heating Policies since 2015 led to the sale of more than half a million units in 2018,⁸ but conversely, government support for gas boilers to replace coal-fired heating slowed the heat pump market in 2020.² However, in northern China, where rural populations heat mainly with coal, the electrification of heating leads to higher emissions, due to China’s still highly carbon-intensive electricity mix.⁹ The climate benefit of electrification depends strongly on the local energy context.¹⁰

According to REN21, it is mostly local governments that have taken initiatives and adopted policies to promote renewables in building heating systems.² For example, Carlsbad (California), Luanzhou (China), Sao Paulo (Brazil) or Montevideo (Argentina) made the installation of solar water heaters for new buildings mandatory. Many cities (Mexico City, Berlin,

Leicester, Jiazuo...) offer subsidies or price reductions to help convert heating systems from gas to electricity.

Finally, some cities have gone so far as to ban the use of fossil fuels for heating new buildings (air and water) (**fig. 1**), in order to accelerate their electrification from renewable sources.¹¹ By the end of 2020, REN21 counted 53 such cities in over 10 countries. For example, in Europe, Vienna took the lead in June 2020 by banning the use of fossil fuels in new buildings in certain districts.¹² But it is in the United States that the movement has gained the most momentum. Since 2019 many cities have adopted local legislations favouring electric heating, to the detriment of a powerful rival: gas.

 **THE OBSERVATORY’S LENS**

Gas vs. electricity, cities vs. states: the story of an American battle for the energy supply of buildings

Driven by a very favourable market in the early 2010s, natural gas was set up as a “bridge fuel” in the United States, supposed to enable a gradual energy transition and act as a buffer between the abandonment of coal, which is a major emitter of greenhouse gases, and the deployment of renewable energy. As a result, 85% of the coal-fired power plants repurposed to burn other types of fuels between 2011 and 2019 have been converted to gas-fired plants.¹³ Gas is now the country’s leading energy source (35% of the energy mix, 39% of the electricity mix¹⁴). However, whether it is used for electricity production or heating, gas remains a major



emitter of greenhouse gases.^c Based on this observation, but also on economic and political considerations, some cities are trying to stop gas from being used for heating and instead, to 'electrify everything', with the idea being using renewables to power the equipment.

2019: Californian cities open the race

The Berkeley City Council kicked off the movement in July 2019 by passing a law banning the use of gas in new residential and non-residential buildings, in line with California's goal of achieving 100% renewable electricity by 2045.¹⁵ Shortly before, the California State Energy Commission had estimated in a report that electrification of buildings offered "the most promising path to achieving emission reduction goals at the lowest cost".¹⁵ Many Californian cities quickly followed suit, sometimes replicating the Berkeley measure almost identically (San Jose in September, San Francisco in December), sometimes requiring electrification readiness for new buildings (San Luis Obispo in August) or imposing higher energy efficiency thresholds for gas-fired buildings (Davis in September).

The reaction of the gas industry was swift: the American Public Gas Association, which groups and represents gas distributors, called the bans "extreme" and "heavy-handed", saying they "eliminate consumer choice, stifle innovation, and diminish the flexibility to respond to GHG emission goals, with least-cost solutions for consumers". In turn, the powerful American Petroleum Institute stated in March 2020 that it would fight the spread of such bans.¹⁹ In June 2020, Mother Jones magazine revealed that the American Gas Association is conducting an intense campaign on social networks, including paying influencers to promote the use of natural gas for cooking behind the hashtag #cookingwithgas.¹⁶

Early 2020: Conservative States fight back

As of February 2020, these gas lobbies found a sympathetic ear in some states. Prompted by the public gas supplier Southwest Gas, Arizona, which borders California, adopted a law prohibiting its cities from taking such measures, despite the protests of several large cities such as Phoenix and Tucson.¹⁷ In the eyes of the environmental NGO Sierra Club, which defends the gas ban, this law is a clear sign of the close links between state administrations and the gas lobbies.¹⁸ Following Arizona, the states of Missouri, Mississippi, Minnesota, Oklahoma and Tennessee announced they were considering similar measures. This movement is reminiscent of the tensions that arose a few years earlier when Texas, Oklahoma and Colorado prevented cities from banning hydraulic fracking.

At the same time, there was a tug of war in Massachusetts: the Boston suburb of Brookline, inspired by the nascent Californian movement, voted to electrify heating systems for all new buildings in November 2019.¹⁹ But a few months later, in July 2020, the Massachusetts Attorney General overturned this

decision, ruling that it was not within the city's jurisdiction.²⁰ However, she asked the state to study the future of the gas industry in light of its climate commitments. In response, a dozen Massachusetts towns (Belmont, Somerville, etc.) joined forces with the think tank Rocky Mountain Institute to create the Massachusetts Building Electrification Accelerator. This initiative serves as a framework for advocacy for building electrification (via local petitions for example) and the redefinition of decarbonisation strategies at the local level (through the implementation of incentive zoning).²¹ In December 2020, Massachusetts published a climate roadmap, which proposed a new local code promoting the electrification of buildings and carbon neutrality of the sector,²⁰ but the governor vetoed it a few weeks later, judging it unsuitable for the development of the real estate market.²¹

In Seattle, the largest city in Washington State, the city administration also declared its intention to ban the connection of new buildings to the gas network at the beginning of 2020 but was met with strong resistance from the gas lobbies. After many months of fighting, particularly against Puget Sound Energy, the city's main natural gas supplier,²² it was forced to abandon its project. A 2018 study commissioned by the city had shown that buildings were responsible for a quarter of the city's GHG emissions, half of which came from commercial buildings, and had increased by 8% compared to 2016.²³

This example is indicative of the tensions these bills raise with incumbent gas suppliers in cities, who are often major employers and thus polarise the debate between the climate argument and the economic one. In addition to the challenge of decarbonising Philadelphia Gas Works (PGW), manager of the oldest gas network in the United States, supplier to more than 500,000 residents and responsible for 22% of the city's emissions, there is the retraining of 1,600 workers and the risk of price increases for the poorest households at stake.²⁴ In New England,^d Eversource, the region's largest gas supplier, has committed to becoming "carbon neutral" by 2030 and is investing heavily in offshore wind. Yet the company is still investing in gas, and fighting against the electrification of city heating systems, including as co-leader of the Consortium to Combat Electrification, a lobby group in Washington.²⁵

Results: electrification is progressing, so is resistance

Despite resistance from some states and gas companies, many cities have succeeded in mandating the electrification of new buildings. In California, 49 cities have adopted measures to reduce the use of gas in new buildings.²⁶ In Massachusetts, Brookline passed a new measure in June 2021 restricting the use of fossil fuels in new construction (this time not going as far as a blanket ban), on which the Attorney General has six months to give a ruling.²⁷ In total, 160 towns in Massachusetts have expressed a willingness to adopt similar measures.²⁷ New York City is currently considering a bill to ban the use of natural gas in new buildings.²⁸ The Seattle City Council fi-

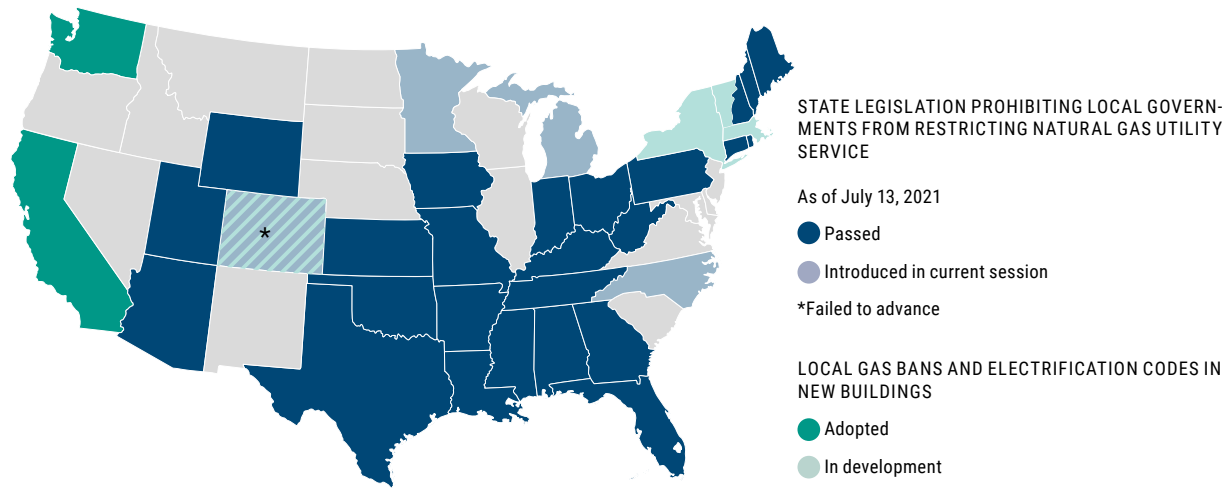
c As an order of magnitude: in 2019 in the United States, according to calculations by the Energy Information Agency, coal emitted an average of 1,002 gCO₂/KWh (2.21 pounds/KWh) of electricity produced, compared to 412 gCO₂/KWh (0.91 pound/KWh) for natural gas. The EIA considers the other sources of production (biomass, solar, wind, hydro) to be carbon neutral. Source: EIA (up. 15/12/2020). [How much carbon dioxide is produced per kilowatt-hour of U.S. electricity generation?](#)

d New England refers to a region on the east coast of the United States, covering the states of Maine, Vermont, New Hampshire, Massachusetts, Connecticut and Rhode Island.

FIGURE 2

US STATES THAT HAVE PASSED (OR ARE PREPARING TO PASS) BANS OF LOCAL LAWS RESTRICTING THE USE OF GAS IN NEW BUILDINGS

Source : S&P Global, 2021



nally adopted a new building energy code in early 2021 that includes a ban on natural gas for new commercial buildings and residential buildings over three stories high.²³ However, it will still be possible to use natural gas for cooking.

Other types of pro-electrification measures have been taken in other cities, without going as far as banning gas heating: the cities of Boulder (Colorado), New York City and Washington D.C., for example, have partnered with manufacturers, distributors and government agencies to install heat pumps fuelled by renewable energy.¹¹ This is also the case of Denver, Colorado, which has teamed up with the giant Xcel Energy to help the poorest households acquire heat pumps.²⁹ The city plans to require the installation of electric heating systems for new buildings within 3 years. Colorado considered prohibiting gas bans by local governments, but the law did not pass.³⁰

In contrast, Washington State considered banning gas for heating in new commercial and residential buildings, which would have been a first for any state, but this law didn't pass either.³⁰ New York State is currently only considering the role of gas in its energy transition.³¹ The State of Maine has taken a different approach, setting a target of installing 100,000 heat pumps per year by 2025 (there are around 500,000 homes in the state), and doubling the purchase subsidies for this equipment.¹⁹

Eighteen states, mainly republicans, have followed Arizona in banning the gas ban (fig. 2),³⁰ sometimes pushed by the blurred lines between politics and the oil and gas industries. For example, David McCormick, a member of the House of Representatives in Louisiana and head of the oil and gas company M&M Oil, has introduced bills to make his state a 'sanctuary for fossil fuels'.³² In Michigan, Representative Michele Hoitenga, who until February ran an oil and gas consulting

firm, is now spearheading a bill to prohibit local governments from banning gas-fired equipment in residential buildings.³³ Many of these states, particularly in the South and Northeast, are home to active gas wells, and are sitting on gas reserves that can be exploited for many years to come.^e After West Virginia, Ohio became the second of the three Appalachian basin states (home to huge shale gas reserves) to restrict gas bans, and Pennsylvania is preparing a similar law.³⁰ The overview provided in **Figure 2** is clear: the "Electrify everything" movement is still not for everyone.

 **KEY TAKEAWAYS**

While the electrification of heating systems is now recognised as an effective lever for the decarbonisation of buildings (provided that they are supplied with low-carbon electricity), the policies implemented by the States remain weak overall, and place more emphasis on abandoning oil-fired boilers, even if it means subsidising gas-fired boilers, gas still being presented as a "bridge fuel".

At the same time, helped by economic, political and energy contexts that are generally favourable to renewables, around fifty cities in the United States have taken the lead, over the last two years, by each banning or restricting the use of gas in new buildings. The response from gas suppliers and producers was swift: intense lobbying campaigns led about twenty federal states to prevent their municipalities from taking such measures. These conflicts put at stake the just transition of employment in regions dependent on crude oil production, as well as the access of the majority to affordable and decarbonised energy, while putting the preservation of jobs and the protection of consumers first.

e According to Atlas data from the Energy Information Administration



REFERENCES

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- 1 IEA (2020). [Renewable Heat](#). *International Energy Agency*
- 2 REN21 (2021). [Renewable 2021. Global Status Report](#)
- 3 Abergel, T., Delmastro, C. (13/12/2020). [Is cooling the future of heating?](#) *International Energy Agency*
- 4 IEA (2020). [Heat Pumps](#). *International Energy Agency*
- 5 BloombergNEF (19/01/2021). [Energy Transition Investment Trends](#)
- 6 EHPA (2021). [Market Report 2021](#). *European Heat Pump Association*
- 7 Vikkelsø, A., Boye Olesen, G. (2021). [Analysis of the existing incentives in Europe for heating powered by fossil fuels and renewable sources](#). *European Environmental Bureau, Coolproducts*
- 8 IEA, IRENA, REN21 (2020). [Renewable Energy Policies in a Time of Transition: Heating and Cooling](#)
- 9 Wang, J., Zhong, H., Yang, Z. et al. (2020). [Exploring the trade-offs between electric heating policy and carbon mitigation in China](#). *Nature Communications*, vol. 11 n°6054.
- 10 GABC (2020). [2020 Global Status Report for Building and Construction](#). *Global Alliance for Building and Construction*
- 11 REN21 (2021). [Renewable in Cities 2021. Global Status Report](#)
- 12 Giovannini, S. (09/07/2021). [No more fossil fuels for new buildings in Vienna](#). *Energy Cities*
- 13 Aramayo, L. (05/08/2020). [More than 100 coal-fired plants have been replaced or converted to natural gas since 2011](#). *US Energy Information Administration*
- 14 CDE (04/11/2020). [Rappels sur la situation énergétique des Etats-Unis en quelques chiffres clés](#). *Connaissance des Energies*
- 15 Cagle, S. (24/07/2019). [Berkeley became first US city to ban natural gas. Here's what that may mean for the future](#). *The Guardian*
- 16 Leber, R. (17/06/2020). [The Gas Industry is Paying Instagram Influencers to Gush over Gas Stoves](#). *Mother Jones*
- 17 Whitman, E. (24/02/2020). [Cities hate it, but Ducey signs bill banning local bans on natural gas anyway](#). *Phoenix New Times*
- 18 Groom, N., Valdmanis, R. (05/03/2020). [As climate fight intensifies, US states seek to block local natural-gas bans](#). *Reuters*
- 19 Mingle, J. (14/04/2020). [To Cut Carbon Emissions, a Movement Grows to 'Electrify Everything'](#). *Yale E360*
- 20 DiChristopher, T. (12/01/2021). [Mass. building gas ban movements expands after 2020 setback](#). *S&P Global*
- 21 McKenna, C., Mushegan, S. (20/01/2021). [Massachusetts' Governor must act to secure clean, affordable buildings](#). *Rocky Mountain Institute*
- 22 Holden, E. (20/08/2020). [Revealed: how the gas industry is waging war against climate action](#). *The Guardian*
- 23 Bernton, H., Gutman, D. (01/02/2021). [Seattle City Council passes measure to end most natural gas use in commercial buildings and some apartments](#). *The Seattle Times*
- 24 Mingle, J. (20/04/2021). [Cities confront climate challenge: how to move from gas to electricity?](#) *Yale E360*
- 25 Storrow, B. (03/05/2021). [Leaked Docs: Gas industry secretly fights electrification](#). *E&E News*
- 26 Gough, M. (27/04/2021). [California's cities lead the way to a gas-free future](#). *Sierra Club* [last consulted 09/07/2021]
- 27 Gellerman, B. (03/06/2021). [Brookline tries again for a fossil-free future](#). *Wbur*
- 28 DiChristopher, T. (27/05/2021). [NYC lawmakers aim to block natural gas use in new buildings, major renovations](#). *S&P Global*
- 29 Prentzel, O. (16/06/2021). [About 30% of Denver's homes lack air conditioning. Here's the city's environmentally friendly solution](#). *Colorado Sun*
- 30 DiChristopher, T. (20/07/2021). [Gas Ban Monitor: Building electrification evolves as 19 states prohibit bans](#). *S&P Global*
- 31 Walton, R. (08/06/2020). [Massachusetts may become third state to begin planning for transition away from gas heating](#). *Institute for Energy Economics and Financial Analysis*
- 32 Sneath, S. (09/05/2021). [Bill seeks to make Louisiana 'fossil fuel sanctuary' in bid against Biden's climate plans](#). *The Guardian*
- 33 House, K. (10/06/2021). [Michigan lawmaker wants to block local bans on natural gas](#). *Bridge Michigan*