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To: The House Select Committee on the Climate Crisis

From: Arjun Makhijani, Ph.D., President, Institute for Energy and Environmental Research

Subject: Response to the Request for Information regarding actions and policies to address the climate crisis

Date: 2019-11-22

I have provided sector specific responses to the questions below. However, I would first like to make a comment on the 45% by 2030 and net zero by 2050 targets in the first paragraph of the Request for Information. The 2030 target is the median value of the range of 40% to 60% provided in the 2018 IPCC report. These are global targets. Wealthier countries, including the United States, have differentially greater responsibilities under the 1992 United Nations Framework Convention on Climate Change.

Looking at the IPCC report as a whole, 60% by 2030 and net zero by 2045 for all greenhouse gases are much more appropriate targets for the United States and all other countries that are members of the Organization for Economic Cooperation and Development. My responses, therefore, are directed towards achieving these goals. They are based on many years of technical work both national and for specific states, most of all Maryland, including assessments of technical, cost, and equity issues. Some resource materials are mentioned at the end of this memorandum; I would be happy to provide more. My responses below are in blue. . I have been working on energy issues since 1970. My CV can be downloaded [here](#).

## **Sector-Specific Policies**

1. What policies should Congress adopt to decarbonize the following sectors consistent with meeting or exceeding net-zero emissions by mid-century? Where possible, please provide analytical support that demonstrates that the recommended policies achieve the goal.

### **a. Transportation**

- The sale of new petroleum on-road vehicles should be banned by 2035, and the ban should be announced as soon as possible so that manufacturers can make suitable investments.
- The federal government should purchase only electric and/or hydrogen fueled on-road vehicles for its own use after 2024, unless otherwise required for performance reasons.
- The federal government should provide financial support to state and local governments to acquire only electric and/or hydrogen fuel cell vehicles after 2024.
- The federal government should ask all cities to prepare plans for public transport as a public utility – safe, dense, affordable and frequent -- using only zero emission vehicles. The goal

should be for all cities to have vibrant, clean public transit systems within ten years. The federal government should encourage suitable zoning to valorize the transport and reduce travel in personal vehicles. It should also institute policies and financial support that would enable low- and moderate-income people who live in the improved transit corridors to remain in their homes.

- There are no commercially ready technologies for displacing petroleum in the aircraft and marine sectors, but technologies are available that have been demonstrated to work. These need to be commercialized. Specifically, NASA has flown aircraft using cryogenic hydrogen fuel. In the 1980s, the Soviet Union flew a converted passenger jet using cryogenic hydrogen. Commercial aircraft need to be redesigned, and suitable safety studies comparing such aircraft with jet fuel-using airplanes should be an urgent and large development priority. The same applies to ships, especially large cargo ships. NASA and private companies are developing short-range electric and hybrid aircraft. These efforts should be expanded. The goal should be to commercialize 100% renewable energy aircraft by or before 2030.
- Orient incentives for electrification to high-use vehicles, including public transit buses and taxis, airport vehicles, school buses, delivery trucks, robotic vehicles.
- Support the electrification of the non-road transport sector, including agricultural and construction equipment via battery or fuel cell electrification.
- Support the acceleration of new battery designs based on more commonly available materials like zinc, for a variety of uses including for on-road vehicles and off-road equipment.
- Put in place comprehensive programs for recovery and recycling of materials from solar panels, batteries, wind turbines, etc.

b. Electric power. The Select Committee would like policy ideas across the electricity sector but requests specific comment on two areas:

- i. If you recommend a Clean Energy Standard, how should it be designed?
  - The United States should adopt the IPCC 5 report's definition of renewable energy:
    - "Any form of energy from solar, geophysical, or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use." Source: IPCC 2014, Mitigation volume, p. 1261. The period over which the rate of use and replenishment is calculated should be one year. Nuclear energy and trash are not renewable under this definition. Much, but not all, hydropower would be renewable.
    - This definition should be used as the basis for defining "clean" energy, which must first of all be renewable, and, in addition, have minimal or zero air, water, and soil pollution in the course of its utilization.
    - Solar and wind would be the foundation of a renewable and clean energy future.
    - A Clean Energy Standard would specify acquisition of clean, renewable electricity, and not just the certificates representing such electricity, in the following targets:
      - 70% to 75% by 2030 depending on the extent of hydropower availability.
      - 100% by 2040.
      - These targets should be accompanied by suitable supports for charging and other infrastructure needed for electric vehicles.

- A target of two percent per year improvement of efficiency in existing electricity uses overall --- that is not including conversion of buildings and vehicles to electricity.
- Encourage suitable regulations to be issued by FERC to prioritize solar and wind in the loading order for electricity designated for interstate transport.

ii. How can Congress expedite the permitting and siting of high-voltage interstate transmission lines to carry renewable energy to load centers.

- Before expediting new interstate lines, Congress should incentivize local microgrids powered by solar energy, and if suitable, wind energy – with both electricity storage and seasonal thermal storage. A robust, distributed electricity system, especially if accompanied by seasonal thermal storage, heat and cold, will be much better suited to increasing resilience in an era of climate extremes. The Drake Solar Community in Alberta, Canada uses solar thermal technology to provide more than 90% of its heat – and winters in the area are comparable to the colder regions of the United States. Cooling can be accomplished by seasonal storage of coldness in insulated cells in the ground or in ice stored in insulated cells. Heat can also be similarly stored on a seasonal basis. Storing heat in insulated cells seasonally is the technology employed by the Drake Solar Community. The cheapest energy source in a system with a large amount of wind and solar is likely to be electricity that would otherwise be curtailed in the spring and fall.
- Offshore transmission backbones should be incentivized and possibly built by the federal government. The revenues from leasing offshore tracts for offshore wind would likely be much greater in the context of the creation of these transmission backbones.
- In California, transmission lines carrying electricity from floating offshore wind farms should be buried and connected to networks of suitably protected microgrids, especially in areas where grid-initiated fires present significant risks. A similar approach can be followed along the Atlantic, Gulf, and Great Lakes coasts to prevent economic and social disruption caused by extreme events. In other words, a renewable energy transition should be used as an occasion for rethinking the grid to a smart, distributed, robust, and resilient grid.
- The National Renewable Energy Laboratory should work with states, public utility commissions, utilities, and Regional Transmission Operators to enable states and local jurisdictions to create distribution system operators who would manage local smart grids and the large number of distributed assets, including solar installations, distributed battery storage, microgrids, and demand response aggregators.
- Demand response should be optimized and, as appropriate, aggregated, both at the distribution system level and the high-voltage transmission level.

c. Industry

- Incentivize the use of renewable hydrogen obtained, for instance, by electrolysis of water – to replace oil and natural gas in industry both in areas where hydrogen is a feedstock, such as in ammonia production, and where it can be used as a fuel in combined heat and power systems based on fuel cells.
- Create a vigorous research and development program to develop concentrating solar power for use in high temperature heating applications.

- Vigorously develop hempcrete technology, as well as standards for measuring its strength and durability as a replacement for concrete.
- Put in place a research and development program that will result in displacing energy intensive materials, including those used for buildings, in favor of materials produced using regenerative agricultural practices.

#### d. Buildings

New buildings:

The federal government should set the following standards for buildings it owns or rents.

- Net zero CO2 construction with passive building standards for all new residential buildings of four units or less by 2022; the same for commercial buildings by 2025. Apartment buildings of more than four units would be defined as commercial buildings for this purpose; offsite solar installations built expressly for meeting the net zero standard would be permitted for the commercial net zero CO2 standard.
- No fossil fuel use infrastructure in the new buildings, residential or commercial. Specifically, new buildings with natural gas connections would be disqualified.

Freddie Mac and Fannie Mae should not purchase mortgages for new residential construction unless they meet the above standards.

Existing buildings:

A robust program to support the conversion from fossil fuels to renewable energy of all existing buildings by 2045.

2. What policies should Congress adopt to ensure that the United States is a leader in innovative manufacturing clean technologies; creating new, family-sustaining jobs in these sectors; and supporting workers during the decarbonization transition?

- Incentivize offshore wind, lease ocean areas expeditiously, and encourage littoral states to set high targets for offshore wind. Offshore wind has the potential to become the largest new manufacturing industry in the United States.
- Ensure union-friendly contracting for the federal government.

3. What policies should Congress adopt to ensure that environmental justice is integral to any plan to decarbonize these sectors?

- Increase energy assistance support to enable states to enact an affordable energy plan under which low-income households eligible for energy assistance would pay no more than six percent of their gross income for household energy bills. Such programs exist in some states, including Illinois, New Jersey, and Colorado.
- Provide incentives to convert diesel trucks to electricity as soon as possible, in port and other heavy traffic areas that tend to be in low-income communities of color.

- Support the development of public transit as a public utility and ensure that low income families can continue to live in the corridors with upgraded transit. IEER is preparing a report on this topic and additional detail can be provided upon request.
- Remediate the highly polluted areas that are now dominated by petrochemical industries, coal ash ponds, and uranium mining wastes and ensure that clean water resources are available in such areas, especially in rural communities.
- Ensure that Freddie Mac and Fannie Mae have rules incentivizing high efficiency standards for affordable housing, including rental housing.
- Ensure that the retrofit programs to upgrade housing to high energy efficiency standards give priority to low income households.
- Provide financial backstops for low-income households who may not have the credit or financial resources to own solar on their roofs and/or to participate in community solar programs.

## **Cross-Cutting Policies**

### **4. Carbon Pricing:**

a. What role should carbon pricing play in any national climate action plan to meet or exceed net zero by mid-century, while also minimizing impacts to low- and middle-income families, creating family-sustaining jobs, and advancing environmental justice? Where possible, please provide analytical support to show that the recommended policies achieve these goals.

Carbon pricing is, in general, not an effective approach to reducing emissions. Consider the heavy taxes on transportation in many European countries, which are on the order of \$400 per metric ton of CO<sub>2</sub> – far higher than anything proposed for the United States. European vehicles still get only about 35 to 40 miles per gallon; moreover, many of these cars are diesel, which has higher energy content per gallon, so part of the difference is illusory, not to speak of the higher pollution caused by diesel vehicles. Thus, despite a tax that is in effect a huge carbon fee, European countries still consume a large amount of oil in the vehicular sector. In contrast, efficiency standards for appliances have resulted in dramatic efficiency improvements and emissions reductions – often accompanied by lower prices for the more efficient appliances. Perhaps the most dramatic example is frost-free refrigerators, which consumed 100 kilowatt-hours per cubic foot per year in 1972. Today, as a result of federal and state standards, first promulgated in California in 1977, the consumption is just 20 kilowatt-hours per cubic foot per year. – Efficiency standards have been progressively tightened since the late '70's, even as costs have come down. Standards for air-conditions, washing machines, and other appliances have also been very effective in increasing efficiency and reducing electricity use.

The targets above for electricity and transportation are direct mandates, incentives/disincentives, and regulations that will accomplish the transition faster, more economically, and more cleanly than carbon taxes.

Further, carbon fee and dividend approaches, while helping many low-income families, would hurt others. Some would face higher expenses despite the dividends, as for instance those who live in rural areas with old vehicles and inefficient homes. Many more would face cash flow problems due to higher costs at the gas pump, for instance.

Potential exceptions to the above arguments are:

- carbon taxes of energy-intensive industries accompanied by incentives and support for the transition out of fossil fuel use
- taxes on methane leaks from interstate natural gas pipelines and leaks at oil and gas wells based on a 20-year global warming potential for methane. These funds could be used to transition industry off of fossil fuels.

b. How could sectoral-specific policies, outlined in questions 1-3, complement a carbon pricing program?

See above.

## 5. Innovation:

a. Where should Congress focus an innovation agenda for climate solutions? Please identify specific areas for federal investment and, where possible, recommend the scale of investment needed to achieve results in research, development and deployment.

- Electric and hydrogen aircraft and ships, in the latter case, with or without sails.
- Materials research to reduce the use of or to replace cement and steel with agricultural materials like hemp and bamboo that are regeneratively grown and sequester carbon in soils.
- Research on the efficient use of materials like cement and steel.
- Heat transfer research to make much more efficient heat pumps, solar thermal systems, and the like.
- See agriculture section below.

b. How can Congress incentivize more public-private partnerships and encourage more private investment in clean energy innovation?

## Agriculture

6. What policies should Congress adopt to reduce carbon pollution and other greenhouse gas emissions and maximize carbon storage in agriculture?

- Promoting regenerative agriculture should be a top priority, This involves:
  - Reducing the risk for farmers for the three-to-five, possibly more in some cases, year transition period to regenerative agriculture by providing financial assistance of various kinds.
  - Support for creating markets for the different mixes of agricultural products that will be produced since regenerative agriculture typically has more crop diversity.
  - Assisting with the creation of infrastructure like local storage depots, local slaughterhouses, etc.
  - Providing scientific support for measuring the soil and water quality improvements that occur with consistent adoption of regenerative practices.
  - Encouraging states to transition their schools of agriculture away from industrial farming and toward regenerative agriculture.

- Mandating purchase of organic regenerative food for all federal purposes – to reach 100% by 2028.
- Supporting states and local governments to achieve the same purchasing mandate for their own purposes, including for universities, colleges, hospitals, and schools by 2028.

7. What policies should Congress adopt to help farmers, ranchers, and natural resource managers adapt to the impacts of climate change?

Marrying renewable electricity with regenerative agriculture could provide significant revenues for farmers; appropriate safeguards to protect prime lands for food production and conservation purposes must be included. In addition, support for transmission access for farmers and cooperatives of farmers installing solar and wind farms may be needed.

### **Oceans, Forestry and Public Lands**

8. How should Congress update the laws governing management of federal lands, forests, and oceans to accelerate climate adaptation, reduce greenhouse gas emissions and maximize carbon storage?

### **Non-CO2 Greenhouse Gases**

9. What policies should Congress adopt to reduce emissions of non-CO2 greenhouse gases, including methane, nitrous oxide, and fluorinated gases?

- No new interstate oil or natural gas infrastructure should be permitted. Oil and gas leasing on federal land and waters should be stopped; the federal government should discourage such leases on state lands. Coal-fired electricity plants should not be transitioned to gas-powered or to combined heat and power using natural gas or coal.
- Two-thirds reduction in halogenated greenhouse gases – HFCs and SF6 – by 2030 and complete phase out by 2040.

### **Carbon Removal**

10. How can Congress accelerate development and deployment of carbon removal technology to help achieve negative emissions?

Regenerative agriculture and agroforestry, and reforestation of degraded lands should be the main approaches to carbon sequestration have been discussed above. In addition, methane removal from the atmosphere should have a high priority. It can be pursued by incentivizing crops that harbor methanotrophic bacteria, which consume methane in air pockets in the soil. Certain cattle grazing practices are also net zero or decrease overall methane.

Methane could grow into a much bigger problem due to melting permafrost and increasing meat production. The federal government should initiate research into the production of the hydroxyl radical,

OH<sup>-</sup>, from water using renewable energy. The OH<sup>-</sup> ion is a very efficient destroyer of methane; the tiny OH<sup>-</sup> concentrations in the atmospheres are the principal way in which methane in the atmosphere is destroyed.

## **Resilience and Adaptation**

11. What policies should Congress adopt to help communities become more resilient in response to climate change? The Select Committee welcomes all ideas on resilience and adaptation but requests comments on three specific questions:

- a. What adjustments to federal disaster policies should Congress consider to reduce the risks and costs of extreme weather and other effects of climate change that can no longer be avoided?
- b. How can Congress better identify and reduce climate risks for front-line communities, including ensuring that low and moderate-income populations and communities that suffer from racial discrimination can effectively grapple with climate change?
- c. What standards and codes should Congress consider for the built environment to ensure federally-supported buildings and infrastructure are built to withstand the current and projected effects of climate change?

- Solar microgrids with electricity and thermal storage sufficient to meet essential loads should be an essential part of the guidance for resilience. See above. Locally-sourced agricultural products would build community resiliency as well as decrease transportation costs.
- Federal flood insurance policies need to be revamped in light of a variety of factors relating to climate change.
- Training in green building methods, solar and wind installation, and emergency management should be focused in low-income communities to provide jobs and to give people the tools to help build local resilience.
- Communication tools, internet access, etc. must be expanded and updated so grids can be optimized (even during “normal” times) and emergency/disaster responses can be coordinated

## **Climate Information Support**

12. Our understanding and response to the climate crisis has relied on U.S. climate observations, monitoring and research, including regular assessment reports such as the National Climate Assessment. What policies should Congress adopt to maintain and expand these efforts in order to support solutions to the climate crisis and provide decision makers – and the American people – with the information they need? Where possible, recommend the scale of investment needed to achieve results.

Public health education to increase understanding of health benefits from (1) decreased toxic emissions from the following sectors: oil, gas and concrete production and end-use; transportation corridors; and industrial agriculture dependent on applications of petrochemical-derived products; and (2) increased healthy soils; carbon sequestration through soil, plants and forests; and lower consumption of meat. Note that animals are integral to healthy soils, but they must be in ecological balance.



## International

13. The climate crisis requires a global response. U.S. leadership is critical for successful global solutions. What policies should Congress adopt to support international action on the climate crisis?

Given the scale, speed, and intensity of the climate crises, it is important for all countries, including those with relatively low person emissions to achieve carbon neutral and then carbon negative systems. Wealthier countries are obligated under the 2015 Paris Agreement to provide \$100 billion in assistance. They are falling short. Moreover, given the reality that wealthy countries will exceed their per person carbon budgets – only 570 gigatons are remaining for the entire world – the money should be in the form of grants or long-term zero-interest loans. Sharing emission reduction technologies for local use in developing countries should be free of patent restrictions and fees. The United States will exceed its per person carbon budget in the next few years.

**In addition to your responses to any of these questions, please include any other specific policies that you think Congress should adopt to solve the climate crisis and adapt to the impacts of climate change.**

*Note: The Select Committee may choose to publish your responses in whole or in part. All responses will become part of the permanent committee record in the National Archives.*

### Some Resources

- [Renewable Maryland Project webpage](#) with links to many publications
- [Prosperous, Renewable Maryland](#)
- [Beyond a Band-Aid](#) – Just transition paper – with Labor Network for Sustainability
- [Energy justice](#) in Maryland – equity and affordability book and [infographic](#)
- [IEER 2015](#) report on conversion of buildings from fossil fuels to efficient electric systems
- [IEER/PSE Healthy Energy 2017](#) New Jersey renewable energy roadmap, including comparison of nuclear subsidies with renewable energy costs
- IPCC 2018 [Summary for Policymakers](#) and URL from which [other chapters can be downloaded](#)
- [IPCC 2014](#), URL from which all chapters can be accessed
- United Nations Framework Convention on Climate Change, 1992: [UNFCCC text](#)
- New Jersey Percentage of Income Payment plan known as the [Universal Service Fund](#).