Recommendation #6 (Approved March 21, 2024) on Supply Chain Analysis

We recommend that the Department of Commerce (DOC) convene a whole-of-government coalition of federal agencies involved in the transition to clean, renewable energy to conduct an analysis of the current energy supply chain components and materials subject to constraints and identify any anticipated (i) supply shortages (ii) supply concentrations and (iii) dependency on potentially adversarial nations, each of which could impact the Country's ability to meet the Administration's policy goal of carbon-free electricity by 2035 and export targets of Department of Commerce.

We recommend the DOC coordinate an inter-agency survey of U.S. manufacturers of the impacted energy sectors involved in the clean tech energy transition (i.e., on- and off-shore wind, solar photovoltaics, transformers, electric grid, battery/storage, hydropower, marine energy, biomass, fuel cells, green hydrogen, etc.) and lead the coordination within the impacted federal agencies to produce a comprehensive report that will include:

1) the current list of components most critical within each clean tech energy sector and their corresponding current supply chain status;
2) the current manufacturing capacity in the United States;
3) the alternative country(s) of production for each component;
4) the current demand deficit/surplus for each component;
5) projected need of each component in order to satisfy the Administration's policy goals (using 2035 as a targeted sample year based upon the stated goal of reaching 100 percent carbon-pollution free electricity by 2035);
6) projected deficit/surplus and its impact on export opportunities or import threats for each component based upon current manufacturing capacity, with the goal of identifying specific components for which new or expanded domestic production capacity or importation strategy is required to mitigate any projected constraint.

Sub-Committee(s): Clean Energy Supply Chains

Background Information: See Attachment 1 for detailed background explanation.

Expected Effect on U.S. Export Competitiveness:
To develop effective export policies impacting energy sector components, it is incumbent first to fully understand the current marketplace and assess where (1) constraints exist that are currently constraining or will constrain the growth of clean energy; and (2) where dependencies exist on foreign markets that may not have the United States' interests in mind. With such a substantial anticipated increase in the size of the clean energy sector

and its related demand on critical components and materials over the coming years, any such constraints and risks will only grow in impact.

By doing so, the Administration can focus its initiatives on the identified components and materials that are shown to be in constraint based upon the projected growth in demand of the related clean energy sector technology, which will allow for tailored manufacturing incentives and import/export policies to mitigate the constraints. As these domestic needs are satisfied, the U.S. can focus on exporting these components to the international markets.

Specific Agencies Responsible for Implementation:
DOC, DOE and Department of Labor, with inputs from the Office of Management and Budget (OMB), and Department of Treasury. The assessment should include inputs from U.S. industry representatives across the clean energy manufacturing sector and its equipment/material supply chain, including fabrication and maintenance services.

Measures of Success:
The goals of this study should be to identify and communicate:

1) the current list of critical components within each clean tech energy sector and their corresponding current supply chain status;
2) the current manufacturing capacity in the United States;
3) the alternative country of production for each component;
4) the current demand deficit/surplus for each component;
5) projected need of each component in order to satisfy the Administration's policy goals (using 2035 as a targeted sample year based upon the stated goal of reaching 100 percent carbon-pollution free electricity by 2035) and would recommend as a baseline that we identify for each renewable energy industry sector a 1GW modeled buildout (or energy sector equivalent measurement) such that as we scale depending on the administrations goals or it's adjustments, the levers can be adjusted accordingly;
6) projected deficit/surplus for each component based upon current manufacturing capacity, with the goal of identifying specific components for which new or expanded domestic production capacity is required to mitigate any projected constraint.

ATTACHMENT 1 - BACKGROUND

Background information: Issues associated with ongoing supply chain constraints in the energy sector have been well reported and, to its credit, the Administration is focusing on addressing the issues. To exacerbate the issues, projected growth within the global market for clean energy materials is expected to increase exponentially in the coming decades—jumping by 400% for some materials, and as much as 4,000% in the extreme case of lithium and graphite used in batteries. As the National Renewable Energy Laboratories (NREL) has observed, for some materials critical to the development of clean energy sources, a small number of countries (some of which are adverse to the United States) control reserves, processing operations and production facilities for components critical to clean energy.

On December 8, 2021, President Biden signed Executive Order 14057, which formalized the Administration's policy to achieve a carbon-pollution free electricity sector by 2035 and net-zero emissions economy wide by 2050. Further, on February 24, 2021, the President signed Executive Order 14017, named "America's Supply Chains," in which he announced the policy of securing and strengthening the resilience of America's supply chains, which resulted in several actions from the federal government, including:

- The Department of Energy (DOE) releasing a report entitled America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition in February 2022;
- In June 2022, the President issued the presidential determinations that allowed the use of Defense Production Act powers to accelerate domestic production of five key sectors: 1) solar photovoltaics; 2) transformers and electric grid components; 3) heat pumps; 4) insulation; and 5) electrolyzers, fuel cells and platinum group metals.
- The President signed into law the Bipartisan Infrastructure Law, the Inflation Reduction Act and the Chips and Science Act.

To an extent, some federal agencies and private entities have begun collection of some of this data for a limited subset of the energy sector. This recommendation will augment those efforts and make the data more compelling and useful to determine potential future supply chain constraints in the energy sector.

For instance, in May 2023 the Blue Green Alliance, a non-profit working to solve today's environmental challenges in ways that create and maintain quality jobs and build a clean, thriving, and equitable economy released an analysis of certain portions of the clean technology supply chain in which it created a detailed spreadsheet listing specific components and materials within each clean technology energy sector and the current status of the domestic supply chain for that component. While this does not analyze the current and projected demand for these components as is recommended herein, it is a thorough list of the components for these specific portions of the sector that should be the starting point to get the input of the manufacturers.

Further, in August 2023, the DOE released its Supply Chains Progress Report that provided an overview of its research into the current status of supply chains within the U.S. energy sector industrial base. In Table 4 in the Report, DOE provides a list of nine high-level components within the identified technology in the energy sector on which it is focusing. In Tables 5 and 6, the Report identifies examples of potential government investments and sources of funds for these nine identified components. While helpful, this high-level overview may not address the full scope of the underlying supply chain issues.

As an example, one of the nine identified components is listed as "Transformers" and correctly notes that the transformer manufacturers are a critical component to meet the transition goals and that there are limited domestic players within this sector. While fully accurate, this is only the surface of the supply chain issue within this sector and does not recognize much more fundamental issues with which those manufacturers must deal. Based upon the Blue Green Alliance analysis, public filings and informal data gathering from the domestic transformer manufacturers, the domestic transformer manufacturing sector is currently facing unprecedented shortages and lead time delays in critical underlying components and materials (see list below) that are not identified or addressed in the DOE Report. These shortages and lead time delays for these critical component and materials will be further exacerbated as the transition to clean energy resources takes hold:

- Labor shortages
- Grain Oriented Electric Steel (GOES)
- CTC conductors
- Load Tap Changers
- Bushings and Lightning Arrestors
- Insulation (raw material)
- Insulation component
- Copper
- Aluminum
- Transformer tank body and structural steel
- Certain valves and radiators.

Similarly, February 24, 2022 the DOE released a report entitled Hydropower Supply Chain Deep Dive Assessment in which it evaluated supply chain status and issues impacting that sector. The DOE correctly noted that demand for hydropower and Pumped Storage Hydropower is anticipated to increase due to relative age of the infrastructure and the transition to carbon pollution-free generation. As a result, "it is important to evaluate supply chain vulnerabilities and potential bottlenecks that might slow down the desired pace of refurbishments or new development." The DOE identified large steel casting/forgings, generator windings and "small subcomponents involving microchips" as difficult to source domestically and with long lead times. One factor exacerbating the

shortages in the hydropower supply chain is the general absence of standardization due to each project being optimized to the available water elevation change and flow available at each project location. Stockpiling feedstocks is not an economic option when most equipment is custom engineered and manufactured. There are hundreds of manufactured components in hydropower units and many are customized steel components requiring general fabrication and machining manufacturing shops to produce them. The labor and material impacts of COVID and other recent global events have impacted the availability and even the existence of some of these small custom shops tightening the supply chain for less specialized custom components. Based upon the Blue Green Alliance analysis, public filings and informal data gathering from the domestic hydropower manufacturers, the sector is currently facing shortages and lead time delays in critical underlying components and materials (see list below) that are not identified or addressed in the DOE Report:

- Heavy steel plate material
- Heavy stainless steel plate material
- Aluminum-Bronze plates and castings

At present, we are unaware of a comprehensive government-wide analysis assessing the current supply chain on a component basis in any of these sectors and comparing that to the anticipated need for that component as demand adjusts to meet the transition goals. It is the intention of this Recommendation that the DOC, in cooperation with other impacted federal agencies like the DOE, do a comprehensive study of the current and projected energy sector supply chains for the purpose of identifying specific components and materials that either are currently constrained or, upon expected expanded demand due to the transition to clean energy sources, will become constrained.