

# ACCELERATING DEEP DECARBONIZATION IN THE U.S. BUILDINGS SECTOR

## EXECUTIVE SUMMARY

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### The Challenge

Commercial and residential greenhouse gas (GHG) emissions make up 12 percent of direct GHG emissions in the US and 32 percent of total GHG emissions when electrical use is included. To achieve carbon neutrality by mid-century, the building sector needs to radically ramp up efficiency and electrification in both new and existing buildings. Furthermore, the sector may need a supply of carbon neutral gas for building end uses that are resistant to electrification.

Decarbonizing the building stock will be a massive transformation because America already has 150 million existing buildings, most of which will still be here in 2050. In addition, the building stock will increase by roughly 30 percent by 2050, and these new buildings will also need to be carbon neutral by 2050. While it is relatively straightforward and cost effective to bake in efficiencies when new buildings are being built, it can be quite expensive and invasive to jettison and replace equipment in existing buildings. One major strategy is to garner the benefits of the natural cycle of renovations to improve efficiency and reduce emissions.

To decarbonize new buildings and retrofit the existing building stock logistically and without breaking the bank, we propose launching the following policies.

### The Solution

Becoming carbon neutral by 2050 is a complex undertaking that will require a singular vision and extraordinary coordination across multiple federal agencies, cities, and states. To that end, we propose the creation of a new White House Office of Climate or a Department of Climate and Carbon (DCC), with a cabinet level secretary reporting directly to the president. The Office or DCC should be given explicit authority to regulate carbon and to coordinate the carbon related activities of the other departments (Transportation, EPA, HUD, etc.) and the states in order to stabilize the climate.

Achieving carbon neutrality by 2050 will also require the unique undertaking of sustained effort over 30 years. To that end, America will need comprehensive climate legislation committing the country to achieving specific greenhouse gas reduction targets by 2030, 2040, and 2050. The legislation should require each 4-year administration to submit its plan for achieving the immediate and long-term reduction goals after one year in office.

As much as possible must be incorporated into the comprehensive legislation to effectively

require successive administrations to support this long-term effort and achieve the long-term goals. With respect to the building sector, legislation should require the federal government to regularly develop and enforce an increasingly stringent National Energy Code for Buildings (NECB) that regulates both carbon and energy, as well as regular and aggressive improvements to the appliance standards, with specific goals and requirements established for each. Without a statutory mandate properly scaled to this multi-decade challenge, the goal of a carbon neutral building stock by 2050 cannot be reached.

Finally, action must be taken to address the relatively high cost of electricity. One solution is to apply the social cost of carbon in order to make electricity more cost competitive in areas where the grid is cleaner and to redistribute the proceeds in an equitable manner. Another is to significantly reduce the heating and hot water loads in buildings with increased efficiency, so that the increased costs due to electrification are outweighed by the decreases in energy demand.

## Policy Recommendations

### *New Buildings*

The NECB should require that, starting in 2025 or before, all new buildings be fossil fuel free and built to meet aggressive standards of efficiency, especially with respect to heating and cooling. This will address roughly a quarter of the 2050 building stock. These aggressive new codes should also address mobile homes where many low-income rural residents reside.

The NECB would address operational energy use (e.g., energy used and carbon emitted due to heating, cooling, lighting), as is traditional for energy codes. It would also address carbon emissions due to energy used in buildings, and other ways in which the construction, operation, and demolition of buildings impact GHG emissions. It should regulate embodied carbon (i.e., the carbon emitted during the creation of the building) by setting carbon or cement limits on various types of concrete, by requiring that all carpet be taken back and recycled into new carpet, or even by setting limits on embodied carbon per square foot of construction. Similarly it should place caps on the global warming potential of new refrigerants and on testing and eliminating refrigerant leaks or methane leaks in buildings.

### *Existing Buildings*

The NECB, like all energy codes, would apply to existing buildings as well as new ones, and it needs to aggressively promote decarbonization at the time of upgrades and equipment replacement in order to be effective in decarbonizing existing building stock. The code needs to garner the benefits of the natural cycles of renovation. Marginal improvements above standard practice are the least expensive and least invasive way to achieve carbon reductions in existing buildings. The NECB should include provisions that replacement hot water heaters everywhere and replacement space heating systems in Climate Zones 4 and below must be fossil fuel free from 2035 on. And it should ramp up requirements on replacement equipment, such as windows.

Little is known at the granular level about how buildings use energy across the country, and you cannot manage what you do not measure. Congress' omnibus legislation should require each state to regularly create a census of its building stock, including annual benchmarking of energy use and carbon emissions from buildings larger than 25,000 sf, and a representative sampling of such information for smaller buildings no later than 2025. The legislation should also create a

program to manage and enforce this effort at the federal level and provide funding and general resources to states.

*Research, Development, Demonstration & Deployment of New Technologies, Enhanced Manufacturing, and Appliance Standards*

The building industry has long been neglected in terms of funding for new technologies and strategies. This plan proposes that, over the next five years, the Federal Government ramp up spending on building-related research, development, demonstration and deployment (RDD&D), including the development of carbon neutral fuels appropriate for buildings, to five percent of the national RDD&D budget from its current low of 0.1 percent. The Federal Government should also support the development of local manufacturing for advanced building products in the rust belt and in areas that are likely to lose jobs in the energy/carbon transition, making long-term commitments for support.

Finally, the Federal Government should act immediately to upgrade appliance standards and address technologies such as computers and displays that are not currently regulated but fall under federal control. Congress should modify existing legislation to allow states to regulate appliances when the federal government fails to meet its upgrading deadlines and to allow fuel neutral standards in order to ensure standards are regularly and aggressively updated.

*Lead by Example in the Public Sector at the Federal, State and Local Level*

It's in the public interest to improve the public building stock, so we propose beginning efficiency efforts with buildings owned by federal, state, and local governments. This building stock represents eight to ten percent of the nation's existing building square footage and energy use. At the national level it includes the General Services Administration properties, the military, post offices, and other facilities and represents roughly 3.6 billion square feet, with another roughly one billion sf of public housing for a total of 1.5 percent of the existing building stock. A much larger percentage of America's building stock is owned and operated by states and localities, including public schools (est. 7.2 billion sf or 2.4 percent of existing building stock), public universities and public hospitals, along with libraries, fire stations, police stations, homeless shelters, correctional facilities, and numerous other types of facilities. With this in mind:

- Congress should fully fund energy and carbon emissions reductions across the federal building portfolio, with a mandated carbon reduction target of 90 percent by 2035.
- Congress should provide block grants to states and localities to implement Leading by Example programs to decarbonize their public portfolios on an accelerated (2040 or before) schedule.

*Federal funding, incentives, and a Covid-19 stimulus package*

To go from the "business as usual" case to a carbon free building sector will cost an estimated additional \$64 billion per year each year through 2050. The federal government will need to appropriate approximately 25 percent of this to prime the pump and pay for the decarbonization of the federal portfolio, assistance to states and localities, incentives and assistance for the private sector, the development and enforcement of codes and standards, R&D, training and education, subsidies to manufacturers, and management.

This infrastructure investment will provide much-needed upgrades and repairs to our valuable, but aging national building stock, and it will produce almost half a million well paid, construction related jobs each year. This will be a boon to blue collar workers who have suffered diminishing options and wages over recent decades. Several times the average annual funding should be spent on decarbonizing the building stock over the next few years as a stimulus to help recover from the Covid-19 recession. Recommended financial actions include:

- Provide funds to cities and states to adopt and enforce the NEBC. Provide additional funding, including funding for staff, for cities and states that exceed the minimums, especially codes that require energy/carbon reductions in existing buildings.
- Use all the financial instruments at the federal government's disposal to encourage energy/carbon improvements in the building sector, including Fannie Mae policies, tax incentives, low cost loans, depreciation schedules, PACE financing, etc.
- Fund a national program to promote electrification in buildings where it would reduce bills for heating and hot water. This would include buildings with propane and areas where the electrical heat with heat pumps cost less than natural gas heating.
- Provide generous subsidies for affordable and low-income housing.

## Outcomes

Several of the policies proposed in this chapter are likely to be resisted by affected industries, lobbies, and political interests—namely the creation of a National Carbon and Energy Code, the adoption of aggressive appliance standards, and working to develop affordable low-carbon fuels for buildings. However, the real risk here is an insufficiently effective approach that's just marginally better than the status quo. Indeed, a less aggressive policy sets America up for potentially huge expenses and an unwise level of dependence on uncertain markets like carbon neutral fuels and carbon sequestration and capture. In contrast, our proposed policy gradually accrues decarbonization when it is least expensive: when new buildings are being built and when renovations are occurring. While it might seem burdensome at first, this path will be far less costly for most Americans, since it will gradually and inexorably deliver a low-carbon building sector at a fairly low increased incremental cost. This path will also bring sector emissions close enough to zero that emerging technologies could be expected to take us across the finish line.