Subcommittee on Environment and Climate Change
Hearing on
"Building a 100 Percent Clean Economy: Pathways to Net Zero Industrial Emissions"
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The Honorable John Shimkus (R-IL)

1. One issue that your testimony notes about concrete and that also applies to other industrial processes is the need for high-temperature heat, sustained over long periods of time.

    a. Congress has been pursuing policies for advanced nuclear reactor technology that may enable industrial uses at small, localized high temperature reactors. Just a week ago we moved legislation to help develop markets for the fuel infrastructure for advanced reactors, and we hope to enact that into law.

    b. Would this be promising technology to pursue?

    RESPONSE: The cement industry will always need high-temperature heat as part of its production process. While the industry has not explicitly investigated the potential of using heat generated by nuclear reactors, we welcome the opportunity to explore this as a low-carbon source of fuel.

2. Raising energy and production costs in energy intensive or trade exposed industries can be harmful for communities in terms of lost jobs and economic output, especially if the developing world is unable to make the same changes to their energy and manufacturing systems.

    a. What are the risks of leakage of U.S. industrial jobs to other nations if cost of energy or processing is increased compared to international competitors?

    RESPONSE: The cement industry faces considerable risks from international competitors if the federal government controls greenhouse gas emissions through a price on carbon or other measures. Cement is traded globally as a commodity in a heavily competitive marketplace. American cement manufacturers face competition chiefly from China, India, Russia, Vietnam, and Brazil. These countries offer a marketplace advantage in such a system as they could export unregulated, higher carbon cement into the U.S. market without incurring carbon-related costs imposed on domestic manufacturers. Such "leakage" undermines U.S. competitiveness and rewards countries with less rigorous environmental, health & safety regulatory requirements.

As Congress considers comprehensive climate legislation, it will need to consider how interlinked *and* competitive markets are today. It will also need to consider the ability of the manufacturing sector to absorb the uncertainty and costs associated with reducing CO2 and other greenhouse gas (GHG) emissions. The cement industry suffered from the most recent recession from 2007-2010. Seventeen plants have closed since then, and no new cement manufacturing facilities have been constructed in the U.S. since 2009. Further, as of 2017, cement consumption in the U.S. is down 23 percent from its peak in 2005.

Other industrialized economies have pursued varying types and degrees of greenhouse gas regimes, such as the European Union, Canada, Australia, and California. These systems have served as real-world examples for the economic and trade impacts of limiting GHG emissions. Multiple studies from the Environmental Protection Agency, California Air Resources Board, Cement Association of Canada have found that the risks to industry are profound and could lead to plant closings, and job losses.

b. What are the impacts on technical skills, supply chains, R&D and innovative capacity in U.S. manufacturing and industries exposed to relatively high energy or production costs?

RESPONSE: A strong cement industry will be better able to invest in R&D and innovation. Increasing leakage would weaken the cement industry, thereby limiting its opportunities to invest in R&D and innovation.

c. What policy options have been proposed to prevent leakage, to what extent have they been examined for impacts on specific industries, and to what extent will this require international cooperation? The European Union, Canada, and California all account for the unique situation of the cement industry and other EITEs by adjusting the formula for credit allocation to account for the market disadvantage. A tariff or border adjustment on imported goods could also be utilized in cap and trade, carbon tax, or other system. Foreign competition will be essential for any GHG system to ensure mutual compliance and reporting of GHG emissions, tariffs,

RESPONSE: Consistent with the findings of these studies, government regulators in each of these jurisdictions have deemed cement manufacturing to be an EITE industry and provide certain protections through adjustments to credits and tariffs on imported goods.

3. What work has been published to your knowledge of the economic costs, the impacts on prices and supply, or employment impacts from reducing emissions in the industrial sectors? What work has been done to evaluate the legal, economic, and socio-economic impacts of deep decarbonization of the industrial sector?

RESPONSE: Multiple studies have found that the cement industry faces additional hurdles that other manufacturers or businesses will not face.

- **A 2008 report on the impact of the European Trading Scheme concluded that:** "Based on the expected cost of production in the EU assuming the carbon cost of CO2 versus the cost of producing in non-ETS countries, clinker and cement production in the EU is not competitive without free allowances allocation. As a result, the "wise businessman" will prefer to relocate production to more competitive countries, this leading to production offshoring."[1]

- A 2016 review by the Cement Association of Canada concluded that "[s]ince the introduction of the carbon tax in B.C. in 2008, imports of foreign-made cement to the province have gradually climbed from less than 5% in 2008 to a peak of over 40% as the tax progressively increased to $30 per tonne."[2]

- In 2017 comments to the California Air Resource Board, the Coalition for Sustainable Cement Manufacturing & Environment (CSCME) warned that "even after accounting for allowance allocations under CARB's proposed framework, an allowance price of just $20 would cause California cement production to decline by 46 percent."[3]

- In 2009, the Environmental Protection Agency found in an analysis of the American Clean Energy and Security Act (Waxman-Markey, H.R. 2454), "If the adoption of a domestic cap-and-trade program leads some manufacturing activity and its associated emissions to shift to countries that do not yet have comparable greenhouse gas regulations, along with the economic concerns that this poses, this presents environmental concerns because the resulting "emission leakage" can undermine the environmental effectiveness of a domestic emissions cap."

a. Would you please list pertinent studies?

RESPONSE: See above.

4. According to a recent report by the Energy Futures Initiative, many "subnational decarbonization strategy and road-map reports contain insufficient detail for establishing effective and efficient implementation policies and programs."

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[1] Boston Consulting Group, *Assessment of the Impact of the 2013-2020 ETS Proposal on the European Cement Industry; Final Project Report* (November 2008)
[2] Cement Association of Canada, *Input From the Cement Association of Canada, March 2016 B.C. 2016 Climate Leadership Plan* (March 23, 2016).
[3] CSCME, *Comments on Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms* (Jan. 20, 2017) CSCME; *see also Comments on CARB's May 17 Public Meeting on Allowance Allocation* (June 7, 2010)
4 Environmental Protection Agency, *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries* (December 2, 2009)

a. What should be done to develop a more in depth understanding of the cost and economic impacts of state and regional (subnational) decarbonization policies, particularly in the industrial sector?

RESPONSE: The Cement Sustainability Initiative published a technology roadmap for the global industry in 2018 that identifies pathways for supporting a transition to a low-carbon economy.[4] While this roadmap provides useful insights into actions that the industry can take to decarbonize, additional work is needed to translate this guidance to the US because of the significant variation in cement production practices across the world. In particular, more detailed work is needed to understand the costs of decarbonization of the US cement industry at a regional level and the expected economic impacts.

The Honorable Markwayne Mullin (R-OK)

1. Cement manufacturing is a heat intensive process. What is the primary fuel source?

RESPONSE: For 2016, the most widely used fuel in cement kilns was coal and petroleum coke, which is 57% of the total share of fuels used.

a. Are there other fuel sources cement manufacturing can use?

RESPONSE: The cement industry uses a wide variety of fuels including natural gas, coal, and secondary materials like tires to achieve the high temperatures necessary to create cement. Secondary material is a term for post-industrial, post-commercial, post-consumer paper, plastic, and other materials that have tremendous energy value. Their use as fuels helps to reduce industrial emissions of greenhouse gases (GHG) and other emissions. They also limit landfill disposal of materials that can become public health vectors and safety risks, conserve natural resources, and provide low-cost sustainable fuels.

Increased use of alternative fuels is a strategic priority for the cement industry, which sees them as an important component of the industry's long-term sustainability strategy. Indeed, the percentage of alternative fuels used within the US cement industry is well below that of European manufacturers, a result of the significant regulatory obstacles domestic manufacturers face in using these fuels. We see this as a promising area for further discussion on opportunities to increase the use of alternative fuel sources.

b. How much of the cement industry uses natural gas as fuel?

RESPONSE: As of 2016, natural gas makes up 15.5% of total fuel consumption.

[4] Cement Sustainability Initiative, *Technology Roadmap: Low-Carbon Transition in the Cement Industry* (2018).

c. What is preventing the industry from using more natural gas to offset carbon emissions?

RESPONSE: Price and access constitute barriers to using natural gas to reduce emissions.

2. I understand that around 60% of the CO2 emitted by the cement industry comes from the chemical reaction during the calcination process- and we can't change that. However, you mentioned that carbon dioxide could be embedded within cement, aggregate, and concrete products: how does this technology work, and how soon is it from being commercially available?

RESPONSE: Cement, aggregate, and concrete can be produced from captured carbon dioxide using a process called *mineralization*, which involves exposing minerals to carbon dioxide to create a carbonate mineral. It is a natural process that took place over millions of years to create the limestone used in the production of cement. More recently it has been proposed as a form of carbon capture and utilization to create materials that can be used in concrete production. This includes the production of binders, aggregates, and concrete (i.e., carbon dioxide is used in the mixing process) using carbon captured from industrial sources, potentially including cement plants. Several companies have been created over the past decade in an attempt to commercialize mineralization for building products. There is significant variation in the degree to which they make use of carbon dioxide. Most of the companies are in a start-up phase with demonstration plants or small production volumes, but several of them have products currently being used in construction projects. In some cases, the technologies can only be used to make concrete blocks in production facilities (as opposed to cast-in-place concrete on job sites) because of the requirements to control the mixing of carbon dioxide with minerals. As such, this limits their application to cases where concrete blocks can be used (such as buildings). A good summary of the specific companies working in this space and their current status can be found in an article published this year.[5]

[5] C. Collins, *Recasting Cement: The Race to Decarbonize Concrete*, Medium (2019).