What the Green New Deal Could Cost a Typical Household

A Framework to Estimate the Minimum Costs to Restructure American Society According to the Green New Deal for 11 States and More than a Quarter of Americans

*By Daniel Turner and Kent Lassman**

In early 2019, a handful of progressive Democrats galvanized their party around a set of proposals that, even if only partially implemented, would radically restructure vast areas of the American economy and impose large and ongoing costs on every American household.

This set of proposals, called the Green New Deal (GND)—introduced in the 116th Congress as H.R. 109 and S. 59—has earned attention, depending on the source of commentary, either as an instrument of effective leadership for the 21st century or as an unserious ideological signaling exercise. In either case, it is difficult to read as a set of genuine policy proposals; it is perhaps better described as a far-reaching, aspirational set of guideposts for a resurgent progressive politics.[1]

In July 2019, we released the results of our analysis on how the GND would affect a typical household in each of five states. We have revisited and extended the analysis to cover six additional states. In one, Wisconsin, we draw on new work to highlight industry-specific effects for agriculture. Where possible, we have updated data and calculations to account for new information such as population and autos on the road.

The Green New Deal has a long progressive pedigree. It was championed by statewide and national Green Party candidates for governor and president as early as 2006. Presidential candidate Jill Stein gave it prominence in 2012. The GND has attracted early attention from scores of Democrats, including nine presidential candidates and 12 United States Senators. In response, Republicans pushed for a vote on the GND in the Senate that failed to attract a single vote from Democrats, including the resolution's 12 cosponsors.[2]

At its root, the Green New Deal is a radical blueprint to decarbonize the American economy. Carbon—whether contained in wood, coal, gas, or oil—is a byproduct of burning fuel. Eliminating these energy sources would have massive ramifications for the economy.

While this paper focuses on the GND's energy components, the GND among other goals, seeks to guarantee "a job with a family-sustaining wage, adequate family and medical leave, paid vacations, and retirement security" as well as high-quality health care, affordable and safe housing, affordable food, and access to nature. In a word, it promises a utopia.

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* *Daniel Turner is the executive director of Power the Future. Kent Lassman is the president and CEO of the Competitive Enterprise Institute.*

Regardless of the GND architects' intentions, this paper examines the some of the major tradeoffs associated with taking significant portions of the GND seriously. What would it mean to actually implement significant portions of the proposal? Can we understand the effects at a household level in different regions of the country?

To that end, the following analysis examines the transformation of electricity production, transportation, elements of shipping, and construction in 11 representative states that implementation of the GND would necessitate. It requires a considerable number of assumptions that we share in order to allow readers to come to their own conclusions about the merits of the GND compared to alternative uses of scarce societal resources.

The sum of our analysis is not favorable for the GND's advocates—or for the typical household budget. At best, it can be described as an overwhelmingly expensive proposal reliant on technologies that have not yet been invented. More likely, the GND would drive the American economy into a steep economic depression, while putting off-limits affordable energy necessary for basic social institutions like hospitals, schools, clean water and sanitation, cargo shipments, and the production and transport of the majority of America's food supply.

We do not include in this analysis estimates of the cost of the non-energy components of the GND. Those costs might dwarf the energy-related costs by an order of magnitude. For each of 11 states, we provide a range of estimated costs as well as a best estimate.

Findings

At a minimum, the Green New Deal would impose large and recurring costs on American households.[3] We conclude that among the 11 states analyzed, the GND would cost a typical household a minimum of $74,287 in the first year of implementation. Among 10 of the states, excluding Alaska at $84,584, the average household burden of the GND in its first year is $75,168. For the subsequent four years, the average annual costs per household for 10 of the 11 states is $47,755, decreasing to $40,706 for ever after. The expenses in Alaska are more than $10,000 more per year per household.

Sum of Household Costs

State	Year 1 Household Costs	Annual Household Costs Years 2-5	Annual Household Costs Years 6 and Ever After
Alaska	$84,584	$57,171	$51,740
Colorado	$74,287	$46,874	$40,451
Florida	$76,109	$48,696	$40,828
Iowa	$76,683	$49,270	$41,420
Michigan	$74,470	$47,057	$40,602
New Hampshire	$74,723	$47,310	$39,821
New Mexico	$74,432	$47,019	$40,970
North Carolina	$74,609	$47,196	$40,697
Ohio	$75,807	$48,394	$40,663
Pennsylvania	$75,307	$47,894	$40,983
Wisconsin	$75,252	$47,839	$40,906

Methodology

While the Green New Deal is a wide-ranging proposal, it mainly amounts to an imposition of a significant set of constraints on energy generation. Implementation of the GND would shift energy consumption entirely to electric current from today's primary sources, including fossil fuels. At present, Americans consume energy from many different resources. In general, fossil fuels and some renewable fuels directly power most transportation and much industrial, commercial, and household equipment. The GND would likely reduce the net energy consumption by these various areas while shifting all energy demand toward either the electric grid or self-contained renewable sources like solar panel arrays designed to power particular units.

In 2019 Benjamin Zycher of the American Enterprise Institute analyzed the cost of electricity under the GND.[4] His study looks at current electricity generation and estimates what it would cost to replace all non-GND compliant electricity generation—such as coal, natural gas, petroleum, and nuclear—with wind and solar power. Zycher also looks at the cost of emissions, transmission, backup power, and land for replacement capacity.

Zycher's analysis is understated because it does not calculate additional demand for electricity—the dynamic effects of policy changes—that would obtain as a result of GND implementation. Zycher's low-end estimate addresses the transformation of current power generation to GND-compliant power provision. Of course, other provisions of the GND would generate significant demand increases as well. Moreover, Zycher's cost estimates extend indefinitely and would affect American households far into the future.

Energy research firm Wood Mackenzie estimates that the greening of the U.S. power sector would cost approximately $35,000 per household and take 20 years.[5] Wood Mackenzie estimate a total price tag of some $4.7 trillion, including around $1.5 trillion to add 1,600 gigawatts of wind and solar capacity and $2.5 trillion of investments in 900 gigawatts of storage. Another $700 billion is estimated for new high transmission power lines to move that electricity from sun-drenched deserts and windswept plains to the urban areas where it would be used.

Most provisions of the GND are so broad and open-ended that the list of potential programs necessary to implement the program is only limited by the capacity of legislators to imagine new government programs. Therefore, it is impossible to calculate the maximum cost of the GND. However, other parts of the GND are more precise, sufficiently so that an approximate minimum cost estimate is attainable.

In addition to the GND renewable mandate, the GND calls for:

1. The elimination of "pollution and greenhouse gas emissions from the transportation sector as much as is technologically feasible;"
2. "[U]pgrading all existing buildings in the United States and building new buildings to achieve maximal energy efficiency, water efficiency, safety, affordability, comfort, and durability, including through electrification;"[6]
3. Where technologically feasible, the elimination of the use of fossil fuels and other combustible, greenhouse gas-emitting energy sources.

This study evaluates estimated cost of the GND in four specific categories across 11 representative states:

1. Additional electricity demand;
2. Costs associated with shipping and the logistics industry;
3. New vehicles; and
4. Building retrofits.

These cost estimates were made with the available data and analysis. Where possible, such as for the number of households in each state, we updated calculations from our July 2019 analysis to reflect newly available data. Taken together, we present low-end approximations given the GND's unprecedented scope. A key source, in addition to Zycher's analysis, was produced in early 2019 by Douglas Holtz-Eakin and Dan Bosch of the American Action Forum. Holtz-Eakin and Bosch estimate the costs of a "low-carbon electricity grid" (at $5.4 trillion versus Zycher's $8.95 trillion annual expenditures), the costs of a zero-emission transportation system, and a national "green housing" policy.[7] Taken together and coupled with our own analysis, these estimates develop a floor of expectations for the costs associated with the implementation of the GND in the near and intermediate term.

The states selected for analysis demonstrate diverse climates, geography, economies, and populations.

- Alaska is a remote, sparsely populated, and cold state.
- While not remote, Iowa and Wisconsin share some characteristics with Alaska but have stronger diversity of power generation. Manufacturing and agriculture production are critical and would have meaningful effects from implementation of the GND.
- Florida and North Carolina are among the largest of the states in terms of population and economy. They are economic powerhouses of the Southeast, in a temperate-to-warm climate.
- New Hampshire is a small state that is well connected with larger economies in the region in a cold climate.
- New Mexico is a small state in terms of population, but large geographically. It is generally warm and is situated between significant large states by all metrics.
- Colorado, Michigan, Ohio, and Pennsylvania are large states in terms of geography, economy, and population in a mild-colder climate and are well integrated with large regional economies.

Previous Analysis

Evaluating the impact of the GND in these states will provide a glimpse into the proposal's broader national impact and information similar states can use to infer their own cost estimates.

As shown in Figure 1, earlier analyses provide a range of new, annual costs expected for each household in each of our selected states from a low end of $24,028 in Colorado to upward of $89,000 in all our states. These estimates cover only three aspects of the GND proposal and do not include the dynamic effects of increased demand on the power grid, such as, for example, the transformation of all automobiles to zero-emission vehicles.

The cost estimates for the power grid transportation do not include the costs necessary to replace or retrofit machinery currently dependent on fossil fuels or other combustibles. Therefore, not counted in this analysis are road-building and maintenance equipment, tractors and other farm equipment, or the standard tools of heavy construction for, among other things, new buildings, windmills, solar and other alternative energy facilities. Such an estimate would require an inventory of every machine of this type in the country, from propane-powered forklifts to natural gas stoves to diesel-powered tugboats and cost estimates of all replacement technology capable of being indirectly powered by wind and solar and necessary to achieve parity in terms of their ability to perform the same work.

Figure 1. Previous Estimates Produce Range of New Annual Household Costs – Electric Power, Transportation, Housing

State	Households[8]	Annual Household Costs – Zycher GND Power System	Wood Mackenzie – 20 Year Annual Cost for GND Power	Holtz-Eakin and Bosch Power System[9]	Holtz-Eakin and Bosch Net-Zero Emission Transportation (High Speed Rail)	Holtz-Eakin and Bosch Green Housing	Range of New Household Costs from Previous Analyses
Alaska	250,000	Not Available	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$60,000 - $89,000
Colorado	2,180,000	$3,028	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$24,028 – $89,000
Florida	7,180,000	$4,273	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$25,273 - $89,000
Iowa	1,127,000	$4,821	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$25,821 – $89,000
Michigan	3,960,000	$3,665	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$24,665 – $$89,000
New Hampshire	530,000	$3,820	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$24,820 - $89,000
New Mexico	790,000	$4,508	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$25,508 - $89,000
North Carolina	4,010,000	$3,900	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$24,900 – $89,000
Ohio	4,680,000	$3,592	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$24,592 – $89,000
Pennsylvania	5,070,000	$4,549	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$25,549 - $89,000
Wisconsin	2,370,000	$3,865	$35,000	$39,000	$9,000 - $20,000	$12,000 - $30,000	$24,865 – $89,000

Shipping and Logistics

The modern American economy is reliant upon international trade. Local economies (beyond a handful of experimental communities) exchange goods and services. We build, dig, grow, and ultimately ship things, all of which requires a great deal of energy to do.

An estimate for the cost of the GND proposals on shipping and logistics starts with data on goods shipped to each of the model states by transportation methods for which we have data. However, basic economic theory suggests that due to increased costs for GND-compliant shipping, a negative elasticity of demand would reduce the use of these technologies, as higher prices drive away consumers. While this could inflate our estimates, we are confident that the costs for development and deployment of substitute shipping technologies far outweigh reduced demand for traditional shipping even after the expense of retrofitting it to the GND.

Our estimates exclude air cargo and relies exclusively on trucking, rail, and barge traffic for which data are available. While we assume that nearly all freight delivered to these states is via a combination of these modes or via air cargo, air cargo is not specified in the available data and therefore we assume no costs for bringing air cargo shipments into compliance with the GND. As a result, the cost estimates presented here are significantly lower than the likely costs.

The exclusion of air cargo would effectively eliminate the availability of off-season produce, the timely delivery of FedEx and Amazon packages, and a great deal of U.S. mail delivery. Relative comparisons are made between current costs and estimated GND's compliance costs by evaluating the energy intensity of total shipping in terms of BTUs.[10]

The Center for Transportation Analysis's Freight Analysis Framework database provides information on total ton-miles of freight by shipping mode and destination state.[11] These ton-miles also exclude any freight that is not GND-compliant, such as shipments of oil or coal.

Figure 2. Mode-Exclusive Million Ton-Miles by Destination State and Mode, Excluding Non-GND Compliant Freight (2017)

State	Trucking Ton-Miles	Rail Ton-Miles	Barge Ton-Miles
Alaska	2,506.9311	0.2459	1,068.5184
Colorado	25,051.6266	7,556.5294	N/A
Florida	7,8737.1894	1,6593.0234	660
Iowa	33,465.5321	13,693.4209	176.3257
Michigan	35,863.239	7,799.4471	486.0442
New Hampshire	4,216.5778	276.3823	N/A
New Mexico	10,142.5379	1,974.8886	N/A
North Carolina	37,386.0257	15,908.8531	242.0245
Ohio	56,939.1042	15,374.8773	11,514.9623
Pennsylvania	62,771.9956	20,774.6559	1,933.3569
Wisconsin	44,141.3745	13,235.6985	2,753.5069

The British thermal unit (BTU) intensity per ton-mile for trucking, rail, and barge traffic is drawn from an analysis by the U.S. Department of Energy.[12] Trucking is approximately four to five times as energy intensive as rail or barge (1,390 BTU per ton-mile for trucking versus 320 and 225 for rail and barge, respectively).

The combination of ton-miles in Figure 2 with BTU intensity by mode gives us an estimate for the total annual energy consumption, in BTUs, for freight delivered to each model state for each mode of shipping. Figure 3 provides an estimate for increased shipping fuel costs due to GND implementation based on an estimate from the University of Pennsylvania for $32.24 for the production of a million BTUs from renewable sources.[13] For purposes of illustration, we assume extraordinary technological innovation in the development of renewable energy and have halved the cost estimate of a million BTUs to $16.12.

Figure 3. Mode-Exclusive Shipping Energy Consumed in Million BTUs (2017) and Annual Household Costs

State	Trucking BTUs (Millions)	Rail BTUS (Millions)	Barge BTUs (Millions)	Total BTUs (Millions)	Cost (Total BTUs x $16.12/million)	Cost Per Household
Alaska	3,484,634	79	240,417	3,725,130	$60 million	$240
Colorado	34,821,761	2,418,089	0	37,239,850	$600.3 million	$275
Florida	109,444,693	5,309,767	148,500	114,902,960	$1.85 billion	$237
Iowa	46,517,090	4,381,895	39,673	50,938,658	$821 million	$646
Michigan	49,849,902	2,495,823	109,360	52,455,085	$846 million	$214
New Hampshire	5,861,043	88,442	0	5,949,485	$96 million	$181
New Mexico	14,098,128	631,964	0	14,730,092	$238 million	$301
North Carolina	51,966,576	5,090,833	54,456	57,111,865	$921 million	$230
Ohio	79,145,355	4,919,961	2,590,867	86,656,183	$1.4 billion	$299
Pennsylvania	87,253,074	6,647,890	435,005	94,335,969	$1.52 billion	$300
Wisconsin	61,356,511	4,235,424	619,539	66,211,474	$1.07 billion	$451

New Vehicles

A key goal of the Green New Deal is to replace all existing combustible-powered vehicles with electric vehicles (EVs). Current projections are for EVs to be costlier on average than conventional vehicles. EV prices, like conventional gas vehicle prices, vary based on size and features. Perhaps the most critical differentiating feature for the near term is the type of batteries available. EVs that charge faster and have a longer range will undoubtedly fetch higher prices. However, for the purposes of our analysis, a conservative estimate for EV costs to consumers is used. The price of $39,500 is in line with the base MSRPs of the most popular EVs sold today.[14] To control for existing EVs, a ratio of 2.21 EVs per 1,000 residents is used to calculate total EVs in each state.[15]

In Figure 4, the estimated cost of immediate replacement for each household is found by multiplying the non-EVs on the road by the estimated cost of a new car and dividing the result by the number of households in the state. We then determine the average annual cost for each household to convert to EVs using the same assumption of consumers bearing 90 percent of the purchase price, no net present value calculations, and equal payments for five years.

The difference between the annualized cost per EV and the average household cost is to demonstrate the subsidy that would flow from high-ownership households to lower-income households that do not have multiple vehicles. In the case of Alaska, the annual household expense of $5,431 is $2,216 below the cost of for each EV because many households have zero vehicles to convert but would nonetheless help shoulder the transition costs through increased fees, taxes, or regulatory compliance.

Figure 4. Annual Cost of Replacing Existing Non-GND Compliant Vehicles with Electric Vehicles

State	Total Cars	Estimated EVs	Total Non-GND Cars	Annualized Cost per EV For Each of Initial Five Years of Ownership[16]	Total Cost Per State to Immediately Replace Existing Fleet of Personal Vehicles	Average Annual Household Cost for Five Years to Convert to EVs
Alaska	173,487	1,628	171,859	$7,647	$6,788,430,500	$5,431
Colorado	1,785,058	12,540	1,772,518	$7,647	$70,013,750,000	$6,423
Florida	7,778,493	46,860	7,731,633	$7,647	$307,250,750,000	$7,868
Iowa	1,268,996	6,952	1,262,044	$7,647	$49,849,000,000	$7,850
Michigan	3,257,473	21,978	3,235,495	$7,647	$127,802,250,000	$6,455
New Hampshire	505,381	2,992	502,389	$7,647	$19,844,800,000	$7,489
New Mexico	609,494	4,620	604,874	$7,647	$23,893,550,000	$6,049
North Carolina	3,317,918	22,836	3,295,082	$7,647	$130,152,500,000	$6,499
Ohio	4,605,459	25,718	4,579,741	$7,647	$180,910,000,000	$7,731
Pennsylvania	4,463,267	28,182	4,435,085	$7,647	$175,182,500,000	$6,911
Wisconsin	2,092,584	12,782	2,079,802	$7,647	$82,152,100,000	$6,933

Population figures for 2018 drawn from https://www.statista.com/statistics/183497/population-in-the-federal-states-of-the-us/ and an estimate of 2.2 EVs per 1,000 residents.

Commercial cargo trucks are a different matter. There has not been similar adoption of EV technology in trucking. Further, prices of EV trucks are largely speculative at this time. For illustrative purposes (though not included in our analysis or conclusions), the prospective list price of an electric semi-tractor from Tesla is $180,000.[17] Needless to say, this price is speculative and there are more than 15.5 million commercial trucks on the road today. While the economic effects of the GND must account for commercial vehicles, our analysis does not include them, and is therefore a conservative estimate of new vehicle costs. However, we do make a partial accounting for truck freight in our shipping analysis.

These costs are just upfront purchase price seen by consumers. EVs will also impose costs through necessary infrastructure retrofits at homes, businesses, and other public places, each of which will cost many thousands of dollars.

Building Retrofits

The GND calls for maximum building energy efficiency via a complete retrofit of the current built environment in the United States. In the construction industry, these are known as deep energy retrofits (DERs). The cost of a DER can vary considerably, given varying climates, building ages, uses, sizes, and other factors. A 2014 meta-analysis relied upon by the Department of Energy is the basis for our assumptions about residential construction. The average cost per a unit of housing for a DER is estimated at $40,420.[18] We estimated the maximum average cost of a DER for commercial buildings at $75 per square foot.[19]

Almost no data are readily available regarding industrial DERs. Therefore, in our 2019 analysis we relied upon assumptions in the underlying studies and used the average maximum cost for large commercial buildings, $150, per square foot, as an estimate for industrial DERs.[20]

Notwithstanding difficulties of collecting state-by-state data for total building square footage or for the varying usage of energy in commercial versus industrial buildings, we relied upon Energy Information Administration (EIA) data that show that energy consumption per square foot in 2015 was 38,400 BTUs for residences and 82,000 BTUs for commercial buildings.[21] Industrial consumption per square foot was assumed at 100,000 BTUs, given the increase in BTU consumption per square foot from residential to commercial.

Figure 5. Residential DER Investments under GND

State	Residential Units	Total DER Cost ($40,420/ unit)
Alaska	318,336	$12,867,141,120
Colorado	2,424,051	$97,980,141,420
Florida	9,547,305	$385,902,068,100
Iowa	1,409,650	$56,978,053,000
Michigan	4,614,380	$186,513,000,000
New Hampshire	638,091	$25,791,638,220
New Mexico	943,208	$38,124,467,360
North Carolina	4,684,876	$189,363,000,000
Ohio	5,217,423	$210,888,000,000
Pennsylvania	5,713,150	$230,925,523,000
Wisconsin	2,710,723	$109,567,000,000

Combining these figures with total 2016 energy consumption in BTUs per sector—obtained from EIA's state-by-state database[22]—produced estimates of total active square footage of buildings across all sectors.

We then estimated the total cost of a DER for existing structures via two methods. For residential, total DER cost is calculated by obtaining census data on total housing units in each state in 2018 and multiplying this figure by the average residential unit DER cost of $40,420.[23] For commercial and industrial buildings, the average DER cost is obtained by multiplying estimated and assumed DER costs for commercial and industrial buildings, respectively, by total estimated square footage in each of the five states studied.

Critically, the discussion in this paper is about the cost of transition to GND structures. Clearly, any benefits realized from more energy efficient buildings would reduce future operating costs and emissions.

Taken together, the estimated costs for retrofitting current residential, commercial, and industrial buildings is astronomical. Of our representative states, Alaska has the fewest residential structures and other square footage by orders of magnitude. Yet, the combined investments to upgrade residential, commercial, and industrial building stock is a mind-boggling $533.4 billion for Alaska.

Therefore, our conclusions do not include an estimate for DERs for commercial or industrial structures despite the Green New Deal's call for the highest levels of efficiency in all buildings. The effect of including such large numbers—hundreds of trillions of dollars in various states—would be to discourage any examination of any of the GND proposals. For the purposes of public education and our analysis, the key figure is the average cost of a DER for residential homes, $40,420. The costs associated with only upgrading housing stock vary from nearly $12.9 billion in Alaska to almost $231 billion in Pennsylvania.

Summary and Synthetic Estimates for Robustness

Figures 7, 8, and 9 summarize the findings of this study in order to put in context the tremendous costs of the GND. As a final set of calculations, we created synthetic estimates for the variables where multiple analyses exist: the household costs for the electric grid, electric vehicles, and retrofitting the nation's housing stock to comply with the GND.

Zycher's analysis varies by state for the electric grid, while Holtz-Eakin and Bosch offer a national average of $39,000 and Wood Mackenzie finds a national average of $35,000. The first synthetic variable, Synthetic Grid Estimate, takes the average of these three figures. For Alaska, only the latter two estimates are averaged; Zycher did not offer an estimate. For example, in Florida, Zycher estimates $4,273, Wood Mackenzie estimates $35,000, and Holtz-Eakin and Bosch estimate $39,000. The average or combined estimate is the sum of the figures divided by three, $26,091.

We present our own estimate to transform the auto fleet to EVs and include a range of likely expenses from Holtz-Eakin and Bosch for shifting the nation to high-speed rail. The synthetic transportation estimate is the mid-point of the range for high-speed rail combined with the household EV costs.

We also created a synthetic estimate for housing using the average DER cost of $40,240 and the range of likely outcomes found by Holtz-Eakin and Bosch of $12,000 to $30,000. Because there is no state variability in the data, the synthetic housing estimate is $27,413.

The synthetic estimates, when combined with the estimate for increased shipping expenses, produce a single figure for households in each state for the initial year of implementation. For each of the next four years, the household costs would fall by $27,413, reduced by the synthetic estimate of implementing a DER for every home. After five years, the expense associated with converting each household to EVs would fall away.

While it is not possible to express absolute confidence in the estimated costs for these provisions of the GND, the use of synthetic estimates reduces the risk of any one type of analysis skewing the results. Critics will undoubtedly highlight the variance in the data. However, variance is not a detriment when analyzing such a sweeping set of proposals. Rather, it is a mark of humility. Further, we contend that the conclusions drawn here are extremely modest, representing only the energy-related costs. We do not provide estimates for either the transition of the 15.5 million commercial trucking fleet or energy efficient upgrades to every commercial and industrial building. Also included in our analysis are the GND's calls for universal health care and guaranteed employment among other social policies that would have tremendous transition costs.

Conclusion

The Green New Deal is a plan to radically reshape the American economy that would affect every American household. The proposal would impose significant new costs on every aspect of how we live and work. The majority of goods that are currently essential for agriculture, transportation, and construction would be affected. In short, it is not realistic. However, many national political figures seek to implement it as a policy agenda.

All of the potential benefits and social costs—such as massive increases in land use for the production of energy and food without fossil fuel inputs—are beyond the scope of this analysis. Yet we can conclude that the Green New Deal is an unserious proposal that is at best negligent in its anticipation of transition costs and at worst a politically motivated policy whose creativity is outweighed by its enormous potential for economic destruction.

Figure 6. Average Household Costs

State	Annual Average Household Cost to Green Electric Power	Annual Average Shipping Cost Per Household	Annual Average Household Cost to Convert to EV – Authors' Estimate*	Holtz-Eakin and Bosch et. al. Estimate of Zero-Emission Transportation – Annual Cost for High-Speed Rail	Average Residential DER One-Time Cost	Holtz-Eakin and Bosch et. al. Green Housing Estimate – One-Time Cost
Alaska	$35,000 to $39,000	$240	$5,431	$9,000 to $20,000	$40,240	$12,000 to $30,000
Colorado	$3,028 to $39,000	$275	$6,423	$9,000 to $20,000	$40,240	$12,000 to $30,000
Florida	$4,273 to $39,000	$237	$7,868	$9,000 to $20,000	$40,240	$12,000 to $30,000
Iowa	$4,821 to $39,000	$646	$7,850	$9,000 to $20,000	$40,240	$12,000 to $30,000
Michigan	$3,665 to $39,000	$214	$6,455	$9,000 to $20,000	$40,240	$12,000 to $30,000
New Hampshire	$3,820 to $39,000	$181	$7,489	$9,000 to $20,000	$40,240	$12,000 to $30,000
New Mexico	$4,508 to $39,000	$301	$6,049	$9,000 to $20,000	$40,240	$12,000 to $30,000
North Carolina	$3,900 to $39,000	$230	$6,499	$9,000 to $20,000	$40,240	$12,000 to $30,000
Ohio	$3,592 to $39,000	$299	$7,731	$9,000 to $20,000	$40,240	$12,000 to $30,000
Pennsylvania	$4,549 to $39,000	$300	$6,911	$9,000 to $20,000	$40,240	$12,000 to $30,000
Wisconsin	$3,865 to $39,000	$451	$6,933	$9,000 to $20,000	$40,240	$12,000 to $30,000

* *These costs are for each of the first five years.*

Figure 7. Synthetic Estimates and Best Estimate of Household Costs

State	Annual Synthetic Grid Estimate	Annual Transportation Estimate – EV and High-Speed Rail	Synthetic Housing Estimate	Annual Average Shipping Cost Per Household	First Year Implementation Best Estimate to Transition Power, Shipping, Transportation and Construction to GND
Alaska	$37,000	$19,931	$27,413	$240	$84,584
Colorado	$25,676	$20,923	$27,413	$275	$74,287
Florida	$26,091	$22,368	$27,413	$237	$76,109
Iowa	$26,274	$22,350	$27,413	$646	$76,683
Michigan	$25,888	$20,955	$27,413	$214	$74,470
New Hampshire	$25,940	$21,189	$27,413	$181	$74,723
New Mexico	$26,169	$20,549	$27,413	$301	$74,432
North Carolina	$25,967	$20,999	$27,413	$230	$74,609
Ohio	$25,864	$22,231	$27,413	$299	$75,807
Pennsylvania	$26,183	$21,411	$27,413	$300	$75,307
Wisconsin	$25,955	$21,433	$27,413	$451	$75,252

Figure 8. Sum of Average Household Costs

State	Year 1 Household Costs	Annual Household Costs Years 2-5	Annual Household Costs Years 6 and Ever After
Alaska	$84,584	$57,171	$51,740
Colorado	$74,287	$46,874	$40,451
Florida	$76,109	$48,696	$40,828
Iowa	$76,683	$49,270	$41,420
Michigan	$74,470	$47,057	$40,602
New Hampshire	$74,723	$47,310	$39,821
New Mexico	$74,432	$47,019	$40,970
North Carolina	$74,609	$47,196	$40,697
Ohio	$75,807	$48,394	$40,663
Pennsylvania	$75,307	$47,894	$$40,983
Wisconsin	$75,252	$47,839	$40,906

Addendum – The Green New Deal's Impact on Wisconsin Agriculture

*By Will Flanders**

Wisconsin's official nickname, "the Dairy State," belies the importance of agriculture to the state as a whole. While both national and state trends point toward consolidation of the agriculture industry and a reduction in the number of farms, the sector remains an important part of Wisconsin's economy. More than 435,000 people were employed in agriculture-related jobs in 2017, representing 11.8 percent of employed persons in the state.[24]

The Green New Deal represents as important a threat to agriculture as it does to other parts of the economy. With its goal of zero emissions and promotion of organic farming methods, farmers are likely to incur substantial new costs, which will be passed on to consumers. This addendum explores two areas in which the GND could impact farming—by reducing crop productivity and by requiring a curtailment of emissions from dairy.

Crop Productivity Reduction. In 2012, Dutch researchers Tomek de Ponti, Bert Rijk, and Martin K. van Ittersum conducted a meta-analysis on the productivity difference between conventional and organic farming methods. Because organic farming eschews some modern farming methods, such as genetically modified crops and herbicides and pesticides, it produces generally lower yields than traditional farming. Across 34 studies specific to corn, the researchers found that organic yields were 11 percent lower than those using traditional techniques. This means that the average farmer could expect to see 11 percent less marketable produce on the same size farm after adopting organic methods.[25]

For the purpose of estimating the cost to Wisconsin of an 11 percent yield reduction, we assume that this reduction is achieved without any increases in cost to farmers (or that organic farming decreases costs). In reality, it is likely that costs would increase, as the net present value of organic crops has been found to be lower in the absence of cost premiums, which would necessarily go away were all farming in the United States to go organic.[26] We examine the likely impact on two important crops for Wisconsin, corn and soybeans.

Corn is arguably the most important component of the agricultural economy in Wisconsin after dairy. in 2016 corn represented $1.315 billion in cash receipts—12.3 percent of all agricultural receipts in the state, according to the most recent Department of Agriculture (USDA) data.[27] An 11 percent reduction in yield would impose $144.675 million in costs on the state's economy. These costs would be borne by farmers, their families, and the

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* *Will Flanders is the Research Director at the Wisconsin Institute for Law and Liberty. Dr. Flanders holds a Ph.D. in Political Science with a specialization in American Politics and Public Policy from Florida State University, as well as an M.S. in Political Science and an M.S. in Applied American Politics and Policy from the same school.*

communities they live, in addition to any costs they would have to bear for converting their farm to organic.

Soybean production is a large and growing part of Wisconsin's agricultural economy. According to the same USDA source, soybeans brought in $885 million in cash receipts in 2016.[28] An 11 percent reduction in yield would result in a loss of approximately $97.35 million to Wisconsin's economy.

The case could be made that the loss of yield could be made up for by the expansion of farming, yet increasing deforestation and the footprint of farming in the state are at odds with the Green New Deal's stated goals.

Agricultural Emissions. A major goal of sustainable farming advocates is to reduce livestock farming. According to some estimates, agriculture is responsible for approximately 13 percent of global emissions.[29] Thus, many environmental activists urge people to become vegan or vegetarian in order to help stave off global warming.[30]

This is particularly problematic for Wisconsin, which is heavily reliant on the dairy industry for its economic well-being. There are 1.28 million dairy cows in the state across 9,520 farms, according to recent estimates from the Wisconsin Milk Marketing Board.[31] What would the Green New Deal mean for these farmers?

The Green New Deal does not specifically mention how to address livestock emissions, but clues can be found in the fact that it has a goal of zero *net* emissions rather than zero *total* emissions. As explained by Sen. Edward Markey (D-MA) in an initial draft of the proposal, the Green New Deal's architects "set a goal to get to net-zero, rather than zero emissions, in 10 years because we aren't sure that we'll be able to fully get rid of farting cows and airplanes that fast."[32] A goal of zero net emissions suggests that the emissions of agriculture would have to be offset in some manner.

Fortunately, environmentalists have provided us with an estimate of just what it should cost polluters to prevent global warming. Economist William Nordhaus estimated that polluters should have to pay $230 per metric ton of carbon dioxide (CO^2) emissions in order to remain below 2.5 degrees Celsius of warming.[33] This works out to about $2,000 per year per cow.[34]

It is easy from these figures to estimate the cost of the GND to the state's dairy farmers. Given the number of cows in the state, this would represent an annual cost of approximately $2.560 billion to Wisconsin's dairy industry. Some of this might be borne by consumers, but it is likely that consumers would seek milk alternatives as the price of milk shot up. Indeed, consumers are already moving away from milk at a time of low prices.[35] This could lead to mass closures of small farms in an industry that is already struggling.[36]

Another approach is to compare the gas production of a single cow with the EPA's estimated social cost of that level of emission.[37] Theoretically, the price of agricultural goods would have to increase to a sufficient extent to offset this cost. A 2018 study estimated that a cow on a North American Farm produces the equivalent of 11,280 kilograms, or 11.28 metric tons, of CO_2 emissions per year. The second lowest EPA estimated social cost of a metric ton of CO_2 is $43.90.[38] This works out to a cost $633,845,760 annually.

Model	Estimated Cost
Nordhaus Estimate	$2,560,000,000
EPA Social Cost Estimate	$633,845,760

Conclusion. The Green New Deal's harms are not limited to heavy industry, but would represent a tremendous shock to all sectors of Wisconsin's economy. In all agriculture-reliant states, the move toward organic farming would undermine both farmers' bottom lines and state revenue. Policy makers must consider the full implications of such a proposal before moving toward such a dramatic upheaval of the American economy.

Notes

[1] Recognizing the duty of the Federal Government to create a Green New Deal, H.R. 109/S. 59, 116th Congress, https://www.congress.gov/bill/116th-congress/house-resolution/109/text, https://www.congress.gov/bill/116th-congress/senate-resolution/59?q=%7B%22search%22%3A%5B%22green+new+deal%22%5D%7D&s=2&r=3.

[2] Vote summary, "On the Cloture Motion (Motion to Invoke Cloture on the Motion to Proceed to S.J. Res. 8, Vote Number 52, 3/5 Vote Result: Cloture Motion Rejected March 26, 2019, 04:18 PM, https://www.senate.gov/legislative/LIS/roll_call_lists/roll_call_vote_cfm.cfm?congress=116&session=1&vo te=00052#top.

[3] Benefit-cost estimates rely on net present value (NPV) to provide analysts a tool to see how various benefits or costs change over time. Similarly, robust cost estimates utilize NPV analysis, and costs are calculated as negative future cash-flows. The various elements of the GND—from changes in housing stock to vehicles to the electric grid—would all require specialized and differing discount rates to find the NPV. Therefore, we did not discount future costs. This analysis is a composite of others' work as well as our own estimates and there is no single discount rate available that is sensible for either the component parts of the GND or the other cost estimates. Admittedly, this may overestimate the effects of the GND in the out years but we are confident that the magnitude of the estimated costs are not affected by minor variances in discount rates or the NPV for the GND.

[4] Benjamin Zycher, *The Green New Deal: Economics and Policy Analytics*, American Enterprise Institute, 2019, https://www.aei.org/wp-content/uploads/2019/04/RPT-The-Green-New-Deal-5.5x8.5-FINAL.pdf.

[5] Nichola Groom, "Weaning U.S. power sector off fossil fuels would cost $4.7 trillion: study," Reuters, June 27, 2019, https://www.reuters.com/article/us-usa-carbon-report/weaning-u-s-power-sector-off-fossil-fuels-would-cost-4-7-trillion-study-idUSKCN1TS0GX.

[6] H.R.109.

[7] Douglas Holtz-Eakin, Dan Bosch, Ben Gitis, Dan Goldbeck, and Philip Rossetti, *The Green New Deal: Scope, Scale, and Implications*, American Action Forum, February 25, 2019, https://www.americanactionforum.org/research/the-green-new-deal-scope-scale-and-implications/.

[8] With 127.59 million households in the United States in 2018. "Number of households in the United States in 2018, by state (in millions)," Statista,

https://www.statista.com/statistics/242258/number-of-us-households- by-state/.

[9] Holtz-Eakin and Bosch provide national estimate and an average household estimate. The household estimate is presented here.

[10] A British thermal unit is a unit of measure for energy. One million BTUs is enough to dry about 50 loads of laundry.

[11] Freight Analysis Framework Data Tabulation Tool (FAF4), Center for Transportation Analysis, accessed July 10, 2019, https://faf.ornl.gov/faf4/Extraction2.aspx.

[12] Trucking and Rail BTUs per ton-mile: U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Freight Transportation Demand: Energy-Efficient Scenarios for a Low-Carbon Future," Transportation Energy Futures Series, March 2013, https://digital.library.unt.edu/ark:/67531/metadc844590/m2/1/high_res_d/1072830.pdf.
Barge BTUs per ton-mile: U.S. Department of Transportation, Bureau of Transportation Statistics, Table 6-10 Energy Intensities of Domestic Freight Transportation Modes: 2007-2013, https://www.bts.gov/archive/data_and_statistics/by_subject/freight/freight_facts_2015/chapter6/table6_10.

[13] Energy Cost Calculator, College of Agricultural Sciences, Cooperative Extension, Pennsylvania State University, accessed July 10, 2019, https://buffalo.extension.wisc.edu/files/2011/01/Energy-Cost-Calculator-for-Various-Fuels-PSU.pdf.

[14] Jeffrery Rissman, "The Future of Electric Vehicles in the U.S.," Energy Innovation Policy and Technology LLC, September 2017, https://energyinnovation.org/wp-content/uploads/2017/10/2017-09-13-Future-of- EVs-Research-Note_FINAL.pdf.

[15] Mark Kane, "State-By-State Look at Plug-In Electric Cars per 1,000 Residents," InsideEVs, December 1, 2018, https://insideevs.com/news/341522/state-by-state-look-at-plug-in-electric-cars-per-1000-residents/. The number of registered automobiles in 2017 for each state is drawn from https://www.statista.com/statistics/196010/total-number-of-registered-automobiles-in-the-us-by-state/.

[16] The cost of an EV purchased for $39,500 can be amortized across five years with a typical low interest auto loan. We assume that each auto is purchased with 10 percent down ($3,950) and $35,550 on credit at 2.9 percent. This generous formula creates an annual burden, in addition to the down payment, of $637.21 a month or nearly $7,647 a year. To simplify the analysis, we assume that the down payment is provided through a combination of new federal and state subsidies, and therefore consumers are responsible for 90 percent of the purchase price. The remaining 10 percent of cost does not go away, taxpayers pay for it.

[17] Tesla Semi, Tesla website, accessed July 10, 2019, https://www.tesla.com/semi.

[18] Brennan Less and Iain Walker, "A Meta-Analysis of Single-Family Deep Energy Retrofit Performance in the U.S.", Environmental Energy Technologies Division, Berkeley Lab, prepared for the U.S. Department of Energy, Office of Scientific and Technical Information, 2014, https://www.osti.gov/servlets/purl/1129577.

[19] Daniel S.Bertoldi, "Deep Energy Retrofits Using the Integrative Design Process: Are they Worth the Cost," Master's Projects and Capstones, University of San Francisco, spring 2014, https://repository.usfca.edu/capstone/22.

[20] Ibid.

[21] Energy Information Administration, Summary annual household site consumption and expenditures in the U.S.—totals and intensities, 2015," Table 2.1 May 2018, https://www.eia.gov/consumption/residential/data/2015/cande/pdf/ce1.1.pdf.
Energy Information Administration, Major fuel consumption intensities (BTU) by end use, 2012, Table E2, May 2016 https://www.eia.gov/consumption/commercial/data/2012/cande/pdf/e2.pdf.

[22] Energy Information Administration, Alaska End-use energy consumption 2017, estimates, accessed July 10, 2019, https://www.eia.gov/beta/states/states/ak/overview.

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[26] United States Department of Agriculture, National Agricultural Statistics Service, 2017 Wisconsin Agricultural Statistics, https://www.nass.usda.gov/Statistics_by_State/Wisconsin/Publications/Annual_Statistical_Bulletin/2017AgStats_web.pdf.

[27] Ibid.

[28] Ibid.

[29] CAIT Climate Data Explorer, World Resources Institute, accessed December 18, 2019, https://cait.wri.org/.

[30] Zachary Toliver, "Will 'Green New Deal' Supporters Walk the Walk by Going Vegan?" People for the Ethical Treatment of Animals blog, March 20, 2019, https://www.peta.org/blog/vegan-green-new-deal/.

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[32] Yaron Steinbuch, "AOC explains why 'farting cows' were considered in Green New Deal," *New York Post*, February 22, 2019, https://nypost.com/2019/02/22/aoc-explains-why-farting-cows-were-considered-in-green-new-deal/.

[33] William Nordhaus, "Integrated Assessment Models of Climate Change," *NBER Reporter* 2017 Number 3, National Bureau of Economic Research, https://www.nber.org/reporter/2017number3/nordhaus.html.

[34] Katia Dmitrieva, "The Green New Deal Progressives Really Are Coming for Your Beef," *Bloomberg*, March 13, 2019, https://www.bloomberg.com/news/articles/2019-03-13/the-green-new-deal-progressives-really-are-coming-for-your-beef.

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[37] U.S. Environmental Protection Agency, "The Social Cost of Carbon," accessed February 19, 2020, https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html

[38] Ibid. Inflation-adjusted from reported $42 in January 2017. This number was released in 2016 by the EPA under the Obama administration. The EPA under the Trump administration revised these numbers down drastically. However, any implementation of the Green New Deal is likely to happen under an administration more amenable to the Obama estimates.