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DECARBONIZATION DIALOGUE

**SUPPORTING
REPORT**

This report was developed by Keystone Policy Center and Great Plains Institute to provide context on the Decarbonization Dialogue. It reflects Keystone Policy Center and Great Plains Institute's observations about the process and is not a consensus document. The Keystone Policy Center and Great Plains Institute are deeply grateful to the funders, participants, advisors, and staff who participated in the Decarbonization Dialogue.

EXECUTIVE SUMMARY

The Decarbonization Dialogue, facilitated by Keystone Policy Center and Great Plains Institute, convened experts from different sectors to develop recommendations for near-term federal policies to drive economy-wide and equitable decarbonization. These recommendations were developed by stakeholders with diverse interests and reflect months of dialogue between and among sector-specific working groups.

The Decarbonization Dialogue focused on the power, transportation, and agriculture sectors, recognizing the potential for near-term decarbonization in these sectors, the interrelation of the three sectors, and Keystone and Great Plains Institute's subject matter expertise. Recommendations are both cross-cutting and sector-specific and prioritize impact on emissions and political viability with consideration for equity, cost, economic recovery, and other factors.

The cross-cutting recommendations identify policy opportunities that emerged as the Decarbonization Dialogue progressed, focusing on digital infrastructure, financing, and cross-sector and cross-agency collaboration and coordination in pursuit of decarbonization.

The power recommendations aim to facilitate access to reliable, low cost, clean electricity across the entire country. They include recommendations for principles for economy-wide energy or carbon policy; zero-carbon generation; technology and innovation, inclusive of deployment of tools like conservation and efficiency; transmission and infrastructure planning; and addressing stranded assets.

The transportation recommendations aim to decrease emissions from the transportation sector today while planning for and investing in the transportation technology, systems, and infrastructure needed for the future. They recommend a national low carbon fuel standard; efficiency and performance standards; incentivizes for electrification of fleets, ports, and personal vehicles; infrastructure to support lower carbon transportation; and technology and innovation.

The agriculture recommendations call attention to opportunities for agricultural producers to advance decarbonization, especially where such opportunities present voluntary solutions for farm

owners/operators and are shared with the power and/or transportation sectors. The recommendations suggest augmenting working lands conservation programs to better reward carbon and climate smart practices and ecosystem services; policies to address agricultural waste streams together with agricultural inputs; research and development to increase farm productivity and resilience; energy use on and off the farm; and coordination to enable faster implementation of feed-based responses to enteric fermentation.

Without knowledge of which party would be in control when this effort concluded, the Decarbonization Dialogue was designed to provide a bipartisan, collaborative set of recommendations that could quickly inform debate around climate and decarbonization action regardless of which party was in the majority and who was in the White House. The release of this report comes on the heels of the inauguration of President Biden and the start of a new Democrat-controlled House and Senate. Since January 20, 2021, the Biden Administration and lawmakers are already taking up many of the recommendations that were addressed during the Dialogue, capitalizing on the stimulus efforts and tailwinds from a new political environment to advance core priorities for decarbonization.

The climate crisis presents significant risk for each of the sectors addressed in the Decarbonization Dialogue, along with the economy as a whole. We need only look to the February 2021 winter storm in Texas, 2020 California wildfires, or the 2019 Mississippi floods to demonstrate the acuteness of climate risks for both American families and our power, transportation, and agriculture systems. Ongoing decarbonization policy must consider adaptation, risk, and resiliency alongside mitigation. Whether focused on core principles and general considerations or specific policy ideas, these recommendations offer substantive guidance, supported by bipartisan and diverse interests, that decision-makers can act on today.

This report provides background on the Dialogue's recommendations, including information on scope, process, participants, and the nature of the discussions that generated the final recommendations. It also identifies issues that merit further dialogue and collaboration.

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OVERVIEW

Background and Process

The Decarbonization Dialogue (Dialogue) was initiated as a collaboration of Keystone Policy Center (Keystone) and Great Plains Institute (GPI), borne out of discussions of the Keystone Board of Trustees and the Keystone Energy Board. Board members were instrumental in formulating the goals, scope, and list of additional participants needed to ensure an appropriate balance of perspectives were included. Keystone and GPI intended to develop a decarbonization project that captured a breadth of sectors and was focused on bipartisan viability. In establishing a “brain trust” of policy experts, the Dialogue aimed to develop a powerful set of recommendations supported by leaders from across the geographical, political, and sectoral spectrums.

This effort acknowledges the legislation and recommendations related to climate change and decarbonization in development in Congress, myriad climate-related actions at the state and local level, and various experts weighing in on the right pathways to decarbonization; the goal has always been to build on those existing efforts, not duplicate them. On tailwinds coming from a new Administration, the recommendations aim to cut through the inaction that has dominated the decarbonization issue at the federal level, catalyze implementation of other ideas that have been percolating in the policy space, and help rebuild the American economy.

While the Dialogue aimed to be as broad as possible, it was organized around three sectors—power, transportation, and agriculture—because of the potential for impact, the interrelated nature of those three sectors, and Keystone and GPI’s subject matter expertise. By bringing together the power, transportation, and agriculture sectors in exploring opportunities for bipartisan and cross-sector decarbonization, the process revealed mutual interests across these sectors in a way that other processes have not. The process also surfaced cross-cutting recommendations whose implementation would support decarbonization across the economy.

Guiding Principles and Scope

The Dialogue adhered to the following guiding principles. The recommendations were designed to:

- Contribute to deep economy-wide decarbonization by mid-century, with interim benchmarks;
- Garner support from a wide range of policymakers and stakeholders;
- Consider impacts on communities of color and low-income communities who have historically borne disproportionate impacts from greenhouse gas emissions;
- Account for trends in energy, transportation, and agriculture emissions, and assumptions regarding economic recovery after the pandemic;
- Accommodate state flexibility;
- Take advantage of, build upon, assess support for, and do not duplicate other research, stakeholder, and legislative efforts;

- Recognize the need for continued research, development, and deployment of new technologies to drive decarbonization, while bolstering and maximizing current technologies that could be deployed faster and more broadly to decarbonize today; and
- Provide for energy security, resilience, reliability, and affordability.

In addition to adhering to the guiding principles agreed to at the beginning of the process, Dialogue participants discussed and prioritized the following:

- **A diversified set of recommendations:** In terms of both content of recommendations and policy mechanisms, the group strived to offer flexibility, with multiple technology and policy pathways. No single policy or piece of legislation will achieve the reductions needed.
- **Balance of impact and viability:** This package intends to have near-term political viability and both near-term and longer-term impact. It offers opportunities for elected officials to work across the aisle.
- **Immediacy:** In the U.S. and globally, carbon emissions trends must be reversed in the near term. Significant action must be taken as quickly as possible to mitigate the impacts of climate change and capitalize on the cumulative impact of early reductions.
- **Acknowledgement of uncertainty:** The mid- to long-term impacts of the pandemic are unknown to at least some degree.
- **The international context:** The United States' share of global emissions is only about 15%, so recommendations consider opportunities to advance international decarbonization, especially by exporting clean technologies.
- **A flexible approach to specificity:** The recommendations do not include draft legislation and avoid being overly prescriptive. They aim to provide as much detail as possible while retaining group consensus; as a result, the recommendations are not always consistent in their level of specificity. In some cases, participants identify an area for focus rather than an actual recommendation; in those cases, decisionmakers should prioritize addressing that area in a way that balances consideration for the needs and priorities of all relevant sectors.

While the process ultimately focused on the power, transportation, and agriculture sectors, the Steering Committee also considered:

- Policy mechanisms for decarbonizing the power sector;
- Gas decarbonization, including end-use, methane emissions, and other potential uses for gas outside heating and power generation;
- Oil decarbonization;
- Energy efficiency and conservation;
- Transmission and other infrastructure needs;
- Transportation decarbonization, including electrification, low-carbon fuel standards, and vehicle mileage standards;
- Agriculture and forestry provisions, including the use of offsets and linkages to the energy sector;
- The potential of public lands to play a significant role in decarbonization;

- Emerging technologies, including the use of research, development, and deployment to spur technological innovation; and
- Opportunities for market innovation, including the use of data, digitization, and interregional planning.

Participants

The Dialogue took a multi-level approach to engaging participants that included a steering committee, topical working groups, and advisors as illustrated and described below. Keystone and GPI brought together climate policy experts, sector-specific experts, and leaders with legislative and executive experience from a variety of types of organizations including corporations, nonprofits, associations, law and consulting firms, and public service.

Steering Committee: The Steering Committee comprised national leaders on energy, transportation, agriculture, and climate, with breadth of expertise across topics related to decarbonization, as well as sector-specific expertise.

Topical Working Groups: The recommendations were informed by three Working Groups, each comprising 8-12 members with expertise in one of three sectors: power, transportation, or agriculture. At least three Steering Committee members participated on each of the Working Groups.

Advisors: Experts or leaders were consulted and brought in as speakers on an as needed basis but were not asked to commit to the larger process.

Facilitators: The project team comprised Keystone and GPI staff, serving as facilitators and coordinators for all these groups.

Plenary Group: The plenary group, inclusive of the Steering Committee and Working Group members, met twice to consider the complete suite of recommendations.

A complete list of participants and the capacity in which they participated is available as Appendix A.

Process and Approach to Consensus Building

Between May and July 2020, the Dialogue's Steering Committee met to develop and agree upon guiding principles, a scope, and participants for the effort. Recommendations were developed between August and December 2020. Keystone and GPI held a comment period from December 22, 2020 through January 18, 2021. Recommendations were refined, reviewed for final sign-on by participants, and released in February 2021. A more detailed timeline is available as Appendix B.

Keystone and GPI developed a process that shifted its focus between broad (economy-wide) and narrow (sector- or recommendation-specific) throughout the process to dedicate appropriate time to big-picture policy considerations and sector-specific ideas, with opportunities throughout to incorporate big-picture thinking into sector-specific conversations and vice versa. After building out a balanced Steering Committee, Keystone and GPI worked with the Steering Committee to develop guiding principles, agree upon the project scope, and narrow to three focus areas: power, transportation, and agriculture. In parallel, Keystone staff developed a “policy scan” spreadsheet so that decarbonization recommendation sets from other organizations and coalitions could be easily referenced. A complete list of resources referenced is included as Appendix C.

To establish a baseline for group dialogue, Keystone and GPI brought in experts from power, transportation, and agriculture and asked them to share which policies they believed would contribute to decarbonizing the economy and have bipartisan viability. The Working Groups used these remarks and the policy scan as foundations for discussion, then narrowed to key areas of focus and developed specific recommendations within each area of focus. A plenary group of Steering Committee and Working Group members convened twice in the process to ensure that cross-sector opportunities could be capitalized upon and cross-sector conflicts avoided. Keystone and GPI built in opportunities for feedback throughout: in Working Group meetings and by email among Working Group participants, in Steering Committee meetings and by email among Working Group participants, and in a formal comment period. When the formal comment period concluded, Keystone and GPI held a plenary meeting to discuss key themes from comments and propose final edits before presenting a final set of recommendations to Dialogue participants for endorsement in the first two weeks of February 2021.

The Dialogue aimed to achieve consensus among the Steering Committee and Working Group participants on the final recommendations. Some participants and/or organizations that participated in the Dialogue, focused only on specific sectors and thus did not directly weigh in on nor will be advocating directly for all recommendations in the final package; recommendations were defined as reaching consensus if participants at minimum did not object to their inclusion.

Throughout the process, conversation was off the record. What follows in this supporting report captures the nature of the discussion without attributing comments to any individual or organization; Keystone and GPI authored this report, and it reflects their observations on the process, not consensus views of the participants.

Limitations

While the Dialogue set out to tackle economy-wide decarbonization, it ultimately focused on the power, transportation, and agriculture sectors, where Keystone and GPI have a depth of expertise, previous project work upon which to build, and existing relationships with key experts

who became project participants and/or advisors. This dynamic made it possible to tackle a tremendous amount of ground in a relatively short time frame.

The process was always intended to move quickly, over six to nine months. Because of that design, participants were limited to considering existing research and studies and did not have the time nor budget to commission their own.

Finally, while hard to objectively measure, there are limitations to convening a dialogue virtually. This process could not provide the same richness, relationship building, and informal side debates and negotiations that in-person gatherings can allow for, though it was as rich, productive, and dynamic a discussion as possible in its virtual setting.

Funding

Keystone and GPI are grateful for the financial support that made this project possible. This effort was funded by the William and Flora Hewlett Foundation, ClearPath, Walmart, CPS Energy, and Corteva Agriscience. Jonathan Pershing, Program Director for Environment at the Hewlett Foundation, provided feedback as the project was scoped, on draft recommendations, and on dissemination. ClearPath, CPS Energy, and Corteva all participated on the Steering Committee and in various working groups. Other Dialogue participants were also given the opportunity to support the effort. All participants were given equal weight in the Dialogue, regardless of their ability to financially support it.

CROSS-CUTTING RECOMMENDATIONS

Background and Process

Unlike the more structured approach for developing the power, transportation, and agriculture recommendations, Keystone and GPI did not dedicate conversations to cross-cutting recommendations, but rather identified opportunities that came up organically as the Dialogue progressed. In some cases, a cross-cutting recommendation was identified as such and immediately added to this section; in other cases, a recommendation began as a sector-specific idea, and then the Steering Committee recognized its value as a broader cross-cutting recommendation. These cross-cutting recommendations make clear that certain policies can have a significant impact for either driving decarbonization across multiple or all sectors, or for setting the structural foundation for other policies. This section also makes clear just how interconnected power, transportation, agriculture, and other sectors are when it comes to decarbonization.

Areas of Focus

1) Expand urban and rural broadband infrastructure to provide a foundation for the technological advances that will enable deeper decarbonization in the power, transportation, and agriculture sectors.

At the end of 2017, 21 million Americans lacked access to broadband Internet. Access issues are most acute in rural and tribal areas, where about 26% and 32% of Americans lack access to broadband Internet, respectively.¹ Broadband access is an equity issue. To be sure, it offers numerous benefits for health and education, especially during the pandemic, but it also enables decarbonization. Broadband access is the foundation for a smarter, safer, more reliable, and more efficient power grid; the deployment of distributed energy resources; smarter, safer, more reliable, and more efficient transportation systems; intelligent mobility; and the tools that agricultural producers need to implement and measure carbon-smart processes.

2) Enhance cybersecurity to ensure resilience in power, transportation, and agriculture systems as the economy moves toward decarbonization.

The December 2020 cyberattack² against the U.S. government and other organizations, backed by Russian hackers, is the latest example of the vulnerabilities in our cyber systems. The more interconnected our digital systems become, the more important it is for them to be secure and

¹ Federal Communications Commission, “2019 Broadband Deployment Report,” accessed on February 9, 2021: <https://www.fcc.gov/document/broadband-deployment-report-digital-divide-narrowing-substantially-0>.

² Center for Strategic & International Studies’ list of Significant Cyber Incidents, accessed on February 12, 2021: <https://www.csis.org/programs/strategic-technologies-program/significant-cyber-incidents>

reliable; as we digitize many aspects of our power, transportation, and agriculture systems, this security is a critical foundation for ongoing decarbonization.

3) Accelerate deployment of clean technology and climate resilient infrastructure by establishing a national climate bank, with a designated and significant percentage of funding going to low-income communities, frontline communities, and communities of color.

Each of the sector-specific working groups saw value in a centralized national climate bank to spur investment in clean energy technology and jobs—all the more important in the wake of the pandemic and accompanying economic challenges. Such a bank could be a valuable tool for advancing equity if a designated portion of its funding went to the communities that have borne the brunt of the impact of climate change and those communities that are economically dependent on fossil fuels.

4) Increase funding and initiatives for specific technologies—including but not limited to hydrogen, natural and technological carbon removal, and long-duration storage—that are critical to the future resilience and decarbonization of the power, transportation, industry, building, and agriculture sectors.

While each of the sector-specific recommendation sets address technology and innovation, certain technologies could carry cross-cutting value across the power, transportation, and agriculture sectors, as well as others, leading Dialogue participants to include a cross-cutting recommendation on innovation. The technologies listed in the recommendation language are not intended to be an exhaustive list, but instead to emphasize the likely importance of technologies like hydrogen, carbon removal, and long-duration storage in a decarbonized future.

5) Seek coordination at the federal level through a mandate to work on these proposed solutions across departments and agencies (e.g., Department of Agriculture (USDA), Department of Energy (DOE), Department of Transportation (DOT), Environmental Protection Agency (EPA), Federal Energy Regulatory Commission (FERC), etc.).

The government's policy and regulatory structure can create silos that prevent necessary collaboration on fundamentally cross-sector and cross-agency challenges. But as the Biden Administration has acknowledged, interagency coordination on the climate crisis is essential. This process has demonstrated that cross-sector collaboration on decarbonization can identify mutually supportive strategies and otherwise overlooked nuances to policy development that can inform more durable and bipartisan solutions. While it introduces additional complexity, early and frequent communication and collaboration among the federal agencies involved in decarbonization can ultimately produce stronger policy.

6) Identify opportunities to standardize measurement and verification of emissions and emissions reductions so that measurement and verification tools and the data they produce are affordable, accessible, and interoperable across emerging digital platforms.

Government agencies have massive troves of data that could be better contextualized and converted into decision-useful information. Unfortunately, these data troves are often siloed or hidden (both intentionally and unintentionally) and lack meaningful quality and governance directives to address future system risks. To reward carbon- and climate-smart practices, the private sector also needs to be able to measure and verify emissions and emissions reductions in an objective, affordable, accessible, and interoperable way.

The government should consider opportunities to standardize—through guidelines or otherwise—the tracking of products, materials, and substances across value chains. The guidelines should be made feasible, with a set of minimum criteria for sharing data. They should balance the need to safeguard companies’ commercial and strategic information with consumers’ need for meaningful information on a product’s supply chain and environmental impacts. These efforts can effectively create full traceability of products from their sources to the final consumer, enabling the market to better account for externalities related to emissions and climate change.

Key Areas of Debate

While not reflected in the final cross-cutting recommendations, Dialogue participants considered and discussed other cross-cutting issues that merit additional attention. As discussed in more depth in the power section, participants regularly considered the value of carbon pricing as a tool to enlist the market in advancing economy-wide decarbonization. Many participants saw some value in a carbon price as a complement to and accelerator of other decarbonization policies, but some wondered about its political viability and whether other economy-wide policies would be more effective. Many agreed that if not through a carbon price, policies should identify other ways to internalize the cost of carbon.

The participants also acknowledged that labor is a big piece of the puzzle when it comes to decarbonization. The sector-specific recommendation sets refer to labor and workforce, but additional discussion about impacts on workforce in the clean energy transition are merited. Fossil fuel-dependent communities facing transition will have serious workforce impacts, and the transition to zero-emission vehicles will also change the workforce landscape. Short-term impacts may be addressed at least in part by a stimulus package, and decisionmakers should also consider policy levers for addressing longer term job loss, geographical shifts in workforce, degradation of wages, and re-training opportunities in parallel to considering policy levers for decarbonization.

The climate crisis presents a great deal of risk for each of the sectors addressed below, along with the economy as a whole. We need only look to the 2020 California wildfires or the 2019 Mississippi floods to demonstrate the acuteness of climate risks for our power, transportation,

and agriculture systems. While the recommendations from this Dialogue focus more on mitigation strategies than adaptation, it will be essential that ongoing policy related to decarbonization considers adaptation, risk, and resiliency alongside mitigation.

Why These Recommendations

These cross-cutting recommendations reflect the importance of digital infrastructure, financing, and cross-sector and cross-agency collaboration and coordination in pursuit of decarbonization. Addressing some of these foundational issues at the economy-wide level can eliminate redundancy in a way that may streamline costs, accelerate emissions reductions across all sectors, and ensure that consideration of equity is infused throughout all policy.

POWER RECOMMENDATIONS

Background and Process

The Power Working Group (PWG)³ focused on opportunities to decarbonize the energy sector. It established the following objective for its recommendations: *To facilitate access to reliable, low cost, clean electricity across the entire country.* The PWG also concerned itself with an equitable application of its recommendations and noted the following in its statement of objective: *Policies and legislation implemented in response to these recommendations should prioritize benefits to and reflect consultation with low-income, environmental justice, and rural communities whenever possible. They should also address tribal lands and reflect consultation with Indigenous communities whenever appropriate.*

The PWG established early its dedication to flexibility and a diversified solution set; participants considered and attributed value to all sources of clean energy, from renewable energy to fossil fuels with carbon, capture, and storage (CCS), and to opportunities to reduce energy use and make power systems more efficient and effective through conservation, efficiency, and grid modernization. Participants also focused on the value of decarbonizing the power sector in the short term. Any emissions reductions achieved quickly will be more valuable because of their cumulative effect over time, compared to reductions that cannot be realized until decades from now. And decarbonizing the power sector has significant implications for other sectors that rely on power, for example, transportation electrification will be more valuable with a cleaner grid, and emissions from the energy-intensive agriculture sector can be reduced by making power and transportation cleaner.

To narrow its focus quickly, the PWG considered the input of several experts—Rob Gramlich, Founder and President of Grid Strategies; Bob Perciasepe, President of C2ES; and Rich Powell, Executive Director of ClearPath—at the beginning of its process. These experts were asked to articulate where they saw the most opportunity for impactful *and* bipartisan policy and legislation to facilitate power sector decarbonization. That framing pointed to three clear areas of focus that the PWG used to organize its dialogue (though it ultimately used different categories for its recommendations): tax credits and incentives; transmission and infrastructure; and technology and innovation. The PWG also debated the importance of one sweeping energy policy, such as carbon pricing, cap and trade, a rule under the Clean Air Act, or a clean energy standard, and considered the viability of such a policy under several potential Administration, House, and Senate combinations.

The sections to follow capture the nature of the discussion around these and other issues, including reflections on some key areas of debate and discussion.

³ The Power Working Group focused on electricity, so the term “energy” used in this section specifically refers to power or electricity.

Areas of Focus

Sweeping Energy Policy

1) Consider core principles in development of carbon policy.

- *Align power industry and stakeholders on federal energy policy that addresses the power sector and achieves meaningful and timely emissions reductions. Any such policy should promote technology development and be market-based, equitable, cost-effective, and complementary with policies that address other emitting sectors in the economy.*
- *Implement the Energy Act of 2020 in partnership with the private sector and in a manner that is equitable, cost-effective, and complementary with policies that address other emitting sectors in the economy.*

Many participants in the PWG acknowledged that a sweeping energy or carbon policy, regulation, or goal could have economy-wide value and impact. Carbon pricing is attractive in many circles and is an elegant economic solution, but debates persist about how to set a price that would be impactful, politically viable, and not disproportionately impact lower income communities; cap and trade has been successful on a state and regional basis but has run into federal roadblocks and concerns from some environmental justice advocates; the Clean Power Plan met legal challenges and backlash from some states that believed it to be an overreach; and clean energy standards have increasingly been favored by Democrats and some Republicans but may not be viable with the filibuster intact. Participants discussed at length the potential values and drawbacks of each of these policies. Acknowledging the complexity and importance of continued debates about economy-wide carbon policy and time constraints on its own process, the PWG elected to describe the core principles for consideration in federal energy policy development: Any such policy should be market-based, equitable, cost-effective, and complementary with policies that address other emitting sectors in the economy; the policy should also promote technology development. As the Energy Act of 2020 is implemented and carbon policy continues to be discussed, federal decisionmakers should heed these principles and consult diverse stakeholders, industry, and advocates on policy development.

In drafting its other recommendations, PWG participants carefully considered the objectives often included in clean energy standards—keep existing clean energy assets online; replace otherwise economical assets with new zero-carbon resources; incentivize fossil fuel generators to retrofit; and satisfy new load or gaps in load with existing zero-carbon assets—and attempted to address them in its recommendation set.

Zero Carbon Generation

One objective of a clean energy standard—and of the PWG—is to keep existing clean energy assets online. Market forces, supported where needed by tax credits and technology development and deployment, will be sufficient to keep solar and wind online. But the PWG identified policy needs to ensure that nuclear power and hydropower remain viable.

2) Harness the value of existing nuclear assets.

- *Recognize the zero-carbon value of nuclear energy and invest in necessary technology to keep existing nuclear plants online, where they are needed to meet reliability and emission-reductions goals.*

New York, Illinois, Connecticut, New Jersey, and Ohio have all implemented programs to assist nuclear assets in their respective states. The PWG discussed the importance of properly valuing nuclear as a zero-carbon resource, especially when it comes to merchant generators operating in wholesale markets. The PWG considered opportunities like an investment tax credit for spending on existing nuclear plants, reverse auctions (as proposed in the American Nuclear Infrastructure Act), and other mechanisms to support nuclear energy through the tax code. While PWG participants did not come to consensus on the specifics of a policy to support existing nuclear assets, they wanted to capture their agreement on the value of zero-carbon nuclear energy and encourage additional federal policy discussion on the topic, as well as investment in technology to reduce costs. Technology and innovation related to advanced nuclear technology are addressed in the innovation recommendations.

3) Harness the value of hydropower.

- *Accelerate development of hydropower technologies and practices to improve generation efficiency, environmental performance, and solar and wind integration.*
- *Improve U.S. dam safety.*
- *Increase basin-scale decision-making and access to river-related data.*
- *Improve the measurement, valuation of, and compensation for hydropower flexibility and reliability services and support for enhanced environmental performance.*
- *Advance effective river restoration through improved off-site mitigation strategies.*
- *Improve federal hydropower licensing, relicensing, and license surrender processes to preserve and/or expand the clean power output of all existing hydropower.*
- *Advocate for increased funding for U.S. dam rehabilitation, retrofits, and removals.*
- *Remove regulatory and financial barriers for low head hydro.*

The PWG agreed that hydropower is a valuable clean energy resource and that policies addressing hurdles related to technology, permitting and licensing, data, and funding could ensure that hydropower's clean energy value is captured while mitigating environmental impacts. The National Hydropower Association estimates that up to 12 GW of clean hydro energy could be retired between now and 2031 without permit renewals.⁴ Because hydropower stakeholders and environmental NGOs already came together in October 2020 as the Uncommon Dialogue on Hydropower⁵ and released a set of recommendations to ensure that hydro policy is properly designed, the PWG elected to support those existing recommendations. At the suggestion of agriculture stakeholders, the PWG also added a recommendation focused

⁴ FERC's Hydropower Licensing Page, accessed February 12, 2021: <https://www.ferc.gov/industries-data/hydropower/licensing>.

⁵ Uncommon Dialogue on Hydropower's statement, accessed February 3, 2021: https://woods.stanford.edu/sites/g/files/sbiybj5821/f/hydropower_uncommon_dialogue_joint_statement.pdf/.

on barriers to low head hydro, which could be of interest to irrigation districts if regulatory and financial burdens were removed. While the overall impact would be small (less than 2 GW overall), facilitating such access to low head hydro could offer additional opportunity for collaboration between the energy and agriculture sectors.

Technology and Innovation

A clean energy standard might also incentivize existing fossil fuel generators to retrofit to incorporate CCS technology to reduce or eliminate emissions. It would also need to satisfy any new load demand with zero carbon assets. Technology, innovation, and tax credits focused on enabling innovation can help advance both objectives by making CCS and other zero-carbon generation more effective and affordable. Deployment of existing tools and technology can also reduce demand and make power systems more efficient overall.

4) Accelerate clean energy innovation.

- *Ensure implementation and expansion of the Energy Act of 2020 and generally support the research, development, and demonstration of clean technology. Prioritize technologies needed to drive global decarbonization, with a specific focus on technologies the International Energy Agency has identified as necessary to reach mid-century emission goals but remain at early stages of development, like advanced nuclear, carbon capture, carbon dioxide removal, and low-carbon hydrogen (from renewables, fossils with carbon capture, and nuclear).*
- *Empower ARPA-E to scale up awardees from lab and bench-scale to commercial scale and provide the annual resources necessary to launch multiple new programs while providing the capacity to advance multiple applicants to commercial scale annually.*
- *Facilitate technology transfer through new strengthened commercialization initiatives, such as DOE demonstrations, regional innovation partnerships, the Small Business Innovation Research program, and other incentives, models, and infrastructure to support public/private partnerships.*
- *Establish a function at/role for DOE for systematically demonstrating clean energy projects at commercial scale.*
- *Supercharge investment in innovation and deployment of long-duration storage (including technologies well beyond chemical storage/batteries) and long-distance delivery transmission lines.*
- *Extend, expand, or create new financial incentives to catalyze and deploy clean energy sources, efficiency, transmission, non-generation options, and carbon capture and storage, with clear definitions for what kind of sources qualify (e.g., based on market share or viability or qualities like flexibility, carbon intensity, reliability, etc.) and a clear timeline for ramping down as the technology becomes market competitive. Tax credits should be inclusive across utilization, monetizable, and transferrable.*
- *Implement the Energy Sector Innovation Credit, a permanent, technology-inclusive tax incentive structure that will onboard generations of diverse, profitable clean power technologies. The credit should be inclusive across utilization, monetizable, and transferrable.*

- *Engage environmental justice communities in clean energy RDD&D by creating a DOE Energy Justice and Democracy Program and prioritizing diverse participation in all DOE programs.*
- *Authorize a national critical minerals research program at the DOE and direct the department to develop a national strategy for securing critical minerals in the clean energy and electric vehicle supply chain in an environmentally, economically, and socially responsible way.*
- *Provide significant funding for DOE to pursue research into sustainable recycling of batteries, alternatives for lithium-ion batteries in electric vehicles (EVs) and grid-scale energy storage, and demonstration projects that integrate used EV batteries into the grid.*

The PWG discussed the many opportunities for technology and innovation to advance clean energy, but took care to articulate those areas where research, development, demonstration, and incentives are needed to develop and drive costs down for newer technologies, and where additional focus on innovation or RD&D could distract or hamper the deployment of effective tools on the shelf.

Participants were interested in supporting technologies that could advance global decarbonization; leveraging existing agency structures wherever possible and calling for new programs where needed; strengthening and promoting partnerships and commercialization initiatives; calling out specific technologies like advanced nuclear, carbon capture, carbon dioxide removal, and low-carbon hydrogen; and continuing the research and technology development that will make renewable power more valuable. The PWG also acknowledged the importance of better engaging environmental justice communities in all research, development, and demonstration-related efforts to ensure outcomes meet the needs of those disproportionately impacted by climate change.

The PWG tried to balance specificity with flexibility, acknowledging that regulation should leave space for innovation and avoid locking industry in on a particular technology. This is clear in the way the PWG addresses tax credits, describing important principles for tax credits rather than specific credits except in the case of the Energy Sector Innovation Credit, which itself is designed with maximum flexibility.

5) Deploy available tools and technology for near-term impact.

- *Ramp up deployment of tools and technology on the shelf, especially for conservation, efficiency, and distributed energy resources.*
 - *Expand the Federal Weatherization Program, with enhancement of the program to include new measures and actions that incorporate concepts of Grid-Interactive Efficient Buildings (GEB).*
 - *Provide funding, via direct or block grants, for schools, hospitals, and other public, non-profit facilities to undertake maintenance and capital projects aimed at reducing energy, reducing emissions, and introducing GEB. Incorporate emissions reduction benefit as a competitive screen for applicants.*

- *Establish a Climate Buildings Corps, whose personnel would be available to state, local and non-profit building owners for conduct of a “climate audit.”*
- *Establish energy/carbon intensity standards for buildings, which would be mandatory for federal buildings and serve as models for non-federal buildings.*
- *Create a federal grant program to fund immediate action by state and local governments to undertake a review and revision of building codes and standards for purposes specifically related to changes in energy/carbon intensity of new and retrofitted buildings. Make additional funding for implementation and enforcement.*
- *Revise existing federal “recognition” programs (such Energy Star), or create new ones, to expand the scope to include types of energy efficiency beyond traditional (embedded) efficiency to demand response, load flexibility, system efficiency, etc.*
- *Revise any federal definition of “clean energy” to include all types of energy efficiency to facilitate a more holistic approach to buildings, distributed energy resources, microgrids, etc.*
- *Encourage energy conservation through public education and voluntary standards.*
- *Optimize power supply and delivery, including deployment of distributed energy resources (inclusive of baseload renewable energy resources), to maximize opportunities for decarbonization at the distribution level.*
- *Establish a state, local, and municipal matching funding program to deploy new technologies, with a focus on regulated markets, public power utilities, and rural electric cooperatives.*
- *Finance innovative decarbonization technologies through a reform of the DOE Title XVII Loan Guarantee Program with an expanded portfolio and more flexible financing mechanisms.*

The PWG participants also emphasized the importance of immediate deployment of the tools, technologies, and programs that can have near-term impact on emissions, especially related to energy conservation, efficiency, and distributed energy resources. In many cases, this means ramping up investment in and deployment of technologies that are already established and working well.

The PWG acknowledges and celebrates that many of its innovation goals are already in motion thanks to the Energy Act of 2020, which was passed in late 2020 toward the end of the Decarbonization Dialogue.

Transmission and Infrastructure

6) Modernize transmission planning to drive decarbonization and equitably distribute costs and benefits.

- *Bolster federal leadership for broad and long-term transmission planning in consultation with states and other stakeholders.*
 - *Task and, if needed, authorize FERC to develop a framework for cost allocation that better balances costs among beneficiaries.*

- *Explore the role of states in the transmission planning process and, if needed, recommend a more active role than they have now.*
- *Direct FERC to develop a comprehensive, long-range electric infrastructure transmission planning rule and implement such other rules and regulations as are necessary to achieve established federal emissions targets and support any state policies that establish more stringent standards. These rules and regulations should consider the results of the Interconnection Seam Study and different state-based approaches to planning and standardize some priorities across states, regions, and interconnections.*
- *Work with planning entities to incorporate consideration of greenhouse gas emissions and national climate goals in the evaluation of the benefits of a proposed project.*
- *Amend the Federal Power Act so that the goals of the National Interest Electric Transmission Corridors program help achieve national climate goals.*
- *Enhance transmission and distribution infrastructure to ensure reliability, resiliency, and physical and cyber security while supporting electrification, managing changing load patterns, and integrating long-duration storage, including hydrogen.⁶*
- *Direct FERC to incentivize grid-enhancing technologies (e.g., dynamic line ratings, topology optimization, and power flow control).*
- *Utilize existing authority, smart siting in low-impact areas, and a screen to avoid negative impact on environmental justice communities to site additional transmission, with a focus on opportunities on agricultural lands, federal public lands, highway and rail rights of way, reclaimed minefields, and brownfields. This should include undergrounding of transmission lines in cases where there are significant climate risks to overhead lines, and it is otherwise practical and cost-effective to do so.*

Early on in its dialogue, PWG participants recognized the importance of transmission planning for driving decarbonization, including bolstering federal leadership and reconsidering FERC's approach to planning and cost allocation.

Some participants pushed back on the idea that transmission is the "be-all-end-all" solution for decarbonization. In some regions, dispatchable and baseload renewables can more effectively reduce greenhouse gas emissions than importing power. The PWG ultimately agreed that so long as the value of conservation, efficiency, and distributed energy resources (including baseload renewables) are also harnessed, coordinated transmission planning and additional transmission can play an important role.

⁶ This recommendation was developed by the transportation working group but is reflected in the power recommendations.

7) Modernize regulatory review and permitting processes to support innovative new technologies and rapid deployment.

- *Create a program to enable communities interested in economic development to volunteer to be considered for generation, transmission, and other infrastructure projects, possibly through opportunity zones.*
- *Continue to modernize the Nuclear Regulatory Commission's regulatory framework to ensure that next generation nuclear plants can be deployed successfully to support decarbonization.*
- *Ensure carbon capture permitting requirements do not hinder development.*
- *Consider other environmental review requirements and other aspects of FERC not directly tied to transmission that should be revised.*

Participants considered the importance of siting more transmission and the value of streamlining permitting processes while ensuring that such processes are equitable. Opportunities to align permitting requirements with science-based risk assessments, staffing up agencies responsible for permitting, and taking creative approaches to siting—using existing rights of ways, brownfields, and agriculture lands—were discussed. But participants also acknowledged environmental justice concerns about streamlined processes and offered a recommendation that might enable communities to “opt in” to infrastructure projects.

Just Transitions

8) Support cost-effective transitions that are just and equitable in fossil fuel-dependent communities.

- *Where planned or accelerated retirements of fossil fuel generation assets occur, federal and state legislators and regulators should consider policies that support the local workforce and economy, while mitigating the impact of associated costs on customers, taxpayers, and communities.*

Another main objective of a clean energy standard might be to encourage the closure of otherwise economical plants that cannot be retrofitted with CCS and are no longer compatible with state, regional, or federal clean energy targets. While it does not recommend a specific target, timeline, or comprehensive federal energy policy that might drive some of these closures, the PWG recognizes the importance of supporting the local workforce and economy in such closures, as well as mitigating any impact on ratepayers.

The PWG acknowledged that tools like securitization could advance this goal; many states have recognized this and passed legislation to allow its use for coal closures. Creating more market access might also advance this objective by making emissions-intensive generation that is currently cost competitive less so. While participants did not agree upon such a recommendation to incorporate, competitive markets are addressed further in the section below.

Key Points of Debate

The PWG discussed several potential areas of focus that are not reflected as final recommendations. As noted throughout this document, participants frequently discussed whether to include a recommendation for an economy-wide energy or climate policy. In the absence of consensus agreement, participants elected to describe the principles of such a policy in their first recommendation and continue to recognize the value of such a policy if it can be designed with bipartisan input and support. But leaders should not wait until such a policy can be agreed upon to act on those recommendations and policy ideas that already have robust bipartisan support.

Participants discussed the role of competitive markets in decarbonizing the power sector. The House Energy and Commerce Subcommittee's Powering America series in 2017-2018 explored the role of wholesale power markets in advancing cleaner, cheaper, and more reliable electricity. Policymakers should continue to consider the value of markets, and of opening market access, as they enact clean energy policy. The Renewable Energy Buyers Alliance, Electricity Customer Alliance, and other coalitions of customers and associations are already organized in advocating for those policies.⁷

The PWG also frequently discussed how to balance environmental justice concerns regarding permitting and infrastructure siting with the need to site additional transmission and other infrastructure to enable clean energy access nationwide. Participants were intrigued by the idea of enabling communities to opt into such infrastructure projects, allowing those communities that would be a good fit for a specific project and are interested in economic development to weigh the challenges and opportunities and proactively volunteer to host these projects. This merits further exploration.

Why These Recommendations

PWG participants focused on identifying bipartisan policy opportunities to drive down emissions in the power sector. A bipartisan screen narrowed the focus and kept the group from seriously considering some more ambitious but partisan policy ideas that other collaboratives or advocates might recommend. But a bipartisan recommendation set is valuable for its potential durability; bipartisan policies that become legislation and can endure through changing political environments are more valuable than those that never become legislation or whose prospects would be challenged in courts or in different configurations of Congress. Enduring clean energy legislation focused on electricity is particularly important as a lynchpin for economy-wide

⁷ May 2020 letter to House and Senate leaders from several market-focused associations and organizations, accessed on February 3, 2021: <https://static1.squarespace.com/static/59a83164f7e0ab6c6886dd75/t/5ec2f5b868652471c23961ca/1589835192681/Final+MuIti-trade+letter+to+Congress+on+Competitive+Markets+5+19+2020.pdf>; January 2021 policy statement from the Renewable Energy Buyers Alliance, accessed on February 3, 2021: <https://rebuyers.org/programs/market-policy-innovations/federal-policy-priorities/>.

decarbonization; as the power sector reduces emissions, transportation, agriculture, manufacturing, and other sectors will benefit.

Participants took care to avoid recommendations that unduly burden ratepayers or taxpayers and supported recommendations that drive costs down. Similarly, participants considered what impact their recommendations might have on the low-income and people of color communities that have borne the brunt of the impacts of climate change. In its overall objective statement and throughout its recommendations, the PWG calls for legislation that reflects consultation with these communities, incorporation of environmental justice voices in decision-making and prioritization at DOE, and prioritization of low-income and people of color communities in deployment of demand-side tools that can make energy more affordable and make homes and buildings more comfortable.

Participants acknowledge that the Biden Administration and Congress are eager to stimulate the economy in the wake of the pandemic. Energy policy experts widely agree that such stimulus can and should include investment in the jobs, infrastructure, and technology that will create a cleaner power system for the country. Many of the Decarbonization Dialogue's power recommendations identify ways that the market can drive emissions reductions, but they also call for government investment where it is necessary. Decisionmakers should act quickly on those ideas already supported by a diverse group of stakeholders, many of which are outlined in this recommendation set.

TRANSPORTATION RECOMMENDATIONS

Background and Process

The Transportation Working Group (TWG) focused on opportunities to decarbonize the transportation sector. It established the following goal for its recommendations: *The objective of these recommendations is to decrease emissions from the transportation sector today while planning for and investing in the transportation technology, systems, and infrastructure needed for the future.* As with the Power Working Group, the TWG also concerned itself with equitable application of its recommendations and noted the following in its statement of objective: *Policies and legislation implemented in response to these recommendations should prioritize benefits to and reflect consultation with low-income, environmental justice, and rural communities whenever possible. They should also address tribal lands and reflect consultation with Indigenous communities whenever appropriate.*

Two outside expert speakers—Tony Dutzik, Associate Director and Senior Policy Analyst at Frontier Group and Ted Nordhaus, Founder and Executive Director of The Breakthrough Institute—presented to the Steering Committee to challenge and advance the group’s thinking, helping home in on key areas of bipartisan viability for the TWG. Both speakers and the TWG acknowledged the difficulty of decarbonizing the transportation sector, especially with federal action, in part because of entrenched interests of other sectors. The pandemic, too, presents acute uncertainties for the future of transportation, leaving many wondering about the future of commuting, the safety of public transportation, long-term impacts to leisure travel, etc. That said, the multisector approach of the Decarbonization Dialogue offered opportunities for the TWG to be additive and innovative. And efforts to use stimulus funding to invest in infrastructure and greener jobs will provide ample opportunity for the transportation sector to drive innovation, advance low carbon solutions, and take high carbon infrastructure off the market permanently. With the help of Dutzik and Nordhaus, the TWG identified a few key themes around which to organize its process.

In keeping with the spirit of the Dialogue, TWG participants were focused on multiple different opportunities for decarbonization. They committed early in the process to identifying ways to decarbonize the transportation sector through electrification, biofuels, efficiency, smart infrastructure planning, and innovation. The TWG organized its discussions around these topics and avoided prioritizing one single approach or technology over another. Participants considered the importance of state targets and state flexibility for infrastructure planning and transportation investments, while acknowledging that a national standard for fuels could create valuable certainty and consistency for the transportation industry.

Recognizing the impact of transportation electrification on the grid and of opportunities for lower carbon transportation and/or modality shifts to decarbonize the agriculture sector, the TWG incorporated input from the other working groups to ensure that all recommendations are compatible and mutually reinforcing.

The sections to follow capture the nature of the discussion around these and other issues, including reflections on some key areas of debate and discussion.

Areas of Focus

As it developed its recommendations, the TWG regularly discussed the impact of certain policy ideas on environmental justice communities. Initially, individual recommendations suggested prioritization of communities that have borne the brunt of pollution;⁸ ultimately, participants decided that a focus on low-income and people of color communities, along with rural communities and Indigenous communities, where applicable, belong at the objective level so that consultation with these groups is foundational to all policy development.

The LCFS

1) Establish a national low carbon fuel standard, with exemptions for fuels used in certain applications.

- *Develop a national low carbon fuel standard (LCFS) to build on the Renewable Fuel Standard.⁹*
 - *The standard should set a technology- and feedstock-neutral benchmark for liquid and non-liquid fuels tied to a lifecycle assessment of the carbon intensity of the fuels. The carbon intensity standard should become more stringent (lower) over time.*
 - *The standard should credit practices that reflect the best-available science about the carbon intensity of fuel production, farming practices, land use and land cover changes, and crop productivity.*
 - *The standard should include guardrails to prevent conversion of any sensitive lands with high carbon sequestration and biodiversity value.*
 - *The standard development and life cycle assessment should be transparent public processes informed by all stakeholders, including agricultural producers.*
 - *Consideration should be given to allow for both individual participation as well as aggregate enrollment through intermediaries (e.g., farm data managers) but with care to avoid putting either pathway at a disadvantage.*
 - *For renewable liquid fuels, the LCFS should reward entities in the value chain, including farmers and producers, that use climate-smart practices that reduce carbon emissions, store soil carbon, and reduce nitrous oxide emissions.*
 - *An LCFS should allow other low-carbon fuels, such as shipping and aviation fuels and heating oils, that meet the carbon intensity standards to qualify for credits. These sectors could become potential growth areas for low-carbon fuel demand.*

⁸ While the Dialogue overall focused more on reducing emissions from carbon dioxide and other greenhouse gases than on the impact of criteria air pollutants, transportation policy offers clear levers for reducing pollution and participants regularly discussed both pollution and greenhouse gas emissions.

⁹ Both the transportation working group and the agriculture working group discussed this recommendation. This language reflects input from both groups.

- *The LCFS should complement other zero-emission vehicle (ZEV) programs and greenhouse gas emissions standards for on-road vehicles.*

Early on in its process, participants identified a national low carbon fuel standard (LCFS) as the best policy for reducing emissions from transportation with flexibility for different technologies to play a role. An LCFS acknowledges that electrification and biofuels can both reduce emissions and pollution from the transportation sector. Creating a standard at the federal level provides value for companies by creating certainty for those working in multiple states or regions.

In developing this recommendation, the TWG worked closely with participants in the Agriculture Working Group, recognizing the importance of an LCFS reflecting the best available science about the carbon intensity of farming practices and incorporating input from agriculture producers in policy design.

Existing low carbon fuel standards build in exceptions for fuels used in certain applications, such as aviation and shipping, while offering the opportunity for low-carbon fuels used in those applications to earn credits if qualified. Most participants acknowledged the importance of key exemptions for any national LCFS developed today, but at least one participant envisioned and championed a future where a single standard covers all energy product and service suppliers' supply chain greenhouse gas emissions.

Efficiency First

2) Continue driving emissions reductions with efficiency and performance standards.

- *In developing efficiency and performance standards, use the following principles for standard development:*
 - *Focus on reducing the intensity of carbon emissions.*
 - *Create long-term certainty to provide businesses with a planning horizon by including a known schedule of performance requirements over a long timeframe.*
 - *Build in continuous improvement, so the standards strengthen over time to avoid stagnating and failing to deliver.*
 - *Focus on outcomes, not technologies, to avoid restricting innovation, by prioritizing physical outcomes that provide companies the greatest latitude for innovation so they can seek out the least expensive or most efficient means of achieving the standard.*
 - *Prevent gaming via simplicity and avoiding loopholes.*
 - *Ensure standards are clear and easy for consumers to understand, providing opportunities for the general public and companies to better understand the benefits and drawbacks of different vehicles and fuels.*

TWG participants saw the LCFS and efficiency/performance standards as mutually supportive recommendations; across all sectors, efficiency will remain an essential tool for reducing emissions. Participants recognized the value of such standards but elected not to weigh in on a particular mechanism or standard type, instead describing the important characteristics and

principles that should be part of any such standard.¹⁰ The TWG encouraged a focus on carbon efficiency rather than fuel efficiency to keep the focus on emissions reductions.

The Role of Electrification

3) Incentivize and accelerate electrification of fleets, ports, and personal vehicles.

- *Transition the vehicles in the federal fleet to ZEVs.*
- *Transition the fleet of 500,000 school buses to ZEVs by providing subsidies or incentives.*
- *Subsidize the electrification of public transit buses and trains.*
- *Create a grant program to support fleet conversion for small businesses and nonprofit organizations with little or no tax liability.*
- *Support the electrification of the nation's freight and logistics sector through an annual competitive grant program that supports the integration of EVs and alternative fuel vehicles at ports and intermodal facilities.*
- *Create a tax credit for new zero emission medium- and heavy-duty commercial vehicles.*
- *Electrify ports using a grant program to push port operators to invest in cleaner technologies.*
- *Study the extent to which accelerated vehicle retirement could contribute to transportation emissions reductions and how to design a potential vehicle replacement incentive program, building on the lessons learned from the 2009 "cash-for-clunkers" policy, as well as the experience of certain state programs. Such a study should consider how a vehicle replacement incentive program might maximize emissions reductions, interact with existing federal incentives like the ZEV tax credit, grow the ZEV market with a particular focus on expanding access for disadvantaged groups, and pursue a reasonable degree of cost-effectiveness.*
- *Reform the Light-Duty EV Tax Credit to make it more accessible to more consumers and encourage the expedited manufacturing and adoption of EVs in the passenger vehicle market. Provide consumers with the alternative option of a cash-on-the-hood rebate instead of the credit to reduce barriers to access.*

While the TWG acknowledged the importance of several different technologies for transportation decarbonization, it recognized the value of electrification for rapidly decarbonizing the transportation sector in certain applications. Participants wanted to advance recommendations to support and accelerate that transition, beginning with public and private fleets that can be quickly transitioned and begin reducing pollution in communities across the country. Companies' ability to transition their vehicle fleets to electric will depend heavily on charging infrastructure, but participants wanted to at minimum support those transitions with grants and tax credits.

The participants also talked about incentives for light-duty electric vehicles. They agreed to include a recommendation to reform the Light-Duty EV Tax Credit and incorporate a cash-on-

¹⁰ The TWG's principles borrow heavily from guidance on vehicle performance standards from Energy Innovation, accessed on February 5, 2021: <https://energypolicy.solutions/policies/vehicle-performance-standards/>.

the-hood option for accessibility, but debated about whether a “cash-for-clunkers”-type policy would have the emissions and pollution reduction impacts desired. Participants considered whether such a policy should be focused on trading in a “clunker” for only an EV, or whether it could encompass trade-ins for any lower emission vehicle; most agreed that such a policy could get highly polluting vehicles off the road in a way that a tax credit might not, but also acknowledged that creating a trade-in program only for EVs might be too limiting (because of type and affordability of EVs currently available and current accessibility of charging, especially for renters who may not be able to charge their vehicles at home). While all agreed on the importance of getting the most polluting vehicles off the road, participants continued to debate how to balance political viability, practicality of implementation, and emissions and pollution reduction in the design of a cash-for-clunkers program. Therefore, the recommendation focuses on studying and considering the potential impact of such a program.

Infrastructure

4) Anticipate future infrastructure needs and stimulate transitions to lower carbon transportation.

- *Increase funding for the nation’s rail network to maintain a state of good repair; establish new or improved intercity, commuter, or higher-speed passenger rail corridors; and ensure that rail infrastructure projects account for the effects of climate change.*
- *Increase funding for public transportation to reduce the maintenance backlog and expand public transit access.*
- *Continue to provide funding and incentives to support biofuels infrastructure, including for programs like USDA’s Higher Blends Infrastructure Incentive Program and the Biofuel Infrastructure Partnership at USDA.*
- *Reform and enhance the existing Alternative Fuel Infrastructure Tax Credit.*
- *Establish a federal grant program within the Department of Transportation to fund installation of public EV chargers along the National Highway System.*
- *Establish a federal grant program within DOE to reimburse public and private entities for EV supply equipment installation costs at workplaces, multi-unit dwellings, and parking facilities.*
- *Establish a federal grant program within DOE and the Department of Housing and Urban Development for Section 8 and Section 202/811 properties to fund electrical retrofits of old single- and multi-family housing for EV charging compatibility.*
- *Exempt EV charging stations from the ban on commercial activities at Interstate rest stops.*
- *Establish a national building code that requires all new residential construction to support EV charging.*
- *Adopt federal “dig once” guidelines that require interagency coordination of infrastructure projects to ensure that investments in a state of good repair are complementary with investments in public transit, EV infrastructure, smart transportation surfaces, and broadband.*

The TWG focused its infrastructure recommendations on public transportation, biofuels infrastructure, and EV charging, recognizing that all of these will play a key role in the

infrastructure needed for the future. While many public transportation investment decisions are made at the state level, the TWG recognized that federal investments are important for stimulating those more local investments. Participants also noted that improving the nation's rail infrastructure could be valuable for emissions reductions in the agriculture sector, as shifting to rail drayage can decrease emissions compared to on-road transportation. While biofuels have the benefit of compatibility with the existing infrastructure for internal combustion engines, continued support for existing grant programs and tax credits for biofuels infrastructure is needed. Range anxiety continues to impact public perception and acceptance of electric vehicles,¹¹ so the TWG developed recommendations for grants and other incentives for public charging stations in addition to incentives to encourage incorporation of charging infrastructure in residential and commercial buildings.

Participants frequently discussed how infrastructure planning and investment can be best coordinated when the long-range future of transportation—including impacts from the pandemic and the technologies that will define the transportation system of the future—remains unknown to some degree. To the extent possible, participants wanted to encourage interagency coordination and infrastructure investments that balance the needs of public transportation, fleets, and different types of personal vehicles. The TWG wanted to encourage policy that ties various transportation interests together: With careful planning and strategic investment, state and federal government investment in a state of good repair, public transit, and EV charging, smart surfaces, and broadband can be mutually inclusive; “dig once” guidelines can help.

Technology and Innovation

5) Address supply chain needs, especially for batteries, by investing in domestic manufacturing and recycling.

- *Expand grant programs and/or loan guarantees to U.S. companies, including the Advanced Technology Vehicle Manufacturing program, to construct new or retool existing U.S. facilities to manufacture EVs and associated infrastructure.*
- *Revive the 48C Advanced Manufacturing Tax Credit to provide an investment tax credit to re-equip, expand, or establish domestic manufacturing facilities in the battery storage and transportation technology sectors.*
- *Authorize a national critical minerals research program at DOE and direct the department to develop a national strategy for securing critical minerals in the clean energy and EV supply chain in an environmentally, economically, and socially responsible way.*
- *Provide significant funding for DOE to pursue research into sustainable recycling of batteries, alternatives for lithium-ion batteries in EVs and grid-scale energy storage, and demonstration projects that integrate used EV batteries into the grid.*

¹¹ The Edison Electric Institute estimates that there will be 18.7 million EVs on the road by 2030, approaching 20% of vehicle sales. They estimate that millions more charging stations would be needed to support these vehicles. Report accessed on February 5, 2021: <https://www.eei.org/resourcesandmedia/energytalk/Pages/Issue-In-Depth-11-1-2018.html>.

Investment in jobs and manufacturing for electric vehicles and associated infrastructure can benefit the struggling economy and help the U.S. regain a foothold as a clean technology leader. Additional research and funding related to technology supply chains can ensure that America's lower carbon transportation future is secured through environmentally, economically, and socially responsible ways.

6) Invest in RDD&D for hydrogen and other technologies.

- *Increase federally supported RDD&D to make high-efficiency, zero-emission, long-range trucks commercially viable.*

Hydrogen is likely to be an important part of a lower-carbon transportation future, and TWG participants wanted to drive federal support for RDD&D and other technologies to make zero-emissions long-range trucks (and other vehicle types) commercially viable.

Key Points of Debate

After initial debate about its scope, the TWG elected to focus mostly on light-, medium-, and heavy-duty road vehicles, with some discussion of rail and ports. Participants recognize that it is also important to decarbonize aviation and ocean vessels, but because of the Dialogue's focus on near-term opportunities, participants did not discuss these applications except in addressing some of the technologies that may enable their decarbonization in the future.

Participants talked about transportation pricing and taxation, acknowledging debates about the value of the gas tax and recommendations to shift to a tax focused on vehicle miles traveled. While the Decarbonization Dialogue's recommendations do not weigh in on those debates, participants suggested a focus first on *what* cities and states will need for their transportation systems, followed by determination of the cost and the funding mechanisms that would address those needs.

Participants also regularly discussed the role of electrification versus biofuels versus hydrogen versus other technologies for the future of transportation. The focus on optionality acknowledges that both electrification and biofuels will be important for near-term decarbonization, and that hydrogen could play an important role in the future. Uncertainty about the future of transportation makes infrastructure planning difficult, and it also presents serious challenges for manufacturers trying to make decisions for long-range planning. Additional dialogue about how to plan for a lower carbon future amid this uncertainty is merited.

Why These Recommendations

Developing recommendations to decarbonize the transportation sector presented more uncertainty than the other sectors: The pandemic radically altered Americans' relationship to transportation for everyday use, travel, and shopping and no one can be certain what the "new

normal” will look like; several different technologies and vehicle types are poised to play valuable roles in the future of the sector and while the direction of some vehicle types is clear, technology advancements in the next 10 years may require adjustment of current assumptions; and regional and state transportation needs vary widely. Amid this uncertainty, the TWG focused on opportunities to reduce emissions in the near-term using available technology. This meant considering a variety of technologies while encouraging research and innovation to help determine the future of transportation. This strategy offers essential roles for a variety of stakeholders and industries, creating a broad tent for collaboration on transportation policy.

Getting the dirtiest cars and fleet vehicles off the road as quickly as possible will have significant impacts for pollution in environmental justice communities, and continued investment in infrastructure and manufacturing mean that labor will play a key role in decarbonizing transportation. Decarbonization of our transportation systems is rife with both opportunity and challenge; these recommendations advance those opportunities and would positively impact environmental justice communities, workers, and consumers if implemented, in addition to reducing emissions.

AGRICULTURE RECOMMENDATIONS

Background and Process

The Agriculture Working Group (AWG) focused on opportunities to decarbonize the agricultural sector. It established the following objective for its recommendations: *To call attention to opportunities for agricultural producers to advance decarbonization, especially where such opportunities present voluntary solutions for farm owners/operators and are shared with the power and/or transportation sectors.* The AWG also concerned itself with the equitable, producer- and science-informed application of recommendations and noted the following in its statement of objective: *Policies and legislation implemented in response to these recommendations should be crafted in consultation with agricultural producers and communities with disproportionately high environmental burdens; enhance farm profitability; be based on sound science and analysis that accounts for affordability and feasibility of the transition for producers as well as the full life cycle of products; and create opportunities for states to coordinate in and among themselves.*

Experts from within and outside the AWG—Sara Hopper, Corteva Agriscience; Bruce Knight, Strategic Conservation Solutions; Ladonna Lee, U.S. Farmers and Ranchers in Action; and Robert Parkhurst, Sierra View Solutions—spoke at an early Steering Committee meeting to suggest potential directions for the agriculture recommendations. Key principles that came up multiple times in the AWG discussion include the need to shape recommendations to the ecological, economic, and social context of a given farm and its surrounding community. Often practices that deliver ecosystem services, such as clean water and healthy soil, also end up improving the productivity of farms, but implementing these practices requires significant up-front investment, and the financial benefits of a more resilient operation can take years to realize. For this reason, USDA conservation programs already incentivize the adoption of these practices. Adding climate smart practices to the mix increases the complexity of farmer decision-making, therefore the AWG often discussed stacking these practices, so that a suite of related practices could be implemented at once and would return a single payment for their multiple benefits without undue burden on the farmer.

Some of the recommendations proposed by the AWG require only the removal of administrative hurdles to accomplish, and therefore can be envisioned for short-term implementation. The expedited approval of feed additives to reduce methane emissions from enteric fermentation fits in this category. Other recommendations require additional technical solutions, such as the siting of renewable energy on agricultural lands, and with support can scale up to be a significant mid-term solution. Lastly, the long-term solution set includes continuing to support the adoption of practices that will improve the resilience of agricultural soils, sequestering carbon and enabling farms to weather the storms of a changing climate. Choices made in the

agricultural sector have the potential to greatly shape the options available to other sectors, given the volume of agricultural products and inputs requiring transport, the agricultural production of biofuels, and the potential for agricultural land to contribute to renewable power generation.

Given the complexity of farm operations, from global trade dynamics to local farm communities to the microbial ecology of soils, the AWG started as broadly as possible. Initial mapping of solutions sought to identify as many points of leverage in the farm carbon cycle as possible. Those leverage points were then narrowed and prioritized to the current number of recommendations using a survey instrument. Each strategy identified in the first step was ranked by AWG members on a scale of likelihood to be successful, both politically and in the reduction of carbon if promoted by the dialogue. The resulting prioritized list was refined and categorized to produce these recommendations. The sections to follow capture the nature of the discussion around these and other issues.

Areas of Focus

Carbon and Climate Smart Practices

1) Augment working lands conservation programs to better reward carbon and climate smart practices and ecosystem services

- *Start a USDA-administered carbon bank,¹² possibly including incentives for ecosystem services, to pay farmers for their carbon and greenhouse gas reduction, sequestration, and removal practices. A successful carbon bank should stabilize the value of carbon and ecosystem services for farmers and advance science-based, consistent, and cost-effective measurement and verification processes.*
- *Incentivize carbon reduction and sequestration practices alongside the full suite of ecosystem services by requiring federal conservation programs to document and reward the co-benefits of environmental conservation and farm resiliency (e.g., water quality, soil health, soil conservation, biodiversity, etc.) and the practices adopted primarily for climate benefits.*
- *Incentives for carbon and greenhouse gas reduction and removal practices should not displace existing farm finance programs and funding for climate smart practices (i.e., conservation programs in Title II of the Farm Bill).*
- *Support efforts to advance the development of indicators to move from practice-based incentives to performance-based outcomes and compensation for decarbonization and ecosystem services.*
- *Develop a tax credit similar to 45Q that delivers transferrable and refundable credits to U.S. farmers for qualified investments in climate mitigation, carbon sequestration, and other ecosystem services. The credit should allow flexibility for producers and be subject to*

¹² Similar to the carbon bank recommended by the Food and Agriculture Climate Alliance.

*publicly available policy guidance developed by the USDA in consultation with producers for measurement and verification.*¹³

The most highly prioritized set of recommendations by the AWG centers on improving existing farm conservation programs. AWG recommends augmenting these programs to pay farmers for carbon sequestration and greenhouse gas reduction as well as other ecosystem services, documenting and rewarding the connection between environmental conservation, farm resiliency, and climate benefits. Whereas payments have typically been offered for the completion of practices, such a system would measure and reward outcomes. Payment mechanisms could include a USDA-administered carbon bank,¹⁴ a tax credit similar to 45Q, or traditional incentive programs, but should not displace existing farm finance programs.

In their discussion of payments, group members discussed ways in which existing USDA-operated conservation programs could be connected with public or private markets that would pay for performance in carbon reduction. The Working Group had a high degree of consensus around this issue. Its appeal is tied to the preexisting structure of these programs, which have well-defined standards for conservation practices and are administered through a broadly distributed network of USDA field offices with preexisting farmer relationships. Any recommendations that deliver payments to farmers may consider taking advantage of this existing structure. The identification of 45Q was not a recommendation to edit that specific tax credit but to acknowledge that something similar, provided it is transferable or refundable, could be developed specific to agricultural practices.

Waste Streams

2) Amend existing or enable future policies to address agricultural waste streams together with agricultural inputs in a combined organic waste recycling, wastewater treatment, and power strategy.

- *Further invest in research and appropriate incentives to select the best on- and off-farm approaches and technologies for removal and recovery of nitrogen and phosphorus from animal manure.*
- *Incentivize emissions reductions at fertilizer manufacturing facilities and incentivize the inclusion and use of recycled nitrogen and phosphorus.*
- *Combine treatment of food waste, livestock waste, municipal organics, and agricultural woody biomass to produce compost for use as a soil amendment.*
- *Remove barriers to transporting manure from on-farm sources to on- or off-farm sinks.*

¹³ Both the power working group and the agriculture working group discussed this recommendation. This language reflects input from both groups.

¹⁴ One participant noted that the term “carbon bank” could be confusing to farmers and other stakeholders. The term is widely used to describe a system to create payments or credits for carbon storage.

- *Promote the use of manure and food waste for biofuels production as a waste management strategy (versus crop residues, which should be left on the field).*

These recommendations leverage potential efficiencies to be gained in the nutrient flows through agricultural systems. On the inputs side, the AWG recommends incentivizing the reduction of emissions produced in the manufacture of fertilizer and encouraging the incorporation of recycled nitrogen and phosphorus into fertilizer production. On the outputs side, efficiency can be gained by composting manure, food waste, and agricultural woody biomass together as part of a combined treatment strategy.

The AWG coalesced around this issue due to its system-scale focus. Its related recommendations can be achieved through a wide range of policies at the federal and state level, but in principle agricultural waste should be treated as a nutrient and energy resource, as part of a closed-loop system. This circular flow should be considered when applying policies to other parts of the farm system as well. Reducing emissions at fertilizer manufacturing plants was specifically called out since it is a major contributor of greenhouse gases and may require a separate policy mechanism from the other recommendations offered here.

Technology and Innovation

3) Prioritize agricultural research and development that aims to increase farm productivity and resilience along with mitigation and adaptation strategies

- *Support agricultural research and development for new technologies and practices that enable farm systems to better respond to heat stress, drought, flooding, and other forms of environmental volatility.*
- *Support agricultural research and development to better quantify the changes in the carbon-nitrogen cycle for agricultural practices.*
- *Leverage private sector R&D trends and investment and couple with more public research. Protocols should be developed to enable the safe and fair sharing of data to inform analysis and science while protecting the data privacy of individual producers.*
- *Coordinate research across DOE and USDA for development of more climate-friendly products (e.g., research into feed efficiencies that also have a carbon benefit).*

The increasing frequency and severity of extreme weather events requires a full toolbox of mitigation and adaptation strategies to mount an effective response. Therefore, the AWG recommends support for research on ways for farmers to enhance the resilience of their operations to heat stress, drought, flooding, and other forms of environmental volatility. Additional research should also be funded to better quantify the effect of practices on the carbon and nitrogen cycles. The energy of private sector research in this space should be bolstered by public research, enabled by safe data sharing methods that protect producer privacy.

The AWG showed a high level of support for contributions to research and development, both private and public. This research should be conducted in partnership with farmers to ensure that it yields benefits to rural communities. Innovation in the agricultural space has been accelerating in recent years, and this recommendation takes advantage of and contributes to that momentum.

Energy Use

4) In addition to in-field management practices, support on-farm opportunities for decarbonizing energy use on and off the farm

- *Support the availability of multiple pathways to decarbonize on-farm energy use based on optionality and site-specific, science-based outcomes, in lieu of generalized or prescriptive approaches that do not optimize for fullest greenhouse gas emissions reduction or consider cost to the farmer.*
- *Track and incentivize technologies and innovative approaches, such as agrivoltaics, that enable optimization of both farm productivity and energy generation.*
- *In addition to renewable power generation, programs should support innovation and incentives that allow farmers to produce and use biofuels on-farm.*
- *Programs should map and align land conversion from agriculture to power to accomplish positive co-benefits such as the retirement of marginal land and the planting of pollinator habitat.*
- *Create pathways for overcoming hurdles specific to transmission and siting of distributed power production on agricultural lands and in rural areas (e.g., coordinating with federally owned utilities to develop collaborative approaches).*
- *Analyze and address near-term constraints that are limiting the ability of the power sector to install new renewable power generation.*

Over 50% of the U.S. landmass is in some kind of agricultural production¹⁵, which has enormous potential to contribute to renewable power generation, provided certain barriers are overcome. Solar and wind energy occupy large areas of land and can be compatible with agriculture, and biofuels have the potential to offset on-farm energy use. In response to this opportunity, the AWG recommends customizing decarbonization strategies for the needs and site-specific contexts of individual producers.

The AWG wrestled with this recommendation more than others, since in some cases renewable power generation has been in competition with agricultural production areas for land use. Widespread implementation of this strategy also will require significant investment in transmission infrastructure. To arrive at a happy medium the AWG identified a handful of ways in which renewable energy production could coexist with agricultural production, including by

¹⁵ USDA's Economic Research Service's overview of Major Land Uses, accessed on February 9, 2021: <https://www.ers.usda.gov/topics/farm-economy/land-use-land-value-tenure/major-land-uses/>

incentivizing technologies, such as agrivoltaics, that enable the optimization of both farm productivity and energy generation, and identifying co-benefits such as the retirement of marginal land and planting of pollinator habitat that can occur alongside renewable energy generation. The promise of this recommendation lies in the ongoing dialogue between the power generation and agriculture sectors to find mutually beneficial solutions for each location.

Enteric Fermentation

5) Promote cross-departmental coordination to enable faster implementation of feed-based responses to enteric fermentation

- *Enteric fermentation strategies and solutions could offer a significant reduction in methane emissions in the next decade and should not be left out of any decarbonization strategy. Additional research focus and inter-agency support is needed to further develop and facilitate this potential.*

Lastly, the AWG recommends lowering inter-agency administrative hurdles that have held up the adoption of new feed sources for ruminant livestock, primarily cattle.

The AWG proposed this recommendation on its own because the potential for reduction in methane emissions from enteric fermentation is significant and easy to accomplish in a short timescale. Therefore, bolstering support for this strategy and removing barriers should be a key component of any decarbonization plan. The potential of enabling better coordination between federal and state agencies to remove unnecessary administrative barriers should be evaluated in more cases than just enteric fermentation.

Key Areas of Debate

Many of the strategies initially proposed by the group did not make the final recommendation list, whether because of technical, economic, or political reasons. One such strategy is the promotion of cellulosic ethanol production, which has generated national interest. The group ultimately deprioritized it on the grounds that cellulosic crops had not been proven at scale, that corn was already serving this need, and that ultimately it would face political headwinds from both oil and corn ethanol interests.

Another strategy that ultimately was not adopted addressed farm ownership, the idea being that leased land sees less conservation practice adoption than land that is owned and operated by the same entity. The strategy defined alternate lease agreements that would gradually or partially grant ownership to the lessee in the hope that an increasing sense of ownership would encourage adoption of practices with longer-term returns on investment. In the end, AWG members acknowledged the importance of land ownership and adequate tenancy on decision-

making but saw too weak of a connection between it and decarbonization to prioritize the strategy.

Why These Recommendations

The AWG prioritized these recommendations not only because of their potential to decarbonize agriculture but also because of their broader systemic effects. Since agricultural systems overlap so much with power generation and transportation, many strategies identified by these other sectors can benefit from including agricultural producers at the table. Moreover, as the managers of living systems, farmers are at a unique point of leverage in the global carbon cycle, with the ability to close several important waste and input loops. In addition to their effectiveness on the carbon cycle, the group's recommendations have the potential to strengthen the economic potential of producers, enabling them to better steward their land, in a virtuous cycle that leads towards operational and ecological resilience. What is good for the farmer is good for the land.

CONCLUSION

As debates continue in Congress, within Executive Agencies, and at the White House about how to best tackle the climate crisis and decarbonize the economy, the Decarbonization Dialogue points both to policy opportunities that could be acted on immediately with bipartisan support, and to the importance of a cross-sectoral, consensus-based model for development of decarbonization policy.

The effort, too, points to opportunities for continued dialogue: The future of heavy-duty transportation is uncertain and demands collaboration among diverse interests to advance decarbonization while helping industry plan for and invest in the technology and workforce it will need. Agriculture stakeholders are eager for continued collaboration with energy and transportation sectors. The federal government must find a more streamlined way to account for the needs and interests of frontline communities in siting the infrastructure that will be needed under any approach to decarbonization policy. The economic transitions that decarbonization demands must consider the impact on the workforce and allow for tailored, local solutions alongside robust federal support.

Decarbonizing the economy to appropriately tackle the climate crisis is a massive undertaking. But an approach that includes diverse interests can make that undertaking less politically fraught and more durable in the long-term. Even as debates continue over other elements of decarbonization policy, our national leadership should act now on those policies that have already garnered robust bipartisan support.

APPENDICES

APPENDIX A: PARTICIPANTS

A multi-discipline, diverse stakeholder group shaped the recommendations in this document, as part of a steering committee and/or sector-based stakeholder groups. The following individuals participated in the Decarbonization Dialogue in the following capacities, with support from their respective colleagues.

Steering Committee

- Dan Delurey, Senior Fellow for Energy and Climate, Vermont Law School
- Paul Doucette, Energy Transition Executive, Baker Hughes
- Shelley Fidler, Principal, Governmental Affairs, Energy and Environmental Policy, Van Ness Feldman
- Paula Gold-Williams, President and Chief Executive Officer, CPS Energy
- Rob Gramlich, President, Grid Strategies LLC and Executive Director, Americans for a Clean Energy Grid
- Tom Hassenboehler, Partner, The Coefficient Group
- Karl Hausker, Senior Fellow, World Resources Institute
- Mitch Jackson, Vice President, Environmental Affairs & Chief Sustainability Officer, FedEx
- Bruce Knight, Principal and Founder, Strategic Conservation Solutions
- Anjali Marok, Global Sustainability Strategy and Analysis Leader, and Sara Hopper, Manager, Government Affairs, Corteva Agriscience
- Clay Nesler, Vice President, Global Sustainability and Industry Initiatives for the Building Technologies and Solutions, Johnson Controls
- Willie Phillips, Chair, Public Service Commission of the District of Columbia
- Lynn Scarlett, Chief External Affairs Officer, The Nature Conservancy
- Phil Sharp, Former Member of Congress
- Sue Tierney, Senior Advisor, Analysis Group
- Laura Vaught, Federal Affairs Policy Director, Dominion Energy
- Sarah Venuto, Vice President, Public Policy, Duke Energy
- Clint Vince, Chair, Global Energy Practice, Dentons US LLP

Power Working Group

- Dan Delurey, Senior Fellow for Energy and Climate, Vermont Law School
- Paula Gold-Williams, President and Chief Executive Officer, CPS Energy
- Rob Gramlich, President, Grid Strategies LLC and Executive Director, Americans for a Clean Energy Grid
- Tom Hassenboehler, Partner, The Coefficient Group
- Willie Phillips, Chair, Public Service Commission of the District of Columbia
- Rich Powell, Executive Director, ClearPath
- William Sauer, Federal Regulatory Affairs Director and Sarah Venuto, Vice President, Public Policy, Duke Energy
- Phil Sharp, Former Member of Congress
- Laura Vaught, Federal Affairs Policy Director, Dominion Energy

Transportation Working Group

- Sarah Adair, Policy Director, Duke Energy
- Shailen Bhatt, President and Chief Executive Officer and Laura Chace, Chief Operating Officer, Intelligent Transportation Society of America
- Sue Gander, Managing Director, EV Policy, Electrification Coalition
- Mitch Jackson, Vice President, Environmental Affairs and Chief Sustainability Officer, FedEx
- Chelsea Jenkins, Vice President, Government and Industry Relations, John Thomson, Director, Product Development and Emissions Compliance, and Natalia Swalnick, Director of Government Affairs, Roush CleanTech
- Andrew Kambour, Senior Policy Advisor for Energy, The Nature Conservancy
- Ryan Lamberg, Principal, Tied Branch Consultants
- Tom Van Heeke, Policy Lead, Mobility and Climate Change, General Motors

Agriculture Working Group

- Dan Blaustein-Rejto, Director of Food and Agriculture, The Breakthrough Institute
- Jenny Conner Nelms, Senior Policy Advisor for Agriculture, The Nature Conservancy
- Aldyen Donnelly, Director of Carbon Economics, Nori
- Allen Dusault, Director of Research and Development, Franklin Energy
- Bruce Knight, Principal and Founder, Strategic Conservation Solutions
- Ryan Lamberg, Principal, Tied Branch Consultants
- Anjali Marok, Global Sustainability Strategy and Analysis Leader, Corteva Agriscience
- Marty Matlock, Executive Director, University of Arkansas, Resiliency Center
- Robert Parkhurst, President, Sierra View Solutions
- Allison Thomson, Vice President, Science and Research, Field to Market
- Aliza Wasserman-Drewes, Director, Rural Investment to Protect our Environment

Note: Erin Fitzgerald, Chief Executive Officer, U.S. Farmers and Ranchers in Action, participated on the Steering Committee and Agriculture Working Group in an advisory capacity.

Facilitator and Staff Team

- Sarah Alexander, Vice President of Programs, Keystone Policy Center
- Marques Chavez, Director of Communications and Marketing, Keystone Policy Center
- Trace Faust, Senior Project Director, Keystone Policy Center
- Jonathan Geurts, Senior Project Manager, Keystone Policy Center
- Rachel Helbig, Policy Fellow, Keystone Policy Center
- Franklin Holley, Senior Program Director, Keystone Policy Center
- Mallory Huggins, Senior Project Director, Keystone Policy Center
- Judy O'Brien, Director of Development and Strategic Partnerships, Keystone Policy Center
- Christine Scanlan, President and CEO, Keystone Policy Center
- Doug Scott, Vice President of Energy and Efficiency, Great Plains Institute

APPENDIX B: DETAILED TIMELINE

Date	Activity/Meeting	Objective
May 27, June 10, and July 14, 2020	Steering Committee	Agreement among Steering Committee on guiding principles, scope, timeline, and participants
May-July 2020	Steering Committee, Keystone, GPI	Identified funding
	Keystone staff research	Completed review of existing decarbonization efforts and federal legislative proposals
August 11, 2020	Steering Committee	Identified areas of focus for power working group
August 30, 2020	Transport Working Group	Preliminary conversation to discuss possible scope
August 31, 2020	Power Working Group	Preliminary conversation to agree upon areas of focus
September 2, 2020	Steering Committee	Identification of areas of focus for transport
September 16, 2020	Power Working Group	Discussion of tax credits and incentives Agreement on concepts to address in recommendations
September 17, 2020	Ag Working Group	Preliminary conversation to discuss possible scope
September 23, 2020	Steering Committee	Identification of areas of focus for ag
September 30, 2020	Power Working Group	Discussion of transmission, siting, and infrastructure; agreement on concepts to address in recommendations
October 6, 2020	Transport Working Group	Finalization of areas of focus
October 14, 2020	Plenary session with Steering Committee + all Working Groups	Presentation of areas of focus in all areas; discussion among full plenary session and guest expert; further refinement of areas of focus
October 14, 2020	Power Working Group	Discussion of R&D; agreement on concepts to address in recommendations
October 28, 2020	Power Working Group	Review of all three recommendation areas and feedback from Steering Committee; discussion of possible regulatory mechanism; articulation of intersection with other working groups
October 29, 2020	Transport Working Group	Discussion of infrastructure; agreement on concepts to address in recommendations
November 5, 2020	Ag Working Group	Continued discussion of scope

November 5, 2020	Transport Working Group	Discussion of decreasing carbon intensity of liquid fuels Agreement on concepts to address in recommendations
November 11, 2020	Steering Committee	Reflection on impact of election Review and feedback on draft power recommendations
November 11, 2020	Power Working Group	Discussion of feedback from Steering Committee; assessment of expansion/refinement needed before package finalization
November 19, 2020	Transport Working Group	Discussion of electrification; agreement on concepts to address in recommendations
November 20, 2020	Ag Working Group	Discussion about power and transport recs
November 25, 2020	Power Working Group	Considered regulatory mechanisms and feedback from ag and transport groups
December 2, 2020	Steering Committee	Review and provide feedback on proposed timeline for next several months; proposed comment and endorsement process; draft transport recommendations
December 3, 2020	Transport Working Group	Discussed feedback from Steering Committee and assessed expansion/refinement needed before package finalization
December 14, 2020	Ag Working Group	Reviewed draft recommendations; reviewed feedback from Dec 2-9 ag comment/prioritization exercise
December 16, 2020	Steering Committee	Reviewed and provided feedback on draft ag recommendations
December 18, 2020	Ag Working Group	Discussed feedback from Steering Committee and assess expansion/refinement needed before package finalization
December 22, 2020-January 18, 2021	Comment Period	Request for comments from all participants on current draft recommendations
January 20, 2021	Power Working Group	Proposed final edits
January 20, 2021	Transport Working Group	Proposed final edits
January 25, 2021	Ag Working Group	Proposed final edits
January 27, 2021	Plenary session with Steering Committee + all Working Groups	Review refined draft of recommendations based on comments

February 1-12, 2021	Keystone and GPI	Endorsement period
February 19, 2021	Keystone and GPI	Release of products

APPENDIX C: REFERENCES FROM POLICY SCAN

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