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SUPER POLLUTANTS ACT OF 2014

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Institute for Governance & Sustainable Development

Testimony of Durwood Zaelke
the U.S. Senate Environment and Public Works Committee
In Support of the Super Pollutant Act

Introduction

This testimony is submitted in support of the Super Pollutants Act (the Act),[1] which aims to promote interagency cooperation in regard to super pollutants, methane, black carbon, and hydrofluorocarbons (HFCs), and to help prioritize emissions reduction strategies using existing federal authority and programs. The Act would enable federal agencies to work with business and non-profit communities to speed the adoption of super pollutant-reducing technologies and policies, all while supporting US technology innovations and investments to reduce these pollutants at home and abroad.

The Act would establish an interagency task force to review policies and measures to promote, and to develop best practices for, the reduction of these super pollutants. The task force would coordinate and optimize the federal government's existing efforts to address these super pollutants; reduce overlap and duplication of such efforts; and encourage federal operations, programs, policies, and initiatives to reduce super pollutants. The task force proposal is supported by a broad group of U.S. non-governmental organizations (NGOs).[2] The Act will make a significant contribution to climate protection, public health, and agriculture productivity in the US and abroad, and will help spur US innovation and investment in control technology markets at home and abroad.

Background

Reducing HFCs, black carbon, and methane can cut the rate of global warming in half for the next 40 years (more than 0.6°C in cumulative warming by 2050 and up to 1.5°C by 2100).[3] This will significantly reduce near term climate impacts, including reducing the rate of sea-level rise. It also will save millions of lives every year and improve public health, while also increasing agricultural yields.

Because these super pollutants are cleared from the atmosphere in a short period of time, they are also know as "short-lived climate pollutants" or SLCPs. Their short lifetime means that reducing them can produce fast benefits for the climate, for public health, and for agriculture. This is in contrast to carbon dioxide, approximately a quarter of which remains in the atmosphere for thousands of years.[4] Both the super pollutants and carbon dioxide must be cut as quickly as possible to protect the climate system from the growing impacts already occurring, although they deliver their climate benefits on different time scales, with the super pollutants being able to avoid significantly more warming in the near term than carbon dioxide.[5]

One of the super pollutants, black carbon soot, is a traditional air pollutant, and another, methane, contributes indirectly to air pollution as the principal precursor to local photochemical smog.[6] Reducing these pollutants will save millions of lives every year, protect tens of millions of tons of crop yields, and contribute to sustainable development.[7] The U.S. has a number of opportunities domestically to achieve fast, low-cost reductions in super pollutants using existing authorities, as well as procurement policy, voluntary industry agreements, public-private partnerships, and other strategies described below. The importance of mitigating each of the super pollutants is summarized below, along with an overview of select mitigation opportunities the task force might consider.

HFC Mitigation

HFCs are factory-made gases with a warming effect hundreds to thousands of times that of CO_2.[8] The average atmospheric lifetime of the mix of HFCs currently used is 15 years.[9] HFCs are produced as substitutes for ozone-depleting substances (ODSs) in air conditioning, refrigeration, insulating foams, solvents, aerosol products, and fire protection.[10] Unless a production and consumption phase-down of HFCs is implemented in the near-term, HFC emissions will increase dramatically and undermine efforts to curb the long-term driver of climate change—CO_2 emissions.[11] If not controlled, HFC emissions could correspond to up to 20% of CO_2 forcing under the IPCC business-as-usual scenarios in 2050.[12] If CO_2 was constrained from business-as-usual to a 450 ppm stabilization pathway, the radiative forcing of uncontrolled HFCs in 2050 could be as much as 40% of the CO_2 forcing, which would cancel nearly the entire benefit gained from controlling CO_2.[13]

Phasing down HFC production and consumption globally would provide climate protection equivalent to preventing between 87-146 billion tonnes of CO_2 emissions by 2050.[14] Phasing out HFC production would also avoid the build-up and eventual emissions of HFCs contained in existing refrigeration and air conditioning equipment, chemical stockpiles, foams, and other products, collectively known as 'HFC banks.' A fast phase down of HFCs by 2020 would avoid an additional 39–64 $GtCO_2$-eq of emissions.[15] The U.S. and many other countries have proposed phasing down HFC production and consumption under the Montreal Protocol, widely regarded as the most efficient and effective environmental treaty yet created.[16] The treaty has not only put the stratospheric ozone layer on the path to recovery by mid-century, it also has provided the most climate protection to date by phasing out CFCs, and now HCFCs, for a net of 135 $GtCO_2$-eq.[17] More than 100 countries now support phasing down HFCs under the Montreal Protocol, including China and India.[18]

Historically, refrigerant transitions under the Montreal Protocol are accompanied by significant improvements in the energy efficiency of the refrigerators, air conditioners, and other products and equipment using the refrigerants.[19] The phase-out of CFCs under the Montreal Protocol, which began in the mid-1980s, catalyzed substantial improvements in air conditioning and refrigerant energy efficiency—up to 60% in some subsectors.[20] These efficiency improvements were the result of replacing old products and equipment with a new generation of higher efficiency machines utilizing next generation refrigerants.[21] When refrigeration and air conditioning manufacturers redesigned their systems to be CFC-free, many took the opportunity to improve the efficiency of their designs.[22] For example, the U.S. EPA estimated that CFC-free chillers were up to 50% more energy efficient in the U.S. and over 30% more efficient in India than the CFC-based machines they replaced.[23] Similar improvements are expected with an HFC phase down, which will contribute significantly more climate mitigation, while also reducing consumers' operating costs for their air conditioners and other appliances. Currently, low-GWP alternatives exist for all major sectors.[24]

Select U.S. HFC Mitigation Options

- *Develop HFC industry partnership/coalitions to support the adoption of low-GWP alternatives.*

The Task Force could develop public-private partnerships modeled after the *Industry Cooperative for Ozone Layer Protection (ICOLP)* with ad-hoc working groups of experts that can quickly identify, develop, perfect and implement substitutes for high-GWP HFCs worldwide.[25] This could include the *Consumer Goods Forum*, comprised of 400 retailers, manufacturers, and service providers who have committed to begin phasing out HFC refrigerants beginning in 2015, and Refrigerants Naturally!, comprised of global refrigerated beverage and food marketers, working to replace high-GWP HFCs with low-GWP substitutes for new purchases of point-of-sale units and large refrigeration installations.[26]

- *Update Environmentally Preferable Purchasing (EPP) standards to exclude high-GWP HFCs.*

The Environmentally Preferable Purchasing (EPP) program was created by the EPA in 1993 to help U.S. agencies meet their obligations for green purchasing.[27] The EPP program could update its list of designated green products and develop purchasing guidelines to help eliminate products made with and containing high GWP HFCs.

- *Update voluntary green certification and rating standards to eliminate high-GWP HFCs.*

The Task Force could work with certification programs, such as the Energy Star Building program and LEED, to reduce or eliminate the use of high GWP HFCs in new building construction and remodels.

- *Reduce HFC emissions from mobile air conditioning.*

The Task Force could propose improvements to refrigerant containment with better parts and manufacturing quality control, by shifting from do-it-yourself to professional refrigerant servicing, by requiring use of improved recovery and recycle machines, and by creating incentives for refrigerant destruction when vehicles are dismantled at the end of useful life.

- *Prioritize utilization of low-GWP HFC insulation and refrigerants through Federal Housing and Energy Efficiency Loan Programs.*

The Task Force could work with these loan programs to ensure that, where possible, the programs eliminate the use of high-GWP HFCs and promote the adoption of efficient low-GWP alternatives in construction or improvements that they fund or support.

- *Reduce HFC emissions from supermarket refrigeration.*

The EPA could encourage more stringent voluntary standards for the maximum acceptable GWP for refrigerants in the supermarket sector, and work to expand the coverage of the GreenChill partnership, particularly within the companies that make up the Consumer Good Forum.

- *Reduce access to, and non-essential use of, HFC aerosol products.*

The Task Force could expand the list of prohibited non-essential and frivolous aerosol products and establish industry-government partnerships with manufacturers to agree on standardized warning labels highlighting concern for climate and permitting use of high-GWP HFC aerosol products only where technically necessary.

- *Align minimum efficiency standards for refrigeration and air conditioning with HFC reductions.*

The EPA and the Department of Energy (DOE) could work together to phase down HFCs and secure significant gains in energy efficiency in air conditioning and refrigeration by aligning their timetables.

- *Remove barriers to the adoption of low-GWP alternatives in the air conditioning and refrigeration sectors.*

The DOE could work to remove barriers to the adoption of low-GWP alternatives in the air conditioning and refrigeration sectors by supporting research and development, technical validation, and market introduction programs for low-GWP HFC alternatives.

Methane Mitigation

Methane is a powerful greenhouse gas with a 100-year global warming potential 28 times that of CO_2 and an atmospheric lifetime of approximately 12 years.[28] In 2011, the U.S. is estimated to have emitted 567.3 MMt CO_2-eq of methane, down from 578.3 MMt CO_2-eq in 2011.[29] Methane accounted for approximately 8.6% of all U.S. CO_2-eq emissions in 2012.[30] Significant reductions of methane emissions can be achieved quickly and cost-effectively utilizing currently available technologies. In the U.S., the greatest opportunities for methane mitigation come from: 1) recovery of emissions from the oil and natural gas sectors; 2) landfill gas capture and utilization; and 3) the recovery of coal mine ventilation gases. Further emissions mitigation opportunities exist in the

capture and utilization of emissions from manure, and the control of enteric fermentation. A number of methane reduction opportunities were identified in the 2014 U.S. Climate Action Plan Strategy to Reduce Methane Emissions.[31]

Select U.S. Methane Mitigation Options

- *Promote methane capture for oil and gas production leases on public lands.*

Federal land management agencies and the Bureau for Land Management, in particular, could encourage the use of all technically and economically viable control technologies for oil and gas production, including hydraulic fracturing ("fracking"), on public lands.

- *Expand composting and zero-waste programs.*

The Task Force and the EPA could work with municipalities and businesses with existing zero-waste and composting programs that include methane capture to develop best practice models for expanding these programs and to support other municipalities and businesses setting zero-waste or composting goals.

- *Capture coal mine ventilation gas.*

The EPA could promote the capture of coal mine emissions by establishing federal standards for performance for coal mine emissions.

- *Control methane emissions from anaerobic digestion of manure.*

The EPA could work to expand information exchanges with key stakeholders regarding the cost-effectiveness and availability of technologies to control and utilize emissions from the anaerobic digestion of manure, through its AgSTAR program.

- *Remove regulatory barriers for development of methane-based renewable energy.*

The Task Force could work with expert organizations and agencies to remove regulatory barriers to deployment of methane-based renewable energy by continuing to expand and standardize grid interconnection rules and modern net metering laws for small clean energy generators.

- *Capture and combust methane emissions at dairies.*

The EPA could expand existing voluntary measures in the AgSTAR program to provide dairy farms with the technical expertise and information necessary to implement methane control technologies where they are effective.

- *Capture and utilize methane emissions from wastewater treatment.*

The Task Force could work with the Department of Energy Office of Energy Efficiency and Renewable Energy to expand energy production from biogas at all technically feasible wastewater treatment facilities and increase access to technology and financing through programs such as the Federal Energy Management Program's Super Energy Savings Performance Contracts (ESPC).

- *Improve rice field management to reduce methane emissions.*

Emissions of methane from rice fields can be reduced through a number of management techniques such as dry seeding and post-harvest rice straw removal and bailing. The EPA should develop a voluntary program, similar to the successful AgSTAR program, to educate farmers on cost-effective rice field management techniques.

- *Study anti-methanogen vaccines and feed supplements for livestock.*

To achieve near-tern reduction of methane emissions from livestock, the Super Pollutant Tack Force could support research into safe and cost-effective methods for reducing enteric fermentation including anti-methanogen vaccines and modified feed mixes.

Black Carbon Mitigation

Black carbon is a potent climate-forcing aerosol that remains in the atmosphere for only a few days or weeks.[32] Black carbon is a component of soot and is a product of the incomplete combustion of fossil fuels, biofuels, and biomass.[33] Black carbon contributes to climate change in several ways: it warms the atmosphere directly by absorbing solar radiation and emitting it as heat; it contributes to melting by darkening the surfaces of ice and snow when it is deposited on them; and it can also affect the microphysical properties of clouds in a manner than can perturb precipitation patterns.[34] Recent estimates of black carbon's radiative forcing confirm that it is the second leading cause of global warming after CO_2.[35] The total climate forcing of black carbon is 1.1 W m^{-2}, second only to CO_2 (1.7 W m^{-2}). [36]

The main sources of black carbon are open burning of biomass, diesel engines, and the residential burning of solid fuels such as coal, wood, dung, and agricultural residues.[37] In 2000, global emissions of black carbon were estimated at approximately 7.5 million tons, with a large uncertainty range.[38]

Thanks to modern pollution controls and fuel switching, black carbon emissions in North America and Europe were significantly curbed in the early 1900s.[39] However, the U.S. is still estimated to be the source of approximately 8% of all global black carbon emissions.[40] Approximately 50% of these emissions come from the transportation sector, primarily mobile diesel engines.[41] Open biomass burning constitutes the second largest source of black carbon in the U.S., at 35% of total emissions.[42] To address these and other sources of black carbon emissions in the United States, the Super Pollutant Task Force could focus on: continuing to reduce transportation particulate emissions particularly from super-emitting on- and off-road vehicles; expanding the use of battery and grid power for parked highway trucks; encouraging a switch to low-lack carbon fuels; requiring shore-power for at-berth ocean-going vessels and vessel speed reduction (VSR) near port; and banning open burning of agricultural biomass.

Select U.S. Black Carbon Mitigation Options

- *Reduce transportation particulate emissions.*

The task force could review the Diesel Emission Reduction Act (DERA), with an aim to produce vehicle turnover as soon as feasible.

- *Expand the use of battery and grid power for parked highway trucks.*

The EPA could work with state and local authorities to identify and support opportunities for expansion of truck stop electrification projects and provide incentives for truck owners to retrofit existing trucks compatible with electrification technologies.

- *Require shore-power from at-berth ocean-going vessels.*

The EPA could work with State Port Authorities to support the implementation of at-berth short power regulations similar to California's.

- *Reduce port congestion.*

The Task Force could work with industry associations and port authorities to develop and implement best practices for improving on- and off-short port efficiency including expanding the use of virtual arrival systems.

- *Require vessel speed reduction (VSR) near port.*

The EPA could work with other coastal states and port authorities to facilitate the expansion of VSR guidelines, priorities, and regulations for all coastal waters, including the Great Lakes.

- *Control open burning of agricultural biomass.*

The Task Force could develop training and outreach programs for farmers and land managers to educate them on techniques and best practices for eliminating the need to burn agricultural biomass, and develop tools to expand the use of biochar technologies.

- *Set stronger standards for wood-burning stoves and fireplaces.*

The Task Force should explore opportunities to expand the U.S. EPA BurnWise program, identify technical options to improve existing EPA standards both in the Residential Wood Heater program and through the voluntary Fireplace Partnership Program, and encourage states and local regulatory agencies to adopt equal or better standards for wood burning stoves and fireplaces.

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[22] York International, *Taking the bite out of CFC replacement by improving air conditioning efficiency* (press release 14 February 1996) ("Now that production of chlorofluorocarbons (CFCs) has ended, the majority of commercial and institutional building owners and industrial plant managers have a chance to turn adversity into opportunity. That's the premise of a white paper being offered by York International Corp., a major manufacturer of chillers -- the large refrigeration machines at the heart of most large-building air conditioning systems. While there's no escaping eventual replacement or conversion of the 60,000 or more air conditioning systems in the U.S. that use CFCs as refrigerants, the good news, according to York International, is that the energy efficiency of these systems can be dramatically improved with new technology, meaning quicker paybacks and long-term cost savings. The savings, in fact, have been calculated to range between $200,000 and $2 million, depending on local weather conditions, over a 25-year operating life.").

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[33] U.S. Envtl. Prot. Agency, REPORT TO CONGRESS ON BLACK CARBON, xxi (2012).

[34] Bond T. C. *et al., Bounding the role of black carbon in the climate system: a scientific assessment*, Accepted for publication in the J. OF GEOPHYS. RES. –ATMOS., doi:10.1002/jgrd.50171 (2013).

[35] Bond T. C. *et al., Bounding the role of black carbon in the climate system: a scientific assessment*, Accepted for publication in the J. OF GEOPHYS. RES. –ATMOS., doi:10.1002/jgrd.50171 (2013) *(*"We estimate that black carbon, with a total climate forcing of +1.1 W m^{-2}, is the second most important human emission in terms of its climate-forcing in the present-day atmosphere; only carbon dioxide is estimated to have a greater forcing.") (This study confirms earlier estimates by Jacobson (2001) and Ramanathan and Carmichael (2008), which also concluded that BC is the second largest contributor to global warming after CO_2); *and* Jacobson M. Z., *Strong radiative heating due to the mixing state of black carbon in atmospheric aerosols,* NAT. 409:695–69 (2001); *and* Ramanathan V. & Carmichael G., *Global and regional climate changes due to black carbon*, NAT. GEOSCI. 1:221 (2008); *see also* U.S. Envtl. Prot. Agency, REPORT TO CONGRESS ON BLACK CARBON 4, 18 (2012) ("The sum of the direct and snow/ice albedo effects of BC on the global scale is likely comparable to or larger than the forcing effect from methane, but less than the effect of carbon dioxide; however, there is more uncertainty in the forcing estimates for BC….").

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The Alliance
for Responsible Atmospheric Policy

STATEMENT OF

THE ALLIANCE FOR RESPONSIBLE ATMOSPHERIC POLICY

Kevin Fay, Executive Director

December 2, 2014

Legislative Hearing on S. 2911, "Super Pollutants Act of 2014"
Senate Environment and Public Works Committee

Good Afternoon. My name is Kevin Fay. I serve as Executive Director of the Alliance for Responsible Atmospheric Policy, a US industry coalition organized in 1980 to address the issue of stratospheric ozone depletion. We appreciate the opportunity to testify at this legislative hearing on S. 2911, the "Super Pollutants Act of 2014."

The Alliance is composed of manufacturers, businesses and trade associations, which make or use fluorinated gases in their course of business. Today, Alliance member companies are leading the development of next generation, climate- and ozone-friendly, technologies and applications. According to a recent study, the US fluorocarbon using and producing industries contribute more than $158 billion annually in goods and services to the US economy, and provide employment to more than 700,000 individuals with an industry-wide payroll of more than $32 billion. The Alliance represents more than 100 companies across several sectors engaged in the development of economically and environmentally beneficial international and domestic policies regarding fluorinated gases. The Alliance is proud of its extensive history of working in a constructive manner with the U.S. Environmental Protection Agency (EPA) on the protection of stratospheric ozone and the mitigation of climate change. Further, we are also proud of our work towards the development and implementation of the Montreal Protocol on Protection of the Earth's Ozone Layer.

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The Montreal Protocol has achieved impressive success in ozone and climate protection due to a combination of internationally-negotiated CFC and HCFC production and consumption reduction mechanisms paired with domestic implementation measures to control emissions. With hydrofluorocarbons (HFCs) receiving significant consideration under the United Nations Framework Convention on Climate Change (UNFCCC) and potentially under the Protocol as well as expanding domestic measures under current authorities, it is critical to have a comprehensive approach to address their potential climate change contribution, including HFCs already in use in the installed equipment base.

Upon the introduction of S. 2911, the Alliance commended the sponsors of the legislation and encouraged further sponsorship and consideration. We did so because the legislation:

- **Recognizes the appropriate role of the Montreal Protocol in advancing ozone protection, while reducing greenhouse gas emissions, calibrated to the pace of technology developments and the availability of proven, energy-efficient alternatives.**
- **Acknowledges the important role of effective refrigerant management, and recovery and re-use of refrigerant, as near-term approaches that can achieve significant HFC emission reductions.**
- **Closes the HCFC-22 exception that permits the use of ozone-depleting residential air conditioning units. The legislation promotes both ozone protection and improved energy efficiency of newer systems.**

The Montreal Protocol has been highlighted as one of the most effective multilateral environment treaties ever implemented. It is the only treaty in the United Nations system to which every nation in the world is a party. We believe the treaty has been successful because it is grounded in scientific understanding, includes an effective technology and economic assessment process, and recognizes the special needs of developing country economies. The Protocol identifies long-term objectives and achieves its environmental protection benefits in a sensible approach guided by economic feasibility.

The short-lived climate pollutants (SLCPs) that are addressed as part of S. 2911, are also being addressed in a global program called the Climate and Clean Air Coalition (CCAC). CCAC is a partnership of governments, quasi-public agencies and organizations, the private sector, and environment non-governmental organizations (NGOs).

S.2911 would help to focus government activities on the SLCPs and further Congressional understanding of its activities, as well as identify potential future steps. Our comments today are specifically in relation to the provisions governing HFCs.

Support for a Montreal Protocol Amendment on HFCs

Addressing HFCs is one of the key initiatives of the CCAC program. The primary goal is to support the amendment of the Montreal Protocol to utilize its mechanisms and institutions to achieve a gradual phasedown of HFC use and emissions. That effort is buttressed with three other components: government procurement policies which encourage the acquisition of low-GWP technologies as they become available; and two components developed by the private sector, a global refrigerant management initiative and efforts to support development of low-GWP technologies throughout the food cold chain while increasing the utilization of food preservation technology on a global basis.

As a result of our experience under the Montreal Protocol over the last 27 years in achieving the elimination of ozone depleting substances(ODS), we believe that the protocol can play an instrumental role in also reducing the greenhouse gas contribution of ODS substitutes. This approach is far preferable for uniform treatment of HFCs than command and control regulation by the United States and other nations, or the market-fracturing approach that will result if the major economies were to all choose different means of achieving HFC greenhouse gas reductions.

HFCs have provided the ability to rapidly reduce reliance on ODS, and recent scientific assessments have concluded the Earth's ozone layer is on the mend. They are not currently a significant portion of overall global GHG emissions. However, concern for future growth,

particularly in major developing country economies, signals a potential for a significant increase in the HFC greenhouse gas contribution between now and 2050. We believe with the appropriate policy signals and flexible implementation, it is possible to achieve a substantial reduction of HFC greenhouse gas contribution over that timeframe. That is why in September of this year, the Alliance announced its intent **"to take actions and support policies to achieve an 80% reduction of global HFC emissions on a GWP-weighted basis by 2050."**

Since then, we have also launched the Global Refrigerant Management Initiative (GRMI) and the Global Food Cold Chain Council (GFCCC), as part of our efforts under the Climate and Clean Air Coalition to achieve near-term emission reductions as we work on the Montreal Protocol amendment process.

The Montreal Protocol, in its programs to eliminate ODS, has already proven to be the most significant and cost-effective greenhouse gas reduction policy adopted to date. We believe that this success can be repeated as we work to achieve the long-term transition to low-GWP compounds and technologies that also continue to improve the energy efficiency profile of the important user technologies.

S. 2911 acknowledges this success and encourages governments and the private sector to carry-on in an equally successful manner that is both environmentally effective and economically sensible.

Global and Domestic Refrigerant Management Initiatives

The legislation also encourages the utilization of Section 608 of the Clean Air Act as a means of reducing service emissions of current HFC using equipment and promoting the recapture and reuse of refrigerant through recycling and reclamation. We know that the majority of refrigerant emissions occur during the service, maintenance, repair and disposal of air-conditioning and commercial refrigeration units. Moreover, that equipment operates most efficiently when properly charged and maintained, minimizing energy consumption and related greenhouse gas emissions.

As industry we are moving forward with global measures to promote the responsible use of refrigerants. At the September 23 UN Climate Summit, the Alliance, in conjunction with the Air-Conditioning, Heating and Refrigeration Institute and ABRAVA, the Brazilian Association for HVAC-R, launched the Global Refrigerant Management Initiative to reduce leaks and service emissions throughout the industry's global supply chain through better education, training and certification. This initiative has already received the support of industry associations from 9 countries and the EU, representing 4 continents, and is expected to continue expanding in 2015.

Such voluntary actions are important, but can be bolstered by sound policies. That is why in January of this year, the Alliance submitted a petition to extend the regulations under Section 608 of the Clean Air Act to HFCs and other substitutes for class I and class II ozone-depleting substances. These policies have proven effective in limiting ODS emissions and promoting refrigerant re-use; now it is time to bring consistency to stationary refrigerant management regulations by extending them to HFCs and other substitutes for class I and class II ozone-depleting substances.

As a result of the Alliance's petition, EPA recently initiated a stakeholder process to address the related issues and develop a response to the Alliance's petition. The first stakeholder meeting was attended by industry representatives from all facets of the air conditioning and refrigeration industry. While a variety of views were expressed on implementation issues, there was no opposition to the overall objective from the industries in attendance.

In reducing the contribution of HFCs to climate change, initiating proper refrigerant management practices remains the lowest hanging fruit.

Importance of Energy Efficiency

The legislation also calls attention to the important role of the fluorocarbon compounds with regard to the energy efficiency of the air conditioning and refrigeration equipment in which they are utilized. It is well understood that 95% of the greenhouse gas contribution of this equipment

is derived indirectly as a result of its lifetime energy consumption. In the transitions achieved to-date, and the pending transition to low-GWP compounds and technologies, it is imperative that this is part of the technology assessment process. It is also why the Alliance, at the September White House HFC Industry Roundtable, urged Administration officials from the Department of Energy and EPA to better coordinate the next phases of technology transition so that the introduction of low-GWP technologies is in synch with coming rounds of energy efficiency standards. This will allow the industry to more effectively meet these important, but sometimes competing, environmental objectives.

On a related point, the legislation also calls for a study on alternatives to the high-GWP compounds and technologies, including the identification of standards or regulatory barriers that could prevent or slow the introduction of low-GWP alternatives. This study will be useful in two important respects—highlighting the need for coordination of the HFC phasedown with the cycle of energy efficiency standards changes; and identifying issues such as building codes and standards, that could slow the uptake of the developing new technologies. Some of the substitute technologies have a range of characterizations for flammability: non-flammable, mildly flammable, and highly flammable. Safety standards need to be modified to take this into account in order to amend building codes to allow for the installation of such new and beneficial technologies.

The Alliance has established a task force with EPA and DOE to identify issues associated with this codes and standards modification process. This task force will work to ensure modifications, but this process is slow. Officials will need to be mindful of this as they promote the transition to the new technologies.

Dry-22 Condensing Units

The last item highlighted in S. 2911 is language to close a loophole for what are known as "dry-22 units." In a rulemaking five years ago, EPA defined uncharged condensing units ("dry") to be a service component not otherwise subject to the Clean Air Act prohibition to place in commerce equipment that relies on HCFC-22, an ODS that is subject to phase-out under the Montreal

Protocol and the Clean Air Act. As a result of this modification to the rules, the manufacture of these units increased significantly at a time when their phase-out was nearly complete.

A diversity of views existed on the wisdom of the EPA rule modification, and there was not a unanimous view among the affected industry on how to address it. After long consideration, however, the manufacturing industry has recently advised EPA of its unanimous position that the manufacture of these units should now be phased out. The language in S. 2911 would effect this change. This is important because the Montreal Protocol just now imposes on developing countries the initiation of the phase-out of HCFC-22 and other HCFCs. In order for consistency of approach, the Alliance believe it to be constructive that US regulations not appear to be creating loopholes that other countries might wish to emulate. The Alliance supports the language in S. 2911 with regard to dry-22 units.

Industry Innovation and Leadership

Unlike other greenhouse gases, HFCs are intentionally manufactured as valuable industrial gases that help provide important societal services and products. These services and products are important contributors to health, safety, comfort, and productivity. As concern for climate change has increased, industry has recognized the need to alter the projected growth scenarios of HFCs while continuing to achieve global ozone layer protection, and maintaining the availability of these services and products.

U.S. industry has been at the forefront of the technology advances over the last several decades and is now investing in the innovation of low-GWP compounds and technologies that will allow us to achieve ozone protection, climate protection and energy efficiency goals. However, much work remains to be done. Technology pathways have not been identified for all of the critical uses. In the September HFC Roundtable announcements, industry leaders highlighted the multi-billion dollar investments to be made over the next decade in order to achieve these goals. U.S. industry leadership and an effective global approach under the Montreal Protocol will be key to this achievement.

Summary

S.2911 is a useful legislative vehicle with regard to HFCs because it highlights the key issues associated with the introduction of low-GWP compounds and technologies, encourages responsible refrigerant management practices, and emphasizes support for the Montreal Protocol as the most effective means of achieving a gradual HFC phasedown between now and 2050. It helps focus the attention of the relevant US Government departments and agencies, educate members of Congress, and advance the market friendly model of the Montreal Protocol.

As with the effort to eliminate ozone depleting substances, U.S. industry has embraced the technology challenge that must be met in order to achieve this environmental objective. Transitions in many of the key user industries are already underway through a combination of voluntary initiatives and policy proposals and adjustments. The history of efforts to protect the ozone layer and now to address the potential climate impacts of ODS substitutes such as HFCs has been one of significant US leadership, both from the government and the private sector. Alliance members have deemed it far more effective to control our destiny and achieve these objectives through measures that allow for achievement of goals over the long-term while minimizing near-term economic disruption.

Legislation such as S. 2911 furthers this effort by stimulating dialogue and education on issues and matters with which we are concerned. The Alliance appreciates the opportunity to testify before you today, we look forward to working with you in the next Congress as these issues continue to be addressed, and we are happy to answer any questions that you may have.

Alliance to Pursue Long-Term Greenhouse Gas Reduction Goal

Announcement Made During White House Roundtable

Washington, DC, September 16, 2014 -- The Alliance for Responsible Atmospheric Policy today announced support for policies and actions with a goal to reduce global hydrofluorocarbon (HFC) emissions by 80 percent by 2050. "As technology companies, we firmly believe with the right global policies and incentives we can develop and deploy solutions that are both environmentally and economically effective to prevent ozone depletion and global warming emissions," said Robert Wilkins of Danfoss and Alliance Chairman.

The announcement was made during an industry leadership roundtable coinciding with International Day for the Preservation of the Ozone Layer. The event convened representatives from system manufacturers, end users, and fluorocarbon producers in a roundtable briefing of Obama Administration officials. The discussion focused on industry support for a phasedown of HFCs through an amendment to the global Montreal Protocol and technology development and investment commitments from key industry leaders.

In today's announcement, the Alliance stated that it believes a global approach under the Montreal Protocol, the 1987 treaty adopted to address depletion of the Earth's ozone layer, provides the best forum with established institutions to deal with the technical complexities of reducing global emissions of HFCs while maintaining the phase-out of ozone depleting substances such as HCFCs. The Alliance advocated a goal of reducing global HFC emissions by 80 percent by 2050 to be achieved through a Montreal Protocol amendment, highlighted American industry efforts to develop the technologies to realize those reductions and emphasized the need for greater initiatives from the public and private sectors to encourage proper refrigerant management.

HFCs were introduced in order to achieve a rapid phase out of ozone depleting substances and are used widely in air conditioners, refrigerators, foam insulation, technical aerosols, fire protection systems and other critical uses. The demand for these technologies continues to grow due to expansion of developing country economies and the added health, safety, comfort and productivity benefits these technologies provide.

Alliance member companies, which represent more than 95 percent of US HFC production and a significant majority of the manufacturing and other user industries, are committing billions of dollars in research and development and commercialization of new technologies, while also continuing to improve energy efficiency performance. Additionally, the Alliance pledged to work cooperatively with the US EPA and others around the world by sponsoring ongoing technology workshops and initiating efforts to reduce emissions due to leaks and servicing. Earlier this year, the Alliance petitioned the US EPA to expand its regulations governing emissions of ozone depleting substances to also cover HFCs.

"We are technology companies whose products provide comfort, health, food safety and increased productivity. While HFCs have allowed us to eliminate ozone depleting substances, we recognize there is concern if their use were to grow unabated around the globe. We believe an amended Montreal Protocol can most effectively promote the availability of low-GWP replacement compounds and technologies," added Wilkins.

The Montreal Protocol treaty was first signed on September 16, 1987, and is considered to be one of the most-effective multi-lateral environment treaties ever negotiated. It is the only treaty in the United Nations system to which every country is a signatory. The Protocol's success has been a result of its

reliance on sound scientific reviews, ongoing technology assessments and a funding mechanism to assist developing countries. A hallmark of the treaty is the decades-long cooperation among governments, industry and the environment community.

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About the Alliance for Responsible Atmospheric Policy
The Alliance is an industry coalition organized in 1980 to address the issue of stratospheric ozone depletion and the production and use of fluorocarbon compounds. The organization is composed of manufacturers and businesses, including their trade associations that rely on HCFCs and HFCs. According to a recent study, the US fluorocarbon using and producing industries contribute more than $158 billion annually in goods and services to the US economy, and provide employment to more than 700,000 individuals with an industry-wide payroll of more than $32 billion. Today, the Alliance coordinates industry participation in the development of reasonable international and government policies at the nexus of ozone protection and climate change.

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FOR IMMEDIATE RELEASE

Alliance Outlines CCAC Action Plan at UN Climate Summit

New York, NY – September 23, 2014 The Alliance for Responsible Atmospheric Policy, the leading coalition of US companies producing and using hydrofluorcarbons (HFCs), today presented the four-point action plan of the Climate and Clean Air Coalition (CCAC) to reduce global HFC greenhouse gas emissions. The presentation was made as part of the CCAC High Level Assembly meeting as well as at the UN Secretary-General's Climate Summit in New York City. The presentations were made by Kevin Fay, Executive Director of the Alliance for Responsible Atmospheric Policy along with Mike Lamach, Chairman and CEO of Ingersoll Rand, and John Mandyck, Chief Sustainability Officer for United Technologies Building and Industrial Systems, speaking to the formation of the Global Food Cold Chain Council.

The CCAC action plan consists of support for beginning negotiations in 2014 of an amendment to phase down the production and consumption of HFCs under the Montreal Protocol, the promotion of gradual public procurement of climate-friendly low-global warming potential alternatives to HFCs when feasible and support for private-sector organized efforts, including a Global Refrigerant Management Initiative on HFCs in servicing and a Global Food Cold Chain Council to reduce HFC emissions and increase efficiency in the cold food supply chain.

"Collectively, these policy efforts and initiatives have the potential to reduce the equivalent of more than 90 Gigatons of CO2equivalent by 2050, or more than two years of global greenhouse gas emissions," said Alliance Executive Director Kevin Fay. "The hallmark of these activities is that they will also continue the tradition of government, NGO, and industry cooperation under the Montreal Protocol that has made that treaty one of the most effective global environment agreements in history."

A substantial number of CCAC partners and non-partners, including nation-states, intergovernmental organizations, nongovernmental organizations, civil society organizations and private sector entities, have pledged their support for this action plan. The announcement of the four-point plan at the Climate Summit is expected to grow the number of signatories.

The Alliance and other private sector partners participated last week in an HFC Industry Leadership Roundtable at the White House. At that meeting, Alliance member companies and others announced their voluntary commitments to introduce new low- global warming potential (GWP) compounds and technologies to replace the high-GWP compounds and technologies currently in use, and to continue to improve energy efficiency as well. The Alliance pledged to take actions and support policies to reduce global HFC emissions by 80 percent by 2050. The industry leaders advocated for the North American-proposed amendment to the Montreal Protocol as the best means of achieving a global phase-down of HFCs while increasing research and development of the next generation of refrigerants.

About the Alliance for Responsible Atmospheric Policy

The Alliance is an industry coalition organized in 1980 to address the issue of stratospheric ozone depletion and the production and use of fluorocarbon compounds. The organization is composed of manufacturers and businesses, including their trade associations that rely on HCFCs and HFCs. According to a recent study, the US fluorocarbon using and producing industries contribute more than $158 billion annually in goods and services to the US economy, and provide employment to more than 700,000 individuals with an industry-wide payroll of more than $32 billion. Today, the Alliance coordinates industry participation in the development of reasonable international and government policies at the nexus of ozone protection and climate change.

About CCAC
The Climate and Clean Air Coalition to Reduce Short-Live Climate Pollutants is a partnership of governments, intergovernmental organizations, representatives of the private sector, the environment community, and other members of civil society. The coalition seeks to supplement global mitigation measures to address the contributions of methane, black carbon and HFCs to climate change.

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FOR IMMEDIATE RELEASE

Refrigeration Industry Leaders Organize Global Refrigerant Management Initiative

Initiative Marks Milestone Toward Reducing HFC Greenhouse Gas Emissions

New York, NY – September 23, 2014 Three of the world's leading refrigeration associations - The Alliance for Responsible Atmospheric Policy, the Air-Conditioning, Heating and Refrigeration Institute (AHRI), and the Brazilian Association for HVAC-R (ABRAVA), today announced the formation of the **Global Refrigerant Management Initiative** at the United Nations Secretary-General's Climate Summit.

The leakage of refrigerant during the servicing of equipment is the largest source of hydrofluorocarbon (HFC) emissions around the globe. This Initiative will work to identify opportunities to educate the industry's global supply chain on ways to improve the management of refrigerants and to reduce leaks and service emissions, particularly where current leak rates are the greatest. In addition, the initiative will promote the recycling, recovery, reclaiming and end of life destruction of refrigerants and develop policies to promote proper refrigerant management.

"Leaks from equipment installation and servicing are the largest source of HFC emissions around the globe," said Kevin Fay, Alliance Executive Director. "We have established this initiative because it is incumbent on all sectors of our industry to work with our governments to educate the individuals who install, service, and replace HVAC-R equipment on how to handle these refrigerants responsibly and to create a culture of responsible care."

In addition to these leading organizations, this private-sector organized effort will include participation from refrigerant organizations from Australia, Canada, China, Colombia, the European Union, Japan, Mexico and South Korea - a true global coalition that represents 90 percent of refrigeration and air conditioning equipment sold around the globe. The initiative will also work with CCAC (Climate and Clean Air Coalition) partners to develop and implement broad-based public and private sector collaborative programs to reduce HFC emissions by building awareness, training and implementation guidance for proper management, servicing and refrigerant end-of-life practices.

"Environmental stewardship is a hallmark of our industry," said AHRI President Stephen Yurek. "This initiative furthers our commitment to providing for the health, safety, and comfort of people around the world in the most responsible way possible," he said.

The growth of HFC emissions has been identified as a significant concern. HFCs are compounds introduced to rapidly replace ozone depleting substances being phased out by the Montreal Protocol. Currently, HFCs only comprise about 1 percent of global greenhouse gas emissions.

However, unabated, HFCs are expected to increase to greater than 10 percent of greenhouse gas emissions by 2050. ABRAVA International President, Samoel Vieira de Souza said that "There is no question that emissions are a concern of the entire supply chain."

The Alliance and AHRI participated last week in an HFC Industry Leadership Roundtable at the White House. At that meeting, Alliance member companies and others announced their voluntary commitments to introduce new low- global warming potential (GWP) compounds and technologies to replace the high-GWP compounds and technologies currently in use, and to continue to improve energy efficiency as well. The industry will invest $5 billion over the next decade to research, develop, and commercialize low-GWP technologies new refrigerants and the equipment in which they will be used. The Alliance pledged to take actions and support policies to reduce global HFC emissions by 80 percent by 2050. The industry leaders advocated for the North American-proposed amendment to the Montreal Protocol as the best means of achieving a global phase-down of HFCs while increasing research and development of the next generation of refrigerants.

About the Alliance for Responsible Atmospheric Policy

The Alliance is an industry coalition organized in 1980 to address the issue of stratospheric ozone depletion and the production and use of fluorocarbon compounds. The organization is composed of manufacturers and businesses, including their trade associations that rely on HCFCs and HFCs. According to a recent study, the US fluorocarbon using and producing industries contribute more than $158 billion annually in goods and services to the US economy, and provide employment to more than 700,000 individuals with an industry-wide payroll of more than $32 billion. Today, the Alliance coordinates industry participation in the development of reasonable international and government policies at the nexus of ozone protection and climate change.

About the Air-Conditioning, Heating, and Refrigeration Institute

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) is the trade association representing manufacturers of air conditioning, heating, commercial refrigeration, and water heating equipment. An internationally recognized advocate for the industry, AHRI develops standards for and certifies the performance of many of these products. AHRI's 312 member companies manufacture quality, efficient, and innovative residential and commercial air conditioning, space heating, water heating, and commercial refrigeration equipment and components for sale in North America and around the world.

About the Brazilian Association for HVAC-R

The Brazilian Association for HVAC-R (ABRAVA), headquartered in Sao Paolo, Brazil and founded in 1962 is a national association of equipment manufacturers, designers, installers and technicians, as well as retailers of parts and components from around the country. Its mission is to ensure technological and competitive development of refrigeration, air conditioning, ventilation and heating sectors of the country, defending their legitimate interests and promoting the responsible use of equipment and refrigerants to reduce global warming, preserve the environment and improve quality of life.

Supporting organizations:

Brazilian Association for HVAC-R (ABRAVA, Brazil); Air-conditioning, Ventilation and Refrigeration Association (ACAIRE, Colombia); Air-conditioning, Heating, and Refrigeration Institute (AHRI, United States); Alliance for Responsible Atmospheric Policy (United States); National Association of Refrigeration Industry Manufacturers (ANFIR, Mexico); Air-conditioning and Refrigeration Equipment Manufacturers Association (AREMA, Australia); China Refrigeration and Air-conditioning Industry Association (CRAA, China); European Partnership for Energy and the Environment (EPEE, European Union); Heating, Refrigeration and Air-conditioning Institute (HRAI, Canada); Japan Refrigeration and Air-conditioning Industry Association (JRAIA, Japan); Korea Refrigeration and Air-conditioning Industry Association (KRAIA, South Korea); Refrigeration and Air-conditioning Manufacturers Association (RAMA, India); and Refrigerants Australia (Australia)

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FOR IMMEDIATE RELEASE

Refrigeration Industry Leaders Organize Global Food Cold Chain Council

Initiative to Reduce Food Spoilage, Increase Efficiency, and Reduce HFC Emissions

New York, NY – September 23, 2014 A coalition of major companies that comprise the supply chain necessary to move cold food products from field to market around the world today announce the organization of the **Global Food Cold Chain Council**. This initiative seeks to reduce greenhouse gas emission in the processing, transportation, storage and retail display of cold food and to stimulate demand for climate-friendly technology. The announcement was made by the Alliance for Responsible Atmospheric Policy, with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) and other private sector partners at the United Nations Secretary-General's Climate Summit held in New York City.

This private sector initiative will promote efforts that stimulate demand for climate-friendly technologies while reducing refrigerant emissions, and minimizing food spoilage, and enhancing energy efficiency in the food cold chain. The initiative will also work with partners in the CCAC (Climate and Clean Air Coalition) to develop and implement broad-based public and private sector collaborative solutions to reduce hydrofluorocarbon (HFC) emissions in the cold food chain across developed and developing countries. The council will work with individual businesses, associations, governments, and civil society.

"The food cold chain is responsible for nearly one third of global HFC emissions. The GFCCC is part of the Alliance's comprehensive approach to achieving the global reduction of high-GWP HFCs," said Alliance Executive Director Kevin Fay.

The growth of HFC emissions has been identified as a significant concern. HFCs are compounds that were introduced to replace ozone depleting substances being phased out by the Montreal Protocol. Currently HFCs only comprise about 1 percent of global greenhouse gas emissions. However, unabated, HFCs are expected to increase to greater than10 percent of greenhouse gas emissions by 2050.

A more climate-friendly cold chain will not only reduce its own carbon footprint, it will extend food supplies to feed more people and reduce the estimated 3.3 billion metric tons of CO2-equivalent in food waste every year. If it were a country, food waste would be the third largest emitter of greenhouse gases.

The Alliance and AHRI participated last week in an HFC Industry Leadership Roundtable at the White House. At that meeting, Alliance member companies and others announced their voluntary commitments to introduce new low- global warming potential (GWP) compounds and technologies to replace the high-GWP compounds and technologies currently in use, and to continue to improve energy efficiency as well. The industry will invest $5 billion over the next decade to research, develop, and commercialize low-GWP technologies new refrigerants and the equipment in which they will be used. The Alliance pledged to take actions and support policies

to reduce global HFC emissions by 80 percent by 2050. The industry leaders advocated for the North American-proposed amendment to the Montreal Protocol as the best means of achieving a global phase-down of HFCs while increasing research and development of the next generation of refrigerants.

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The Alliance is an industry coalition organized in 1980 to address the issue of stratospheric ozone depletion and the production and use of fluorocarbon compounds. The organization is composed of manufacturers and businesses, including their trade associations that rely on HCFCs and HFCs. According to a recent study, the US fluorocarbon using and producing industries contribute more than $158 billion annually in goods and services to the US economy, and provide employment to more than 700,000 individuals with an industry-wide payroll of more than $32 billion. Today, the Alliance coordinates industry participation in the development of reasonable international and government policies at the nexus of ozone protection and climate change.

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Societal Benefits from Reductions in Emissions of Methane and Black Carbon

Drew Shindell

Written Testimony to the Senate Committee on the Environment and Public Works
Hearing on the "Super Pollutants Act of 2014"
Dec. 2, 2014

Society faces multiple problems arising from the emission of pollution into our atmosphere, including wide ranging impacts on both public health and climate change. Swift and large reductions in carbon dioxide emissions are vital if we are to avoid the worst consequences of climate change in the longer-term, for example from 50 to 100 years from now. At the same time, we are already experiencing effects of climate change that go well beyond global warming, such as shifts in rainfall patterns, rising sea levels, and more intense storms and heatwaves. Hence in parallel, reductions in emissions of other pollutants, including methane and black carbon (also referred to as soot) merit immediate, forceful action as these improve air quality while simultaneously slowing the rate of climate change over the next several decades.

Air pollution is literally killing people. It is the leading environmental cause of premature death, leading to ~7 million premature deaths per year (outdoor and indoor) globally [1]. Air pollution in the US causes about 135,000 premature deaths, 180,000 non-fatal heart attacks, 150,000 cases of hospitalization for respiratory and cardiovascular disease, ~130,000 emergency room visits for asthma, 18 million lost work days and 11 million missed school days [2]. Many of the compounds contributing to air pollution also drive climate change [3].

Multiple, peer-reviewed scientific studies have shown that aggressive reductions of those air pollutants that cause warming, in particular methane and black carbon, can reduce the rate of warming over the next several decades by approximately half [4-6]. A strategy to quickly and dramatically reduce these pollutants hence complements efforts to reduce carbon dioxide, as carbon dioxide reductions have little effect over the next few decades due to how long this gas stays in the atmosphere, which can be hundreds to thousands of years, and the time it will take to change human systems so that they generate less carbon dioxide. Slowing near-term climate change would benefit those already suffering from the impacts of climate changes. It would also improve the chances for both biological and human systems to adapt to the pace of change. Benefits of black carbon reductions are especially large in and near snow and ice covered regions such as the Arctic or the Himalayas.

At the same time, in comparison with projected emissions based on current legislation worldwide, an analysis of one approach to implementing these reductions showed that the improved air quality under such a strategy could save ~45 million lives and increase crop yields by about 1 billion metric tons due to

ozone reductions [4,7,8]. China, India and the United States are projected to see the largest gains in crop yields due to the cleaner air, with over 100 million tons of increased yield in the US. The economic value of the benefits of methane emissions reductions is well above the typical costs of emissions controls, which are less than $250, and sometimes emissions reductions can even be made at a cost savings [9]. Though hydrofluorocarbons (HFCs) do not directly cause poor air quality, curtailing the rapid growth in emissions of these compounds can provide substantial benefit in terms of reducing near-term climate change [6].

Thus efforts to control emissions of methane, black carbon (and co-emissions) and HFCs can provide multiple, large benefits to society. Since neither the damages attributable to climate change nor those due to degraded air quality are incorporated in our current economic markets, emissions reductions are a textbook example of a societal good that could benefit from government intervention. In part this is because the damages due to air pollution are not paid by the emitter, so that there is no economic incentive for emissions reductions, even in cases when emissions controls would be less expensive than the damages they would prevent. The damages are instead paid by those who bear increased health care costs and food prices. The emissions reduction measures described in prior work [4] along with use of low-global warming substitutes instead of HFCs can greatly reduce the damages from climate change over the next few decades while saving tens of millions of lives and hundreds of millions of tons of crops in comparison with business as usual, all at relatively modest cost.

In particular, reducing methane emissions from the oil and gas industry, coal mines and municipal waste and black carbon-related emissions from diesel vehicles, cookstoves, kerosene lighting and small industries such as brick kilns and coke ovens have been identified as actions that would provide great societal benefits [4,5,9-11]. In addition, the Arctic is extremely sensitive to the warming climate, and emissions of black carbon and other particles (or particle precursors) can have an especially large impact there [12,13]. Hence the specific actions in the Super Pollutants Act of 2014 to target many of these activities, to reduce emissions from polar shipping and to encourage use of low-global warming HFC substitutes are, based on the scientific evidence, likely to lead to substantial societal benefits on multiple fronts. The bill's efforts to promote financing would also address an important barrier to implementation [5,9].

Emission reduction efforts targeting these pollutants are currently being pursued by many nations, intergovernmental and non-governmental organizations, especially via the Climate and Clean Air Coalition. Additional US leadership in this area could help inspire others to step up their activities to put into place these urgently needed emissions reduction measures, all of which are developed and in use but need to be much more widely applied to reap the full potential societal benefits. International success in reducing emissions of methane, black carbon (and co-emissions) and HFCs would provide clear benefits to the public. Success could demonstrate that emissions can indeed be successfully reduced through concerted action across

government, industry and civil society for the sake of protecting the climate (at least in part). Success would also highlight how consideration of the full environmental consequences of emissions, including both climate change and air pollution, can guide development and implementation of optimal solutions to both problems.

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COMMENT

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GEOLOGY A history of how we got to grips with Earth's great age **p.340**

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SANJIT DAS/PANOS

A woman in Jharkhand, India, burns raw coal into charcoal, which emits toxic gases that harm her health and affect the climate.

Clean up our skies

Improve air quality and mitigate climate-change simultaneously, urge **Julia Schmale** and colleagues.

In December, the world's attention will fall on climate-change negotiations at the 20th United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties in Lima, Peru. The emphasis will be on reducing emissions of long-term atmospheric drivers such as carbon dioxide, the effects of which will be felt for centuries. At the same time, the mitigation of short-lived climate-forcing pollutants (SLCPs) such as methane, black carbon and ozone — which are active for days or decades — must be addressed (see 'Compounds of concern').

SLCPs cause poor air quality and are responsible for respiratory and cardiovascular diseases. Particulate matter in the atmosphere is the leading environmental cause of ill health, and air pollution is causing about 7 million premature deaths annually[1]. Interactions between warming, air pollution and the urban heat-island effect (which causes cities to be markedly warmer than their surrounding rural areas) will raise health burdens for cities worldwide by mid-century[2]. Air pollution also damages ecosystems and agriculture.

Current air-quality legislation falls short. Existing measures would prevent just 2 million premature deaths by 2040. We estimate that around 40 million more such deaths would be avoided if concentrations of methane, black carbon and other air pollutants were halved worldwide by 2030 (see 'Clean air').

This is not an 'either-or' decision: coordinated action on both climate change and air pollution is necessary. And it is tractable: for example, electric-car sharing or shifting from fossil fuels to renewable power generation would reduce consumption and overall emissions and lead to behavioural ▶

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shifts that are beneficial in both the near and long term[3].

But defining joint CO_2 and SLCP reduction goals is difficult. Researchers need to spell out the benefits and trade-offs of separate and joint air-pollution and climate-change mitigation in terms of public health, ecosystem protection, climate change and costs. A suite of mitigation policies must be designed and applied on all scales — from cities to the global arena.

DOUBLE JEOPARDY

Studies[4,5] estimate that rigorous reductions of global methane and black-carbon-related emissions by 2030 could prevent around 2.4 million premature deaths per year that result from air pollution, and save 50 million tonnes of crops through avoided ozone damage (methane is a precursor for ozone production). Global mean temperature rise would be slowed by about 0.5 °C by mid-century. The rate of sea-level rise would be reduced by 20% in the first half of this century by such measures alone, and by 50% in the second half if CO_2 and SLCP mitigation are combined[6].

Lower air pollution also has societal benefits. Methane captured from landfills or manure can be used to run residential stoves, for example. In developing countries, replacing conventional cooking stoves with clean-burning technologies allows people — women and children, in particular — to invest time in education or financially rewarding work, rather than spending time collecting wood or other materials for basic family needs[7].

All SLCPs must be reduced in concert. Sulphate aerosols cool the climate, as happens following volcanic eruptions. But delaying sulphur dioxide mitigation as a way to temporarily mask global warming is problematic. Greater stresses on people's health and the environment already result from today's enhanced particulate concentrations and acidified rain.

"Energy ministries tend to focus on CO_2 reductions and environment ministries manage air quality."

Coordinated action to mitigate SLCPs and CO_2 is hampered by fragmented policies. For example, energy ministries tend to focus on CO_2 reductions and environment ministries manage air quality. Greenhouse gases are subject to global agreements, whereas air pollutants are more usually limited locally by legislation. Regulation of different climate-forcing compounds is patchy.

Anthropogenic emissions of methane are predicted to increase by about 25% (more than 70 million tonnes annually) by 2030[4], yet the gas is hardly regulated. Methane is covered by the Kyoto Protocol, but most countries' controls focus on CO_2. In the European Union (EU), for example, methane is not covered by the national emissions ceiling directive, the directive on ambient air quality or the EU Emissions Trading System. The EU's industrial emissions directive omits major sources of the gas, such as cattle farming.

Air-quality policies in the EU and the United States have been partially successful in reducing periods of extreme ozone concentration. But average regional concentrations have not declined in the past two decades across Europe, and there is still no legally binding limit, only a target. Trends in the United States are mixed and vary seasonally; in east Asia, surface ozone is increasing.

For black carbon, there are almost no regulatory obligations to report emissions or measure ambient concentrations. Few regional and local assessments have been made. Little change in global black carbon emissions is predicted by 2030, because reductions in North America, Europe and northeast and southeast Asia and the Pacific will be offset by increases in south, west and central Asia and in Africa[4].

Unlinked and narrow air pollution and climate-policy interventions can have mixed results on both fronts. In the EU, for example, legislated vehicle-emissions limits have reduced particulate concentrations by 45% between 1995 and 2008 and are projected to reduce black carbon by more than 90% by 2025 compared with 2000. Yet CO_2 emissions from the ever-growing transport sector are rising. And air quality is not under control. Unregulated residential emissions from biomass heating are rising, and will account for 80% of black-carbon emissions in Europe in 2025.

Also problematic are lax targets. For example, the annual EU limit for particulate matter smaller than 2.5 micrometres ($PM_{2.5}$) that will be binding by 2015 is

COMPOUNDS OF CONCERN

Common air pollutants and industrial chemicals have major influences on the climate, human health and agriculture even though they persist for only a short time in the atmosphere.

	SUBSTANCE	MAIN EMISSION SOURCES	CHARACTERISTICS
	Methane	Oil and gas production Livestock farming Landfills and waste-water treatment Rice cultivation	**Lifetime:** 10 years **Health:** Precursor of ozone production, hampers plant metabolism **Climate:** Second most important climate forcer after CO_2
	Lower-atmospheric ozone	Traffic and transport Residential heating and cooking Agricultural and forest fires Brick production Oil and gas production	**Lifetime:** One month **Health:** Causes respiratory diseases, hampers plant metabolism **Climate:** Greenhouse gas — formed photochemically through reactions involving methane, nitrogen oxide, carbon monoxide and volatile organic compounds
	Black carbon	Traffic and transport Residential heating and cooking Agricultural and forest fires Brick production Oil and gas production	**Lifetime:** Days **Health:** Causes respiratory diseases, carcinogenic **Climate:** Warms lower atmosphere, changes precipitation, melts snow and ice it is deposited on
	Sulphur dioxide and nitrogen oxides	Traffic and transport Residential heating and cooking Agricultural and forest fires Brick production Oil and gas production	**Lifetime:** Days **Health:** Components of particulates, ozone precursors, cause acidification and eutrophication of ecosystems, cause respiratory and cardiovascular illnesses **Climate:** Contribute to negative radiative forcing, mask global warming
	Hydrofluorocarbons	Air conditioning Refrigeration Foam-blowing Fire suppression Solvents	**Lifetime:** Months to decades **Climate:** Strong greenhouse gases

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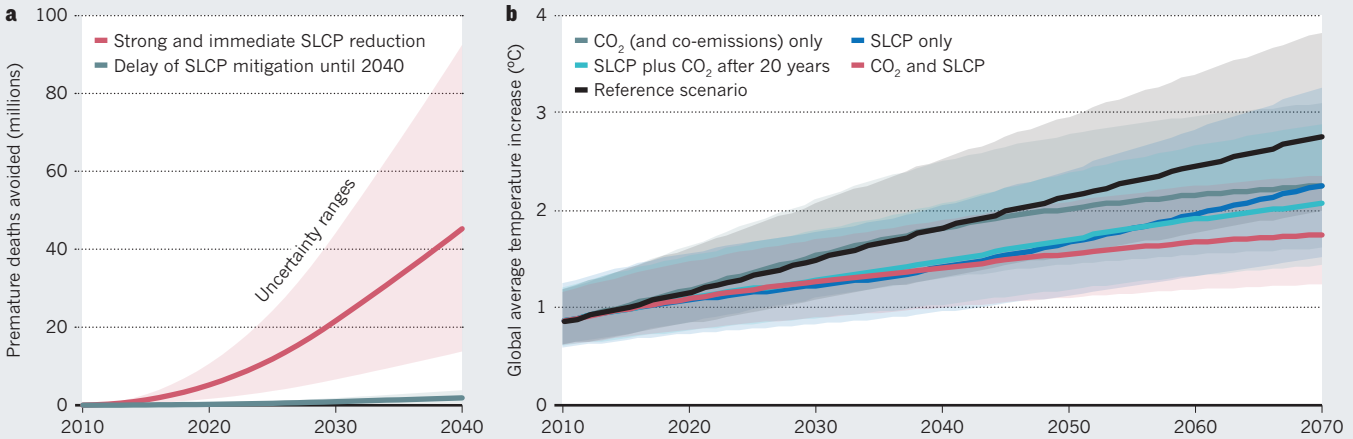
CLEAN AIR

More than 40 million deaths from respiratory and cardiovascular diseases could be prevented by 2030 by halving the concentration of short-lived climate-forcing pollutants (SLCPs) in the atmosphere immediately (**a**). Joint approaches to mitigating SLCPs and carbon dioxide are more effective than separate measures in limiting global average temperature rise[4] (**b**).



Relative to the average from the period 1890–1910.

2.5 times higher than that recommended by the World Health Organization (WHO). And the current PM_{10} (particulates smaller than 10 micrometres) limit is twice that recommended by the WHO. If the EU meets its limit on PM_{10}, no further action to meet the legal requirements will be needed, because the $PM_{2.5}$ value will also be met.

Some coordinated efforts to reduce air pollution and slow climate change have begun. The Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (CCAC), formed in 2012, now includes 42 nations, the European Commission and more than 50 organizations. It focuses on mitigating methane and black-carbon emissions for transport, brick, oil and natural-gas production, household cooking and heating. Since 2009, the Arctic Council runs task forces to reduce black-carbon and methane emissions to slow climate change in the region, and has produced two reports in addition to a scientific assessment of black carbon in the Arctic. But so far, only Norway has developed a national action plan to reduce SLCPs.

None of these efforts addresses structural and behavioural changes. Coordinated action to reduce SLCPs and CO_2 simultaneously is not an objective, because it is assumed that parallel reductions will happen under different policy umbrellas.

DOUBLE DUTY

Effective mitigation of SLCPs will require detailed assessments of the multiple impacts of emitted air pollutants together with CO_2, their sources, their atmospheric interactions and their potential for mitigation[8].

Combined efforts at the city and state level will be particularly important because this is where most people are exposed to air pollution, and 75% of global CO_2 emissions is generated in cities. Positions and task forces should be created to promote joint emissions-reduction strategies across municipal and regional departments. For example, climate policies that encourage combined heat and power plants with low power capacities for cities — thus potentially exempting them from air-quality regulations[3] — should be avoided.

Scaling up and coordinating local efforts and national strategies are necessary. For example, local efforts in the Arctic can be only partly effective because the region is subject to imported pollution from the residential and transport sectors of countries at lower latitudes.

Global organizations such as the CCAC, the World Meteorological Organization and the WHO could assume coordinating roles. Arctic Council member states should take a leadership role in national actions to reduce black carbon and methane at their next ministerial meeting in 2015. The European Commission should propose ambitious emissions limits for methane to the national emissions ceiling directive.

> ***"Unlinked and narrow air pollution and climate-policy interventions can have mixed results on both fronts."***

It is important that steps to limit SLCPs do not distract from CO_2 mitigation, and vice versa. We calculate, building on work[5] by D.S. and colleagues, that a delay of 20 years in reducing CO_2 emissions would result in 0.4 °C more warming by the end of the century than if measures were put in place immediately, with the result that the 2 °C temperature mark would be crossed in the mid-2060s rather than just after 2100 (see 'Clean air').

The 2015 Conference of the Parties meeting in Paris needs to pursue its primary mission to reduce CO_2 for the climate's sake. That said, the scientific community must speak out against recommendations — explicit or implicit[9,10] — to exclude SLCPs from discussions of climate-change mitigation or to delay their reduction. Tens of millions of lives are at stake, along with damage to agriculture, ecosystems and cultural heritage. ■

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TESTIMONY TO THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS OF THE UNITED STATES SENATE

Hearing on the Super Pollutants Act of 2014 (S. 2911)
Washington DC, 2 December 2014

Dr Benny Peiser
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I would like to thank the Chairman and the Committee for the opportunity to testify before your committee on the high risks and costs of unilateral climate policies.

I am the director of the Global Warming Policy Foundation (GWPF), a non-partisan think tank and a registered educational charity based in London. The GWPF, while open-minded on the contested science of global warming, is deeply concerned about the costs and other implications of climate policies currently being advanced in Britain and by other governments around the world.

Since the GWPF was launched in the House of Lords in 2009, it has been scrutinising the economic, social and industrial implications of unilateral climate policies of the UK and the EU.

Europe's climate strategy was founded on two key assumptions: first, that global warming was an urgent threat that needed to be prevented without delay and at all costs; and second, that the world was running out of fossil fuels, which meant oil and gas would become ever more expensive and renewable energy competitive. Both conjectures, however, turned out to be wrong, and as a consequence there is growing realisation within the EU that our unilateral climate policy is misguided and economically harmful.

The growing damage of this go-it-alone approach to the economic stability of Europe and the gradual abandonment of unilateralism is the subject of my testimony.

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EU unilateral climate policy since 2000

The European Union (EU) has long been committed to unilateral efforts to tackle climate change. For the last 20 years, Europe has felt a duty to set an example through radical climate policy-making at home.

European leaders were convinced that the development of a low-carbon economy based on renewables would give Europe a competitive advantage.[1]

It was in this political climate that the EU heads of state and government launched the so-called Lisbon Strategy in March 2000, with the goal of making Europe "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion".

Three months later, in June 2000, the European Commission launched the European Climate Change Programme (ECCP), which developed the EU implementation of the Kyoto Protocol.

In 2002, the EU[2] approved the Kyoto Protocol and committed to cutting its collective greenhouse gas (GHG) emissions to 8% below 1990 levels by 2008–2012, as required by the Kyoto protocol.

Today, 14 years after the EU adopted these key policies, the economies of most EU member states are stagnating or in decline. Last week the OECD warned that the crisis-ridden EU poses a major threat to the world economy.[3]

Recent UN climate summits show that there is no prospect of a legally binding international commitment to cap, let alone reduce GHG emissions. In the absence of a binding agreement, any unilateral policies are bound to burden nations with heavy costs and regulatory burdens without having any effect on the trajectory of global GHG concentrations over the coming century.

Even though EU policy has managed to reduce CO2 emissions domestically, this was only achieved by shifting energy-intensive and heavy industries overseas: to locations where there are no stringent emission limits, where energy and labour is cheap and which are now growing much faster than the EU. Most products consumed in the EU today are imported from countries without any binding CO2 targets. It is no surprise that while the EU's domestic CO2 emissions have fallen, if you factor in CO2 emissions embedded in goods imported into EU, the figure remains substantially higher (Fig. 1).

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[1] http://www.renewableenergyfocus.com/view/928/wind-energy-gives-europe-a-competitive-advantage/

[2] It was then still called the European Community.

[3] http://online.wsj.com/articles/eurozone-stagnation-poses-major-risk-to-global-growth-oecd-warns-1416911402

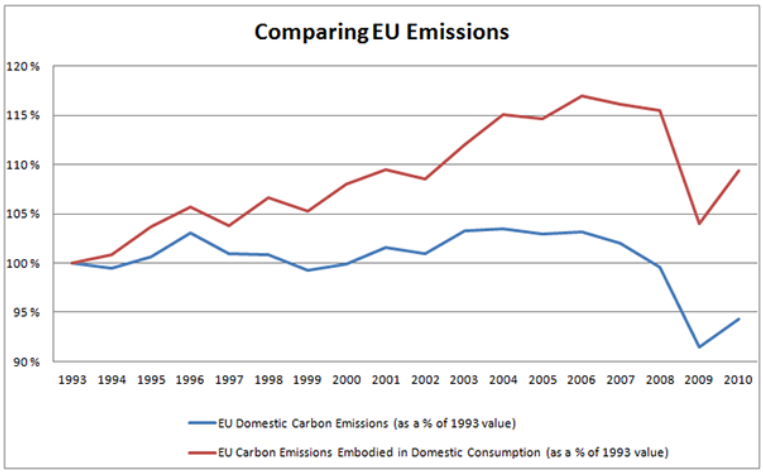

Fig. 1 EU CO2 emissions

EU CO2 emissions remain substantially higher when embedded emissions resulting from imported goods consumed in EU members states are factored in.[4]

EU policymakers naively assumed that Europe's main competitors would follow the shift from cheap fossil fuels to expensive green energy. This never happened and was never truly realistic given the existence of abundant and significantly cheaper options. Europe, as even the editors of the *Washington Post* acknowledged last year, "has become a green-energy basket case. Instead of a model for the world to emulate, Europe has become a model of what not to do."[5]

As energy prices continue to rise, Europe's remaining and struggling manufacturers are rapidly losing ground to international competition. European companies and investors are pouring money into the US, where energy prices have fallen to less than half of those in the EU, thanks to the shale gas revolution.

EU abandons unilateral climate targets

Early proclamations about the urgency of the global warming problem have run up against the reality of the near two-decade-long pause in global surface temperature rises, which was not predicted by climate models. In part as a result, climate change has dropped quite significantly down on the international agenda in recent years.

At the very least, the consistent overestimation of recent warming trends by climate models, a problem openly acknowledged in the last IPCC report, raises the possibility that model-based estimates of the environmental impacts of carbon

[4]http://www.footprintnetwork.org/en/index.php/GFN/blog/deconstructing_carbon_before_un_climate_summit

[5] http://www.washingtonpost.com/opinions/europe-is-becoming-a-green-energy-basket-case/2013/04/21/4b1b81d0-a87e-11e2-b029-8fb7e977ef71_story.html

dioxide emissions are biased high, and that attempts to portray climate change as an imminent emergency are not based on sound empirical evidence.

Another key assumption of European climate policy was that a legally binding climate treaty would be reached and that the EU would greatly benefit from its implementation around the world. In reality, a binding agreement proved to be impossible and is unlikely to be forthcoming anytime soon.

In the meantime, the EU is stuck with extremely costly unilateral targets – an outcome described by the British government's 2009 impact assessment as the "worst case scenario, which would [raise serious questions about] the benefits of on-going unilateral action" and which is unlikely to be "sustainable in practice".[6]

Due to the failure of the international community to agree a follow-up treaty to the Kyoto Protocol, there is no longer any enthusiasm for new unilateral climate targets among most countries in central and eastern Europe. The governments of Poland, Hungary, the Czech Republic, Slovakia, Romania, Bulgaria, Latvia and Lithuania are all opposed to adopting any new CO_2 targets in the absence of a binding UN agreement.

Last year, Antonio Tajani, the EU's outgoing Industry Commissioner, warned that Europe's unilateral climate policies were pushing electricity costs to uncompetitive levels:

> We face a systemic industrial massacre. We need a new energy policy. We have to stop pretending, because we can't sacrifice Europe's industry for climate goals that are not realistic, and are not being enforced worldwide.[7]

Gunther Oettinger, the EU's outgoing energy commissioner, declared in September that the EU should not adopt new binding CO2 targets unless all major emitters would do likewise:

> If there is no binding commitment from countries as India, Russia, Brazil, the US, China, Japan and South Korea, whose governments are responsible for some 70% of global emissions, I think it is not really smart to have a −40% target...If we are too ambitious and others do not follow us we will have an export of production and more emissions outside the EU.[8]

Oettinger's proposal was adopted on 23 October, when EU leaders agreed a conditional CO2 reduction target of 40% by 2030 – provided there is a legally

[6] http://www.openeurope.org.uk/Content/Documents/Rotten_Foundations_-_Open_Europe_Report.pdf

[7] http://www.telegraph.co.uk/finance/financialcrisis/10295045/Brussels-fears-European-industrial-massacre-sparked-by-energy-costs.html

[8] http://www.theguardian.com/environment/2014/sep/25/europe-should-only-cut-carbon-if-world-agrees-paris-climate-deal-eu-energy-chief

binding UN climate treaty. A special "flexibility clause" was added to the final text, allowing the Council to reassess its conditional target after the UN summit.[9]

The EU's post-2020 targets for greenhouse gas emissions and renewable energy are contingent on a legally binding global agreement at the UN climate conference in Paris in 2015. The chances of such an agreement, however, are close to zero. China and India have made their support for such a deal conditional on a legally binding climate finance package of $100 billion per year by 2020 as promised by President Obama at the UN climate conference in Copenhagen in 2009.[10]

Loss of competitiveness

Energy prices for industry

European governments have advanced the most expensive forms of energy generation at the expense of the least expensive kinds. No other major emitter has followed the EU's aggressive climate policy and targets.

EU members states have spent about €600 billion ($882bn) on renewable energy projects between 2005 and 2013, according to Bloomberg New Energy Finance.[11] Germany's green energy transition alone may cost up to €1 trillion by 2030, the German government recently warned.[12]

As a result of these policies, energy prices have risen sharply in Europe (Fig. 2).[13]

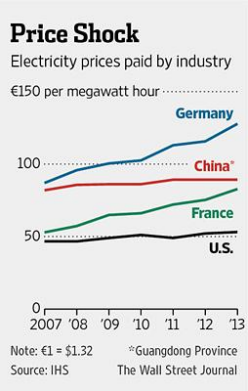

Fig 2. Industrial energy price trends

Source *The Wall Street Journal*, 26 August 2014

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[9] European Council Agreement: 2030 Climate And Energy Framework. http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145356.pdf

[10] http://www.foxnews.com/world/2014/09/24/climate-change-china-rebuts-obama/

[11] Michael Liebreich, Bloomberg New Energy Finance Summit, New York 23 April 2013.

[12] http://www.reuters.com/article/2013/02/20/us-germany-energy-idUSBRE91J0AV20130220

[13] http://online.wsj.com/articles/germanys-expensive-gamble-on-renewable-energy-1409106602

Electricity prices in Europe are now more than double those in the USA (Fig. 3).[14]

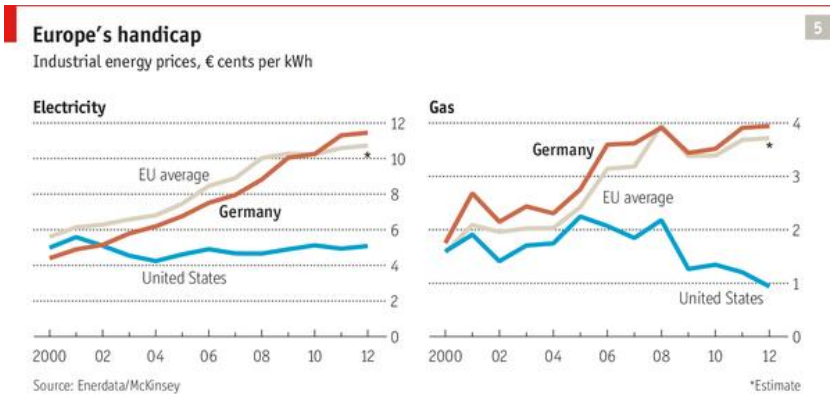

Fig 3. Industrial electricity and gas price trends

Source: *The Economist*, 15 June 2013

Lower gas and electricity prices in 2012 in the United States relative to Europe equated to estimated savings of close to $130 billion for US manufacturing industry as a whole. The IEA estimates that electricity prices in the European Union will remain around twice those in the US in 2035.[15]

High energy prices lead to loss of competitiveness

Europe's manufacturers are rapidly losing ground to international competition. Energy price differentials impact industrial competitiveness significantly. In recent years, the US, together with key emerging economies, has increased its export market share for energy-intensive goods, while the EU and Japan have see a sharp decline (Fig. 4).[16]

[14] http://www.economist.com/news/special-report/21579149-germanys-energiewende-bodes-ill-countrys-european-leadership-tilting-windmills

[15] http://www.worldenergyoutlook.org/media/weowebsite/factsheets/WEO2013_Factsheets.pdf

[16] http://www.gastechnews.com/unconventional-gas/iea-outlook-highlights-role-of-gas-prices-in-competitiveness/

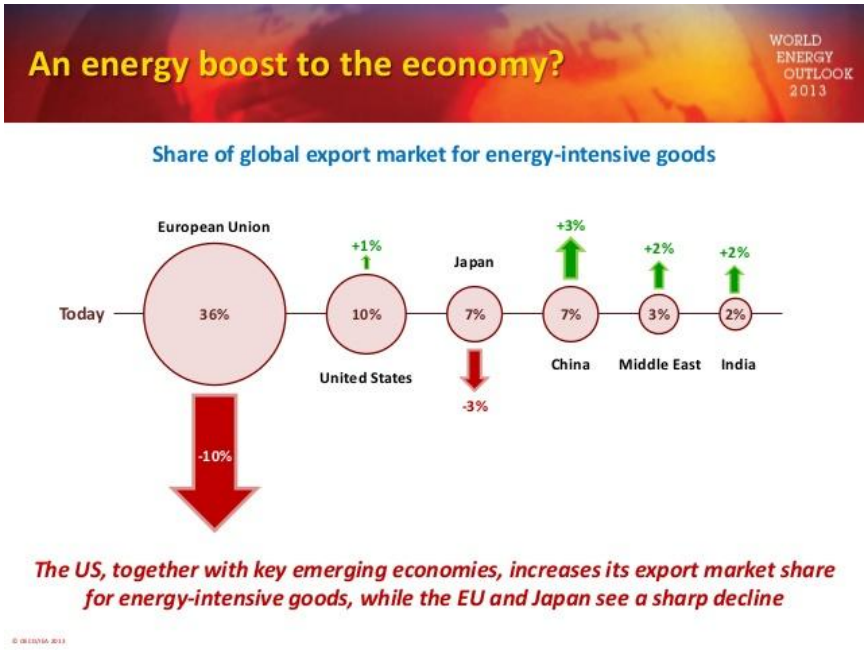

Fig. 4: Global market share for energy-intensive goods

Source: *World Energy Outlook 2013*

The situation is expected to become worse. By 2020 energy taxes may will account for half of UK energy intensive manufacturers' energy bills. The cost of government policy on energy prices paid by UK steelmakers is expected to be over 280% more than the equivalent cost for their American and Russian competitors.[17]

Energy intensive industry expected to decline in the EU

Energy costs are of crucial importance to energy-intensive industries such as chemical, cement, steel and glass manufacturers and oil refiners. The IEA believes that the EU and Japan will see a strong decline in their export shares in these products over time.[18]

The EU's key chemical industry is in sharp decline, facing extinction

The chemical industry is one of the EU's most successful sectors, boasting €527 billion in sales in 2013, making it the second-largest global producer.

High energy costs over the past two decades have contributed significantly to the loss of the EU chemical sector's competitiveness in the global export market. Lost competitiveness has eaten into the EU share of global exports, which fell to 21% in 2012 from 31% in 1991. Due to the erosion of competitiveness, the EU has slipped

[17] www.eef.org.uk/~/media/38010cfb140147b3ab526d6f5832cd87.pdf

[18] http://www.worldenergyoutlook.org/media/weowebsite/factsheets/WEO2013_Factsheets.pdf

from third to fourth out of seven leading global chemical exporters with regard to absolute levels of competitiveness.[19]

In a letter to the president of the European Commission, Jim Ratcliffe, the chairman and CEO of the Ineos chemical group, recently warned that the European chemicals industry is at risk of being wiped out in a decade, with the loss of 6 million jobs if uncompetitive energy prices continued to drive the rapid closure of Europe's chemical plants. Ratcliffe pointed out that in Britain alone 22 chemical plants have closed down since 2009 and not a single new one has been built:

> I can see green taxes, I can see no shale gas, I can see closure of nuclear, I can see manufacturing being driven away. It's not looking good for Europe, we are rabbits caught in the headlights, and we have got our trousers down.[20]

While Europe's high cost policies have become an existential threat to the long-term survival of the chemical industry, cheap energy is reviving the fortunes of the industry in the US (Fig. 5). The shale revolution has significantly lowered energy costs, spurred international demand for goods derived from chemicals and has created a huge competitive advantage. US industry has gone from a trade deficit to a $3.4 billion surplus. By 2018, the trade surplus could reach $30 billion, according to some estimates – a tenfold increase in five years.[21]

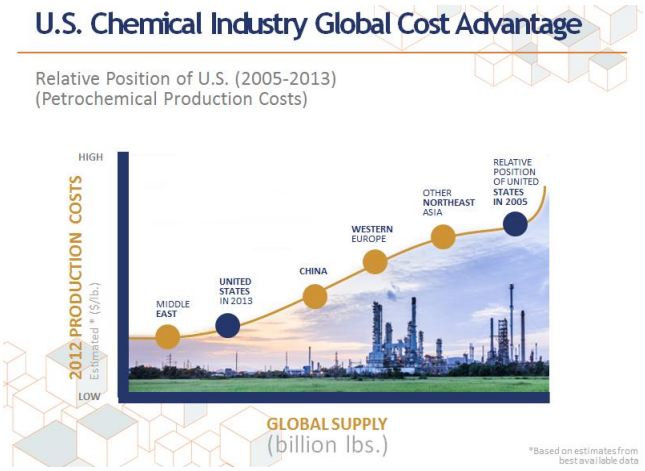

Fig 5. US chemical industry cost advantage

Source: *American Chemistry Matters*, 30 October 2014[22]

[19] http://www.cefic.org/Documents/PolicyCentre/Competitiveness/Oxford-Study-2014.pdf

[20] http://www.telegraph.co.uk/finance/newsbysector/industry/10681902/European-chemicals-industry-could-be-wiped-out-in-a-decade-says-Ineos-boss.html

[21] http://blog.americanchemistry.com/2014/10/u-s-manufacturing-exports-surging-due-to-shale-gas/

[22] http://blog.americanchemistry.com/2014/10/u-s-manufacturing-exports-surging-due-to-shale-gas/

Steep loss of competitiveness in the steel industry

Energy costs alone represent up to 40% of the total costs of a steel plant in Europe, significantly more than in the USA, Russia, the Middle East or China. This is driving global steel investment outside the EU, where there are no such targets or green taxation to reduce CO_2 emissions.

The European steel industry employs 335,000 people. ArcelorMittal Europe estimates that their European steelmaking operations are at a $1 billion energy-cost disadvantage compared with their counterparts in the USA. Aditya Mittal, its CEO, has recently warned that the cost of implementing the EU's 2030 climate targets unilaterally would make European steelmaking unviable. He estimates that the additional costs for the steel sector between 2020 and 2030 would be around €58 billion ($73.76 bn) of which ArcelorMittal would have to bear €20 billion, or an average of €2 billion a year, far exceeding ArcelorMittal's European profits.[23]

While global steel output is increasing, European steel production is in steep decline and continues to lose competitiveness. The EU's share of global steel production has more than halved in recent years, falling from 22% in 2001 to 10% in 2013 (Fig. 6).[24]

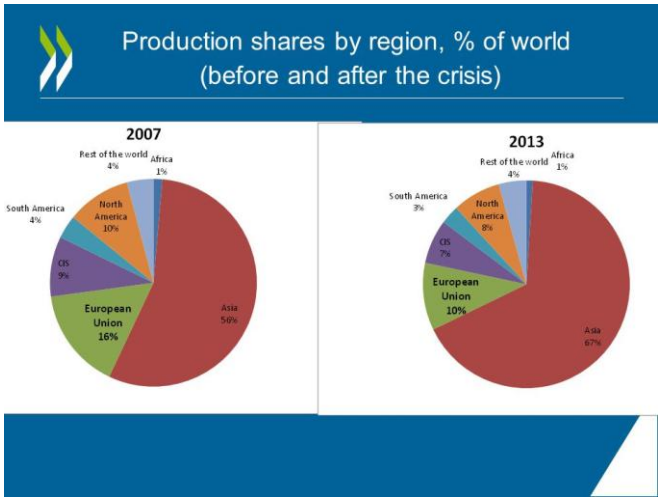

Fig 6. Outlook for the steel market

Source: OECD, March 2014

European manufacturing firms investing in the US

There has been a significant increase in the number of European manufacturers investing in the USA. It is driven by exasperatingly complex and costly environmental and other regulations, and the widening gap between energy and electricity costs in Europe and the USA. Analysts believe that the growing

[23] http://online.wsj.com/articles/saving-european-steel-and-the-environment-too-1414001857

[24] http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetailDoc&id=12706&no=3

investment of European companies in North America is in its infancy and will continue so long as the energy price gap remains significant.[25]

BASF estimates that it could save $688 million/year in energy costs alone if its German chemical plants were situated in the USA rather than in Germany. The company has doubled its capital investment in the USA to $1 billion/year in 2013 and has earmarked an additional $4 billion in capital investment through 2017.

The industrial base is being lost

Governments are increasingly concerned about the growing threat that high energy prices pose to Europe's industrial base. The gap in competitiveness was the central theme of a summit of EU heads of government in Brussels in May 2014.

The data on the share of the EU manufacturing output on a global scale show that the share of manufacturing in Europe (and the US) has been consistently decreasing, while manufacturing in China has been on the rise (Fig. 7).

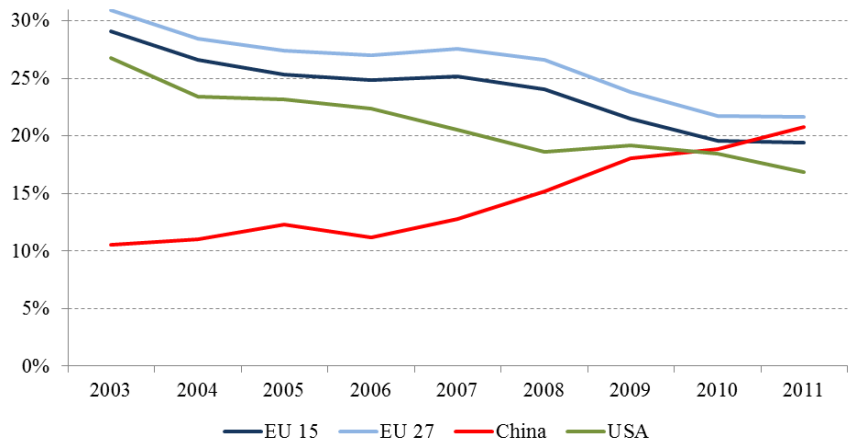

Fig. 7 Shares of global manufacturing output (before the impact of the US shale revolution)
Source: UN National Accounts Main Aggregates Database, European Commission, September 2013.26

High energy prices will further cut into the EU's global share of manufacturing. In sharp contrast, US exports of manufactured products have risen by 6 percent since the start of America's shale revolution, according to a recent report by the International Monetary Fund (IMF). It is clear evidence that cheap energy – already a strong catalyst for chemical industry export growth – is benefiting U.S. manufacturing.[27]

[25] http://www.agracel.com/481-2014-trends-that-excite-agracel-1european-manufacturing-firms-moving-to-usa/

[26] http://europa.eu/rapid/press-release_MEMO-13-815_en.htm

[27] See more at: http://blog.americanchemistry.com/2014/10/u-s-manufacturing-exports-surging-due-to-shale-gas/

Absurd climate policy: cheap coal, expensive gas

Of all the unintended consequences of EU climate policy perhaps the most bizarre is the detrimental effect of wind and solar schemes on the price of electricity generated by natural gas.

Many gas power plants can no longer operate enough hours. They incur big costs as they have to be switched on and off for back-up. When wind and solar output increases, energy prices become more volatile which adds to the costs.

The increasing requirement of utilities to back-up renewable power has undermined the profitability of natural-gas-fired plants in much of Europe, leading to the widespread shutdown of combined-cycle gas turbine plants, which are among the cheapest form of low-carbon power generation.

Every 10 new units' worth of wind power installation has to be backed up with some eight units' worth of fossil fuel generation. This is because fossil fuel plants have to power up suddenly to meet the deficiencies of intermittent renewables. In short, renewable do not provide an escape route from fossil fuel use without which they are unsustainable.[28]

Gas-fired power generation has become uneconomic in the EU, even for some of the most efficient and least carbon-intensive plants. At the end of 2013, 14% of the EU's installed gas-fired plants stood still, had closed or at risk of closure. If all gas plants currently under review were to close, this would amount to 28% of current capacity by 2016.

Almost 20 per cent of gas power plants in Germany have already become unprofitable and face shutdown as renewables flood the electricity grid with preferential energy. To avoid blackouts, the government has to subsidise uneconomic gas and coal power plants. Already half of the 28 EU countries have in place or are planning to subsidise fossil fuel power plants to keep the lights on.

Ironically, the EU's flagship climate policy, its Emissions Trading Scheme, has led to the collapse in carbon prices which is making coal-fired power plants much more economical than gas-fired power plants.

As a result, EU power utilities have been forced to write down their assets, with some €15 bn in 2013 alone. Instead of building new power plants in the EU, major utilities are investing in thermal power plants outside of the EU.[29]

Paying for availability for a substantial proportion of conventional power plants has thus become unavoidable in countries with large shares (10% or more) of renewable electricity.

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[28] http://www.thegwpf.org/images/stories/gwpf-reports/hughes-windpower.pdf

[29] http://notalotofpeopleknowthat.wordpress.com/2014/06/05/eu-energy-markets-in-crisis/

If you think this cannot happen in the US where gas prices are low, think again. Low gas prices are an unambiguous advantage for energy-intensive industries and existing power plants; but they cannot solve the high risk of investment in new power plants that are at risk of becoming inefficient and uneconomic as a result of renewable energy targets.

New US gas-fired power plants face the same economic problems, despite low gas prices. As the share of intermittent renewables generation increases in the US, consumers will find that they have to pay through similar mechanisms to insure adequate back-up. And these mechanisms are extremely expensive as the European experience shows.

Essentially, twice as much generating capacity is needed just to deal with the intermittency of wind and solar energy. In some US state with high renewable mandates, this inevitable rise in cost could happen fairly soon.

While gas for power generation remains cheap in the US because of the shale revolution, it is only cheap for power generation so long as gas plants can run uninterrupted and for long periods of time. If they have to be increasingly switched on and off because of high levels of intermittent renewable, gas plants will be displaced by cheap coal sooner than most people think – just as is happening in Europe right now. Of course, CO2 emissions would rise quickly and significantly too.

Rising energy poverty

According to Peter Lilley, a British MP and member of the Parliamentary Energy and Climate Change Committee, the UK's 2008 Climate Change Act is perhaps the most costly government programme since the introduction of the Welfare State, with an impact of over £17,000 per household. The revised official impact assessment for the Climate Change Act 2008 estimated the cost at up to £430 ($675) billion. This excludes transitional costs which it says could be 1.3–2.0% of GDP up to 2020, and the cost of driving industry abroad, which it says could be significant.[30]

Open Europe estimates that in 2013, as a direct result of the EU's unilateral climate policies, the average energy bill for a medium-sized business was increased by 9% (£130,000/ $200.000) due to EU regulations or UK implementation of EU-defined targets. By 2020, EU-related climate regulations or targets will have increased medium sized firms' bills by 23% (£350,000/$550,000).[31]

In the EU, hundreds of billions are being paid by ordinary families and small and medium-sized businesses in what is undoubtedly one of the biggest wealth transfers from poor to rich in modern European history. Rising energy bills are

[30] http://www.thegwpf.org/content/uploads/2012/10/Lilley-Stern_Rebuttal3.pdf.

[31] http://www.openeurope.org.uk/Content/Documents/Rotten_Foundations_-_Open_Europe_Report.pdf

dampening consumers' spending, a poisonous development for a continent still struggling to recover from the financial crisis.

Germany's renewable energy levy, which subsidises green energy production, rose from €14bn to €20bn in just one year as a result of the fierce expansion of wind and solar power projects. Since the introduction of the levy in 2000, the electricity bill of the typical German consumer has doubled.

As wealthy homeowners and business owners install wind turbines on their land and solar panels on their homes and commercial buildings, low-income families all over Europe have had to foot the skyrocketing electric bills. Many can no longer afford to pay, so the utilities are cutting off their power. The German Association of Energy Consumers estimates that up to 800,000 Germans have had their power cut off because they were unable to pay the country's rising electricity bills.[32]

Conclusions

On costly green energy policies "Europe made the wrong bet", the *Financial Times* warned on Friday. "There are no energy-intensive investments taking place in Europe now," the FT quoted Dieter Helm, professor of energy policy at the University of Oxford. "Why would you locate a new investment in a place with both high labour costs and high energy costs, many of which are self-inflicted?"

The EU's unilateral climate policy is absurd: first consumers are forced to pay ever increasing subsidies for costly wind and solar energy; secondly they are asked to subsidise nuclear energy too; then, thirdly, they are forced to pay increasingly uneconomic coal and gas plants to back up power needed by intermittent wind and solar energy; fourthly, consumers are additionally hit by multi-billion subsidies that become necessary to upgrade the national grids; fifthly, the cost of power is made even more expensive by adding a unilateral Emissions Trading Scheme. Finally, because Europe has created such a foolish scheme that is crippling its heavy industries, consumers are forced to pay even more billions in subsidising almost the entire manufacturing sector.

In the last few years, major economies such as Canada, Australia and Japan have begun to realise the futility of going it alone and have retreated from or abandoned their climate policies and CO_2 targets. Now even the EU has decided to walk away from its go-it-alone approach and has adopted a conditional climate pledge. It has burdened European taxpayers and businesses with astronomical costs while shifting its heavy industry and CO_2 emissions to other parts of the world.

Europe's climate policy failure demonstrates beyond doubt that its unilateralism has been a complete fiasco. The lessons of this self-defeating debacle are clear: don't make the same mistake. Policymakers would be well advised to heed this warning.

[32] http://www.spiegel.de/international/germany/high-costs-and-errors-of-german-transition-to-renewable-energy-a-920288.html

Testimony

Stephen Moore
Chief Economist
Heritage Foundation

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

Legislative Hearing To examine the following items:
S.2911, Super Pollutants Act of 2014

TUESDAY, DECEMBER 2, 2014

My name is Stephen Moore and I am the chief economist at the Heritage Foundation. Neither I nor the Heritage Foundation receive any federal funding.

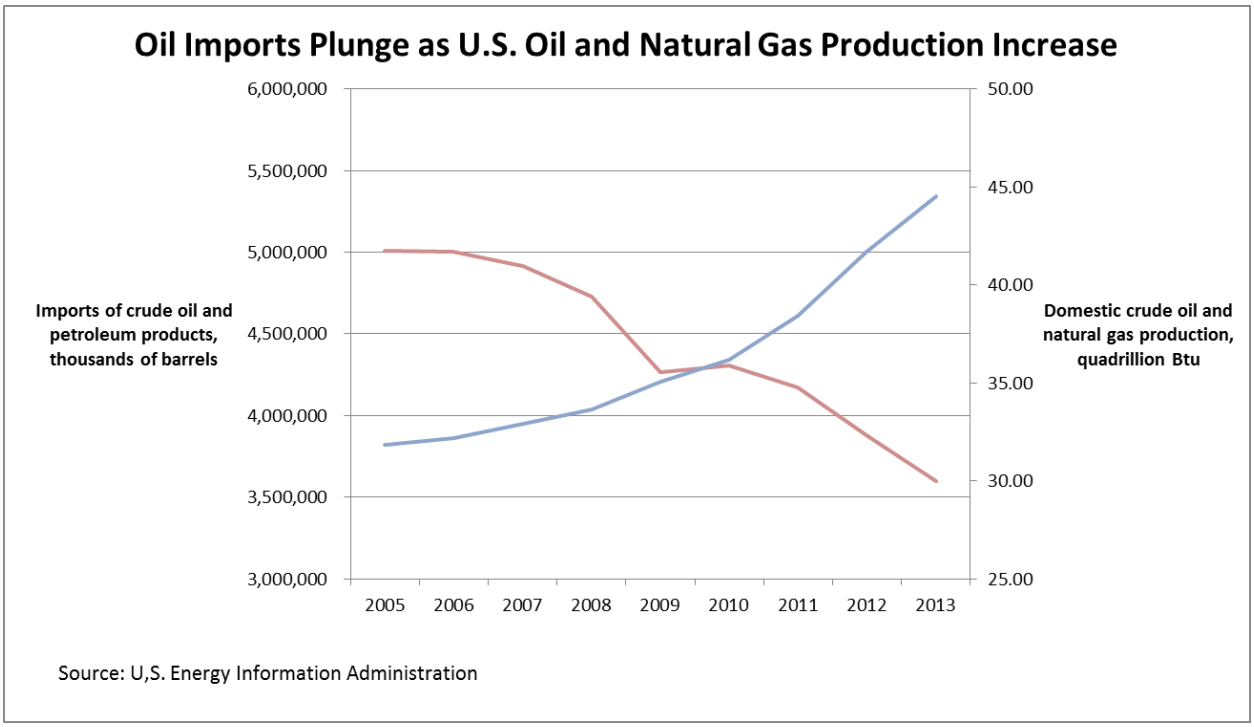
I was asked to comment on the importance of the U.S. Fossil fuels industry on the U.S. Economy and the importance of ensuring that government regulation does not impede this critical industry's growth in future years.

1. The fossil fuels boom is vital to American economic growth.

America is currently experiencing the greatest oil and gas boom in the history of our nation. Over the last seven years U.S. Domestic production of natural gas and oil has increased by nearly 70 percent. This spectacular surge in domestic fossil fuel production was unpredicted even by experts in the industry as recently as 2008-2009. Almost no one saw it coming. The spectacular revival of U.S. Energy development is a result of America's technological prowess, entrepreneurial spirit, and a commitment in the industry to expanding domestic output.

Fracking and horizontal drilling have been game-changing technological improvements that have made shale oil and gas an affordable and abundant domestic energy source. The U.S. has hundreds of years of supply with existing technology, and the drilling procedures keep improving dramatically. As U.S. Production has risen, American reliance on foreign oil

has fallen drastically. See chart. Oil imports are down by more than one thirdin the past eight years and by year 2020 net imports could be down to zero. This means the elusive goal of energy independence is easily within our grasp in the near term.

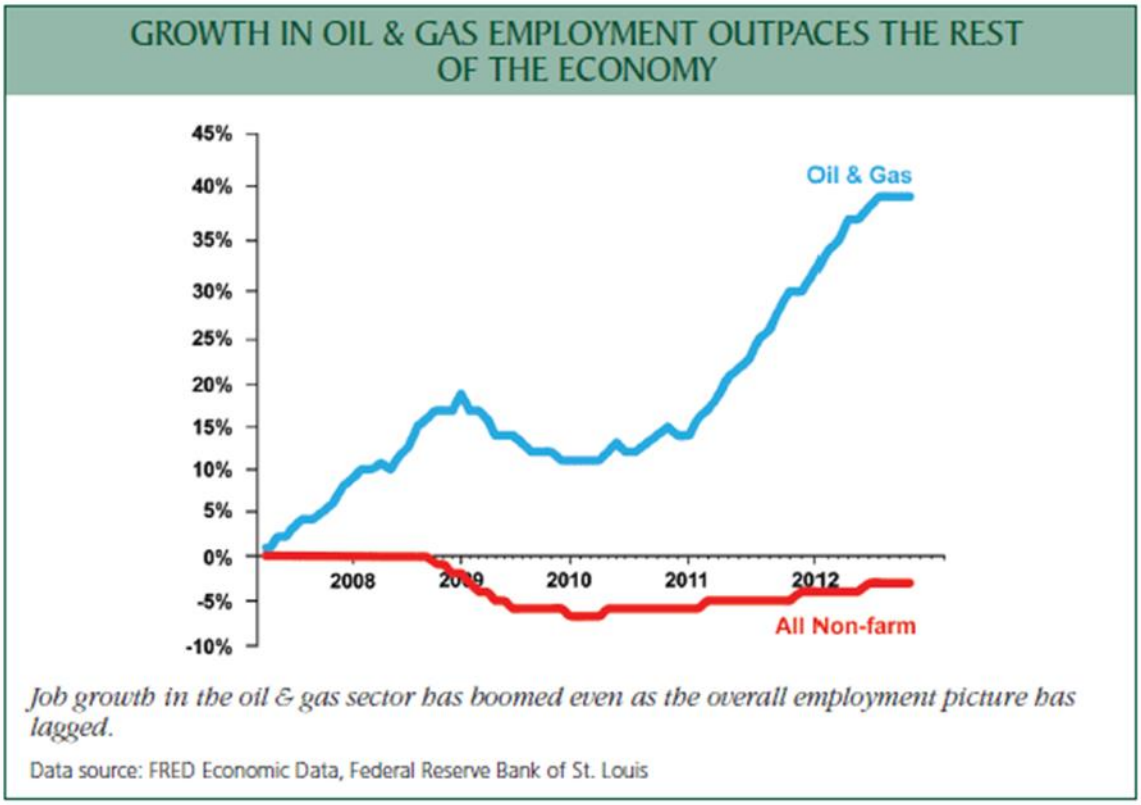


Those who once thought that the U.S. is running out of fossil fuels and that we would soon drill our last barrel of oil have been proven dead wrong. Thanks to the giant shale oil and gas plays in North Dakota, Texas, Oklahoma, Wyoming, West Virginia, Pennsylvania and Ohio, America isn't running out of oil and gas, as President Obama wrongly declared a few years ago, we are running into it.

2. Without the surge of oil and gas development, the Great Recession would not have ended.

The economic ramifications of this fossil fuels revolution are hard to overstate. It is not far from an exaggeration to say that without the surge in shale oil and gas, the great recession of 2008-09 would have lasted several more years. Figure 1 shows the gigantic increase in employment

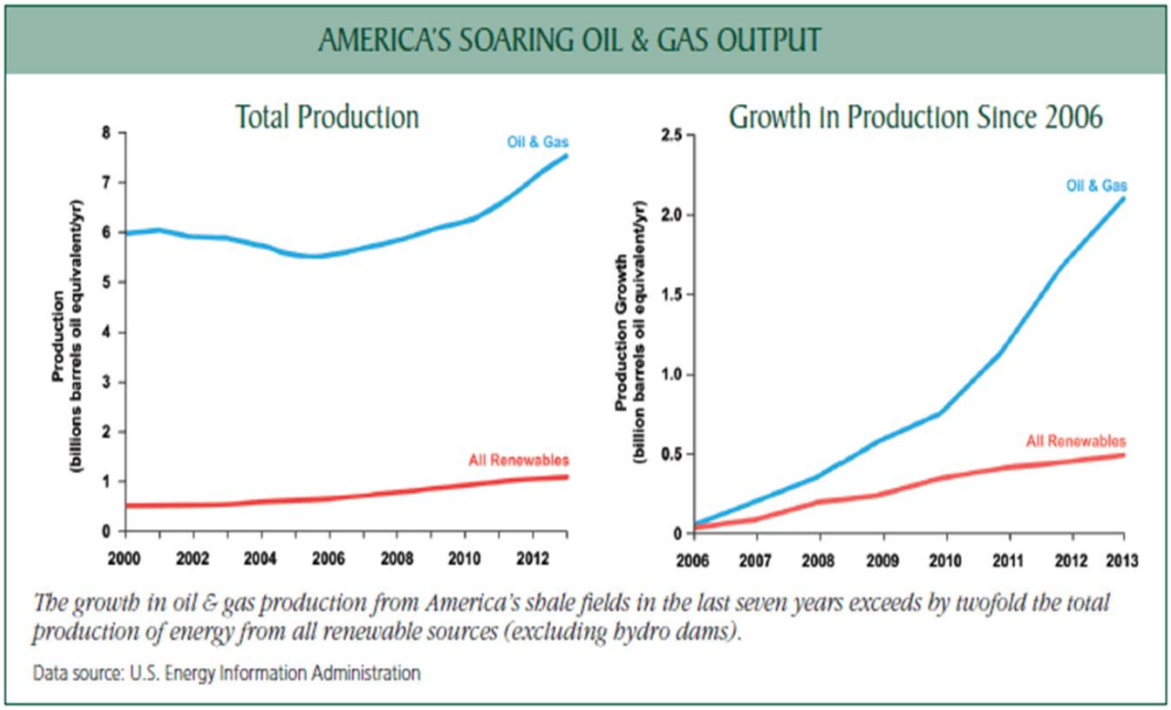
attributable to oil and gas since 2008. The contribution to the U.S. Annual GDP has been in the hundreds of billions of dollars.



Turn off fossil fuel development in America and you turn off the lights on the U.S. Economy - literally and figuratively.

3. Green energy has so far been an inconsequential form of energy production.

Figure 2 shows that almost all the increase in energy production in the US has been from fossil fuels - not so-called "green energy." Despite $70 billion in direct federal taxpayer subsidies under Presidents George W. Bush and Barack Obama, renewable energy remains mostly a niche market. We have an $18 trillion industrial economy - it cannot be powered with windmills and solar paneling anytime soon.



This was the conclusion of energy scientists from Google who were in charge of the search engine company's renewable energy research. They very recently acknowledged the unworkability of "green energy" on an economy-wide scale. According to engineers Ross Koningstein and David Fork, last month:

> *Starting in 2007, Google committed significant resources to tackle the world's climate and energy problems. A few of these efforts proved very successful: Google deployed some of the most energy-efficient data centers in the world, purchased large amounts of renewable energy, and offset what remained of its carbon footprint.*
>
> *Google's boldest energy move was an effort known as RE<C, which aimed to develop renewable energy sources that would generate electricity more cheaply than coal-fired power plants do. The company announced that Google would help promising technologies mature by investing in start-ups and conducting its own internal R&D. Its aspirational goal: to produce a gigawatt of renewable power more cheaply than a coal-fired plant could, and to achieve this in years, not decades.*

Unfortunately, not every Google moon shot leaves Earth orbit. In 2011, the company decided that RE<C was not on track to meet its target and shut down the initiative. The two of us, who worked as engineers on the internal RE<C projects, were then forced to reexamine our assumptions.

At the start of RE<C, we had shared the attitude of many stalwart environmentalists: We felt that with steady improvements to today's renewable energy technologies, our society could stave off catastrophic climate change. We now know that to be a false hope—but that doesn't mean the planet is doomed. They believe the savior could be nuclear energy.

Meanwhile, solar and wind power have received massively greater federal subsidies than oil, gas and coal. A study by the Institute for Energy Research finds that per kilowatt of electricity produced, taxpayer subsidies have been five to ten to twenty times higher for wind and solar energy than for fossil fuels.

4. Shale gas is reducing U.S. greenhouse gas emissions.

This is the environment committee so I should add that although shale oil and gas drilling remains controversial, these breakthroughs in drilling have played a major role in reducing green house gases. The conversion of U.S. Utilities from coal to Natural gas has moved America into the position of reducing our greenhouse gas emissions more than any other industrialized nation. This was a point President Obama made last month and he was right. Coal has also become cleaner, which is reducing U.S. emissions. Here are the changes in greenhouse gas emissions for major nations:

Greenhouse Gas Emitters

Change in Co2 Emissions 2000-2011	
United States	-6.50%
EU-27	-5.60%
Australia	10.10%
Russia	19.30%
India	74.10%
China	156.70%

U.S. Energy Information Administration, 2014.

In other words, the green protesters have it all wrong on fracking and horizontal drilling. These technologies greatly reduce greenhouse gas emissions and make climate change, less, not more probable in the future.

5. The fall in oil prices is a major stimulant to the U.S. Economy and is reducing income inequality.

One other economic windfall from America's fossil fuels rennaisance is worth mentioning given the developments of recent weeks and months. I am referring to the steep decline in gas prices.

The crude oil price has fallen to as low as $66 a barrel at the end of November from nearly $105 a barrel this Summer - a Godsend for consumers. A rule of thumb is that every penny reduction in gas prices represents more than $1 billion in annual savings to American consumers.

So we are nearing a $100 billion a year oil price reduction stimulus to the economy. This is a REAL and durable stimulus, because this extra money injected into the economy never has to be paid back.

The typical household in America spends about $5,900 a year on energy. Cutting these costs by 30 percent means a near $1,800 windfall for each family.

On the Democratic side of the aisle, where there is an emphasis on reducing "income inequality," it is critical to understand that lowering energy costs helps the poor far more than the rich. This is because Census Bureau data find that the rich spend far less than half of their income on energy than the poor. So any policy - such as cap and trade, severe EPA emissions regulations, environmental treaties - would hurt the poor far more than the rich. Any measure to slow down domestic fossil fuel

production is nothing more than a regressive tax on those with low incomes.

One study cited in *The Wall Street Journal* found that the savings to the poor from the reduction in natural gas prices were two to three times bigger than the benefits from the Low Income Home Energy Assistant program. And yet shale gas and oil costs taxpayers nothing.

Since energy is a basic input into everything we produce and consume, lower oil prices make EVERYTHING cheaper - from a candy bar to a computer to an airline ticket. Low domestic energy costs - especially from shale gas - is helping revitalize American manufacturing across the country.

6. Government regulation of the oil and gas industry poses a major threat to the revival of the U.S. Economy.

Congress must resist regulations, mandates, and treaties that would jeopardize this treasure chest of domestic energy resources.

In the recent elections, the American voters made it clear, they want jobs to be job number one in America. Yet the new Clean Power Plant rule and the alleged deal President Obama signed with China over climate change threaten tens of thousands of jobs right out of the gate. For example, EPA rules aim to reduce carbon dioxide (CO2) emissions from U.S. power plants by 30 percent. That’s an enormous and costly burden on our power generating utilities. According to Energy Ventures Analysis, an energy research firm, the annual costs for residential, commercial and industrial energy customers in America would be about $173 billion higher in 2020 —a 37% increase. Average annual household gas and power bills would increase by $680 or 35%. The poor will take a pounding and all the benefits from today's falling gas prices will be reversed.

Similarly, the climate change pact with China sought by President Obama is little more than unilateral economic disarmament by the United States. Beijing has one quest and that is to replace America as the globe's economic superpower. Raising energy prices and transitioning to highly inefficient forms of electricity production in China is in consistent with that goal, and it's doubly unlikely to happen at a time when the Chinese economy has showed signs of slowing down.

Meanwhile, the Obama administration and the Environmental Protection Agency are deadly serious about strangling U.S. Energy security and production with new anti-carbon mandates.

China is building coal burning energy plants nearly every month. They are trying to figure out how to do fracking so they can get at their oil and gas resources. They are importing huge amounts of coal from the U.S. They just signed a $300 billion pipeline deal with Putin to transport billions of barrels of gas to China.

Does any of this sound like the agenda of a nation that is ready to swear off fossil fuels?

Europe and in particular Germany bought into the renewable energy/green jobs charade a decade ago. Now their economy is cratering in part because their energy costs have skyrocketed. Industrial production fell last quarter in Germany and high energy prices are a major reason why. Europe's green energy bubble has burst. The U.S. must not follow the policies of the losers.

Americans want a clean environment. We demand clean air and clean water to keep our society healthy. The reductions in pollutants over the last fifty years have been nothing short of miraculous. This committee has done much to ensure that is the case.

But environmental rules need to be made in ways that won't cripple our fossil fuels-driven economy. The top priority now must be to accelerate economic growth, create more jobs, and expand incomes for those in the middle class. No industry is helping achieve that goal more today than our domestic energy producers.