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COMMENTS OF ITIF

to the

Office of Clean Energy Demonstration, Department of Energy

1000 Independence Avenue SW
Washington, DC 20585

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Request for Information on:	)	
	)	OCED-RFI-23-1
Use of Demand-Side Support for Clean Energy Technologies	)	(DE-FOA-0002995)
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March 23, 2023

INTRODUCTION AND SUMMARY

The Clean for Energy Innovation (CCEI) at Information Technology and Innovation Foundation (ITIF) is pleased to submit the following comments to the US Department of Energy (DOE) Office of Clean Energy Demonstration (OCED) in response to DOE's use of demand-side support for clean energy technologies. ITIF is an independent 501(c)(3) nonprofit, nonpartisan research and educational institute that has been recognized repeatedly as the world's leading think tank for science and technology policy. ITIF's CCEI formulates, evaluates, and promotes policy solutions that accelerate innovation to make energy both clean and competitive.

DOE OCED issued OCED-RFI-23-1 to seek public input for informing DOE's development of demand-side support measures for clean energy technologies. Demand-side support measures represent a potential tool to support DOE's mission by providing a predictable commercial market for clean energy technologies. There are several demand-side support measures, including but not limited to direct procurement, advanced market commitments, and guaranteed price floors.

CATEGORY A: MOST EFFECTIVE DEMAND-SIDE SUPPORT MEASURE FOR GIVEN TECHNOLOGIES

Question 1: What are the potential benefits and drawbacks of DOE implementing demand-side (e.g., carbon dioxide removal, hydrogen, low-carbon cement and concrete, low-carbon steel, sustainable aviation fuels)? (Please specify the technology or technologies in question.) In this question, DOE is not seeking input on the implementation approach.

The benefits and drawbacks of a demand-side support measure depend on the technology readiness level (TRL) and the commercial readiness level (CRL).

Sustainable Aviation Fuel (SAF)

SAF is already available on a limited commercial scale. Several production pathways exist for SAF. Almost all the demand for SAF is currently met through the HEFA production pathway, which is further along the TRL than other pathways. The Finnish biofuel company Neste is set to become the largest global producer of HEFA-based SAF by 2023 with the expansion of its refineries in Rotterdam and Singapore.[1] The current and projected costs of SAF depend on the production pathway. HEFA is currently the cheapest pathway, yielding a product that costs about 2 to 3 times as the cost of conventional jet fuel. However, since it is already being produced at scale, only minor cost reductions are expected in the coming decades.

Airlines are already supporting SAF development by purchasing it at a higher price using negotiated long-term purchase agreements. Moreover, SAF qualifies as an offset under the International Civil Aviation Organization (ICAO) system.[2] The biggest challenges are commercialization scale-up (e.g., from feedstock constraints) and costs. Demand-side support measures can help offset the price differential. However, the techno-economic analysis and the life cycle analysis of SAF pathways show considerable variation across the industry and SAF pathways. These uncertainties could hamper the efficacy of demand-side support measures so drawbacks could include further uncertainty on what qualifies for the incentives (depending on what measures, LCA methodologies are employed).

Long Duration Energy Storage (LDES)

Long Duration Energy Storage is an energy storage system that can provide at least 10 hours of stored energy.[3] LDES is a key solution to the intermittent nature of renewable energy, which is one of the main challenges of decarbonizing and modernizing the grid. Energy storage deployment has increased in recent years, but most deployments had been limited to short-duration systems such as lithium-ion (Li-ion) batteries and sensible heat.[4]

Some LDES technologies such as flow batteries have been deployed worldwide, but the scale remains small. The largest flow battery project so far is a 400 megawatt-hour (MWh) vanadium flow battery system in Dalian, China, a quarter of the size of the Moss Landing Li-ion project in California.[5] Unlike Li-ion batteries, where suppliers have worked their way down the learning curve in markets for electronics and vehicles, the lack of "first markets" and production for flow batteries are major barriers to mass commercialization.[6] Demand-side support measures could address could provide additional market pull, make "first markets" visible and accelerate LDES deployment. However, a drawback is the risk of potential technology lock-in. In the case of energy storage, lithium based batteries made up over half of the rated power deployed since 2010. For energy storage applications that require higher power levels (e.g. industry) other solutions (chemical, thermal options) are a better fit and wouldn't lead to competition with applications where batteries such as Li-ion are an established fit with market needs (e.g. passenger cars).

Process Heat

Process heat accounts for more than 60 percent of on-site industrial energy use and is a good target for reduction of GHG emissions.[7] Zero- or low-carbon process heat can be deployed across hard to abate industries such as chemicals, cement,, steel. However, unlike other technologies specified in this RFI, process heat (and carbon capture) are not products that are purchased directly so a low-carbon procurement approach may be challenging. Potential approaches that could be considered include recognizing low-carbon process heat supplied by a 3rd party contractor, or certification that the process heat supplied delivered is generated from an approved list of low-carbon sources (e.g. biofuels, renewable hydrogen, solar thermal, small modular nuclear, waste heat recycle, upgrading of waste heat via beneficial electrification -for example using an industrial heat pump).[8], [9]

Question 2: What would be the most effective demand-side support measure DOE could use to support commercial scale-up of a given technology (e.g., reverse auctions, advanced market commitments, contracts-for-difference, direct procurement, pooled offtake vehicles)? (Please specify the technology or technologies in question.) In this question, DOE is not seeking input on the implementation approach.

a. What are the most important considerations for DOE in exploring advanced market commitments in particular?

Advanced market commitments (AMCs) are used for undemonstrated technologies in which the cost of developing a new product is too high for the private sector without a guarantee of a sufficient initial market. Vaccines are perhaps the best-known examples where AMCs are used. However, an important consideration is that recipients of AMCs could fail to develop the new products (although competitors of AMCs recipients may leverage the AMCs). Another consideration is that AMCs work best for technologies with large market potential (e.g., vaccines), which may not be true for clean energy technologies, especially in the early stages.

b. What are the most important considerations for DOE in exploring guaranteed offtake prices or contracts-for-difference in particular?

Contract for difference (CfD) is a contract where the buyer must pay the seller the price difference between the market price and a strike price. With respect to clean energy technologies, CfD is relatively new (introduced in the UK in October 2014) and is currently designed to support the deployment of large-scale renewable projects.

The main considerations when designing a CfD are the determination of the appropriate strike price and the volume of funding. The appropriate strike price needs to consider the price trends of the targeted technology and the existing technologies in the market. Accurate analysis and forecast of the strike price can be difficult so the CfD approach would need to address this. Additionally, the funding for the CfD approach would need to be adequate to spur market growth for the low-carbon commodity while also driving innovation in the target industries that would lower cost so that the market expands as the CfD incentive tapers down

The European Commission is considering two-way contracts for CfDs to reform the EU's electricity market design. Whereas in a traditional CfD, which only has a revenue guarantee, in a two-way CfD, if the market price is below the strike price, the seller receives the difference and if the market price is above the strike price, the generator pays back the difference.[10] It improves price stability for end users.

c. What are the most important considerations for DOE in exploring other demand-side support measures (please specify a measure)?

Federal agencies have repeatedly failed to meet the requirements for **direct clean procurement** due to limited alignment with agency missions and a mismatch between the policy tool (government purchasing and asset management) and the policy goal of advancing clean energy (e.g., USPS fleet, building operations to meet the EISA requirement, and energy-efficient products.)[11] The higher up-front cost of many clean energy technologies poses a particular challenge because of the nature of the federal budget and federal procurement processes. However, with the appropriate authority and funding, federal procurement could be an effective tool for DOE. For example, DOE or other federal agencies or partners could commit in advance to purchase the initial output from demonstration facilities supported by OCED or use the Defense Production Act to facilitate the production and procurement of pre-commercial and early commercial clean energy technology.[12]

SAF

The technology readiness level (TRL) depends significantly on what pathway is used to produce the SAF so the demand-side support measure that is most applicable may vary significantly based on the type of SAF. Direct procurement works best on technologies that have a high TRLand could be applicable to SAF from HEFA. Meanwhile, AMCs or inducement prizes might be a better approach for SAF from production pathways such as power-to-liquid (PtL) or alcohol-to-jet (AtJ) with a lower TRL and higher current cost.

LDES

The TRLs and CRLs of LDES technologies vary significantly and need a mix of demand-side support measures. AMCs, which work best when the technological milestones and challenges are clear, the technology has multiple pathways to success and has a large potential market and could be viable for some LDES technologies such as liquid air energy storage. Meanwhile, direct procurement or CfD could be relevant for specific LDES technologies like flow batteries. The Federal Consortium for Advanced Batteries model, which is focused on developing the domestic industrial base for electric vehicle batteries, could be replicated for grid storage applications that are a fit for batteries.[13] The CfD, AMC, and pooled offtake, and reverse auctions are approaches that could be a good fit for a coordinated response at industrial clusters that seek to electrify and need storage to enable reliable, cost-competitive power at large scale from low-carbon energy sources.

Process Heat

Given its large potential markets and applications, AMCs for process heat might be an option. At present, OCED could support a more transformative approach to industrial emissions, which would be particularly important for enhancing market pull and cascading technology adoption throughout the value chain. For example, electric crackers could reduce most carbon emissions as well as several co-pollutants by replacing natural gas with renewable electricity as a means to generate high-temperature process heat.[14] The ability to generate process heat at high temperatures, and support by AMC or other approaches, could be leveraged to other industrial high temperature applications.

1. Hannah Boyles, "Climate-Tech to Watch: Sustainable Aviation Fuel" (ITIF, October 2022), https://itif.org/publications/2022/10/17/climate-tech-to-watch-sustainable-aviation-fuel/.
2. Ibid.
3. The definition is consistent with the DOE's LDES FOA (DE-FOA-0002867). Currently, there is no consistent definition of the duration needed to be considered LDES. Some sources use as low as 4 hours.
4. DOE Global Energy Storage Database, accessed March 7, 2023, https://sandia.gov/ess-ssl/gesdb/public/.
5. Beatriz Santos, "China connects world's largest redox flow battery system to grid" (pv magazine, September 29, 2022), https://www.pv-magazine.com/2022/09/29/china-connects-worlds-largest-redox-flow-battery-system-to-grid/.
6. Anna Goldstein, "Federal Policy to Accelerate Innovation in Long-Duration Energy Storage: The Case for Flow Batteries" (ITIF, April 2021), https://itif.org/publications/2021/04/07/federal-policy-accelerate-innovation-long-duration-energy-storage-case-flow/.
7. Colin McMillan et al., "Opportunities for Solar Industrial Process Heat in the United States" (NREL, January 2021), https://www.nrel.gov/docs/fy21osti/77760.pdf.

8 Edward Rightor, Andrew Whitlock, Beneficial Electrification, ACEEE, 2020, https://www.aceee.org/research-report/ie2002.

9 Edward Rightor, Paul Scheihing, Andrew Hoffmeister, Riyaz Papar, Industrial Heat Pumps: Electrifying Industry's Process Heat Supply, ACEEE, 2022, https://www.aceee.org/research-report/ie2201.

10. European Commission, Questions and Answers on the revision of the EU's internal electricity market design, March 14, 2023, https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_1593
11. Dorothy Robin, "Mission, Money, and Process Makeover: How Federal Procurement Can Catalyze Clean Energy Investment and Innovation" (ITIF, August 2022), https://itif.org/publications/2022/08/15/mission-money-and-process-makeover-how-federal-procurement-can-catalyze-clean-energy-investment-and-innovation/.
12. Ibid.
13. "Energy Department and Other Federal Agencies Launch the Federal Consortium for Advanced Batteries," Office of Energy Efficiency & Renewable Energy, Sep10, 2020, https://www.energy.gov/eere/articles/energy-department-and-other-federal-agencies-launch-federal-consortium-advanced.
14. Edward Rightor, "Why DOE Should Prioritize Transformational Investments in Industrial Technology to Catalyze GHG Reductions" (ITIF, December 2022), https://itif.org/publications/2022/12/19/why-doe-should-prioritize-transformational-investments-in-industrial-technology/.