RFI Transforming Industry: Strategies for Decarbonization

To: Dr. Avi Schultz, Director, Industrial Efficiency & Decarbonization Office
From: Iliana Paul, Deputy Director of Sierra Club's Industrial Transformation Campaign; Yong Kwon, Senior Campaign Advisor of Sierra Club's Industrial Transformation Campaign.
Re: Strategies to Decarbonize America's Industrial Sector

Dear Dr. Schultz,

The Sierra Club respectfully submits the following comments in response to the request for information (RFI) from the Industrial Efficiency & Decarbonization Office (IEDO or the Office) of the U.S. Department of Energy (DOE) on Strategies to Decarbonize America's Industrial Sector, which we understand will feed into an upcoming report, *Pathways for U.S. Industrial Transformations: Unlocking American Innovation*. Sierra Club is America's largest and most influential grassroots environmental organization, and our Industrial Transformation Campaign seeks to transform the way we manufacture the goods society needs to thrive while promoting family supporting jobs on a livable planet.

Sierra Club was grateful for the opportunity to share its perspective with IEDO during the in-person workshop in Washington, DC on May 14-15, 2024 and would like to offer more detailed and additional insights for your Office's consideration. We respond to a number of questions posed in the RFI below. We also would like to take this opportunity to share some high level recommendations with IEDO as it drafts the upcoming *Pathways* report.

Recommendations:

- To meet Biden Administration goals on environmental justice and to build support from fenceline and frontline communities, IEDO should push industry to **prioritize emissions reductions equipment and technologies that have the most significant co-pollution benefits**.
- IEDO and its sister DOE offices should also **continue to build infrastructure around robust community engagement**, by the companies applying for and receiving awards and from the Department itself, including by building on the Community Workforce Readiness Fellowship (RAMP) program.
- IEDO should **facilitate knowledge** sharing, both within U.S. manufacturers and from other countries, to maximize the effects of industrial decarbonization research and development.
- DOE should work with other federal and state agencies to ensure that decisions and benchmarks are **based on accurate and verifiable emissions and pollution data**.

These recommendations and other feedback are explained in more detail below.

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1A.1 What feedback do you have on the primary industrial decarbonization challenges and barriers summarized above? Please list any additional barriers that you think are important.

Many case studies of industrial policies that have successfully jump-started high-tech sectors in other countries underscore how sound macroeconomic management might have a greater consequence on outcomes than any specific policy lever.[1] This is an important insight for the U.S. government's own efforts to accelerate the adoption of green technologies in the industrial sector.

One macroeconomic variable that deserves particular attention by the Department of Energy - and was not listed as a barrier in this request for information - is labor. Specifically, the cultivation of a skilled workforce in the United States to carry out the various tasks associated with this industrial transition to low-emissions technologies. These skills include not only the engineering talents to install and operate the machinery (which must expand as green technology facilities must compete for recruitment vis-a-vis manufacturing firms that are not yet participating in efforts to decarbonize and offer lucrative benefits to hires) but also a broader set of citizen scientists who can monitor local pollution and hold firms accountable for their performance targets.

Heightened pollution monitoring has at least two resulting benefits. First, the proper identification of the problem will prompt research into its solutions - this will be additive to efforts to improve the performance of industrial systems for the benefit of communities and the climate. Second, the resulting pollution reduction will bolster local health and make possible the activation of a more stable workforce both as citizen scientists and workers at facilities that employ green technologies. The U.S. EPA's CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA) suggests that particulate matter pollution in the iron and steel, metallurgical coke, cement, and aluminum industries in the United States in 2020 led to a loss of 140,845 workdays, 832,368 limited workdays, and a range of other harms including premature deaths.[2] The reduction of these health harms represent more workers, higher productivity, and more work days for the economy to draw on to achieve the industrial transition.

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[1] Daniel Okimoto. "Between MITI and the Market: Japanese Industrial Policy for High Technology." Stanford University Press, 1989.

[2] "Coming Clean on Industrial Emissions: Challenges, Inequities, and Opportunities in U.S. Steel, Aluminum, Cement, and Coke." Synapse Energy Economics, September 12, 2023. https://www.sierraclub.org/sites/default/files/2023-09/Coming-Clean-On-Industrial-Emissions.pdf

1A.2 Which barriers do you feel are most important to address first?

Of the six bolded barriers listed under "Primary Challenges and Barriers to Decarbonization," improving the collection of data on community impacts is the foremost barrier to transforming the domestic industrial sector. Absent better understanding of pollution from the industrial sector, including the cumulative effects of industrial clusters, the Department of Energy and other stakeholders face difficulties in accurately assessing whether a particular technological route taken by a facility is the optimal solution to address both climate change and local health harms. Moreover, the lack of credible data hampers the ability of local communities to both negotiate pollution abatement plans with adjacent industrial facilities and hold them accountable to those commitments.

During the regional briefings showcasing the recipients of the Department of Energy's Industrial Demonstrations Project, many companies addressed questions regarding the accuracy of their emissions data by claiming that their facilities were in alignment with monitoring guidance from the Environmental Protection Agency (EPA). However, the Sierra Club found that manufacturing facilities enjoy broad leeway in how they report greenhouse and toxic emissions data reported to the EPA. A survey commissioned by the Sierra Club revealed that many industrial facilities use unreliable estimations when reporting on their greenhouse gas and toxic emissions.[3]

1A.3 How would you recommend the government engage to address these (or other) industrial decarbonization barriers?

Underrepresented Social Criteria

The EPA currently permits industrial facilities to report both greenhouse gas and toxic emissions using a variety of methods, including subjective estimates and figures representing industry-wide averages. The Department of Energy should require facilities receiving public assistance to adopt the best-available monitoring methods for on-site releases that eliminate subjective estimates and rely on objective measurements from equipments. Moreover, these facilities should report on the status of potential points of failure on-site that could lead to fugitive emissions that are not captured by equipment installed at the stacks or other release points.

The government should also bolster the frequency of site inspections and number of staff conducting these inspections to verify that the measurement equipment are operating normally and identify sources of potential failure that could lead to fugitive emissions that bypass detection. Although pollution monitoring may primarily be in EPA's purview, increased capacity on that front would benefit DOE for the reasons described above.

[3] ibid

Inefficient Information Flows

To achieve the Administration's overarching goal of accelerating the adoption of new green technologies while simultaneously enhancing sectoral productivity, the government should create a venue where rival firms receiving public support can regularly share with one another best practices and lessons learned from their decarbonization efforts. The resulting transfers of knowledge promises to lower the cost of optimizing the performance of proven green technologies (measured in time). This space can also have collateral benefits, such as coordinating investment in a shared renewable energy source to repower their facilities (including those in different industries).

The expectation that an innovator would voluntarily offer insights from breakthroughs to rival firms appears to contradict market logic as the former would forgo a competitive advantage in the market. Nevertheless, an examination of the steel industry reveals that rival firms have exchanged critical technical know-how to make collective advances throughout its history.[4] In the case of mini mills in the United States, research suggests this counterintuitive collaboration occurs because an informal understanding exists between firms that laggards receiving insights today would share their breakthroughs in the future.[5]

DOE can play a role in creating the necessary environment for this important knowledge exchange. Common bottlenecks to these knowledge exchanges include the need to build trust through interpersonal relationships and reliance on industry associations to create settings for conversations. This leaves cooperation between key actors that are learning different facets of adopting new technologies to chance and navigating engagement in spaces (i.e. industry associations) where there are also many non-participants in the effort to adopt low-emissions technologies. The government could play a role in creating a consortium for firms participating in public-funded transition work to share research and insights with one another and formalize other means of collaboration. Public entities like the National Laboratories should be party to these spaces to offer support and glean engineering challenges in adopting green technologies.

Two case studies from the semiconductor industry may serve as models for this space. Japan's Electro-Technical Lab, which helped turn participating companies like Toshiba and Sony into

[4] Robert C. Allen. "Collective Invention." Journal of Economic Behavior and Organization 4 (1983) 1-24. https://robert-c-allen.net/wp-content/uploads/2017/12/collinvent.pdf

[5] "Cooperation Between Rivals: The Informal Trading of Technical Know-how," In: *The sources of innovation*, ed. Eric von Hippel (Oxford University Press, 1988).

global electronics superhouses, and the U.S.-based public-private partnership Semiconductor Manufacturing Technology (SEMATECH).[6,7]

1A.4 Aside from cost, what vulnerabilities/challenges do facilities face when adopting new technologies?

The Department of Energy's focus is largely on supporting the front-end cost of deploying new technology at a facility. These front-end challenges include research into the application of new technologies and cost of purchasing and installing new equipment. However, the lack of demand for the products made through a low-emissions process in the market represents a bigger headwind to firms weighing the adoption of low-emissions technology.

For example, Sierra Club's discussions with industry observers revealed that the price premium of producing low-emissions primary steel is approximately 25% higher than traditional routes. Offtakers with net-zero commitments are willing to offer a premium of around 18% for primary steel produced through a low-emissions route. Since primary steel produced through a low-emissions route is expected to have the same performance standard as those produced through a traditional process, this gap between the price steelmakers need and what buyers are willing to pay discourages capital investment in new technologies even if the Department of Energy offers front-end support.

Some of this cost can be lowered by truncating the time it takes for facilities adopting green technology to achieve optimal operation (See response to question 1A.3); however, this is unlikely to lower the cost premium of using green technologies to a level that is market competitive on its own.

Though outside of DOE's mandate, a climate-forward trade policy, which could be created by executive action, that imposes a fee on imports proportional to their embodied emissions represents another pathway to create greater demand for domestically-produced goods with lower emissions. There are also industrial players inside the United States that are not participating in the transition to low-emissions technology that could undermine the market for responsibly-produced goods. In response, domestic measures that impose costs on producers still relying on legacy manufacturing methods may also be necessary to better reflect the cost of pollution that green manufacturers are not imposing on the public.

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[6] Leonard H. Lynn. "The commercialization of the transistor radio in Japan."IEEE Transactions on Engineering Management 45(3), September 1998: 220 - 229. https://www.researchgate.net/publication/3076554_The_commercialization_of_the_transistor_radio_in_Japan

[7] Charles Wessner and Thomas Howell. "Implementing the CHIPS Act: Sematech's Lessons for the National Semiconductor Technology Center." CSIS report, May 19, 2023. https://www.csis.org/analysis/implementing-chips-act-sematechs-lessons-national-semiconductor-technology-center

A further discussion on government purchases to support green steel will be explored in Section 4D.

2.5 How can we differentiate "bridge" investments that produce emissions savings in the near/medium-term but are at least neutral for the path to net-zero emissions (e.g., installing new electrified equipment) versus the "dead-end" investments that produce emissions savings in the near/medium-term but delay or deviate from the path to net zero emissions (e.g., efficiency improvements to fossil-fuel based systems), often causing stranded assets?

The Department of Energy's sample "industrial decarbonization decision tree" presented as part of this Request for Information acknowledges that the identified cross-cutting decarbonization strategies need to be adopted in an appropriate sequence to ensure that investments do not extend the lifespan of assets that use fossil fuels as fuel or feedstock. The Department could itself lay out pathways for high-emitting sectors that would create stranded assets and forewarn industries from going down this route. For instance, carbon capture and storage for process emissions in the iron and steel industry should not precede the adoption of new assets that no longer relies on metallurgical coke as a reducing agent for the iron ore.

One area where this might be particularly complicated is electrification. The Department of Energy and other stakeholders face a conflict between the need to electrify process heating (i.e., increased demand for power) and the push to transition the grid to more renewable energy sources (i.e., potentially slowing down the capacity to increase electricity demand). Here, Sierra Club urges the Department to use its role to ensure that power users are not merely passive actors in the market, but contribute to the buildout of renewable energy sources.

2.10 Are there current policies or interventions that are hindering implementing different decarbonization pathways?

See 1A.4

3.1 What criteria do your industry or organization primarily leverage in decision making?
3.3 Which criteria would you use, and when would they be most useful, to assess the merits of a decarbonization strategy?
3.5 Which criteria do you recommend government prioritize in quantifying the societal impacts of different net-zero emissions pathways?

Sierra Club seeks to prioritize interventions that not only limit climate pollution but also bolster public health and wellbeing. To that end, we look to the following criteria to weigh a pathway:

- Real, verifiable greenhouse gas emissions reductions.
- Reductions in conventional and toxic pollutants.

- Linkage with sustainable economic development. This includes the responsible use of upstream resources (e.g., minerals and renewable electricity) and downstream applications that create healthier communities (e.g., steel for offshore wind).

In other words, Sierra Club prioritizes decarbonization strategies that tackle multiple criteria. Most importantly, we favor strategies that address conventional and toxic pollutants and deliver other co-benefits.

Sierra Club urges the government to consider similar criteria in its decisionmaking. Namely, ensuring that investments and interventions consider:

- Local pollution, or co-pollution, and its consequences for local health across the value chain, with the aim of prioritizing technologies and methods that deliver the greatest benefits to public health.
- Natural resource and ecosystem impacts across the value chain (e.g., groundwater depletion or destruction of wildlife habitat); and
- Family-sustaining jobs, especially community-based hires and the development of skills that can be applied to multiple industries.

3.9 How does your organization work with communities to develop evaluation and impact criteria?

Sierra Club maintains chapters and members across the country, many of whom are intensely familiar with industrial sources as polluters. Work is underway to mobilize our members to review Community Benefits Plans (CBP) put forward by firms that are receiving federal funding for greenhouse gas abatement efforts,such as the Industrial Demonstrations Program. This engagement is aimed to help demonstrate the value of DOE's programs to communities, while ensuring that community needs are addressed by industry.

3.10 How should DOE work with communities to develop evaluation and impact criteria and evaluate individual decarbonization pathways?

DOE should have several rounds of community consultation, especially drawing from communities near industrial clusters and in post-industrial areas, to assess community needs and develop strategies for addressing them. These consultations should lead to written recommendations that inform future DOE programs, with a periodic review process. To that end, DOE should consider a new request for information targeting specifically at fenceline and frontline communities. Should DOE choose to go this route, Sierra Club is willing to assist the Department with the development,dissemination and implementation of this opportunity.

In addition, DOE should build on the Community Workforce Readiness Accelerator for Major Projects (RAMP) program to support community engagement at the project-level, particularly in any instance where there is a CBP element. While RAMP focuses on workforce development, future iterations could focus on community capacity building towards robust engagement with DOE awardees and local pollution monitoring.

3.11 How do you (or would you) account for impacts beyond the boundaries of an industrial facility (e.g., considering supply chain and Scope 3 GHG emissions)?

Substantial work has already been undertaken by various organizations to establish standards for supplier responsibility in the value chain of key industries. Efforts to hold companies accountable for Scope 3 emissions and other impacts beyond the boundaries of their facilities is hampered by the lack of transparency. In light of this barrier, we urge the Department of Energy and other administrative agencies to consider requiring companies that receive public funding, tax breaks, or contracts to monitor and disclose their supply chain to the public.

3.12 What resources are needed to account for impacts beyond the boundaries of an industrial facility (e.g., considering supply chain and Scope 3 GHG emissions)?

DOE should work with other agencies, such as EPA, to establish common reporting requirements across federal, local, and state governments. DOE should also consider how it can enhance cooperation with international governments to more easily monitor sourcing of raw materials and other inputs across borders.

3.14 How can industry measure progress towards environmental justice and energy equity?

We urge the government to require industry to take a proactive role in educating affected communities and understanding how they can address community needs. These disclosures should be publicly reported through a common platform alongside Climate and Economic Justice Screening Tool.

Another proxy for industry's progress is reduction in the permit violations for serial violators. Similarly, absence of pushback from these industry actors on new pollution standards (such as the National Emission Standards for Hazardous Air Pollutants) should also be interpreted as a market of progress that industry is moving satisfactorily towards environmental justice.

4D.1 How do you expect the U.S. demand and production of steel (and specific steel grades) to change by 2050 and why?

The aggregate U.S. demand for steel will be impacted by not only the country's commitment to building out renewable energy infrastructure, but also how much of the supply chain for this infrastructure it chooses to build out domestically. For example, offshore wind pylons require high strength steel that can be more efficiently made from iron ore rather than steel recycled through an electric arc furnace. The government's commitment to building out offshore wind infrastructure, and its determination to make the pylons with steel poured in the United States, will have a significant effect on the future aggregate demand for steel.

4D.5 What technical and/or technology solutions does the subsector need that are not currently available?

One aspect of decarbonizing the steel industry that has received lack of attention in recent years is the management of scrap metal. Recycled steel has many limitations in industrial reutilization because it often contains other metals and alloys that prevent the steel from performing to a certain standard. The adulteration of recycled steel occurs because it is too costly for scrap yards to separate the steel in discarded products from adjacent components.

For example, discarded automobiles are a major source of steel scrap. However, the copper wiring that is part of the electronics in a modern automobile is difficult to separate from the steel body of the automobile. Melting the steel autobody with the copper wiring dilutes the quality of the steel, resulting in a recycled product that would be inappropriate for use as a new auto body.

While there is ongoing research to find ways to isolate the copper and other metals from the steel in a furnace, it might be more cost effective to encourage manufacturers of steel products to redesign their components to make it easier to remove metals that might dilute the quality of the scrap.

4D.8 Are there any other subsector-specific barriers, criteria, metrics, or targets that DOE should be aware of as a decarbonization strategy for this subsector is developed?

Following the response to question 1A.4, demand for primary steel products will be an important driver of decarbonization efforts. A major candidate for growing steel demand is offshore wind, which requires primary steel production to supply plates for the pylons that will support the nacelles of a wind turbine.

One region that represents a promising source of wind energy in North America is the Great Lakes; however, installation of offshore wind turbines in the Great Lakes would require supporting pieces of infrastructure. These include facilities that can roll the plates into pylons, port facilities to load the pylons onto ships, ships that can carry the pylons to areas designated for the turbines, etc. Without supporting infrastructure in place, the government cannot induce

demand for steel - let alone green steel - and prompt investment in new sustainable iron and steel facilities.

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We thank you in advance for your consideration and welcome further opportunities to engage with IEDO. For any questions or additional information, please contact Iliana Paul (iliana.paul@sierraclub.org) and Yong Kwon (yong.kwon@sierraclub.org).

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