Submitted by email to keith.boyea@hq.doe.gov
Response to the U.S. Department of Energy Office of Clean Energy Demonstrations on DOE's Use of Demand-side Support for Clean Energy Technologies

Shell[1] is pleased to offer these comments in response to the U.S. Department of Energy ("DOE") Office of Clean Energy Demonstrations on DOE's Use of Demand-side Support for Clean Energy Technologies, OCED-RFI-23-1. Tackling the demand-side of the equation will be essential in stimulating the growth of the clean energy market. "Clean hydrogen," as defined by the DOE in the Clean Hydrogen Production Standard as having lifecycle emissions less than or equal to 4 $kgCO_2e/kgH_2$, has the unique ability to help decarbonize many hard-to-abate sectors. Thus, we focus our response on demand-side support for clean hydrogen, emphasizing actionable efforts within DOE authority via Regional Clean Hydrogen Hubs ("hydrogen hubs"). Our sole suggestion that is outside the direct remit of the DOE, though we encourage the DOE to consider its part in such initiatives, is to establish a policy on carbon pricing in combination with setting emissions targets, as these will be necessary to sustain demand for clean hydrogen long-term.

Shell has taken an active role in helping to establish a global hydrogen economy. Globally, Shell is involved in many projects that aim to showcase the viability of the industry, including Europe's largest renewable hydrogen hub, with a 200-megawatt electrolyzer in the Netherlands. Construction on this project is underway, with clean hydrogen production expected to start in 2025 using renewable power from an offshore wind farm in which Shell is part-owner. In Canada, we plan to build a large-scale carbon capture and sequestration project at our Scotford refinery that will produce and use clean hydrogen. Not only will it have storage capacity of about 300 million tons of carbon dioxide, but it will further contribute to the region as Canada's first hydrogen hub. Shell has similar aspirations in the United States and is actively progressing projects domestically, including participation in multiple hydrogen hubs.

Oil and gas refineries account for over half of the current hydrogen demand in the United States, most of which use methane to produce hydrogen without carbon capture and sequestration. The obvious first step for industries currently using this form of hydrogen is to transition to clean hydrogen. As a feedstock, hydrogen is found in a wide variety of products including ammonia, refined products, chemicals, and many more. Addressing each of these pathways individually is a difficult task and one that is unnecessary as the most impactful component to decarbonize is typically the hydrogen itself. Therefore, the DOE's demand-side efforts should focus primarily on the adoption of hydrogen applications that deliver the largest carbon reductions. These decarbonization benefits would flow to by-products, offering a more efficient approach in lieu of approaching each by-product individually. This rationale also applies when hydrogen is used as a fuel (for heat or combustion, typically).

As an aspiring clean hydrogen developer across the country, we communicate with many prospective customers and the conversations typically focus on affordability and reliability. Any DOE efforts to address these two concerns would be well received. Such measures could come in many forms including price floors/ceilings and/or contracts for difference (vs. hydrogen

[1] Shell companies have their own separate identities but, in this document, we may sometimes use "Shell," "we," or "us" when we refer to Shell companies in general.

produced from methane without using carbon capture and sequestration, natural gas, etc.). The most successful demand-side mechanisms, such as California's Low Carbon Fuels Standard and Germany's Klimaschutzverträge, allow the market to efficiently shape the response. Therefore, DOE's efforts to address affordability should incorporate competitive forces to determine outcomes, such as using reverse auctions. For this example, the DOE could offer support for a price premium between clean hydrogen and the hydrogen currently on the market as produced from methane without carbon capture and sequestration. The amount could be determined by a reverse auction, awarding the participant who needs the smallest support.

Adoption of clean hydrogen includes one-time costs that can be deterrents. For instance, fuel switching from coal or natural gas often involves capital intensive retrofits of furnaces, boilers, and other equipment, in addition to associated downtime. Unfortunately, demand for low carbon intensity products alone is not strong enough to justify these retrofits. To address this issue, the DOE could deploy incentives, using hydrogen hub funds, that are governed by transparent, market-based mechanisms. As an example, the DOE could propose a request for proposals for retrofit/connectivity and award the most competitive submissions, as scored across pre-determined criteria. The DOE could tailor these efforts regionally, as market dynamics will likely differ. Additionally, fuel switching is very similar across a wide variety of sectors, so supporting this one mechanism could have a large impact.

Reliability is another key consideration for major industrial facilities. The DOE should consider downtime or force majeure allowances that permit clean hydrogen off-takers to utilize hydrogen produced from methane without carbon capture and sequestration in extenuating situations. The DOE could play a variety of roles in this space, including policy support for allowances by serving as an intermediary with clean hydrogen 'virtual reserves.' Such allowances could include temporal exemptions to non-routine events that impact the carbon intensity of produced hydrogen. For instance, a clean hydrogen consumer could be allowed one week of supply exceptions per year without impact to the carbon intensity of their final product. As another example, the DOE could purchase excess clean hydrogen 'virtual reserves' from producers during routine market conditions. When a downtime event occurs and a limited supply of clean hydrogen is available, an otherwise clean hydrogen consumer could substitute hydrogen with a higher carbon intensity and subsequently transact with the DOE's 'virtual reserves' to reduce the carbon intensity of their product. These policies would help market participants better manage risk profiles of clean hydrogen utilization, thereby increasing adoption.

Another function for the DOE's consideration is as a market-maker between short-term offtake agreements and long-term project investments. Aspiring clean hydrogen developers will require long-term guaranteed offtake from credible counterparties to sanction investments, as projects are typically justified by modeling economics over 20+ year lifespans. Meanwhile, many prospective customers may be unwilling to guarantee these agreements in a frontier space, limiting the likelihood for clean hydrogen projects to be approved. The DOE could function as a bridge between these participants by guaranteeing the offtake in later years or by orchestrating long-term offtake agreements through competitive demand-side auctions, prioritizing hard-to-abate sectors. Another option could be the direct procurement of low carbon emission products by the DOE, which could have an additional benefit of sending a strong market signal, especially if it was replicated across other parts of the federal government.

Due to the large market size and potential to reduce carbon emissions, Shell also supports the adoption of clean hydrogen as fuel in the long-haul heavy-duty vehicle sector. Affordability concerns of this early-stage industry are prohibiting wider adoption. DOE efforts to address the total cost of ownership difference when compared to heavy-duty vehicles that use fossil fuels would be well received. Due to its involvement in hydrogen hubs, the DOE sits in a unique position as one of the few parties capable of acting at a scale large enough to accelerate this emerging segment. With their proximity to clean hydrogen, the DOE hydrogen hubs are promising opportunities to help bootstrap this segment, including support for the required filling station buildout.

For the DOE vision of a hydrogen economy to be fully realized, supply and demand for clean hydrogen must grow together, enabled by large scale infrastructure like hydrogen and carbon dioxide pipelines. Shell supports DOE efforts to help the build-out of interconnected infrastructure like open access hydrogen pipelines within hydrogen hubs and, eventually, between them. A commitment to supporting mass balance accounting methodologies so that one pipeline can be used for hydrogen of all carbon intensities would help ensure the most efficient and economic utilization and buildout of infrastructure and thus facilitate market development. Shell would be pleased to continue the conversation about how to collaborate and help facilitate this buildout.

In this letter, we have focused on methods that allow the market to shape clean hydrogen demand, reducing the risk that this demand falters when DOE support ends. DOE market participation needs a design strategy that enables markets to be self-sustaining after support expires. This is a delicate balance and will likely need adjustments as the reality of technological or economic advancements of low carbon alternatives prove themselves. Market mechanisms that include feedback signals or tapering along the maturation curve will be useful to test market viability incrementally. While it is likely that some pathways find sustainable footholds in the market, it is also likely that some do not. As the market for decarbonized hydrogen and associated by-products has yet to fully materialize, partnering with an independent entity that has expertise in demand-side support measures could be very beneficial for the DOE and make implementation more efficient and cost effective.

There are equally important measures the DOE can pursue that do not involve the difficult tradeoffs inherent to direct participation in markets. Currently, there is complexity and a lack of standardization amongst the various greenhouse gas reporting practices in federal agencies. The DOE and EPA could partner on a standardization by all federal agencies and develop a digital program to score and track carbon intensity with greater transparency and coordination. Creation of terminology standards for clean hydrogen production pathways, together with a methodology to calculate life-cycle greenhouse gas emissions and associated certification would help create demand by ensuring integrity and reputational value for companies exploring whether to adopt clean hydrogen as part of their decarbonization goals. Most pressing is alignment on the definition of clean hydrogen between the DOE and Treasury to provide clarity for project feasibility. A near term focus on a federally supported certification process specific for hydrogen would also be particularly valuable. Additionally, alignment with European and other international agencies could further stimulate demand via exports. Public advocacy is another

area of support independent of market participation. Public education is necessary for consumers to understand the importance and benefits of low carbon intensity products. Currently, it is difficult for the average consumer to differentiate between products based on carbon intensity, leaving them unwilling to justify low carbon premiums.

Shell has worked with the DOE and other industry participants on hydrogen for many years and look forward to continuing to serve as a resource.

Yours sincerely,

Eelco Gehring – Shell US Country Lead Hydrogen Industry
Shell Woodcreek Complex – 150 N. Dairy Ashford Rd, Houston, TX 77079
Email: [redacted]
Phone: [redacted]