Six climate change solutions we can all agree on

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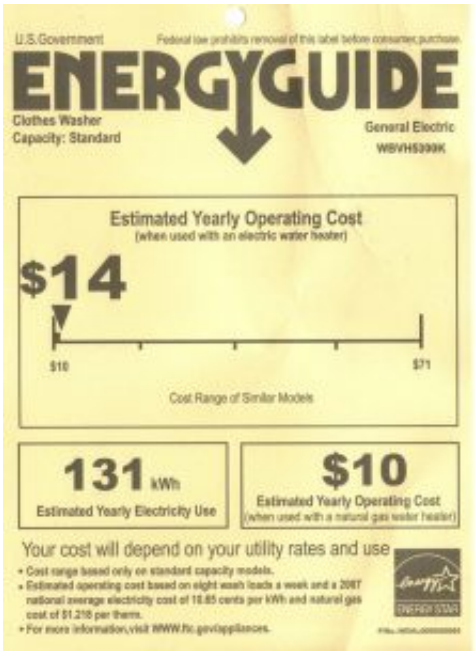

Credit: mrwynd

In the U.S., few issues seem to be as divisive as climate change. Although the science is unequivocal, political polarization has taken climate change hostage. Fortunately, there are solutions that people on both sides of the climate divide might be able to agree on. We have shared values to build upon: All Americans want to feel safe and secure in their homes and communities; Republicans, Democrats and Independents alike value clean air and water; people of every political persuasion care about the environment and support energy security; and

anyone who cares about this country knows that economic growth and national security are essential. Here are six solutions that could help advance these goals.

1. Green infrastructure

When rain falls on streets, parking lots, or other impermeable surfaces, it cannot be absorbed. In Houston, for example, rapid development has resulted in large expanses of impervious surfaces and the destruction of wetlands. These exacerbated the flooding when Hurricane Harvey poured record amounts of rainfall onto Texas, causing tens of billions of dollars in damages. According to the advocacy group Environment Texas, heavy rains in Houston have increased 167 percent since 1950, but there are simple and cost-effective ways to absorb much of that water before it can cause damage. It's called green infrastructure.

Green infrastructure uses plants, trees and soils on green roofs, in trenches, and on green streets, to manage excess stormwater in urban areas.

"It's an easily solvable problem by doing more planting, which then helps climate change," said Steve Cohen, executive director of Columbia University's Earth Institute.

As stormwater flows over parking lots and sidewalks, it picks up heavy metals, bacteria, and other pollutants. It carries those pollutants as it drains into sewers and pipes, and ends up polluting the water bodies it enters. If the runoff contains nitrogen and phosphorus from fertilizer, it can cause eutrophication, a type of water pollution wherein algae bloom and then die, consuming oxygen and creating a "dead zone" where nothing can live. The EPA estimates that eutrophication costs the U.S. over $2.2 billion each year in reduced property values and lost recreational opportunities.

In urban areas, green infrastructure creates permeable expanses where water can be absorbed instead of flooding the sewers. The vegetation filters out pollutants, helps keep streets cooler, cleans the air, restores biodiversity, sequesters greenhouse gases and increases property values, health, and well-being. Green roofs can reduce energy demand as well as cooling and heating costs.

Restored and created ecosystems such as streams, rivers, and wetlands are considered green infrastructure as well. While they perform the same functions as urban green infrastructure, they also help prevent flooding and recharge aquifers.

Green infrastructure can be a cost-effective way to protect clean water. As an example, the Portland Water District in Maine is not required to filter its drinking water because it meets strict quality standards under the Safe Drinking Water Act. Its water comes from Sebago Lake, which is fed and purified by forested land. Because of increased development, however, the community was concerned that it might have to begin filtering its water. In comparing costs, the district found that while a filtration system would cost between $100 and $150 million, a 20-year investment in green infrastructure could save between $12 and $111 million over that time. In 2013, the Portland Water District chose the natural infrastructure route. In addition to ensuring clean drinking water, the community also benefitted from improved habitat for salmon and carbon sequestration.

Green infrastructure at work. Credit: Columbia University

2. Modernization of the grid

The nation's electric grid includes more than 9,200 electricity-generating units and over 600,000 miles of transmission lines. Most of the transmission lines, which were constructed in the 1950s and 1960s and expected to last 50 years, are aging. The American Society of Civil Engineers has given the energy infrastructure of the U.S. a miserable grade of D+.

The grid needs to be modernized so that it can be smarter, more efficient, and more resilient to extreme weather; it needs to be able to better integrate renewable energy sources and be more secure.

A modernized grid could ensure that important circuitry uses water-proof or weather-resistant technology. It could incorporate microgrids, smaller independent systems that can operate even if the larger system fails. Modernizing the grid would also enable it to better incorporate distributed energy, where power is generated by solar panels on homes or buildings or wind turbines instead of by centralized utilities; and a

modernized grid would deploy energy storage technology to even out the intermittent nature of wind and solar energy.

In 2014, a study by the Federal Energy Regulatory Commission revealed that incapacitating just nine key substations could cause a coast–to-coast blackout. A modernized grid would also provide increased defense against cyber attacks. It would have smart two-way communication enabling operators to run the system more efficiently, which would mean lower costs for utilities and for customers; it would make it possible for the system to identify outages and restore service more quickly.

"Modernizing the grid is extremely important for the growth of renewables because of where the renewables will be located geographically," said Michael Gerrard, director of the Sabin Center for Climate Change Law at Columbia Law School. "A smart grid can also go a long way towards addressing the intermittency problem of wind and solar, which will improve our overall electric system reliability. It is especially important because decarbonization will also require moving to electric vehicles, and electrifying such direct fossil fuel uses such as space heating and cooling and water heating. All of this could double the demand for electricity, compelling a great increase in transmission capacity."

3. Renewable energy

Houston is the nation's most important energy hub with almost 5,000 energy-related firms concentrated in the area. According to the New York Times, nearly every oil and gas refinery in Texas and Louisiana was at least partially shut down due to Hurricane Harvey. This is affecting gas prices across the U.S. and in global energy markets. In the short-term, damaged gas and oil refineries are releasing toxic pollutants into the environment, but the long-term impacts of the damage they have sustained remains to be seen.

Renewable sources like wind and solar are considered decentralized or distributed systems because they are made up of individual wind turbines or solar arrays. As such, they are more resilient and less vulnerable to large-scale disruption than centralized utilities. They provide a free and inexhaustible supply of energy that emits no global warming emissions or other pollutants. Because they are clean, they protect our air and water and safeguard the environment.

And since renewable energy is plentiful, it frees the U.S. from being dependent on global supply and demand for our oil prices. It offers true energy independence for the U.S., thus "enhancing our geopolitical security," according to a recent paper by the Center for Naval Analysis Military Advisory Board.

The aging grid in Texas. Credit: Columbia University

"Renewable energy is the future because of some very simple facts," said Cohen. "The source of renewable energy, whether it's solar, wind or geothermal, is free, so the technology is going to get cheaper as time goes on—it has been getting cheaper and will only get less expensive. Fossil fuels are getting harder to extract. You damage the environment

when you extract them, you have to ship them from where you get them to where you use them, and when you burn them, you create climate change. It's really not the way you want to do things."

Over the last decade, the U.S. has generated eight times as much electricity from wind and solar as it did in 2007. Between 2008 and 2015, utility scale solar prices fell 64 percent; rooftop solar prices fell 54 percent, and wind has fallen 41 percent. A report from the Environment New York Research and Policy Center predicts that solar prices will be cheaper than coal by 2025.

That's not the only economic benefit. In 2014, solar power created 50 percent more jobs than oil and gas pipeline construction and petroleum and natural gas extraction combined; and as of 2015, solar energy employed more people than coal mining. Solar job growth has climbed 123 percent over the last six years and is continuing apace. In 2016, 2.5 million Americans worked in "clean tech," including renewable energy and energy efficiency technology.

4. Carbon pricing

In the U.S. and in much of the rest of the world, fossil fuels are heavily subsidized because the true cost of the impacts resulting from the carbon dioxide emissions they generate—extreme heat, drought, floods, and health effects—are paid for by taxpayers, not by the industries that produce the emissions. The International Monetary Fund estimated that globally, fossil fuels are receiving $5.3 trillion of subsidies due to costs that governments (and ultimately taxpayers) end up paying toward the impacts of air pollution, floods, droughts, and storms exacerbated by climate change. Most economists and policy experts agree that the most effective and cheapest way to curb the carbon dioxide emissions that are warming the planet is to "put a price on carbon."

The Climate Leadership Council, founded by Republican politicians, business leaders and economists, authored The Conservative Case for Carbon Dividends, a proposal for a revenue neutral tax on carbon. Major international businesses, including General Motors, ExxonMobil, BP, Johnson & Johnson support the idea.

Under this proposal, companies would pay a tax of $40 per ton of carbon (resulting in an approximately 36-cent increase per gallon of gas), with the rate rising over time. The tax would be collected wherever fossil fuels enter the economy, for example at a mine or port, and be levied on imports from countries that do not price carbon. Such a tax could potentially raise $200 to $300 billion a year—money which would be used to provide monthly dividends to American families, with approximately $2000 going to an average family of four (these dividends would also grow over time). According to the Department of Treasury, the bottom 70 percent of Americans would receive more in dividends than they would pay in higher energy costs. The plan would also result in smaller government as the tax could eliminate the need for many of the Environmental Protection Agency's regulations for carbon emissions.

"If you have a high enough tax and it's imposed in the right way and free of loopholes, it can achieve the same emissions reductions as certain kinds of regulations," said Gerrard. "A price on carbon maximizes innovation and tends to find the lowest-cost method of achieving the objective. It also percolates through the economy and sends price signals to many sectors, thus it can have ultimately a broader and more beneficial impact [on society]."

In other words, a clear and consistent policy would stimulate the private sector, encouraging business and the financial community to invest in clean energy. Their investments would result in economic and job growth since clean energy is one of the fastest growing sectors of our economy.

The U.S. military, because it is concerned about the impacts of sea level rise and storm surges on its operations and on national security, might well favor a carbon tax. In 2016, a bipartisan group of national security and military leaders issued a Climate Security Consensus Project Statement that said the U.S. needs "a robust agenda to both prevent and prepare for climate change risks, and avoid potentially unmanageable climate-driven scenarios. Failing to do so will magnify and amplify risks to existing and future U.S. national security objectives."

Solar array at De Anza College in San Francisco. Credit: Darin Dingler

5. Carbon capture and storage

The term "clean coal" generally refers to carbon capture and storage. It involves capturing carbon dioxide from coal-fired power plants, processing and transporting it, and storing it where it theoretically will not leak, usually underground.

Carbon can be captured from fossil fuel power plants before the fossil fuel is combusted through a gasification process; post-combustion, the CO2 is separated from the flue gas with a filter made from a solvent that absorbs CO2. After the CO2 is captured, it is compressed and

transported via pipes to a storage site. Currently, it is mainly oil and gas companies that practice underground storage, or geological sequestration. In a process known as enhanced oil recovery, CO2 is injected into depleted oil or gas reserves to drive the remaining oil to the drilling site or improve its flow. In the U.S., only the Petra Nova plant in Texas, which began operating in January, is capturing CO2 from coal burning and using it for enhanced oil recovery.

Most commercial efforts for carbon capture and sequestration have been plagued by years of delay and billions in cost overruns; moreover the technology does not eliminate all coal emissions. This is why the U.S. Energy Department has been trying to develop more efficient and cost-effective technology, stating, "The successful development of advanced CO2 capture technologies is critical to maintaining the cost-effectiveness of fossil fuel based power generation."

"If carbon capture and sequestration were effective and affordable," said Gerrard, "there would be a lot to say for it."

A bipartisan group in Congress is pushing for an extended and enhanced tax credit to encourage the development and utilization of carbon capture and sequestration.

6. Energy efficiency

Energy efficiency is the easiest and most cost-effective way to cut energy use and save people money.

"It's non-polluting," said Gerrard. "Much of it creates a lot of jobs. It's reliable, it's not intermittent, it doesn't run out, it doesn't have siting controversies, and there's a lot of untapped potential."

Buildings are responsible for 32 percent of energy use globally, and

almost 80 percent of that energy is wasted due to lights and electronics left on or poor insulation. Retrofitting buildings to better conserve energy and make lighting more efficient is often paid back in five to seven years, on average. Moreover, energy efficient buildings attract investors and are valued more highly than other buildings because they cost less to operate; they also have higher occupancy rates because tenants want buildings with lower utility rates.

Energy efficiency allows utilities to save money by not having to build more power plants, power lines, and substations to produce energy, and this also ultimately lowers electric rates for consumers.

Energy Star is a good example of the effectiveness of energy efficiency. The 25-year-old voluntary program certifies products, buildings, and homes that use less energy and produce fewer greenhouse gas emissions. It has saved businesses and families about $430 billion in energy costs while costing only about $50 million a year, and employing 290,000 workers who manufacture Energy Star products and materials in the U.S. The energy efficiency sector as a whole employs about 2.2 million people.

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