Testimony

Of

Pat Choate

Director

The Manufacturing Policy Project

Tucson, Arizona

Before

The U.S. House Energy and Water Development Appropriations Subcommittee

Washington, DC

March 17, 2021

Chairwoman Kaptur and Ranking Member Simpson:

I am honored that you asked for my observations on the subject of "Manufacturing for a Clean Energy Future" and its effect on U.S. efforts to confront climate change.

Clean Energy

I will begin with two rhetorical questions.

Question one: What is the principal source of Green House emissions in U.S. cities?

Question two: What has the most reliable, abundant, inexpensive source of clean energy we can use to reduce Green House emissions in U.S. cities? Coal? Fuel Oil? Propane? Nuclear? Natural Gas? Geothermal? Solar? Wind? Raw sewage water?

The answer to question one is that the principal source of U.S. Green House emissions comes from our energy inefficient buildings and construction.[1] The UN and International Energy Agency (IEA) reports that in 2017 the buildings and construction sector worldwide accounted for 36% percent of final energy use and 39% of energy-and process-related emissions. (Figure 1) Put into perspective, that is more energy use and more unwanted emissions from energy-inefficient buildings and construction than from all transport combined (cars, trucks, trains, ships and planes) or all industry combined.

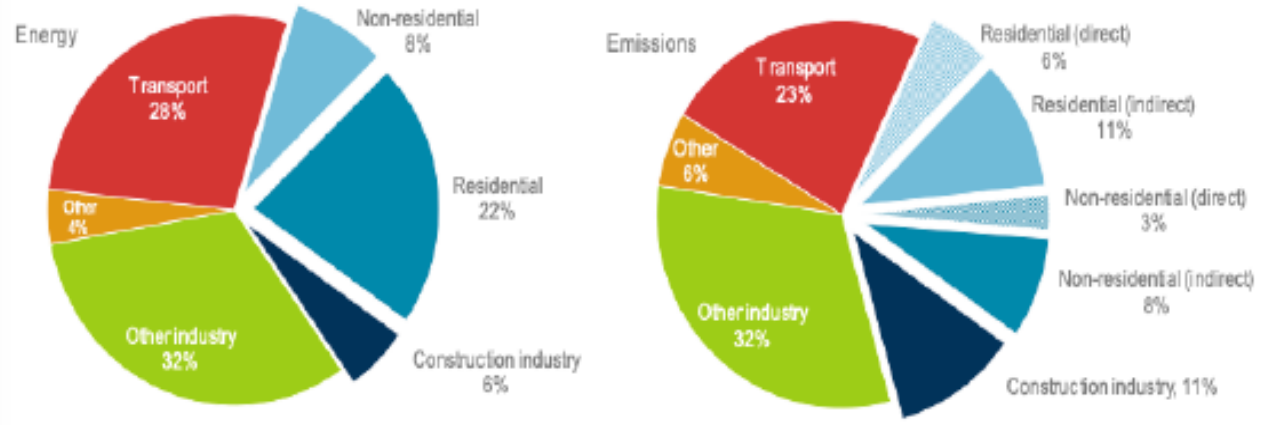
Closer to home, the New York Times reports that 90% of the buildings in New York City today will still be used in 2050, and that nearly 70 percent of the city's carbon emissions comes from these buildings. The same situation is found in virtually all U.S. cities. If New York is to cut its emissions, the NYT concludes, fixing its aging buildings is essential.[2] So it is in virtually all America's cities.

These UN and IEA reports are confirmed by the U.S. Energy Department which reports that in the U.S. *"the buildings sector accounts for about 76% of electricity use and 40% of all U.S. primary energy use and associated greenhouse (GHG) emissions making it essential to reduce energy consumption in buildings in order to meet national energy and environmental challenges."*[3]

---

[1] https://www.worldgbc.org/sites/default/files/2018%20GlobalABC%20Global%20Status%20Report.pdf
[2] https://www.nytimes.com/2020/12/29/business/new-york-passive-house-retrofit.html
[3] https://www.energy.gov/sites/prod/files/2017/03/f34/qtr-2015-chapter5.pdf

Figure 1 • Global share of buildings and construction final energy and emissions, 2017



Note: *Construction industry* is an estimate of the portion of the overall industry sector that applies to the manufacture of materials for buildings construction, such as steel, cement and glass.

Sources: Derived from IEA (2018a), *World Energy Statistics and Balances 2018*, www.iea.org/statistics and IEA *Energy Technology Perspectives* buildings model, www.iea.org/buildings.

The U.S. Energy Department also reports that 55 percent of this energy use is for heating and cooling.[4]

The UN and IEA in their most recent Status Report also noted that since 2010. space cooling is the fastest-growing use of energy in buildings, growing by 8% in year 2018 alone.[5] The demand, of course, is certain to rise as the world's climate becomes warmer.

As to question two, where is the least costly and most reliable source of energy to deal with the largest part of city emissions (buildings), the answer is raw sewage.

As farfetched as the answer may seem, it is the reality. Wastewater from buildings holds within it clean heat that is generated from bathing, cooking, industrial uses and all the many other ways that we heat water for use. The challenge is to extract that clean heat from dirty water.

[4] https://rpsc.energy.gov/energy-data-facts
[5] https://www.iea.org/reports/global-status-report-for-buildings-and-construction-2019

By way of an example technology, an inventor from Canada and one from Germany have modified Thermal Heat Exchange (THE) technology to very efficiently extract the thermal energy (heat) in sewer water. A striking demonstration of this technology and its benefits exists barely one-third of a mile from the U.S. Capitol at the DC Water headquarters which is built atop a 100-year-old sewer pumping station. As repulsive as that may seem, it is not. In a new three-year old, 151,000 square-foot, smart-glass building, the heat for the circulating water system used to heat and cool the building is drawn from wastewater that comes from within and below the building. At DC Water's headquarter, dirty water yields clean energy.

The device is self-contained and small – about the dimensions of a small table used by witnesses in a Congressional hearing room. It has been retrofitted into a pumping plant almost a century old. Wastewater comes in one end, is filtered and then passed across a plate that on its other side has fresh water into which the heat is transferred. The two never touch. This heated water is put into a circulating water system that fuels the heating and air conditioning. The wastewater exits the other side. The entire process is sealed and without odor. Payback from savings is from three to five years. The life of the device can be as much as 45-years. Operations are continual monitored. Maintenance is minimal.

The fuel savings for heating and cooling the DC Water building are significant, about $100,000 annually. Equally significant, more than 1.5 million gallons of fresh water are saved annually that otherwise would have been used in air conditioning cooling towers. Best of all, this waste heat emits no Green House emissions. Only the outside production of the electricity used to power the machine creates emissions. The efficiency ratio of the machine is 3.5 – 5 to 1. This means that for every unit of energy used to operate the machine, 3.5 to 5 units of heat energy are captured for use. If hot industrial water is available, that ratio can be 10 to 1 or more. When DC Water eventually gets its electric power from a renewable energy source, such as solar, wind or something else, it will be in a true net zero building emitting zero emissions.

While a few places in Europe use sewer-based thermal energy extraction, as do a few locations in Canada, it is almost non-existent in the United States. Now, however, in addition to the unit in DC Water, The American Geophysical Union Headquarters at 2000 Florida Ave NW also has an operational unit. The AGU, which represents earth and space scientists who study climate change, have the first net-zero building in DC, an achievement that would have been impossible without the use of thermal energy from the sewer.

In sum, sewer-based thermal energy extraction provides a means to cut building energy costs by up to 70 percent when retrofitted into older, existing buildings and thus carbon emissions from heating and air conditioning are reduced to zero. Done at scale this is a cost-effective means to accelerate the reduction of U.S. green gas emissions.

This technology can also be used to create a new utility that produces significant new revenues for cities that install a loop system which provides the energy transfer heat to many buildings on the same sewage system. This technology is an easy retrofit because buildings are already connected to local sewer lines. Customers could receive cost savings on their heating and air

conditioning and be future-proofed against any forthcoming emissions requirements. The city would have an assured long-term new source of revenues it could use for other purposes such as rehabilitating aging water and sewer systems. Such a utility has the potential in many Regions of the U.S.to become their largest energy authorities.

As significant as heat recovery technology is, switching to no-carbon, low-carbon and renewable energy sources is only one of several recommendations that the IEA and UN make to address the challenge of mitigating building emissions. They advise (1) using low-carbon building materials, (2) building energy saving envelop improvements (the walls and roofs), (3) nature-based solutions and (4) equipment and system efficiency.

Manufacturing

The realization of savings from Clean Climate Industries necessitates that the many clean climate technologies and machines ultimately be manufactured and installed. Consequently, in the years immediately ahead, millions of new and better 21st Century jobs are going to be created to fill this demand. The big question is where will these technologies be manufactured and who will get the jobs?

Manufacturing climate control machinery and technologies not only offers President Biden and the U.S. Congress a direct, cost-effective means to expand U.S.-based manufacturing, but it also provides them the opportunity to confront America's growing problem of Regional Economic Inequality (REI).

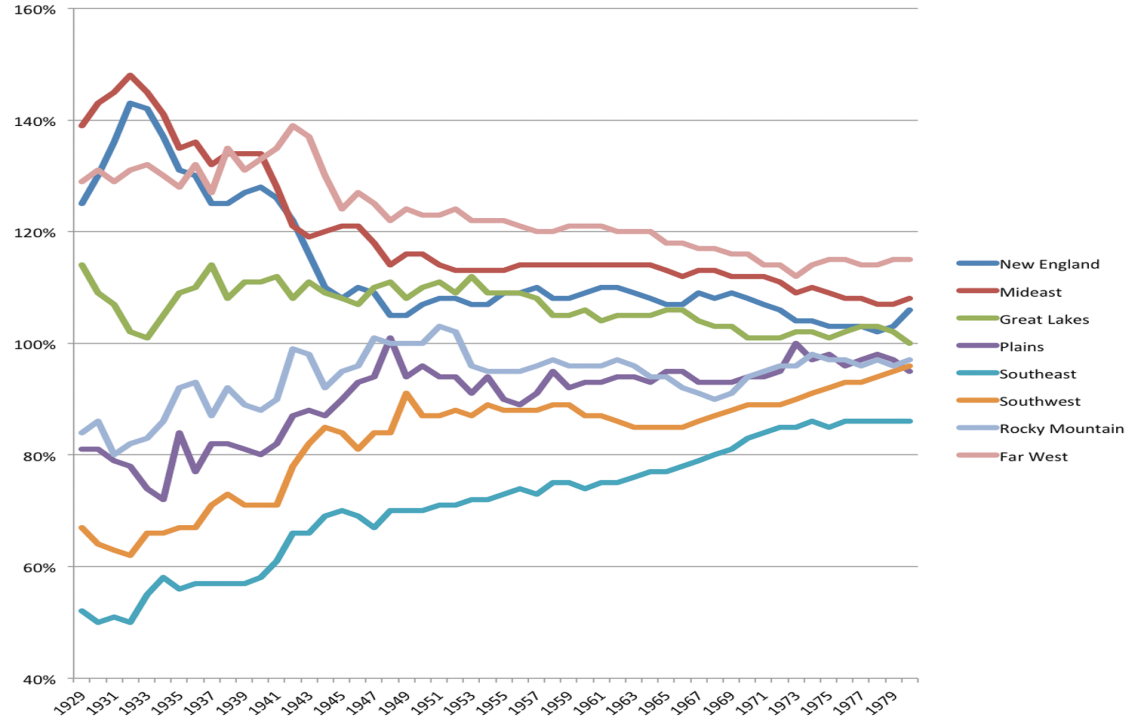
Two basic policies seem essential. The first is that the machines and technologies be Made in the USA with American workers. The second is that these factories be located where they will reduce the nation's Regional Economic Inequality, which is both demonstrable and substantial.

In a 2015 article in the Washington Monthly, Phillip Longman documented how regional inequality was even then out of control.[6] He pointed out that the country's founding government policy worked to ensure that towns, cities and regions would not gain an unwarranted competitive advantage. The structure of the Senate, he notes, reflects a compromise among the Founders meant to balance the power of densely and sparsely populated states. For more than a century, the nation struggled with how to keep the railroads from discriminating against some places and favoring others. The Sherman Antitrust Act and its enforcement prevented oligopolies or duopolies from dominating an industry. The anti-chain store legislation passed in 1936 (Robinson-Patman Act) prohibited chains from extracting price concessions from suppliers or from gobbling up markets so that local vendors could survive. Airlines had to serve small towns if they wanted to serve big ones. Trucking rates were kept regionally non-discriminatory. Defense jobs were spread out nationally. By these and dozens of other means, the national government worked to ensure that jobs and income were regionally distributed, specifically to minimize Regional Economic Inequality.

[6] https://washingtonmonthly.com/magazine/novdec-2015/bloom-and-bust/

Between 1930 and 1980 what resulted was what Longman called the creation of a "Single American Standard of Living." As Figure 2 displays, the regional per capita income as a percentage of national average income merged between 1929 and 1979. These policies to reduce regional inequality worked well and satisfied a larger national purpose of a more equal distribution of jobs, incomes, and opportunities. There was a uniform and uniformly achievable path to the "American Dream" – in essence and understandably a fair social pact for Americans.

Figure 2. The Emergence of a Single American Standard of Living: Regional Per Capita Income as a Percentage of National Average



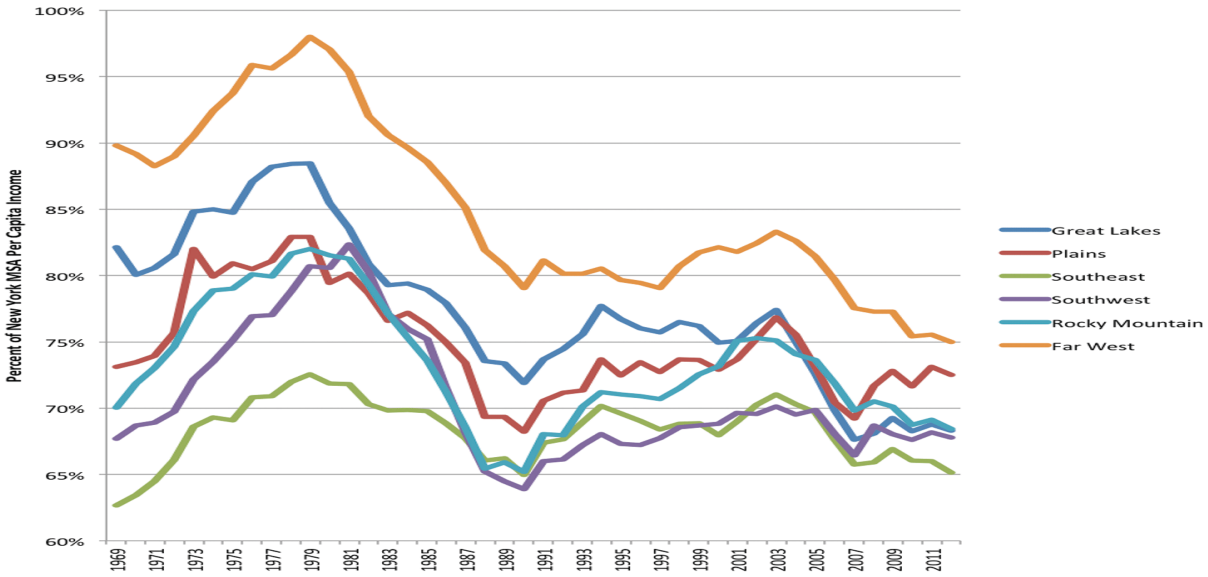
Phillip Longman, "Bloom and Bust" – Washington Monthly, December 2015

But since the late 1970s the inequality between a few locations at the expense of other entire regions has continually widened. Longman measures this by comparing the per capita income of selected regions and that of the New York Metropolitan Area. While the Far West had a per capita income almost equal to New York's in the early 1980s, that fell to 75 percent by 2011. Every other region had the same experience of comparative decline. (Figure 3)

As long as a decade ago, the per capita incomes in New York City, San Francisco and Washington DC had grown since 1980 to be significantly greater than those for Americans as a whole. For New York City it was more than 260 percent greater, for San Francisco – almost 180 percent and Washington DC more than 160 percent. (Figure 4)

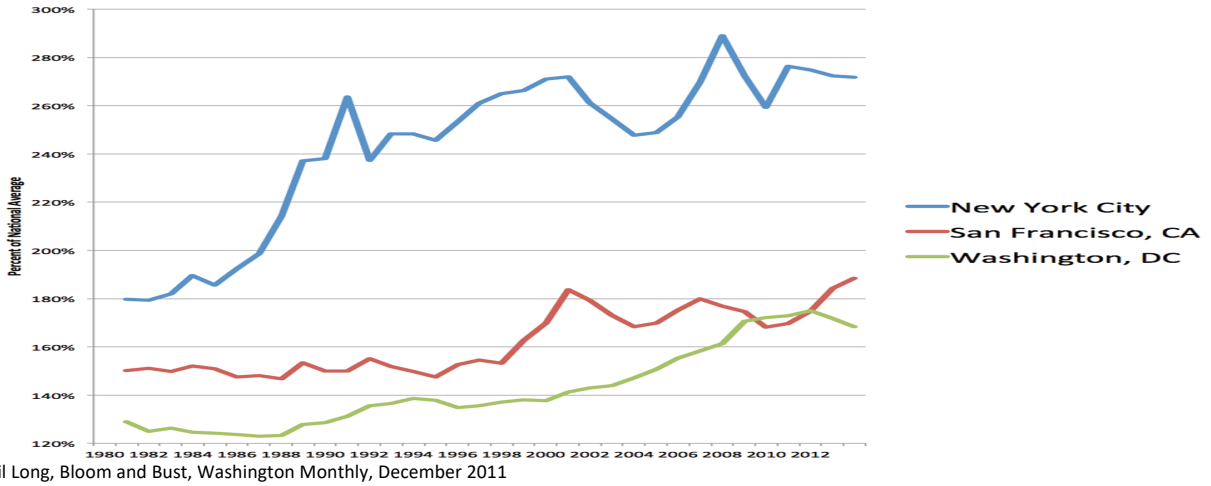
Finally, the Economic Innovation Group of Washington DC has mapped economic distress on a county -by-county basis and publishes a map of its Community Distress Index.[7] The DCI Index is calculated by using seven metrics to determine the Distress Score. They are (1) Number of High School Diplomas, (2) Housing Vacancy Rate, (3) Adults Not Working, (4) Poverty Rate, (5) Median income, (6) Change to Employment, and (7) Change in Businesses.

Figure 3. Per Capita Personal Income of Selected Regions Compared to the New York Metropolitan Area



Phil Longman, Bloom and Bust, Washington Monthly, December 2015

Figure 4. Rise in the Per Capita Income of Selected Cities Compared to the Per Capita Income of Americans

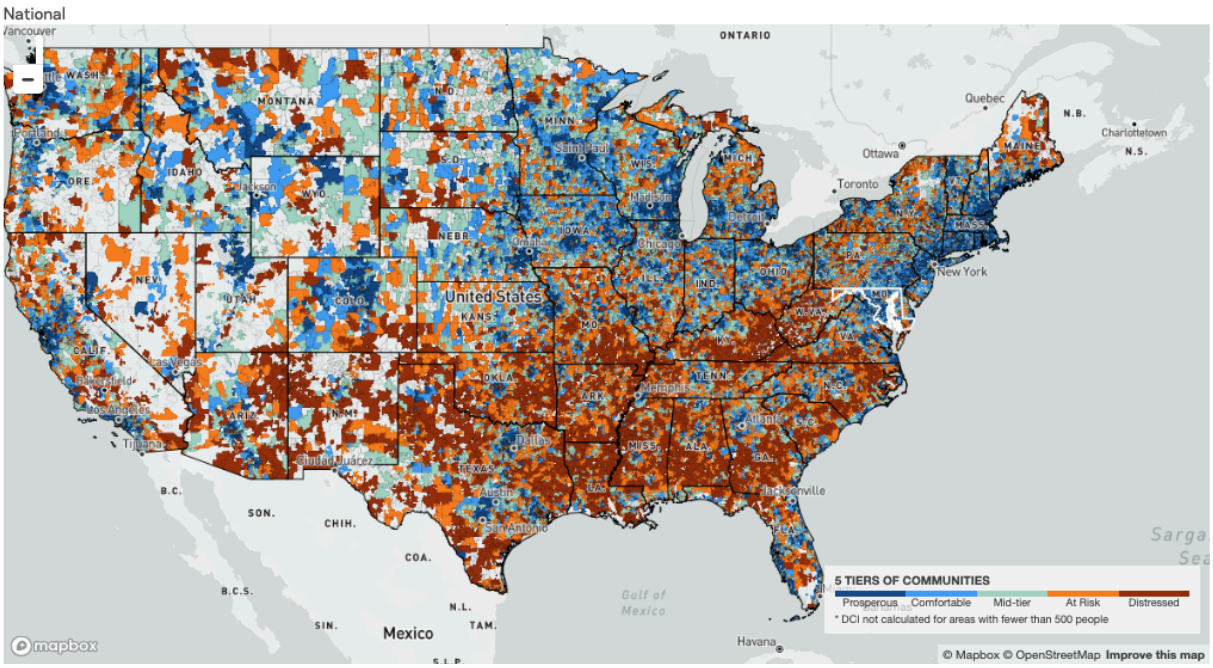


Phil Long, Bloom and Bust, Washington Monthly, December 2011

[7] https://eig.org/dci/interactive-map

The DCI reveals great regional inequality across the United States (Figure 5). Note the distress in the Great Lakes Region, the Mississippi Delta, the Crescent Region in the Southeast U.S., the Southern Border, and Eastern Parts of the Northwestern U.S. They are significant and involve tens of millions of workers and families. These inequalities lead inevitably to discontent and polarization – based upon economic reality and exacerbated by agents purveying ideological discord.

Figure 5 - Distressed Community Index



Source: https://eig.org/dci/interactive-map

Conclusion

The price of power related to water and sewage treatment is the largest energy cost in most city budgets. It is an obligation they are required to pay. Yet to pay, they then must pass on these costs to their rate payers. Consequently, cities have become burdened by vast bonded indebtedness, which many cannot afford. Years ago, the Federal Government paid a 80-20% match for these improvement. Today, it is a 50-50% match. These environmental-related energy costs are crippling communities and ratepayers coast-to-coast.

Focusing on the energy production potential of thermal heat extraction in the water/wastewater treatment process could revolutionize the manner by which cities heat and cool their built environment and dramatically lower their costs. A heretofore largely ignored part of our infrastructure would move to center stage and make a major contribution to reducing greenhouse gases.

In sum, climate change is the most dangerous threat to our personal and national security that the U.S. has faced in generations. But it is also a massive manufacturing and jobs opportunity. Moreover, it offers an almost once-in-a-generation opportunity to reverse the great economic inequality between regions which is worsening year-by-year.

Chairwoman Kaptur and Ranking Member Simpson, thank you for this invitation. I look forward to your comments and any questions you may have of me.