

Testimony of Edward Stones
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Before the Select Committee on the Climate Crisis
U.S. House of Representatives
Solving the Climate Crisis: Manufacturing Jobs for America's Workers

Introduction

Chairwoman Castor and Ranking Member Graves, and members of the Committee, thank you for the opportunity to share Dow's perspective on actions we are taking to address climate change, and the impact these actions have on our ability to compete globally. My name is Edward Stones, and I am the Global Business Director for Energy and Climate Change within Dow's Feedstocks & Energy business. In this role I am accountable for delivering power and steam at Dow's 14 company-operated generation facilities, as well as steam, utilities, and energy services to more than 100 manufacturing facilities globally. I also have responsibility for Dow's energy conservation and greenhouse gas emission reduction efforts, and provide business guidance for the Company's global advocacy efforts in energy sustainability and climate change.

Dow Intends to Remain the Premier Material Sciences Company

Dow was founded in Midland, Michigan in 1897, and is one of the world's leading manufacturers of chemicals, plastics and advanced materials. We supply thousands of products to customers in approximately 160 countries, connecting chemistry and innovation with the principles of sustainability to enable everything from fresh water, food, and pharmaceuticals to insulation, paints, packaging, and personal care products. About 15,000 of Dow's 37,000 employees are based in the United States.

Dow has invested billions of dollars into its U.S. operations over the last decade because we intend to continue as the country's premier materials science company – today and well into the future. That means innovating and growing here in the U.S. while competing globally. The regulatory environment in the U.S. will frame our ability to deliver on that promise. We believe the time is now for the U.S. Congress to establish a market-based price on carbon, so the U.S. can continue to lead the world in new product development while reducing impact on the environment.

Global Scale of the Challenge

Addressing climate change is one of the greatest technical, social and economic problems ever faced by humanity. Today, the earth has roughly 7 billion inhabitants, about 1 billion of whom live with limited access to energy, and another 1 billion of whom have no power in their homes or communities. Human activity causes greenhouse gas (GHG) emissions of more than 50 billion tons/year of CO₂ equivalents (CO₂e)¹. Between 2010 and 2030, the world's middle class is expected to double in size, and by 2040, humanity's energy consumption is expected to increase by 28% vs. 2015². By 2050, the population is expected to grow by another 2 billion people, and power demand will grow by 30 to 50 percent³. Despite this increase in demand, the International Panel on Climate Change has called for the globe to be carbon neutral by

¹ UN Environment Emissions Gap Report, 2018.

² 2017 International Energy Outlook, US EIA.

³ *Ibid.*

sometime between 2040 and 2055 so as to preserve the chance to limit temperature increases to less than 1.5 degrees Celcius⁴. Together, these points suggest humanity must both increase energy usage dramatically and simultaneously eliminate net emissions.

However, historical data suggest the energy economy is unlikely to evolve quickly. Since the industrial revolution, economic growth has been accompanied by increased energy usage and emissions. Global energy demand doubled from 1995 to 2015⁵. From the time energy sources achieved five percent of the global energy demand, it took coal fifty years to supply 40 percent of that demand, crude oil fifty years to supply 30 percent, and natural gas fifty years to supply 20 percent. Renewables do not yet supply 5 percent of the global energy demand⁶. Although the need for action is clear, the time scale required for solutions will be decades, not years⁷.

Dow's Approach to Reducing Carbon Emissions

We accept the scientific consensus that climate change caused by increasing greenhouse gas emissions from human activity has serious consequences for the planet and society if left unaddressed. Dow's approach to climate change is deeply rooted in the Company's ambitions and values:

- Our ambition is to become the most sustainable materials science company in the world, and we strive to make a positive impact on society and the planet in everything we do.
- Protecting the planet is one of our three core values.
- Our 2025 Sustainability Goals aim to help lead the transition to a sustainable planet and society.

In 2015, Dow embarked on its third and most ambitious set of 10-year sustainability goals – the 2025 Sustainability Goals. Dow's sustainability journey has evolved from focusing on operational efficiency (footprint), to product solutions to world challenges (handprint), to recognizing that only through collaboration can we join others to accelerate the progress toward a sustainable planet (blueprint). The 2025 goals are centered around building blueprints for a sustainable planet, which are aligned to the UN Sustainable Development Goals and integrate public policy solutions, science and technology, and value chain innovation. The aim is to build solutions between government, business and society that generate shared values and are long lasting, scalable, and transformative. We know there are others who share our blueprint vision, and we want to join existing conversations and convene new ones on how we as companies and organizations can accelerate sustainable practices through collaboration.

Dow's 2025 goals are designed to harness Dow's innovation strengths, global reach and the passion of our employees to expand the Company's impact around the world, driving unprecedented collaborations to develop societal blueprints that will facilitate the transition to a sustainable planet and society.

Through our 2025 Sustainability Goal on World-Leading Operations Performance, Dow is committed to driving environmental benefits for our communities and the world. Making our

⁴The International Panel on Climate Change special report on global warming of 1.5 °C (2018)

⁵ Richard Newell and Daniel Raimi (2018)

⁶ V. Smil, Scientific American 2014, based on IEA data

⁷ Grateful acknowledgement is made to Jason Bordoff of Columbia University for compiling the data presented.

operations as efficient as possible is not only important for the environment, but also makes clear business sense. We continue to actively:

- Maintain our absolute GHG emissions at or below our 2006 baseline, though we will grow globally by 2025.
- Obtain 750 MW of energy from renewable resources by 2025 (Dow is already one of the largest users of renewable energy in the chemical industry).
- Offset new emissions of Priority Compounds, VOC's and NOX, though we will grow globally by 2025.

Dow Products Contribute to Reducing our Customers' Emissions

Dow materials help customers and brand owners reduce the energy demand and carbon emissions of many of their products. On average, for each unit of carbon emitted by the chemical industry's processes, the resulting products will save 2 to 3 units of carbon emission over their lifetime⁸.

- Polyurethane provides thermal insulation, vibration dampening, and noise abatement in building structures and transportation applications.
- Heat transfer fluids enable concentrated solar facilities, which provide clean energy to more than 500,000 homes.
- Silicone sealants for buildings reduce emissions ~200 Kg CO₂e per Kg of silicone.
- Advanced Polyethylene enables down-gauging, reducing the packaging materials required while preserving performance.

Responding to the Physical Effects of Climate Change

Dow is experiencing the physical effects of climate change in two areas: manufacturing sites with hurricane exposure, and through water scarcity concerns. Forty to fifty percent of our volume is produced in the U.S. Gulf Coast with high exposure to hurricanes. In those locations, we have already implemented a host of mitigating factors like improved levy systems to prevent flooding, enhanced 'greenbelt' areas to separate us from local communities, designing equipment specifically to sustain adverse weather, and water conservation programs. At the same time, there are places around the globe where water scarcity due to increased drought is a real concern. We've taken actions there – with our local communities – to improve those situations.

We factor in all of these potential risks when making decisions about existing or future asset investments. We believe the consequences for these types of events will continue to increase unless society – and government – take action.

The Need for New Technology Development

Dow's approach to carbon emissions has transitioned beyond an initial focus on energy efficiency and meeting renewables targets to additionally developing and deploying new technologies, and ensuring a corporate wide focus on carbon reduction at our sites and with our customers.

⁸ Innovations for Greenhouse Gas Reductions: A Life-Cycle Quantification of Carbon Abatement Solutions Enabled by the Chemical Industry, International Council of Chemical Associations, 2009, Amsterdam.

We believe the transition to a lower carbon economy will require unprecedented cooperation between business and government. It is important that policymakers fully appreciate the technological, economic and societal challenges of such a transition. Achieving meaningful emissions reductions will require equally significant technology breakthroughs, which will take time, resources, and collaboration.

Despite continuous improvement, the high efficiencies of industry's current processes mean we are approaching a limit in the emission reduction that can be achieved through incremental improvements. Achieving further substantial carbon emission reductions will require a paradigm change supported by technology breakthroughs.

Over 96 percent of all manufactured goods are directly touched by the business of chemistry, which is why the chemical sector is the key to achieving breakthrough technology solutions to enable downstream emissions reductions. On average, for each unit of carbon emitted by the chemical industry's processes, the resulting products will save 2 to 3 units of carbon emission over their lifetime.

Dow is pursuing innovative chemical processes to deliver step changes in emissions intensity for our own operations and for others once fully commercialized, likely around 2030. The Company recently announced a retrofit of one of our mixed-feed crackers in Plaquemine, Louisiana with proprietary fluidized catalytic dehydrogenation (FCDh) technology. This technology will allow Dow to lower energy usage and associated greenhouse gas emissions by roughly 20 percent when compared to conventional propane dehydrogenation technologies, thereby improving our overall sustainability.

Most sources of process heat today rely on fired heat, and few options exist for low carbon alternatives. This makes carbon capture and storage (CCS) and next generation nuclear critical technology and policy solutions. CCS needs to be explored at sites where a destination for CO₂ is available as it may be the only technically available control technology today. State and federal governments have a role to play in defining and enabling the infrastructure required for collecting and moving captured CO₂. Funding for approaches to utilize captured carbon beneficially (CCU) also will be helpful. Next generation nuclear facilities are an additional potential source of zero-carbon steam and power. Governments have a role to play in catalyzing the development and deployment of new nuclear technologies as well, and in expediting the permitting and construction processes.

Solving the Energy Trilemma While Maintaining Industrial Competitiveness

One of the key actions to lower overall carbon emissions of the industrial sector is to lower the carbon footprint of the sector's purchased power. Dow is on the leading edge of integrating renewable energy into our manufacturing operations. The Company is already one of the largest users of renewable energy in the chemical industry, and we are well on our way to surpassing our goal of obtaining 750 MW of energy from renewable sources by 2025.

A major challenge facing society in the pathway to a lower carbon intensity – especially in the electricity sector and for industrial consumers – is the energy trilemma of affordability, sustainability, and reliability. Both the reliability and quality of the power grid are of paramount importance in ensuring the competitiveness of the industrial sector. Many of the regulations focus on one or two of these pillars alone, and often with significant negative consequences for

the other legs of the trilemma. Instead, a holistic approach is needed to avoid unintended consequences.

The most significant consequence of poorly crafted regulations would be carbon leakage, where U.S. regulations were out-of-sync with the rest of the world and manufacturers moved operations to locations with less stringent requirements. We need broad, global alignment on greenhouse gas emissions reduction programs, and the U.S. needs to be a leader. The consequences for getting energy policy wrong are dire. For example, a \$19 Billion U.S. chemical industry trade surplus in 1997 became a deficit from 2001-2007 as resources became economically unavailable for industry⁹. Over this period, more than 200,000 jobs were lost in our industry¹⁰.

Real world data clearly show the value of natural gas as a key driver for resolving the trilemma. From 2008-2017 in the U.S., natural gas increased its share in power generation dramatically, displacing outdated coal fired plants that were retired because of unfavorable economics. Germany, on the other hand, subsidized a substantially increased mix of renewables, replacing mostly nuclear plants. During this time, the U.S. CO₂ emission intensity for power decreased by much more than in Germany while electricity was delivered to the average household at less than one-half of the price. Today, emission intensity in the U.S. is lower than in Germany, demonstrating the importance of natural gas-fired power generation as the stabilizing, cost-efficient anchor in the transition to a lower emission future (EIA, UBA).

Impact of Grid Design and Power Regulation on Industrial Consumers

The technical aspects of grid design matter a great deal to industrial consumers. When considering renewable energy policy and grid design, policymakers need to account for the intermittency and peak load variability that comes along with integrating large amounts of renewable energy into the grid. Industrial processes operate on a continuous basis making us a consistent and predictable energy consumer. In return, we rely on a similarly consistent and reliable supply of power and steam to manufacture our products. This is best provided by a portfolio of energy supplies which includes both renewables and gas fired cogeneration.

Some of the technical challenges associated with integrating renewable power into the grid are outside of our control, including access to abundant and affordable low-carbon power capacities. Similarly, we are seeing reductions in the quality of the power received from the grid at our facilities in terms of inertia and frequency control. Additionally, the intermittency of renewable power supplies dramatically increases the volatility of power markets – including run ups from ~\$30/MWh to \$9000/MWh for power during several hours this summer in Texas.

With respect to power grid planning and renewable energy policy development, we would like the Committee to consider the following major points:

- Cogeneration/ Combined Heat and Power (CHP) are an important part of efficiently meeting future power demand.
- In 2018, emissions of carbon dioxide (CO₂) by the U.S. electric power sector were about 33% of total U.S. energy-related CO₂ emissions.¹¹

⁹ US Dept. of Commerce data for SITC Code 5 (Chemicals and Related Products) from tse.export.gov web site.

¹⁰ US Bureau of Labor Statistics employment for Chemicals and allied industries in 2007 vs 1997, <https://www.bls.gov/oes/tables.htm>.

¹¹ US EIA FAQ website, accessed 9/6/2019. <https://www.eia.gov/tools/faqs/faq.php?id=77&t=11>

- Federally driven solutions may cause unintended regional consequences.
- The ISO framework is the best way to address regional specific power needs. This model preserves state authority, maintains transmission owner withdrawal rights, and includes a cross section of stakeholders from the region.
- Federal agencies (i.e. FERC) have a role in defining the criteria under which regional ISO's operate. Attention needs to be paid to the impact of renewables on the power grid (i.e. through factors such as spinning inertia, ramp rate, load factors, seasonality, etc.).
- Federal policy should continue to encourage widespread utilization of cogeneration at industrial plants and large facilities. Examples:
 - Right to sell cogeneration/Combined Heat and Power (CHP) generated energy or capacity to a utility at avoided costs and/or open access market based rates.
 - Cogeneration/CHP considered eligible resources for efficiency and carbon emission reduction.

In Germany, the Netherlands, Australia, the UK, and the U.S., clean energy targets have had significant unintended consequences, resulting in wide day and night swings in power pricing and highly unattractive investment environments for power producers. Over time, gas and coal generation are retired, leading to higher risk of blackouts, etc.

Government Policies on Climate

Partnership, collaboration, and government engagement are necessary to drive many of the actions that will make meaningful impacts. For example, partnership will be needed to deploy CCS, which will likely be needed on some of our processes and for power generation grid stability. In those cases, we will work on how to capture the carbon, and rely on our partners in government and industry to provide a network grid where we can store or use the carbon we capture. Governments also need to ensure the playing field is level, rules do not overlap, feedstock is treated differently than fuel and not unfairly penalized, and liability is addressed.

We believe the time has come for Congress to put in place a federal policy to protect against the worst impacts of climate change. Taking action now allows us to meet the challenge at the lowest overall cost to society. We believe a market-based price on carbon is the most efficient and effective way to lower greenhouse gas emissions. Dow has been working proactively through trade associations and coalitions to advocate for a federal solution. We are proud to be founding members of the newly announced CEO Climate Dialogue, a group of U.S. and global Fortune 500 CEOs that are committed to advancing climate action. The goal of the group is to urge Congress to enact a market-based approach to climate change.

To the extent that Congress considers a policy framework to address climate change, we believe public policy should:

- Recognize and value the chemical industry's use of hydrocarbon feedstocks (in both traditional and nontraditional forms) that are transformed into products rather than emitted as CO₂.
- Eliminate federal regulations that are made duplicative or unnecessary through the enactment of comprehensive federal regulations.
- Prioritize regulations at the federal level instead of creating a patchwork of state and/or regional levels. Regulations should be harmonized, and state and/or regulations made duplicative or unnecessary should be eliminated.

- Recognize industry's allocation of time and resources to deliver efficiencies and breakthrough innovation by protecting it from the broad legal liabilities of climate change.
- Dedicate revenue generated as a result of carbon pricing exclusively to developing new technologies to avoid future emissions, and/or support infrastructure required to capture emissions or enable lower carbon emissions.
- Establish a standard protocol to account for the emissions that are avoided through the use of manufactured products, and generate credits that can be applied against the emissions of the manufacturer. Similar protocols should be established for re-used CO₂ (i.e. through Carbon Capture and Utilization).

The key to continued manufacturing competitiveness is a well-executed, comprehensive energy policy which addresses supply and demand, energy security, and environmental objectives.

Conclusion

Thank you for the opportunity to share Dow's perspective on reducing industrial sector greenhouse gas emissions, and the actions we have taken to reduce the impact of our own operations and those of our customers. There is an important role for Congress to play in crafting a federal regulatory framework that achieves meaningful emissions reductions at the lowest possible cost to society. We look forward to working with members of the Committee and all interested stakeholders on this important issue.