Office of Clean Energy Demonstrations

THE OFFICE OF

CLEAN ENERGY DEMONSTRATIONS

FY25 OCED Analysis National Laboratory Call Information Session Part 1

April 23, 2024

Day 1 Schedule

Time (ET)	Topic	Schedule
12:30 – 1:00 PM	Day 1 Intro	-Agenda for day -Goals of Lab Call -Overview of Lab Call schedule and criteria -Intro to project focused topic areas
1:00 – 1:50 PM	Topic 1: Techno-Economic Analysis Standards and Tools	-Topic overview (15 mins) -Q&A (35 mins)
1:50 – 2:00 PM	BREAK	
2:00 – 2:55 PM	Topic 2: OCED Support for Quantifying and Verifying Life Cycle Environmental Impacts	-Topic overview (20 mins) -Q&A (35 mins)
2:55-3:10 PM	BREAK	
3:10 – 3:50 PM	Topic 3: Quantification of Socioeconomic Impacts	-Topic overview (15 mins) -Q&A (25 mins)
3:50 – 4:20 PM	Topic 4: Resilience and Security Analysis	-Topic overview (15 mins) -Q&A (15 mins)
4:20 – 4:30 PM	BREAK	
4:30 – 5:00 PM	Topic 5: Technical Support for Clean Energy Projects	-Topic overview (15 mins) -Q&A (15 mins)
5:00 – 5:15 PM	Day 1 wrap-up	
5:30 – 6:30 PM	No Host Happy Hour optional	The Brighton at the Wharf

Welcome to OCED's Analysis Laboratory Call!

- Opening remarks
- Overview of OCED mission and mandate
- Organization structure and topic area leads
- Where we are in our journey
- Overview of OCED's portfolio
- What we hope to get out of today's call

OCED Mission

Deliver clean energy technology **demonstration projects at scale** in partnership with the **private sector** to **accelerate deployment**, **market adoption**, and the **equitable transition** to a decarbonized energy system.”

OCED mandate

SCALE EQUITABLE, CLEAN ENERGY

Help enable 100% clean electricity by 2035 & net -zero emissions by 2050 through an equitable energy transition

UNLOCK NEW INVESTMENT

Unlock and scale trillion-dollar clean energy follow on investment from the private sector and other sources of capital

DE-RISK TECHNOLOGY

Maintain risk-based, balanced, and defensible portfolio of investments

PROVIDE PROJECT OVERSIGHT

Serve as primary DOE office to deliver full scale clean energy demonstration projects and project management oversight excellence

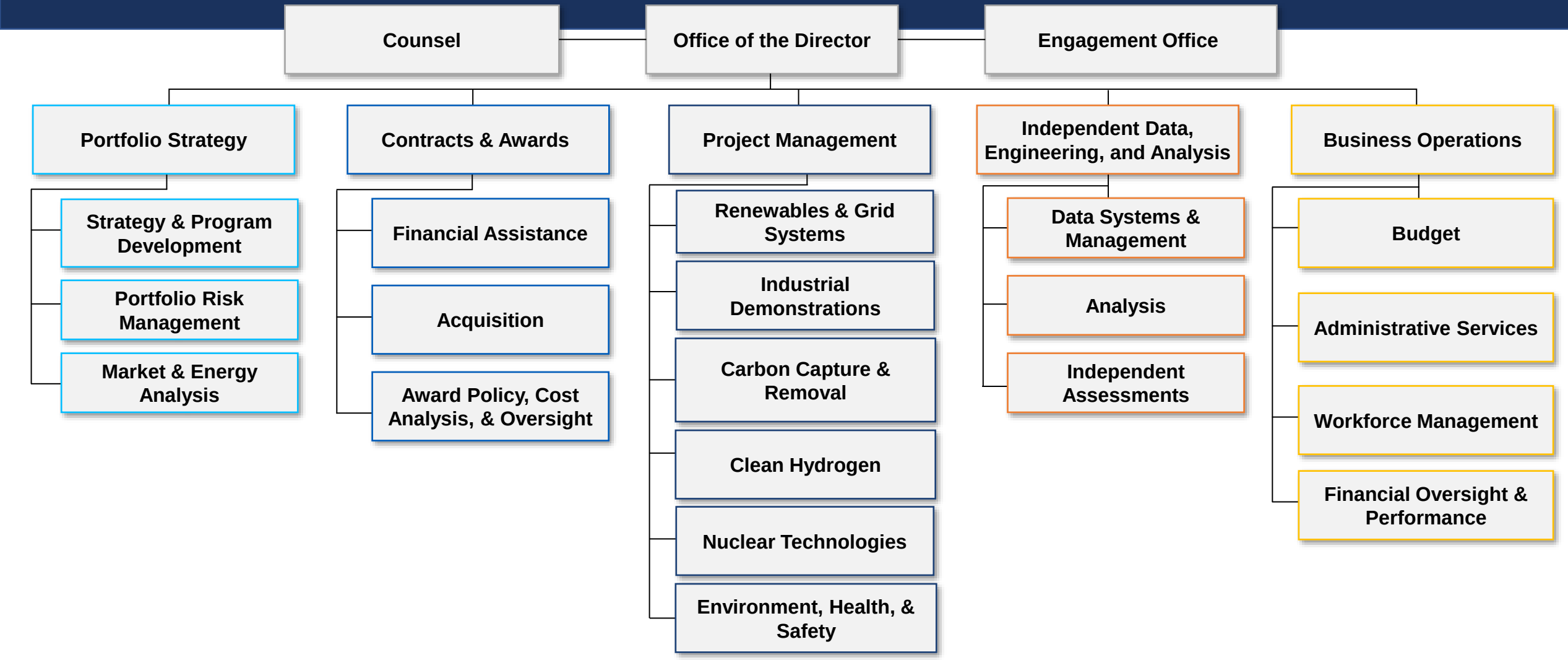
ENGAGE & COLLABORATE

Leverage private sector and broader energy ecosystem to inform OCED and DOE technology commercialization efforts

Leveraging National Laboratories to accomplish OCED's mission

- Demonstrating success of FOAK projects and sharing insights to the market can drive commercialization of critical clean energy technologies
- National Laboratories can play a key role in supporting these projects and analysis activities
- OCED will leverage Laboratories expertise, infrastructure, modeling and analysis capabilities, and convening power to overcome challenges to deployment and commercialization
- Topics within this analysis-themed Lab Call require core skills of national labs to enhance project outcomes, understand portfolio opportunities and risks, conduct strategic analysis, and amplify benefits of OCED projects

OCED programs advance demonstration goals



Develops multi-year program plans and monitors demonstration projects at the portfolio level	Solicits, reviews, selects, and negotiates awards; closes out financial assistance agreements	Provides world-class project management oversight for demonstration projects	Conducts expeditious and consistent technical evaluations to support OCED activities	Provides management support (budget, workforce, IT, and administrative services)

OCED Laboratory Call leads and contact information

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Where we are in OCED's journey

- Phased approach to project management for a majority of the portfolio (using Cooperative Agreements)
- Majority of the FOAK pilot and commercial scale projects are in negotiations
- As projects come under award and begin journey through Go/No-Gos (GNGs), OCED will need rigorous analysis and subject matter expertise to support projects and decision-making
- Similarly, OCED will leverage portfolio analysis & risk management tools to inform decisions and new programs
- Note, OCED is using Other Transaction (OT) Authority, Partnership Intermediary Agreements, and Prizes for:
  - H2 demand-side program (still in negotiations)
  - Liftoff Enabling Programs (with OTT and other offices) with labs, industry, and communities

OCED scope

Advanced Reactor Demonstrations ($2.5 billion)

Carbon Management ($7 billion)

Clean Energy Demonstrations on Mine Land ($500 million)

Distributed Energy Systems Demonstrations ($50 million)

Energy Improvements in Rural or Remote Areas ($1 billion)

Industrial Demonstrations ($6.3 billion)

Long-Duration Energy Storage Demonstrations ($505 million)

Regional Clean Hydrogen Hubs ($8 billion)

Liftoff Enabling Programs ($133 million)

Regional Clean Hydrogen Hubs ($8B)

Build 6-10 regional clean H2Hubs across the country to create networks of clean hydrogen producers, consumers, and local connective infrastructure to accelerate use of clean hydrogen.

- Feedstock diversity
- End use diversity
- Geographic diversity
- Employment and training

Current Status

- Selected 7 regional H2 hubs at $7B of federal funding
- Standing up demand-side initiative to close gaps in offtake and support market liftoff

Carbon Management

Three programs, $7B

Carbon Capture Demonstration Projects:

Develop six at scale carbon capture facilities from gas, coal and industrials

- 2 FOAs issued: FEEDS and Demos
- 6 FEEDS under award of 8 selected
- 3 Demos selected, 2 Nat Gas 1 Coal

Carbon Capture Large-Scale Pilot Projects:

Establish and test innovative carbon capture pilot projects to support new processes and technology at scale

- 4 projects selected

Regional Direct Air Capture Hubs:

Develop four regional direct air capture hubs to capture and sequester, utilize, or sequester and utilize at least 1,000,000 metric tons of CO_2 annually

- 2 DAC Hubs selected (Topic 3)
- 1 under award

- Additional carbon management projects in Industrial Demonstration Program and Hydrogen Hubs
- ~$2B in funding for more demonstration FOAs

Industrial Demonstrations ($6.3B)

Demonstrate transformational technologies to decarbonize energy-intensive industries

- Drive a U.S. competitive edge in low- and net-zero carbon manufacturing
- Help build a market for green products through high-impact, replicable solutions

Current Status

- Selected 33 projects across more than 20 states for award negotiations
- Portfolio includes projects across iron & steel, cement, aluminum, chemicals, refining, food and beverage, glass and pulp and paper

Advanced Reactor Demonstrations

Support domestic nuclear industry in design, licensing, construction, and operation of two advanced nuclear reactors

Current Status

- November 2022: Awarded $2.5B in funding through the Bipartisan Infrastructure Law

TerraPower Natrium Reactor

- November 2021: Selected Kemmerer, WY as preferred site

X-energy Xe-100

- Partnering with Dow Chemical Company
- May 2023: Selected Seadrift, TX as preferred site

Long-Duration Energy Storage Demonstrations

Three programs

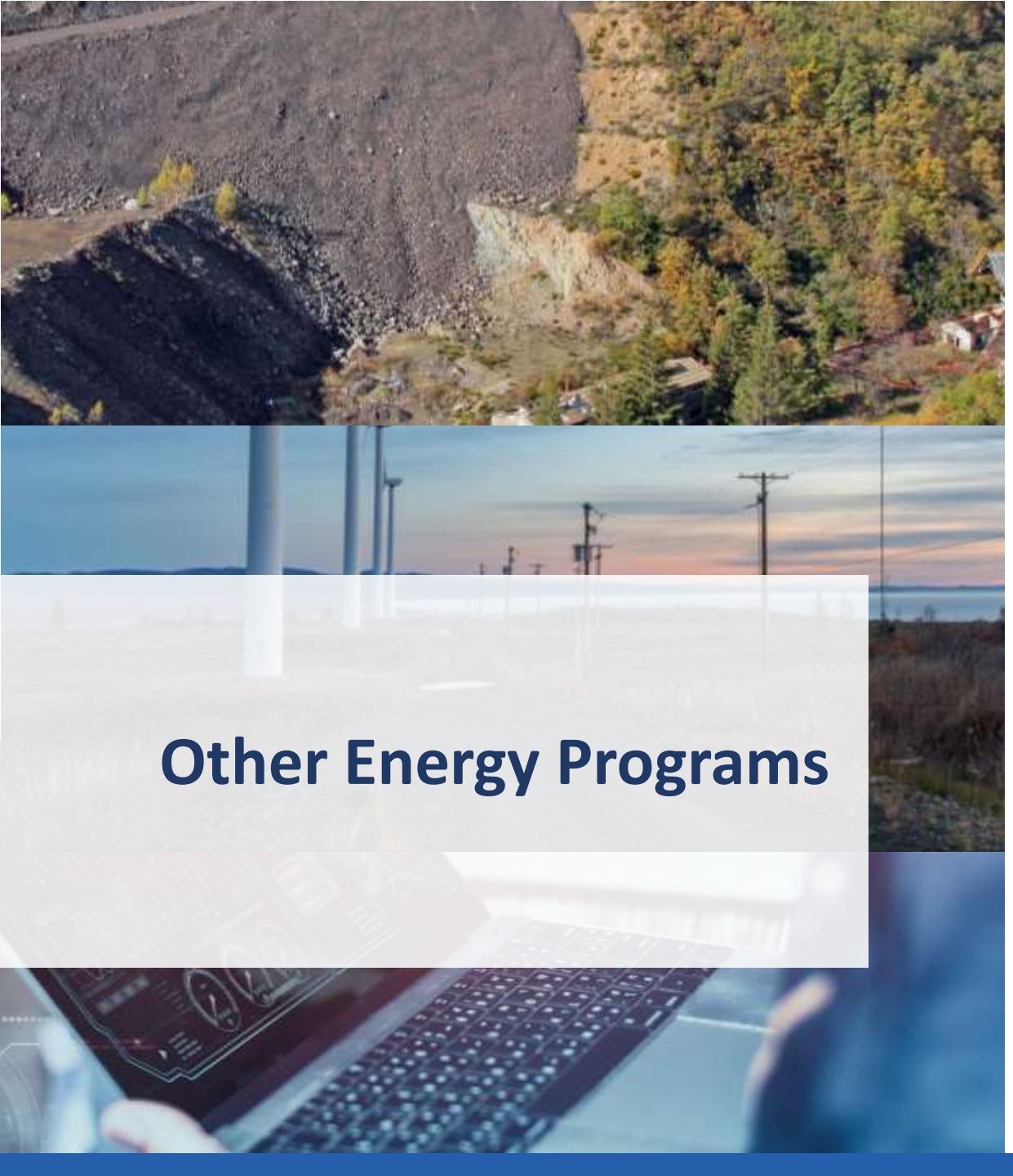
($500M)

Long-Duration Energy Storage (LDES) Demonstrations: Develop energy storage technology to supply energy at peak periods of demand, improve energy efficiency, reduce peak load, provide ancillary services, and increase microgrid feasibility.

- 15 Projects selected
  - 6 projects from LDES lab call

DOE/DOD Long-Duration Energy Storage Joint Program: Collaboration between DOE and Department of Defense (DOD) for long-duration demonstrations on government facilities.

Long-Duration Energy Storage Pilot Grant Program: Bring the range of benefits provided by storage to targeted recipients including states, tribes, and utilities.



Other Energy Programs

Clean Energy Demonstrations on Mine Land ($500M):

Show technical and economic feasibility for clean energy projects on current and former mine land

- 5 projects selected

Energy Improvements in Rural or Remote Areas ($1B):

Improve resilience, safety, reliability, and availability of energy in rural or remote areas and increase environmental protection from adverse impacts of energy use

- 17 projects selected for funding awards across 20 states and 30 tribal communities
- 67 selected Energizing Rural Communities Prize winners

Distributed Energy Systems Demonstrations ($50M):

Develop reliable, resilient and cost-effective energy

- Currently undergoing reviews.

Recall: Lab call schedule

Activities	Targeted week *(week of)*
Release Lab Call	March 29, 2024
Feedback sessions (Hybrid)	April 23, 2024
Concept papers + slide decks due	June 10, 2024
Formal feedback sessions	July 15, 2024
Revised CPs, teaming and budget	August 23, 2024
Initial funding decisions	September 6, 2024

Recall: Analysis lab call includes direct support to projects and support to contextualize and direct portfolio development across 9 topic areas

Topics	Anticipated # of awards	FY25	FY26	FY27	
1. OCED Techno-Economic Analysis (TEA) Standards and Tools	1-4	$4M-$8M	$4M-$8M	$4M-$8M	*Project support*
2. OCED Support for Quantifying and Verifying Life Cycle Environmental Impacts	4-7	$5M-$9M	$5M-$9M	$5M-$9M	
3. Quantification of Socioeconomic Impacts	1-4	$1-$1.5M	$1-$1.5M	$1-$1.5M	
4. Resilience & Security Analysis	1-3	$1M	$1M-$2M	$1M-$2M	
5. Technical Support for Clean Energy Projects	1-2	$2M	$2M	$2M	
6. Assessment and mapping of current and future hydrogen and carbon-related infrastructure	1	$2M-$4M	$2M-$4M	$2M-$4M	*Portfolio support*
7. Alternative fuels and energy carriers in context for the U.S.	1	$500k-$1M	$500k-$1M		
8. Clean hydrogen “State of the Market” reporting and economic scenario modeling	1	$1M-$2M	$1M-$2M	$1M-$2M	
9. Energy markets and grid mid-term regional outlook (3-10 years)	1	$500k-$1M	$500k-$1M	$500k-$1M	
Total	15-22	$17-$29.5M	$17-$30.5M	$17.5-$29.5M	

Goals for today

- Get formative input from National Labs on gaps/direction of Lab Call
- Clarify OCED's goals and desired outcomes
- Discuss how labs should proceed in structuring concept papers
- Discuss lab teaming and partnerships
- Next steps in the lab call process

Questions?

Topic 1 includes direct support to projects and analysis for OCED TEA priorities

Topics	Anticipated # of awards	FY25	FY26	FY27
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Total	15-22	$17-$29.5M	$17-$30.5M	$17.5-$29.5M

Project support

Portfolio support

Topic 1 Goals

- Identify and refine standards for TEA for evaluating commercial deployments to be leveraged by OCED projects
- Provide project level support for conducting and reviewing TEAs across OCED's portfolio using best practices
- Identify gaps in existing tools and methodologies and develop solutions catered to OCED's portfolio for addressing them
  - Tooling to be developed – as necessary -- should be user-friendly, quick, and facilitate key sensitivity and scenario analysis
- Collect, store and manage data supporting the goals outlined above

Topic 1: OCED Techno-Economic Analysis (TEA) Standards and Tools

Anticipated awards: 1-4

FY25-27 budget: $4M-$8M/yr

Overview:

- Focuses on technology areas with greater uncertainty within OCED's portfolio: H2, carbon management and industrial
- Solicits recommendations for refining TEA standards
- Proposals for developing new and enhancing existing tools
- Encourages proposals to address competing goals of consistency & specialization

Subtopics	Description
1.1: TEA for Regional Clean H2Hubs	• Identifying techniques and measurements to evaluate financial performance for commercial projects • Development and enhancement of user-friendly TEA tools aligned to selected projects • Recommendations for identification and analysis of project data from awarded projects • Collection, storage and handling of project data • Project-level TEA support as needed
1.2: TEA for OCED's carbon management provisions	
1.3: TEA for Industrial Demonstration Projects	
1.4 TEA for LDES, renewables & nuclear	

Topic 1: TEA Standards and Tools

Area of interest 1.1: TEA for Clean Hydrogen Technologies

- Technologies: Hydrogen production, processing, transport, storage and end-use
- Relevant OCED Provisions: Regional H2Hubs, Industrial Demonstration Program

Area of interest 1.2: TEA for Carbon Management Technologies

- Technologies: Direct air capture (DAC) and point source carbon capture
- Relevant OCED Provisions: DAC Hubs, Carbon Capture Large Scale Pilots, Carbon Capture Demonstrations, Industrial Demonstrations Program, H2Hubs

Area of interest 1.3: TEA for Industrial Demonstrations Technologies

- Technologies: carbon capture, electrification of industrial processes, biofuels, and more
- Industries: cement manufacturing, aluminum, iron and steel, glass, pulp and paper, and chemicals and refining
- Relevant OCED Provisions: Industrial Demonstration Program

Area of interest 1.4: TEA for Long Duration Energy Storage (LDES), Renewables, and Nuclear Energy

- Technologies: solar, wind, hydroelectricity, LDES, and nuclear
- Relevant OCED provisions: Clean Energy on Current and Former Mine Lands, H2 Hubs, LDES, Industrial Demonstrations Program, Energy Improvements in Rural and Remote Areas, Distributed Energy Systems

Topic 1: TEA Standards and Tools (cont.)

Potential Lab Activities:

- Project level TEA support
- Identification or development of TEA standards for evaluating performance of specific technologies
- Scenario and sensitivity analyses that assess economic impacts of different market scenarios
- Development of uncertainty quantification methodologies to inform confidence determination and interpretation of TEA estimates

Guidance:

- OCED intends to integrate the strongest responses across Topic 1 into a single, collaborative TEA topic area award to ensure consistency of performance
- For Topic 1, expectation is OCED's focus will roughly align to dollar size of technology provision being supported. I.e., hydrogen, carbon management and industrial spaces likely largest analysis areas
- Teams should demonstrate expertise in specific decarbonization technologies and/or industries
- Proposed methodologies should specify any tools and software to be used in the analysis
- Any new proposed tooling should not duplicate existing resources. Tools should be easy-to-use, open source to help advance broader commercial adoption of modeled technologies

Estimated Budget: $4M – $8M

Estimated Number of Awards: 1-4

Expected Project Duration: 3 years

Discussion

Topic 2 includes direct support for assessing project and program level life cycle environmental impacts

Topics	Anticipated # of awards	FY25	FY26	FY27
1. OCED Techno-Economic Analysis (TEA) Standards and Tools	1-4	$4M-$8M	$4M-$8M	$4M-$8M
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9. Energy markets and grid mid-term regional outlook (3-10 years)	1	$500k-$1M	$500k-$1M	$500k-$1M
Total	15-22	$17-$29.5M	$17-$30.5M	$17.5-$29.5M

Project support

Portfolio support

Life Cycle Assessment- the compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

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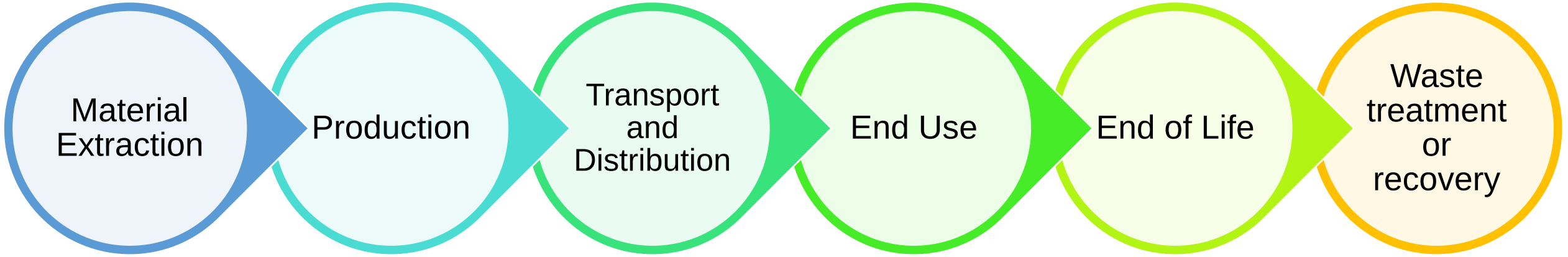

Assessing the full life cycle environmental impacts of OCED-funded projects serves key demonstration purposes

1. Supports OCED's mission and Justice40 directives
2. Influences project financial viability because of tax incentives
3. Helps de-risk these technologies and addresses community concerns

Topic 2 Goals

- Quantify GHG emissions, water use, and air pollution impacts of OCED programs and projects
- Provide project level support for conducting and reviewing LCAs across OCED's portfolio using best practices
- Identify gaps in existing tools and methodologies and develop solutions catered to OCED's portfolio for addressing them
- Collect, store and manage data supporting the goals outlined above

Topic 2: OCED Support for Quantifying and Verifying Life Cycle Environmental Impacts

Anticipated awards: 4-6

FY25-27 budget: $5M-$9M/yr

Overview:

- Quantifying key life cycle environmental impacts of OCED programs including GHG emissions, water and air quality impacts
- Building OCED's analytical capabilities and filling gaps in assessment of project and program-level impacts
- Includes collection, storage, and management of data

Subtopics	Description
2.1: LCA Support for Decarbonization Technologies	• Project-level LCA support for major technology areas in OCED's portfolio
2.2: Emissions Monitoring, Reporting, and Verification	• Emissions data analysis for verification of LCA against real performance and model assumptions for project-level LCAs
2.3: Water Impacts of Awarded Projects	• Technical support for assessing water use and water quality impacts
2.4: Air Quality Impacts of OCED Programs	• Evaluation of air quality impacts through atmospheric chemistry modeling

Subtopic 2.1: LCA Support for Decarbonization Technologies

Area of interest 2.1.1: LCA for Carbon Management Technologies

- Technologies: Direct air capture (DAC) and point source carbon capture
- Relevant OCED Provisions: DAC Hubs, Carbon Capture Large Scale Pilots, Carbon Capture Demonstrations, Industrial Demonstrations Program, H2Hubs

Area of interest 2.1.2: LCA for Industrial Demonstrations Technologies

- Technologies: carbon capture, electrification of industrial processes, biofuels, and more
- Industries: cement manufacturing, aluminum, iron and steel, glass, pulp and paper, and chemicals and refining
- Relevant OCED Provisions: Industrial Demonstration Program

Area of interest 2.1.3: LCA for Clean Hydrogen Technologies

- Technologies: Hydrogen production, processing, transport, and end-use
- Relevant Provisions: Regional H2Hubs, Industrial Demonstration Program

Area of interest 2.1.4: LCA for Long Duration Energy Storage (LDES), Renewables, and Nuclear Energy

- Technologies: solar, wind, hydroelectricity, LDES, and nuclear
- Relevant OCED provisions: Clean Energy on Current and Former Mine Lands, H2 Hubs, LDES, Industrial Demonstrations Program, Energy Improvements in Rural and Remote Areas, Distributed Energy Systems

Subtopic 2.1: LCA Support for Decarbonization Technologies

Potential Lab Activities:

- Project level LCA support
- Identification or development of LCA best practices for specific technologies
- Scenario and sensitivity analyses that assess emissions impacts of different market scenarios
- Development of uncertainty quantification methodologies to inform confidence determination and interpretation of emissions estimate

Guidance:

- OCED intends to integrate the strongest responses across subtopic 2.1 into a single, collaborative LCA topic area award to ensure consistency of performance.
- Teams should demonstrate expertise in specific decarbonization technologies and/or industries
- We encourage proposals that explore the comprehensive life cycle emissions impacts associated with federal tax incentives including 40B, 45V, 45Q, and 45Z
- Proposed methodologies should specify any LCA related tools and software (e.g., GREET, OpenLCA, etc.) to be used in the analysis
- Concept papers should include how applicants will utilize and contribute to the Federal LCA commons

Estimated Budget: $3.25M – $5.5M

Estimated Number of Awards: 1

Expected Project Duration: 3 years

Subtopic 2.2: Emissions Monitoring, Reporting, and Verification

Potential Lab Activities:

- Analysis of large volumes of emissions data such as those from continuous emissions monitoring systems in industrial settings.
- Review of project-level approaches to emissions monitoring, reporting, and verification to ensure transparency and alignment with program level emissions goals.
- Validation of modeled emissions estimates against real world data using robust statistical analysis.
- Guidance and recommendations for integrating real-world emissions data into modeling frameworks to better refine project-level life cycle emissions estimates.

- **Guidance**:
- Concept papers should describe the expected approach to data processing and analysis, and identify key performance metrics to be used in assessments
- We welcome proposals that will use standard emissions monitoring data to conduct novel and creative analyses

Estimated Budget: $500K - $1M
Estimated Number of Awards: 1
Expected Project Duration: 3 years

Subtopic 2.3: Water Impacts of Awarded Projects

Potential Lab Activities:

- Development and enhancement of analysis tools to characterize water impacts.
- Technical support for assessing water use and water quality impacts (i.e., freshwater eutrophication, freshwater acidification, human toxicity, and ecotoxicity) on a project-by-project basis.
- Targeted assessments of opportunities to improve water quality, reduce water stress, and/or improve efficiency of water use.
- Identification and assessment of key gaps and uncertainties in existing LCA tools (e.g., GREET, OpenLCA) used to assess water impacts.

Guidance:

- Concept papers should detail the expected approach to data analysis and identify key performance metrics to be used in the assessment. Potential deliverables include a high-level report with data analysis and discussion and curated datasets for use in future OCED analysis.

Estimated Budget: $500K - $1M/yr
Estimated Number of Awards: 1
Expected Project Duration: 3 years

Discussion

Subtopic 2.4: Air Quality Impacts of OCED Programs

Potential Lab Activities:

- Identification and assessment of key gaps and uncertainties in existing LCA tools (e.g., GREET, OpenLCA) used to estimate air pollutant emissions.
- Quantification of local- to regional-scale air quality impacts of market adoption of clean energy technologies in OCED's portfolio compared to business-as-usual emissions scenarios using atmospheric chemistry modeling.
- Comparison of air quality tools (e.g., CMAQ, WRF-Chem, dispersion models, etc.) and workstreams to develop targeted methodologies for assessing net air quality impacts of OCED's programs.
- Identification of emerging air pollutants associated with novel technologies (e.g., carbon capture, hydrogen production, etc.) and assessment of the corresponding environmental impacts.

Guidance:

- Concept papers that include atmospheric chemistry modeling should identify and justify the specific models to be used.
- We encourage proposals that will contextualize model results by analyzing of the social cost of air pollution impacts.

Estimated Budget: $750K - $1.5M
Estimated Number of Awards: 1-2
Expected Project Duration: 3 years

Topic 3: Direct support to projects and analysis for OCED community benefits priorities

Topics	Anticipated # of awards	FY25	FY26	FY27
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Total	15-22	$17-$29.5M	$17-$30.5M	$17.5-$29.5M

Project support

Portfolio support

Topic 3: OCED Quantification of Socioeconomic Impacts

Anticipated awards: 1-4

FY25-27 budget: $1M-$1.5M/yr

Overview:

- Quantifying key metrics (in support of GNG decisions) to evaluate recipient progress toward Justice40 goals
- Augmenting OCED's analytical capabilities and developing tools for project and program-level socioeconomic impact assessment

Areas of Interest	Description
3.1: Analysis and quantification of economic impacts	• Support to assess, quantify, and/or validate the economic impacts flowing to identified communities of interest
3.2: Analysis and quantification of human health impacts	• Support to assess, quantify, and/or validate human health impacts of awarded projects in communities of interest • Utilizes data from LCA analysis; considers impacts in the context of historic cumulative burdens
3.3: Development of social risk evaluation framework	• Development of a social risk framework to support project readiness evaluation across multiple provisions • Considers potential social and cultural risks within both communities of interest and community at large
3.4: Impact evaluation and tool, model, or dashboard development	• Perform Impact Evaluation to quantify the outcome of funded projects (e.g., job training programs, job pipeline development programs, program adoption rates, etc.) • Dashboard/tool development to present summarized analyses or data visualization across projects/portfolio

Topic 3 Goals

OCED seeks lab expertise to support community benefits analysis and to develop tools used in project and program evaluation.

- Analyze and quantify impacts, particularly to communities of interest.
  - Economic Impacts
  - Human Health Impacts
  - Program Impact Evaluation

- Impact Evaluation dashboard, tool, or model to enhance interpretation and visualization of results.

- Develop a Social Risk Evaluation framework to support project evaluation.

Topic 3 Goals

**CBPs are considered alongside assessments of engineering, procurement, and construction; business development and management; permitting and safety; and technical data and analysis.*

Negotiations Conducted

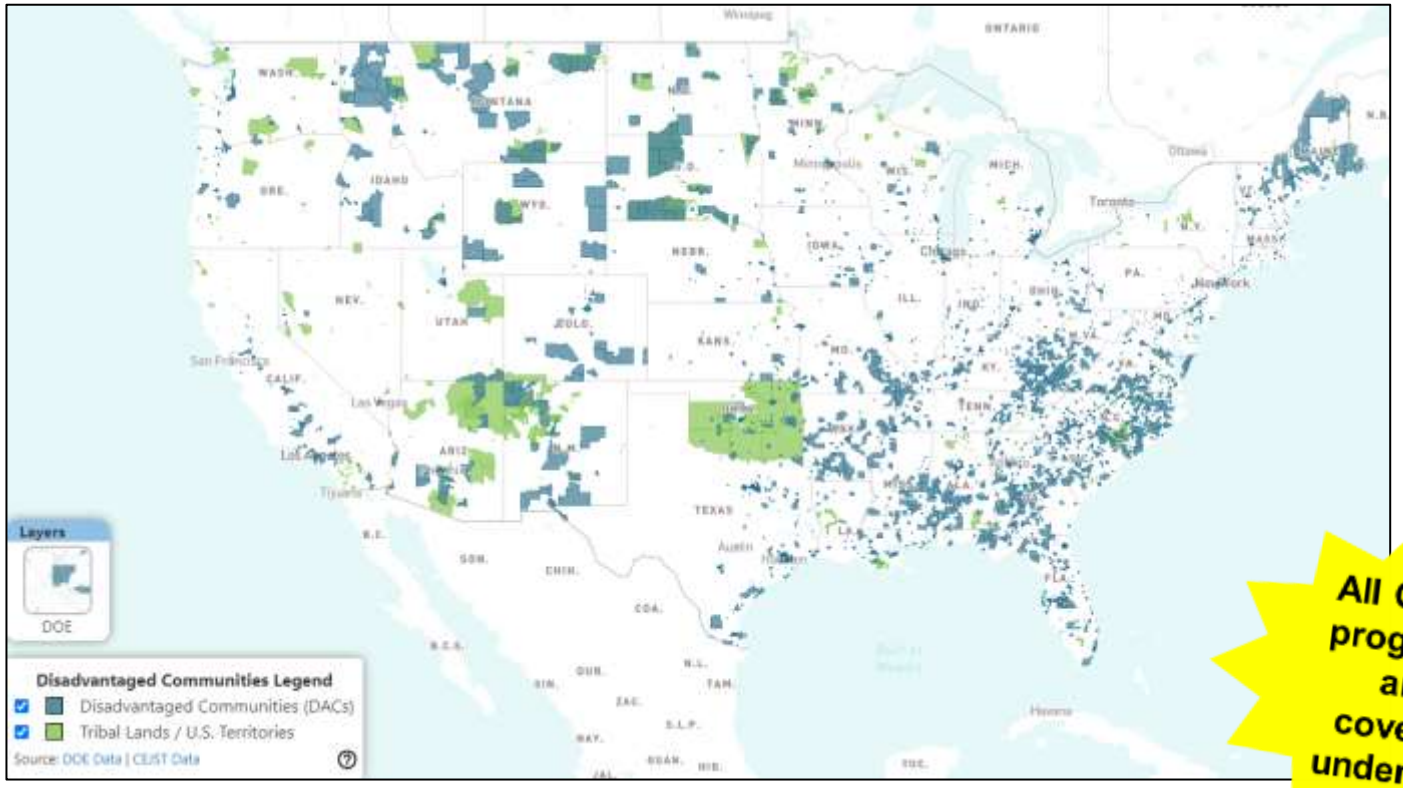
Go/No-Go Decisions

Topic 3 Guidance

Justice40

COVERED FEDERAL INVESTMENTS → **40% OF THE OVERALL BENEFITS** → **DISADVANTAGED COMMUNITIES (DACs)**

- Community & Labor Engagement
- Diversity, Equity, Inclusion, & Accessibility
- Investing in the American Workforce
- Justice40 Initiative



DOE DAC Reporter https://www.energy.gov/justice/tools

All OCED programs are covered under J40

Topic 3 Guidance

JUSTICE 40 POLICY PRIORITIES

- Decrease energy burden in disadvantaged communities (DACs)
- Decrease environmental exposure and burdens for DACs
- Increase parity in clean energy technology access and adoption in DACs
- Increase access to low-cost capital in DACs
- Increase clean energy enterprise creation and contracting in DACs
- Increase clean energy jobs, job pipeline, and job training for individuals from DACs
- Increase energy resiliency in DACs
- Increase energy democracy in DACs

Policy Priority	Example Benefit	Example Metric
Decrease energy burden	Reduction in energy costs due to intervention/technology	Annual energy expenditures at household and/or community level, before/after intervention
Decrease environmental exposure and burdens	Reduction in local GHG emissions, reduction of point sources, reduced cumulative burden	Measurement of pollutant loading before and after intervention, examined in local context

Discussion

Topic 4 includes direct support to projects and analysis for OCED security priorities

Topics	Anticipated # of awards	FY25	FY26	FY27
1. OCED Techno-Economic Analysis (TEA) Standards and Tools	1-4	$4M-$8M	$4M-$8M	$4M-$8M
2. OCED Support for Quantifying and Verifying Life Cycle Environmental Impacts	4-7	$5M-$9M	$5M-$9M	$5M-$9M
3. Quantification of Socioeconomic Impacts	1-4	$1-$1.5M	$1-$1.5M	$1-$1.5M
4. Resilience & Security Analysis	1-3	$1M	$1M-$2M	$1M-$2M
5. Technical Support for Clean Energy Projects	1-2	$2M	$2M	$2M
6. Assessment and mapping of current and future hydrogen and carbon-related infrastructure	1	$2M-$4M	$2M-$4M	$2M-$4M
7. Alternative fuels and energy carriers in context for the U.S.	1	$500k-$1M	$500k-$1M	
8. Clean hydrogen “State of the Market” reporting and economic scenario modeling	1	$1M-$2M	$1M-$2M	$1M-$2M
9. Energy markets and grid mid-term regional outlook (3-10 years)	1	$500k-$1M	$500k-$1M	$500k-$1M
Total	15-22	$17-$29.5M	$17-$30.5M	$17.5-$29.5M

Project support

Portfolio support

Critical Infrastructure Resilience and Security

"Systems and assets, so vital to the U.S. that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters." - NIST

[Presidential Policy Directive 21]

- "Policy of the United States to strengthen the security and resilience of its critical infrastructure against both physical and cyber threats."
    - "Identifies the Energy Sector as uniquely critical because it provides an "enabling function" **across all critical infrastructure sectors.**"

Topic 4 Goals

- OCED projects will have resilience and security priorities specific to both awardee interests and DOE requirements.
- Developing FOAK technologies will include a suite of potential threats including internal and external bad actors, negligence and accidental events, and other critical infrastructure vulnerabilities.
- Physical and cyber risk profiles and mitigation techniques will frequently be cross-functional with complex interrelated impacts.
- Resilience factors include identifying potential foreign impact risks, effects from natural hazards, and integration impacts between new technologies and established grid systems.
- **OCED seeks lab expertise to analyze a suite of security threats and resilience impacts, specifically in the context of protecting industry and DOE interests in demonstration technologies.**

Topic 4: OCED Resilience & Security Analysis

Anticipated awards: 1-3

FY25-27 budget: $1M-$2M/yr

Overview:

- Research and advise on cyber and physical security of critical infrastructure;
- Recommend detection, evaluation, identification, assessment, response and mitigation techniques protecting critical energy infrastructure
- Provide expertise on infrastructure resilience and foreign influence

Areas of Interest	Description
4.1: Physical and cyber-security of critical infrastructure	• Project-level support to assess, advise and provide reports and findings on the physical and cyber-security of critical infrastructure across project plan, build, and operate phases.
4.2: Critical infrastructure, intellectual property, or economic security related information protection and scenario analyses, to include foreign influence vetting	• Support expertise on protections for critical infrastructure, intellectual property, and economic security. Proposals should include methodologies and systems for technology-specific information protection, scenario-based testing and analysis of potential impacts and mitigations, and proactive vetting procedures for high-impact risks as appropriate.
4.3: Assess and evaluate critical infrastructure resilience impacts originating from a variety of sources	• Provide expertise in infrastructure resilience and potential impacts from multiple exposure factors. Impact sources may include foreign influence, changing technology and project elements, and natural hazards.

AOI 4.1: Physical and Cyber Security

Focus: Assess, advise, and provide reports and findings on the physical and cyber-security of critical infrastructure across project plan, build, and operate phases.

Guidance: Proposals should walk through how they will identify, analyze, and mitigate threats and opportunities in the cyber-physical environment.

- OCED seeks expertise not only in physical and cyber threats, but also specific experience in analyzing cyber mitigations for specific physical infrastructure.

- Proposal should demonstrate systems engineering expertise in security to highlight potential fail points in critical infrastructure.

- Support should be prepared to analyze specific systems, test failure scenarios, and propose mitigation techniques.

AOI 4.2: Protections and Scenario Analysis

Focus: Support expertise on protections for critical infrastructure, intellectual property, and economic security. Provide methodologies and systems for technology-specific information protection, scenario-based testing and analysis of potential impacts and mitigations. Include proactive vetting procedures for high-impact risks as necessary.

Guidance: Proposals should include techniques for systemic review of potential foreign influence, intellectual property threats, and critical infrastructure risks.

- OCED seeks expertise in private sector, commercial security interests and alignment with DOE resilience goals.

- Proposals should demonstrate knowledge of intellectual property protections and common threats. Proposals should also provide specific methods for proactive scenario testing.

- Support should include appropriate methodologies to review foreign influence vectors, provide effective vetting platforms, and recommend balanced mitigation approaches.

AOI 4.3: Critical Infrastructure Resilience

Focus: Provide expertise in infrastructure resilience and potential impacts from multiple exposure factors. Impact sources may include foreign influence, changing technology and project elements, and natural hazards.

Guidance: Proposals should include methods to detect, evaluate, identify, and assess both potential impacts and resilience techniques.

- OCED seeks expertise in analyzing projects to identify impacts that could disrupt a critical infrastructure project. This may include security threats, but should also include impacts from foreign influence, negligence, accidents, climate change, natural hazards, or other factors.

- Proposals should demonstrate knowledge of critical infrastructure resilience, common threat vectors, and commercial-level mitigation techniques.

- Support should include evaluation, detection, assessment, and response tools specific to energy industries and critical infrastructure.

Discussion

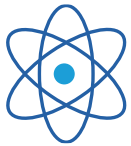
Topic 5 includes direct support to projects and analysis for OCED Technical Support

Topics	Anticipated # of awards	FY25	FY26	FY27
1. OCED Techno-Economic Analysis (TEA) Standards and Tools	1-4	$4M-$8M	$4M-$8M	$4M-$8M
2. OCED Support for Quantifying and Verifying Life Cycle Environmental Impacts	4-7	$5M-$9M	$5M-$9M	$5M-$9M
3. Quantification of Socioeconomic Impacts	1-4	$1-$1.5M	$1-$1.5M	$1-$1.5M
4. Resilience & Security Analysis	1-3	$1M	$1M-$2M	$1M-$2M
5. Technical Support for Clean Energy Projects	1-2	$2M	$2M	$2M
6. Assessment and mapping of current and future hydrogen and carbon-related infrastructure	1	$2M-$4M	$2M-$4M	$2M-$4M
7. Alternative fuels and energy carriers in context for the U.S.	1	$500k-$1M	$500k-$1M	
8. Clean hydrogen “State of the Market” reporting and economic scenario modeling	1	$1M-$2M	$1M-$2M	$1M-$2M
9. Energy markets and grid mid-term regional outlook (3-10 years)	1	$500k-$1M	$500k-$1M	$500k-$1M
Total	15-22	$17-$29.5M	$17-$30.5M	$17.5-$29.5M

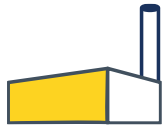
Project support

Portfolio support

Recall: OCED Technical Project Areas

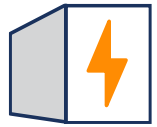


Advanced Reactor Demonstrations



Industrial Demonstrations

Carbon Management



Long-Duration Energy Storage Demonstrations

Clean Energy Demonstrations on Mine Land

Regional Clean Hydrogen Hubs

Distributed Energy Systems Demonstrations

Energy Improvements in Rural or Remote Areas

Topic 5 Goals

OCED seeks lab expertise to de-risk technology performance, scale-up, and integration across the demonstration project portfolio.

- Provide areas and depths of expertise that are beyond the standard available in the practical engineering market.
- Use digital engineering expertise to provide high-quality modeling and simulations to predict and evade unexpected critical failure modes.
- Use cutting edge tools and techniques to identify critical failure risks in the systems and components of OCED projects.
- Provide alternatives based on data and analyses when critical risks are identified

Topic 5: Technical Support for OCED Clean Energy Projects

Anticipated awards: 1-2

FY25-27 budget: $2M/yr

Overview:

- Support for modeling and simulations
- Technical research for OCED projects throughout the duration of the cooperative agreements

Subtopics	Description
5.1: Modeling and Simulation Capabilities	• Provide expertise in developing a range of digital engineering and analysis tools including process and technology models and simulations, alternatives and trade off analyses relative to OCED's demonstration projects.
5.2: Specialty Systems & Scale Up Expertise	• Provide expertise in one or more of OCED's portfolio technologies to provide data, information, and analysis on specific technical topics affecting project planning, design, implementation or performance; facilitate strategic de-risking of OCED projects in conjunction with Independent Engineers and/or OCED staff.

AOI 5.1: Modeling and Simulation Capabilities

Focus: Leverage or develop digital engineering tools and apply those across project plan, build, and operate phases. These tools will be used to de-risk critical or enabling technical project sub-elements.

Guidance: Proposals should focus on de-risking the success of the industrial deployments by providing options and tradeoff analyses to support OCED decision-making and prioritization.

- Proposals should identify specific current and/or developing capabilities that will be applied and what the expected utility these tools will be for de-risking key technical areas of OCED projects.

- Proposals should identify which areas within the OCED project technologies are expected to be targeted for use of these tools (clean H_2, LDES, direct air capture, point-source carbon capture, and/or those relevant to OCED's Industrial Demonstration Program (e.g., iron and steel, aluminum, cement and concrete, glass, pulp & paper, chemicals and refining, etc.)).

AOI 5.2: Specialty Systems & Scale Up Expertise

Focus: Provide specialty technical capabilities in one or more of OCED's portfolio technologies to provide data, information, and analysis on specific technical topics and advanced or emerging technologies. This expertise will de-risk the successful integration, performance, scale-up, and deployment of critical technologies in the OCED projects.

Guidance: Proposals should identify which technology areas from OCED's portfolio will be contained within their scope of coverage and which specific areas of expertise will be offered.

- Proposals should demonstrate experience with the identified technology areas and at what development or deployment stage this experience was gained.

- Support should be prepared to analyze specific components, systems or subsystems, test failure scenarios, and propose mitigation techniques or alternatives.

- Proposals should identify what unique Lab capabilities (e.g. specialty knowledge, facilities, equipment, or services) are being offered that are exceptional in the areas being targeted.

Discussion

Topic 6 consists of portfolio support for energy infrastructure

Topics	Anticipated # of awards	FY25	FY26	FY27
1. OCED Techno-Economic Analysis (TEA) Standards and Tools	1-4	$4M-$8M	$4M-$8M	$4M-$8M
2. OCED Support for Quantifying and Verifying Life Cycle Environmental Impacts	4-7	$5M-$9M	$5M-$9M	$5M-$9M
3. Quantification of Socioeconomic Impacts	1-4	$1-$1.5M	$1-$1.5M	$1-$1.5M
4. Resilience & Security Analysis	1-3	$1M	$1M-$2M	$1M-$2M
5. Technical Support for Clean Energy Projects	1-2	$2M	$2M	$2M
6. Assessment and mapping of current and future hydrogen and carbon-related infrastructure	1	$2M-$4M	$2M-$4M	$2M-$4M
7. Alternative fuels and energy carriers in context for the U.S.	1	$500k-$1M	$500k-$1M	
8. Clean hydrogen “State of the Market” reporting and economic scenario modeling	1	$1M-$2M	$1M-$2M	$1M-$2M
9. Energy markets and grid mid-term regional outlook (3-10 years)	1	$500k-$1M	$500k-$1M	$500k-$1M
Total	15-22	$17-$29.5M	$17-$30.5M	$17.5-$29.5M

Project support

Portfolio support

Topic 6 Goals

- OCED is investing in the development of large-scale projects in both carbon and hydrogen infrastructure.
- For OCED carbon and hydrogen projects to be successful, transportation, utilization, and storage infrastructure must scale to accommodate new producers and offtakers.
- Multiple projects and initiatives have been conducted separately to quantify carbon and hydrogen transportation and storage capacity, needs, and future capabilities, but have not been incorporated into a singular system.
- **OCED seeks lab expertise to highlight the current need for hydrogen and carbon infrastructure in context of OCED's announced projects.**
- **OCED seeks lab expertise in developing modeling tools building on existing work to estimate the business case for future carbon and hydrogen transportation projects.**

Topic 6: Assessment and Mapping of Current and Future Hydrogen and Carbon-related Infrastructure

Anticipated awards: 1

FY25-27 budget: $2M-$4M/yr

Overview:

- Assess hydrogen and carbon infrastructure needs
- Leverage existing tools for modeling & mapping
- Near term focus: OCED projects for actionable intelligence
- Deliverables: Reports for H2 and CO2 with costs and business cases & user-friendly mapping tools

Areas of Interest	Description
1: Analysis of Current State of Carbon Infrastructure and Assessment of Future Infrastructure Needs	Includes analysis of the cost and business cases to support OCED and other projects.
2: Analysis of Current State of Hydrogen Infrastructure and Assessment of Future Infrastructure Needs	Includes analysis of the cost and business cases to support OCED and other projects.
3: Tools for mapping current and potential infrastructure needed to support the growth of hydrogen and carbon markets	Enables OCED and external stakeholders to map potential and proposed H2 and CO2 infrastructure. Includes consideration of State and Federal regulations, permitting, community impacts, and both domestic and global export markets.

AOI 6.1: Analysis of Current State of Carbon Infrastructure and Assessment of Future Infrastructure Needs

Focus: Analyze the current state of carbon transport, utilization and storage infrastructure, assess future infrastructure needs in the United States, and analyze the cost and business cases for various forms of carbon transport, utilization, and storage.

Guidance: OCED seeks proposals coming from prospective teams with experience in conducting analysis of current and future carbon infrastructure networks (i.e., transport, utilization, and storage), market assessments, permitting, state and local policy, and other barriers.

- Leveraging existing data, modeling tools, and capabilities from applied R&D offices or industry is encouraged.
- Teams should consider all forms of carbon transport individually and in multi-modal settings.
- Teams should consider which carbon transport developments are most needed based on OCED's current portfolio of carbon management projects.

AOI 6.2: Analysis of Current State of Hydrogen Infrastructure and Assessment of Future Infrastructure Needs

Focus: Analyze the current state of hydrogen transport, utilization and storage infrastructure, assess future infrastructure needs in the United States, and analyze the cost and business cases for various forms of hydrogen transport, utilization, and storage.

Guidance: OCED seeks proposals coming from prospective teams with experience in conducting analysis of current and future hydrogen infrastructure networks (i.e., transport, utilization, and storage), market assessments, permitting, policy, and other barriers.

- Leveraging existing data, modeling tools, and capabilities from applied R&D offices or industry is encouraged.
- Teams should consider the impacts of electricity grid modeling, future capacity expansion, existing state and federal policy, regional considerations, community concerns, and global market dynamics.

AOI 6.3: Tools for mapping current and potential infrastructure for H2 and Carbon

Focus: Develop tools to enable OCED and external stakeholders to map potential hydrogen and carbon infrastructure alongside existing transport, storage, and end uses. This could benefit existing DOE funded projects in OCED, FECM, IEDO, and HFTO's portfolios by showing current and potential infrastructure from producers to utilization or storage. This could enable investments by informing siting, scaling, teaming structures, community concerns, regulatory environment, etc.

Guidance: Tools in this area of interest should utilize GIS or equivalent capabilities to enable mapping of current and proposed infrastructure as well as the placement and business case modeling for industrial CO2 or H2 production facilities, CO2 or H2 transportation/pipelines, storage, or end use markets. Proposals will have multiple capabilities, including:

- Leverage and/or build upon existing models and tools related for H2 and carbon
- Mapping capabilities / visualization tools
- Ability to estimate cost, technical specs, and business case
- Have network optimization tools incorporated
- State/county level regulatory / policy implications
- Potential community impacts.

Topic 7 consists of portfolio support for the analysis of alternative fuels

Topics	Anticipated # of awards	FY25	FY26	FY27	
1. OCED Techno-Economic Analysis (TEA) Standards and Tools	1-4	$4M-$8M	$4M-$8M	$4M-$8M	*Project support*
2. OCED Support for Quantifying and Verifying Life Cycle Environmental Impacts	4-7	$5M-$9M	$5M-$9M	$5M-$9M	
3. Quantification of Socioeconomic Impacts	1-4	$1-$1.5M	$1-$1.5M	$1-$1.5M	
4. Resilience & Security Analysis	1-3	$1M	$1M-$2M	$1M-$2M	
5. Technical Support for Clean Energy Projects	1-2	$2M	$2M	$2M	
6. Assessment and mapping of current and future hydrogen and carbon-related infrastructure	1	$2M-$4M	$2M-$4M	$2M-$4M	*Portfolio support*
7. Alternative fuels and energy carriers in context for the U.S.	1	$500k-$1M	$500k-$1M		
8. Clean hydrogen “State of the Market” reporting and economic scenario modeling	1	$1M-$2M	$1M-$2M	$1M-$2M	
9. Energy markets and grid mid-term regional outlook (3-10 years)	1	$500k-$1M	$500k-$1M	$500k-$1M	
Total	15-22	$17-$29.5M	$17-$30.5M	$17.5-$29.5M	

Topic 7 Goals

- OCED understands that the pathway to decarbonization requires the usage of alternative fuels and energy carriers to displace fossil fuels in key sectors.
- OCED is looking to understand our potential role in assisting alternative fuels and energy carriers in achieving commercial liftoff.
- **OCED seeks lab expertise in analyzing the role of alternative fuels and energy carriers in economy wide decarbonization, the market landscape for these products, and adoption opportunities across sectors.**

Topic 7: Alternative Fuels and Energy Carriers in the Context of the United States

Anticipated awards: 1

FY25-26 budget: $0.5M-$1M

Overview:

- Analyze the market landscape for alternative fuels across selected scenarios
- Analyze the role of alternative fuels in the path for economy-wide decarbonization in multiple sectors
- Informs potential demo programs for OCED beyond BIL and IRA funding

Area of Interest	Description
The Technical Potential of Alternative Fuels and Role in Economy-Wide Decarbonization	• Develop a report focused on the market landscape for alternative fuels and energy carriers for a variety of decarbonization scenarios, investigating metrics such as technical potential, commercial readiness, emissions impact, demand / willingness to pay, feedstock forecasting, etc. • The economy-wide breakdown would analyze alternative fuels and energy carriers' role in a variety of sectors including, but not limited to, key industrial sectors, aviation, maritime shipping, and heavy-duty trucking.

Topic 7: Alternative Fuels and Energy Carriers

Focus: Develop an in-depth analysis report on the economy wide readiness and market landscape for alternative fuels and energy carriers.

Guidance: OCED seeks proposals coming from prospective teams with experience in conducting analysis related to market assessments, technical and commercial adoption readiness, and demand forecasts.

- Proposals should look at the opportunities and impact of alternative fuels in energy carriers across the full economy, but proposing teams can recommend specific breakdowns.

- Proposals should look at a variety of metrics including but not limited to:
  - Total Addressable Market
  - Preferred Alternative Fuels by sector
  - Current and Projected Demand
  - Willingness to pay by sector
  - Emissions, land, and water use impact across the full lifecycle
  - Impact towards net zero emissions

Discussion

Topic 8 consists of portfolio support for the analysis of clean hydrogen economics

Topics	Anticipated # of awards	FY25	FY26	FY27	
1. OCED Techno-Economic Analysis (TEA) Standards and Tools	1-4	$4M-$8M	$4M-$8M	$4M-$8M	*Project support*
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Total	15-22	$17-$29.5M	$17-$30.5M	$17.5-$29.5M	

Topic 8 Goals

- OCED is heavily invested in the development of a clean hydrogen economy within the United States through the Hydrogen Hubs and Hydrogen Demand Side programs.
- The success of OCED's hydrogen projects and programs is reliant on a strong understanding of the current and future economic landscape for hydrogen (domestic and global).
- Following the success of DOE's Pathways to Commercial Liftoff Reports, commercial entities are using DOE backed information to guide their investments and watch trends, including real-time rapid response analysis to provide fresh insights.
- **OCED seeks lab expertise in assessing the state of the hydrogen market through market data capture & reporting in tandem with clean hydrogen economic scenario modeling to understand current and future trends impacting the hydrogen economy.**

Topic 8: Clean Hydrogen "State of the Market" Reporting and Economic Scenario Modeling

Anticipated awards: 1

FY25-27 budget: $0.5M-$1M/yr

Overview:

- Gather and publish reliable data highlighting the "at the moment" state of the clean H2 economy
- Conduct economic modeling informed by markets and incentives to highlight the future trajectory of clean H2
- Supports OCED's H2Hubs and demand-side / H2DI
- Feeds into Liftoff report updates.

Areas of Interest	Description
1: Develop Market Data Capture and Reporting for Quarterly "State of the Market" Data Summaries	• Report synthesizing the status and key updates in indicators related to the growth of the U.S. H2 economy.
2: Economic Scenario Modeling for Clean Hydrogen	• Develop forward-looking market scenarios and analyses for the H2 economy at national and regional levels. • Use forward looking analyses to provide as needed support for OCED's project portfolio (i.e. H2Hubs and Demand-Side) and risk management.

AOI 8.1: Market Data Capture and Reporting

Focus: Develop market data capture and reporting for quarterly “state of the market” data summaries.

Guidance: OCED seeks proposals to establish or leverage a team to design and implement market tracking capabilities. Proposals may partner with/or leverage market data tracking firms.

- Deliverables for this project, a quarterly “State of the Market” summary, should be designed to be publicly facing and not rely on proprietary data.
- Data from DOE, including OCED projects and H2 demand side program (if anonymized/aggregated data) could be used for analysis to support this report.

AOI 8.2: Economic Scenario Modeling for Clean Hydrogen

Focus: Develop forward looking market scenarios and analyses for the clean hydrogen economy.

Guidance: OCED seeks proposals to build a core team delivering on regular reporting around economic deployment scenarios and key market drivers for the development of the clean hydrogen economy.

- Proposals that identify collaborations and/or outreach and engagement with the financial / investor ecosystem are strongly encouraged. Close collaboration with OCED and DOE partners is envisioned.
- Proposals should conduct hydrogen market scenarios at U.S. regional and national levels as well as for global markets.
- OCED also seeks as needed support from this team for emergent strategy and analysis topics (i.e. rapid response analysis).

Discussion

Topic 9 consists of portfolio support for the analysis of energy markets

Topics	Anticipated # of awards	FY25	FY26	FY27	
1. OCED Techno-Economic Analysis (TEA) Standards and Tools	1-4	$4M-$8M	$4M-$8M	$4M-$8M	Project support
2. OCED Support for Quantifying and Verifying Life Cycle Environmental Impacts	4-7	$5M-$9M	$5M-$9M	$5M-$9M	
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Topic 9 Goals

- Grid decarbonization is an essential for OCED's projects' success as electrification plays a key role in a variety of projects.
- Increased electrification → power demand rise = growing need for flexibility in power systems.
- OCED's projects could directly impact local grid and energy markets by significantly increasing grid load in their respective regions.
- Energy and power market prices and forecasting could have a direct impact on the business cases for OCED projects.
- **OCED seeks lab expertise in synthesizing energy and power markets data and potential headwinds/challenges, with a focus on impacts between 3-10 years to support project and portfolio specific insights or actions needed.**

Topic 9: Energy Markets and Grid Mid-term Regional Outlook

Anticipated awards: 1

FY25-27 budget: $0.5M-$1M/yr

Overview:

- Develop mid-term (3-10 year) power and energy market analysis
- Focus on pricing forecasts, key energy forecasting metrics, and regulatory market changes at the regional level
- Encourages partnerships with National labs and existing market intelligence providers

Area of Interest	Description
Energy and Power Markets Tracking and Synthesis	• Develop mid-term energy and power markets data synthesis to be delivered semi-annually focused on regional pricing, headline regulatory market changes, and key metrics such as power generation asset mixes, load growth forecasting, drivers of power load, proposed capacity installations, and major developments in transmission build plans. • Could inform/contextualize OCED's strategy, project / portfolio risks, and actionable intelligence for decision making.

Topic 9: Energy Markets and Grid – Mid Term Regional Outlook

Focus: Develop and/or customize energy and power markets data to highlight current and forecasted trends with the granularity needed to support OCED's overall strategy, project/portfolio risks, impacts and inform decision makers.

Guidance: Proposals that leverage partnerships with existing market intelligence, datasets, and assumptions as well as tools and approaches that integrate with how the private sector makes decisions (i.e., industry, utilities and grid operators, regulatory bodies, etc.) are strongly encouraged.

- Proposals should produce semi-annual reporting on pricing and price forecasts across all markets across the continental US, Alaska, and Hawaii.
- Proposals should also provide semi-annual reporting on headline market changes and forecasting which could have broader ramifications on power markets.
- OCED is focused on a mid term (3-10) year outlook to focus our attention on how power markets impact our projects.

Discussion

Thank you!

OCED

Office of Clean Energy Demonstrations

For more information, please contact oced@hq.doe.gov