DEMONSTRATE
DEPLOY
DECARBONIZE
2023

Deploy Dialogues

Summary Report

PREPARED WITH SUPPORT OF NEXIGHT GROUP BY THE
U.S. DEPARTMENT OF ENERGY LOAN PROGRAMS OFFICE

MARCH 2024

Table of Contents

DEPLOY23

Introduction

On September 26-27, 2023, the U.S. Department of Energy's Loan Programs Office and the Cleantech Leaders Climate Forum co-hosted Demonstrate Deploy Decarbonize 2023, or **Deploy23**, in Washington, D.C. Deploy23 brought together senior leaders from industry, the broader ecosystem (e.g., investors, non-profits, labor unions, advisors), and government (e.g., DOE, broader interagency, and state, local, and Tribal groups) to catalyze deployment of and investment in new clean energy and decarbonization technologies.

The purpose of the event was to build momentum towards deployment of critical clean energy and decarbonization technologies in the U.S. by building trust between leaders across the private and public sectors and broader stakeholder ecosystem. Over 400 senior executives across industry, finance, and the broader clean energy ecosystem attended the inaugural deployment summit, as well as over 100 federal, state, local and Tribal government representatives and members of the press. The two-day Deploy23 event featured the Deploy Dialogues, a series of professionally facilitated workshops that provided space for industry leaders to discuss challenges and identify solutions in key areas. The Dialogues focused on topics related to the DOE's recent Pathways to Commercial Liftoff reports, including Carbon Dioxide Removal (CDR), distribution grid modernization (*Innovative Grid Deployment* Liftoff report forthcoming), industrial decarbonization (Carbon Capture and Storage (CCS), chemicals & refining, heat, and procurement & buy-side initiatives), and Virtual Power Plants (VPPs).

This document summarizes the seven Deploy Dialogue session topics. It is not a verbatim transcript, rather a summary of key themes and ideas discussed in each session. All sessions took place under the "Chatham House Rule," meaning no statements were confidential, but no attribution is provided. Dialogues were not designed to and did not result in a consensus of opinions, but rather drew on individual insights from a diverse set of participants. While the overall objective of the Dialogues was the same—bringing together public and private sector stakeholders to discuss advancing deployment—each session was tailored to the specific sector in focus, resulting in slight differences in structure and outputs.

Deploy Dialogues Executive Summary

Deploy23 programming centered on *Deploy Dialogues* — a set of facilitated workshops designed to surface solutions to clean energy deployment challenges. This report summarizes takeaways from the Dialogues. Summary of these takeaways are presented below, organized into four themes that cut across the seven Dialogue topics.

Theme 1: Accelerating Government Execution & Capacity Building

1. **Accelerate deployment of full government toolkit by making availability and access more transparent, faster, and easier to navigate.** Some senior executives said they were "overwhelmed" when exposed to the full range of tools DOE/USG can bring to bear to support demonstration and deployment of clean energy technologies. Additional transparency and guidance on how to navigate funding opportunities (including DOE's grant and loan programs) will unlock greater private sector understanding of and willingness to apply to existing programs. Greater certainty and speed of government process timelines will facilitate private capital allocation decision-making towards energy transformation.

2. **Continue to build regulatory capacity and accelerate review and permitting processes across all levels of government (federal, state, and local).** Executives noted the pace of technology change – driven by the Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA) – is outpacing the rate of capability development within government institutions to understand, evaluate, and approve novel technologies. Investing in regulatory capacity building and education (e.g., Clean Energy Innovator Fellowship) will be critical to accelerate innovative technology deployments. Streamlining permitting processes and providing clarity on timelines is critical to enabling faster deployment.

Theme 2: Amplifying Community Engagement and Local Economic Development

3. **Companies can leverage community and union engagement as a competitive differentiator and project deployment accelerator.** Industry leaders

highlighted community and labor engagement as a baseline source of competitive advantage. Activating philanthropic support, directly engaging with mayors, and working with community foundations and local education institutions can also strengthen community engagement.

4. **Utilities could socialize the benefits of new technologies, not just the costs.** For example, a clear benefits quantification framework for grid deployment technologies could unlock performance-based investment models that ensure benefits of grid upgrades are equitably shared. Utilities could make rate cases based on performance improvements across the grid, ensuring the benefits of grid investments (e.g., distributed energy resources (DERs)) accrue to all communities rather than just those that can afford them.

5. **State and local governments can leverage a clean and reliable grid to unlock economic development opportunities.** Companies are increasingly looking at the availability of clean power and strength of the local grid when making investment decision (e.g., new manufacturing site, etc.). By setting ambitious state energy goals and aligning investment priorities behind these solutions, state economic development agencies and governors can build a competitive advantage to spur economic growth and reduce emissions (over 10% industrial CO2 reduction from clean grid).

Theme 3: Enabling Repeatable Deployments

6. **Public assistance for demonstration and early deployment could be evaluated with a balance between technical merit and repeatability** – establishing standard blueprints, templates, technical specifications, etc. For example, documenting and sharing deployment best practices, benefits and costs assessment methodologies, standard contracting/purchase agreements for clean hydrogen, Direct Air Capture (DAC) Hubs, and industrial demonstrations to help medium-sized businesses that are ready to scale but lack extensive legal and administrative teams. Another example for Virtual Power Plants (VPPs) and innovative grid technologies (e.g., advanced data management solutions, Grid Enhancing Technologies (GETS)): formalizing technical specifications that worked well and analytical methods (e.g., cost/benefits quantification) that can justify pay out in terms of grid resilience, distribution system cost deferral, and other benefits not typically compensated.

7. **A clear framework for utility and industrial data transparency could be**

established and enforced at a federal level (similar to HIPAA). For grid modernization, transparency is needed to enable better identification of grid needs, entry of new technologies, and management of critical grid systems. Legacy concerns over data sharing and transparency and uncertainty of data ownership within the utility space inhibits piloting and scaling of innovative technologies, including VPPs, advanced data management systems, and other digitally enabled grid solutions. For industrial decarbonization, public data availability on subsurface characterization could accelerate development of storage sites for CCS.

Theme 4: Establishing Federal Standards and Processes

8. **Stronger regulations ("sticks") will be critical for certain sectors where incentives ("carrots") are proving insufficient, such as refining.** Industry leaders suggest that regulations will be the only way refineries will make meaningful progress towards a net zero by 2050 timeline and address their industrial production emissions footprint. Regulations could include federal standards that mimic California's Low Carbon Fuel Standard, which has forced refineries in the state to invest capital to retrofit assets, or standards for measuring and marketing lower carbon products to appropriately credit chemical companies that bring clean products to market (similar to the Energy Star program for buildings).

9. **Standard models for measuring carbon intensity of products and performance-based standards could be established to unlock premiums and applications of low-embodied carbon materials**. For many applications, 45Q incentives do not fully cover the cost of CCS or existing standards exclude novel compositions. Standard measurement approaches for carbon intensity (e.g., Argonne National Laboratory's GREET model for transportation fuels) and performance-based standards (i.e., not specifying composition) can enable industry to find ways to monetize the low-carbon value of both traditional and novel products (e.g., "RECs for low-carbon, novel cement or plastics").

10. **Enabling direct procurement by government agencies for industrial commodities could make demand signal durable and transparent** to unlock investment in low-embodied carbon construction materials (e.g., cement/concrete, steel, glass). Demand structured into a long-term durable demand signal could result in actual facilities reaching final investment decision and getting built (e.g., 5-10 year, bankable demand-side support from

government in form of revenue guarantees, contract from differences, etc. to lower cost of new projects getting built). Government agencies could be allowed to purchase directly from plants and on a multiyear basis, rather than indirectly through design-and-build contracts. Work with philanthropic organizations could cover additional risk. Proactively publishing volumes expected to be consumed by projects over next decade would create case for supply-side investments.

Carbon Dioxide Removal

Carbon dioxide removal (CDR) purchases are hitting exponential growth curves: purchases in 2023 have already surpassed the record highs of 2022. Carbon removal markets are clearly maturing but not without growing pains. Buyers and sellers face a variety of potential challenges related to carbon registries, monitoring reporting and verification (MRV) methods, validation and verification bodies, and many more ecosystem safeguards.

Participants in this Dialogue focused on decreasing CDR market friction to accelerate deployment and ensure high-integrity climate benefits.

Key Themes from CDR Dialogue

The CDR Dialogue's key theme is that holistic and community approaches in the public and private sectors are crucial to increase the speed of CDR deployment.

1. Increasing the speed of CDR deployment requires **addressing obstacles in a holistic way**, such as agreement on MRV best practices; allocating funds for all aspects of a project, not just deployment; identifying ways to share knowledge related to permitting and other legal issues; and establishing compliance markets to provide the demand signals needed.
2. **Leveraging existing DOE programs and assets** can help speed deployment and address barriers. For example, connecting the CarbonSAFE program with EPA Class VI permitting requirements; engaging National Laboratry experts who can effectively communicate the science of CDR to the public; and proactively sharing recent progress and future opportunities for CDR through increased outreach and publicity with Secretary Granholm.

Anticipating how hidden obstacles could hinder the speed of deployment. These risks include the ownership of carbon accounting credentials and liability, potential supply chain restrictions, and expiration of 45Q tax credit.

Incorporating community engagement from the start of a project to ensure broad support. Community engagement, while resource intensive, is essential to the success of any project. DOE can help support community engagement by developing and

distributing resources on CDR that can be distributed to communities and leveraging existing workforce at National Laboratories. CDR is a U.S. success story and needs to be messaged that way as part of community outreach and gaining broader support.

Distribution System Grid Modernization

As technology continues to develop and the need for clean energy increases, existing grid infrastructure will become increasingly out of date. The grid must be flexible enough to adapt to new energy technologies and resilient and reliable enough to withstand increasingly severe weather events.

The Grid Modernization Dialogue examined ways to quickly and efficiently modernize the existing distribution grid during two sessions – one on investment challenges (Day 1) and a second on operational challenges (Day 2). These sessions focused on innovative distribution technologies that can improve the capacity, reliability, resiliency, and flexibility of the existing system. Technologies in scope included:

Grid Capabilities	Technologies & Applications (not exhaustive)
Data, Communications, and System Automation Solutions	• Advanced Distribution Management Systems (ADMS) and component systems such as Distributed Energy Resource Management Systems (DERMS) • Digitization and visualization of grid components and systems (e.g., digital twins, digital substations) • Advanced sensors • Alternative synchronization & timing • Data management systems & advanced data analytics • Computational & communications technologies
Distribution Grid Enhancing Technologies (GETs)	• Advanced Power Flow Controllers • Power Factor Corrections • Advanced transformers (e.g., flexible transformers) • 4–10-hour energy storage • Network topology optimization
Resiliency & Reliability Solutions	• Automation and digitization of substations that supports hardening against disruptive events • Fault Location, Isolation, and Service Restoration (FLISR) and/or smart reclosers • Advanced substation technologies to promote efficiency & agility • Technologies or approaches that reduce interconnection queues for clean energy (and/or integration of electrification load)

Key Themes from Grid Modernization Dialogue

The Grid Modernization Dialogues' key theme is that collaborative, transparent, and agile approaches and adjustments to conventional business and regulatory models, coupled with effective stakeholder engagement, are vital to advance innovative technology deployment. This involves not only addressing technical aspects but also regulatory and workforce considerations. These considerations include:

1. **Shared Technology Deployments.** Electrically connected utilities should explore opportunities for sharing technology deployments. This collaboration not only enhances efficiency but also promotes transparency in resource allocation and technology utilization.
2. **Socializing Savings.** Making a compelling business case involves highlighting the savings and benefits of projects, rather than merely focusing on the costs. By emphasizing the positive outcomes, decision-makers can gain support for initiatives.
3. **Target Early, Small Deployments.** Prioritize early and smaller deployments over large, system-wide projects. This agile approach allows for faster experimentation and the testing of new rate and tariff structures. It also helps in quantifying the impacts, which can inform broader deployments.
4. **Regulatory Process Enhancement.** Advocate for regulatory processes and decisions that enable anticipatory and flexible utility investments. There may be a role for federal authorities to provide a framework and guidance to facilitate this flexibility.
5. **Customer Narrative.** Strong customer narratives play a crucial role in accelerating success. Engage stakeholders early in the process to build these narratives, ensuring their perspectives are considered throughout the decision-making and deployment phases.
6. **Workforce Capacity.** Recognize that workforce capacity, including talent shortages in IT and line worker positions, is a critical enabler for successful deployment. Addressing these capacity issues is vital to project execution.
7. **Align investment processes with the characteristics of technology types.** Differentiating between technology types is needed. For example, hardening and reliability infrastructure tend to receive easier regulatory approval, whereas customer-facing technology can pose more significant challenges

under current investment processes. Business cases and valuation processes should reflect the true value add of the technology (e.g., valuing situational awareness or improved customer service for software systems vs. hardening value for physical infrastructure), which may require changes to existing processes.

DEPLOY23

Industrial Decarbonization: Carbon Capture and Storage

Every decarbonization roadmap for the industrial sector features a central role for Carbon Capture Storage (CCS). And though CCS deployment in the industrial sector has been limited to date, the Bipartisan Infrastructure Law and the Inflation Reduction Act have created a policy environment in which several types of CCS projects are commercially viable. Billions of dollars in projects in industrial CCS for steel, cement, ammonia, and other industries have already been announced, but the path from announcement to Final Investment Decision (FID) is long, as this sector has seen before.

Participants in this Dialogue focused on solutions to dramatically accelerate responsible CCS deployments for industrial decarbonization.

Key Themes from CCS Dialogue

1. **Community Engagement and Messaging.** CCS projects would benefit from industry-driven outreach, better integration of communities into decision-making, and stronger messaging around the regional economic benefits of CCS technologies. NGOs and workforce development groups can help empower communities, increase transparency, convey core competency needs, and socialize the safety aspects of novel technologies demonstrations. Partnerships with labor unions can strengthen deep engagement with communities.
2. **Regulatory Strategies and Incentives.** Stronger regulatory support will help advance the utilization of CCS and related technologies. Industry and government must work together to establish materials standards and support initiatives, such as establishing a durable value stream for low-embodied carbon projects, that encourage the production of green/low-carbon materials.
3. **Permitting and Approval Processes**. More efficient screening processes will accelerate the time required to review and approve permits for safe long-term CO2 storage solutions. Industry and DOE should work with EPA to alleviate permitting requirements for Class VI wells without compromising safety including solutions for overcoming issues related to engaging homeowners and landowners in eminent domain cases.

Industrial Decarbonization: Chemicals and Refining

Assets across the chemical and refining sectors have been optimized to operate 24/7/365. Taking any one component offline can mean downtime for an entire operation unit, with material output and cost implications. Adapting or upgrading facilities often requires changes to engineering, daily operation, and even business models—all of which can slow or prevent the implementation of decarbonization levers. However, failure to make retrofits during a once- or twice-in-a-decade window risks missing the opportunity to decarbonize critical assets before 2030.

Participants in this Dialogue focused on solutions to accelerate decarbonization of chemicals & refining processes.

Key Themes from Chemicals & Refining Dialogue

1. **Optimizing regulatory requirements and incentives to achieve decarbonization.** Incentives can focus on reduction of downtimes when implementing new decarbonization systems and rewarding new product creation and production. Companies would benefit from a low-carbon certification scheme to help them brand their products and market their investments in decarbonization. Regulations can provide the proper impetus for technology implementation and green energy conversion (e.g., Tennessee Valley Authority and the Low-Carbon Fuel Standards in California).
2. **Streamlining processes for timely construction and operation of new plants.** The minimum timeline today from siting to operation of a new facility is 5-7 years due to permitting at all government levels with various agencies. Recognition of these existing requirements and finding opportunities to efficiently issue permits is a key to timely implementation in upstream, midstream, and downstream processes.
3. **Cultivating relationships and partnerships between government and industry.** The active listening approach between DOE with industry to determine financial incentives with industry balanced with regulatory incentives is more effective than traditional regulatory approaches. However, in certain sectors like refining, significant decarbonization is unlikely to occur with incentives alone. Regulatory requirements are the only thing that will move the needle

because without a demand-side pull, companies view decarbonization as ‘elective surgery.’

4. **Initiating unique opportunities that will mature in 1-2 decades for first movers.** Now is the prime investment era in decarbonization and green energy-based technologies in the chemical and refining industry. Companies cannot only focus on technology that is commercially viable today. Investors who are fast followers can also benefit, but only in the near term.

Industrial Decarbonization: Heat

Heat sources account for a majority of industrial emissions today. Multiple available technologies can reduce emissions (e.g., electrification, hydrogen, small modular nuclear reactors (SMRs)); however, these technologies face common challenges to deployment across industries—particularly with regard to supply certainty and cost. With historic public sector support and planned projects, we have an opportunity to identify and share key information from early projects to address these concerns and accelerate heat decarbonization across industries.

Participants in this Dialogue focused on accelerating the decarbonization of industrial heat processes.

Key Themes from Industrial Heat Dialogue

1. **Partnering in a value stream to share risk and create certainty.** Original equipment manufacturers (OEMs) have partnered with supply chain companies to eliminate risk and costs using lean methodologies. Heat decarbonization should use a value stream manufacturing hub model to spread technology implementation risk and improve supply certainty especially when margins are minimal. Value chain de-risking can result in willingness by OEM partners to make long-term investments in tandem with government financial incentives.
2. **Enabling heat technology implementation by reducing operational safety and reliability risks.** Industry and investors understand the various heat decarbonization technology business cases, and a risk for successful implementation are operational problems that can cause lack of public and industry confidence in these new technologies. Models like heat as a service or Energy Service Company models could be an approach to reduce these risks. Successful accomplishment also includes small scale demonstration projects that can be immediately upscaled “behind the fence” with safety and reliability redundancies.
3. **Increasing clean generation across industry, especially in rural areas.** Electrification of heating – already available for many applications, requires a significant amount of power. Many manufacturing sectors struggle to secure that power at competitive rates. In rural areas, today’s grid is insufficient for

electrification of heat technologies. Capacity increases must incorporate clean power sources and must be accomplished on a timetable to meet investment expectations.

4. **High costs are a consistent barrier – new business models and/or greater incentives or regulatory requirements are needed to accelerate uptake.** Energy as a service (e.g., ESCO) or other innovations in business model structures are needed due to cost structure of products. In regions with low-cost fossil heat (e.g., natural gas), low-carbon solutions are not cost competitive, so subsidies, incentives, or regulatory requirements are needed.
5. **Engaging the local community.** Despite the higher costs of heat decarbonization technologies, community engagement has proven to be a key to success. This is true in a green steel manufacturing example where breathable air quality is not impacted and safety is the top priority in a worker/manufacturer partnership.

Industrial Decarbonization: Procurement and Buy-Side Initiatives

The United States will need to mobilize more than $1 trillion of capital for industrial decarbonization to achieve net zero by 2050. Low-carbon procurement is increasingly recognized as a powerful lever to move markets and attract capital, but a variety of economic, structural, and policy barriers can prevent demand-side commitments from translating into supply-side investment and action.

Participants in this Dialogue focused on innovative procurement models that provide off-take assurance for low-carbon cement, steel, aluminum, and other industrial goods.

Key Themes from Procurement Dialogue

1. **Turning Federal Procurement into a Bankable Demand Signal.** Allowing large federal buyers to directly procure low-carbon commodities and make direct offtake commitments to projects can unlock private investment at scale.
2. **Improving Transparency of Federal Procurement.** Potentially standing up a public portal that tracks and forecasts government procurement of key low-carbon industrial materials can improve credibility of the demand signal for investors.
3. **Streamlining Procurement Processes.** Standard procurement agreements and template contracting models can facilitate supply-demand partnerships and lower barriers to entry for smaller enterprises.

DEPLOY23

Virtual Power Plants

VPPs are at an inflection point. Peak demand is growing for the first time in a decade, and this demand is more flexible than ever thanks to growth in electric vehicles, connected appliances, and other behind-the-meter distributed energy resources (DERs). To move beyond pilots and rapidly scale VPPs, we need repeatable approaches that work across jurisdictions. The innovation across the VPP industry has introduced complexity such as different specifications and preferences across regulatory frameworks, device manufacturers, VPP vendors, and utilities. This comes at the expense of repeatable models that can scale up rapidly.

Participants (including DER manufacturers and retailers, VPP operators, utilities, regulators, and consumer advocates) in this Dialogue focused on increasing standardization in VPP operations to support VPP liftoff.

Key Themes from VPP Dialogue

VPP projects will scale faster when a broader range of services (from the same aggregation of DERs) is recognized and procured by utilities and regional grid operators, and the benefits of the VPP are fairly compensated. Key needs highlighted by participants included:

1. **Adapting utility and regulatory processes to accommodate VPPs:** VPPs are most often compensated for energy and/or capacity, but the benefits of VPPs in terms of grid resilience, capital efficiency, distribution system cost deferral, and other factors are often discounted, leading to sub-optimal grid investment decisions. Although the technology for the reliable delivery of these grid services has been demonstrated, the institutional processes of utilities and their regulators – including cost-benefit analyses involved in grid planning and utility compensation schemes– need to adapt in order for VPPs to be chosen over traditional load management strategies.
2. **Developing uniform data protocols:** The lack of uniform data protocols (e.g., interoperability of systems, privacy standards) adds friction to project planning, execution, and performance measurement.

In response to the Dialogue prompt to identify ways that increased standardization in VPP operations could expedite the design and implementation of individual projects, participants highlighted a combination of utility and market regulations, and industry-wide data policies:

1. **Regulations:** Participants advocated for market-wide adoption of a comprehensive cost-benefit assessment that would quantify the full range of VPP benefits to inform inclusive market regulations (e.g., performance-based ratemaking for distribution utilities, favorable FERC Order 2222 implementation).
2. **Data policies:** Participants advocated for common customer energy data architectures, data sharing policies (e.g., HIPAA in healthcare), and customer enrollment protocols.

The final part of the Dialogue discussion focused on ways that DOE can further support the deployment of VPPs in six issue areas. Specific issues raised by participants for DOE's consideration included:

- Increasing education and awareness of the value of grid services and VPPs, in particular with public utility commissions (PUCs).
- Improving communication from DOE on available and expected funding for DERs that would inform both electricity demand forecasts and growth in the flexible capacity of DERs.
- Relatedly, improving resource adequacy modeling to better understand needs.
- Describing potential methods for cost-benefit assessments for VPPs and traditional assets that take into account a broader range of value (e.g., distribution system cost/deferrals, resilience).
- Focusing on state and federal coordination.
- Describing the potential standards for customer information sharing to prevent utilities from creating obstacles to VPPs qualifying, enrolling, and settling DER-owners/VPP participants.
- Providing (more) technical assistance to PUCs and utilities.
- The Loan Programs Office (LPO) could provide utilities with financing under existing authorities for potential grid investments needed to support VPPs.