

10th Annual: Wirth Chair Sustainability Awards

What would you ask the next President of the United States to do in the first 100 days of the Administration to address climate change?

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The next President of the United States will have the ability to create change and identify solutions to a complex problem not only to this country, but to every nation in our global community. He (or she) will have a unique opportunity to alter the American ideology on sustainability and propel this nation into a leading role for global efforts regarding environmental issues. The question for this essay could be interpreted two different ways based on the definition of the phrase climate change. Most sources would define climate change as the physical change of the environment or atmosphere over time that has been caused by anthropogenic factors [1]. Specifically, the accelerated production of greenhouse gases (CH₄, CO₂, and aerosols) that began during the Industrial Revolution and has created an increase of temperature in the Earth's atmosphere. However, there is a second interpretation of the phrase climate change that could be addressed. By describing climate as a mood, feeling, or cultural opinion, this would define the phrase as a change of the national attitude towards environmental sustainability as a whole. Before a physical change in the climate can occur a social change in our nation must occur first.

Therefore, I choose to adopt the latter definition of climate change. In order to be successful our nation will need to create a comprehensive plan that works toward getting Americans both involved and invested in every aspect of environmental sustainability. I will address issues and suggest ideas in this essay that will expand past greenhouse gas (GHG) emissions produced by fossil fuels - to fostering a culture within our society that is more environmental mindful and sustainable. My recommendations to the future President of the United States will focus on three areas that have potential to create the largest impact on a physical climate change: energy use, the built environment, and waste reduction. I hope that the following essay provides pragmatic solutions that can be easily implemented and will encompass policy change, development of new national programs, and continued advancement in areas of scientific research.

Energy Usage and Consumption:

A large portion of the nation's CO₂ emissions, a substantial 38%, comes from the energy industry [2]. Accelerated use of renewable energy sources can make a large impact on GHG emissions and much advancement has been made in the last ten years. Several energy companies now offer the purchase of 100% wind power for both commercial and residential properties, some at a lower cost than conventional power. However, this varies greatly depending on the region of the country that you live in because of wind patterns [3] and solar availability. Solar power is seldom offered as a large-scale power source and it is something that is installed on an individual basis. Energy tax credits and energy grants are currently being offered at a state level for solar conversion, but tax

credits that are offered are approximately \$2000 and annual energy saving tend to be around \$375 [4]. With solar conversion costing anywhere from \$16,000-40,000 to install and states suggesting to finance conversions through mortgage loans [4], the cost is too much for the average home or business owner. According to the US Census Bureau, 4,980,000 homeowners sold their homes and moved in the year 2004 [5]. The average American moves about 12 times in their lifetime [6], which means that the typical homeowner lives in one property for only approximately 5 years. In addition, 33% of new businesses close within two years and a staggering 56% close within four years [7], leaving many commercial properties remaining vacant for long periods of time. Federal tax credits and national energy grants must be made available for the solar conversion of residential and commercial properties where individuals see the system pay for itself in a much shorter period of time. With a federal tax credit as well as state tax credits it will make it both more affordable for a homeowner and they will see a benefit in a shorter amount of time. This is especially important if they are unsure how long they are going to stay in their home. I am also suggesting more federal money allocated to the research and advancement of both solar and wind power energy resources. Technology that is used for the light harvesting cells, called photovoltaic cells, need to become more efficient and cost effective, especially for residential areas that are shaded by trees.

Wind power is much more advanced, but turbines are designed in such a way that they are most efficient for the Great Plains region of the country. The scientific community should be encouraged to begin researching and designing different types of wind turbines to be used in different geographical landscapes. This way we can effectively utilize highway margins, shores of the Great Lakes and oceans, as well as in urban areas to harvest wind and make wind power readily available in every region of the country.

Fuel type for transportation and farming equipment is another issue that can be addressed. Increase advancement could be made in the types of engines and exhaust systems used in agricultural equipment in order to decrease GHG emissions from these machines. This equipment has the potential to be as (or more) sophisticated and energy efficient as transportation vehicles. Passenger vehicles contribute to 20% of GHG emissions [8], so increasing fuel efficiency can make a large impact. Diesel-powered engines get 30-35% more miles per gallon than gasoline-powered vehicles [9], and most car companies make diesel models for other countries of the world. It might be possible to work with the car companies to retrofit their US plants to start producing a larger amount of diesel vehicles for US consumers. This would be a more short term idea, while further research is conducted on biofuels. There are many issues that still need to be tackled in the production of biofuels in the US. Algae are being used right now, but there will always be the problem of getting enough biomass to be efficient for fuel production.

Corn and soybean are good crops to make biodeisel because they are major agricultural crops in the US, but they are not as efficient as sugarcane that is used in Brazil due to the lower sugar/higher cellulose content [10].

Furthermore, crops must travel long distances to centralized processing plants which most likely will become locations for biofuel production plants. One suggestion that I have for decreasing the transportation distance is to set up more local processing plants for crops. It appears that the national consumer is now looking to go back to a community model, where they are buying houses in neighborhoods with central markets and parks systems. Individuals, along with restaurants, are now looking for locally grown and raised products because they are able to ensure freshness and it supports local economies. The organics movement is at an all time high and people are choosing to shop at old fashioned farmer's markets and organic markets, like Whole Foods Market. Between the years 1997 and 2003 retail sales of organic products went from \$3.6 billion to \$10.4 billion, 190% increase [11]. With this momentum in the nation it seems sensible to create local processing plants for agriculture. When biofuel production facilities are added to these processing plants the corn being used can be supplemented with local crops, specifically fruits, with higher sugar contents to increase the efficiency of ethanol production. These crops can be ones that are discarded because of blemishes, bruises, insect damage, or are overripe. It is logical to shift the focus of biofuel production from using one "golden" crop (or organism) to using a recipe of multiple crops based on the local agriculture.

Agricultural areas are a prime source of property to use for both wind and solar power generation. With efficient land use farmers can subsidize their farms by collaborating with energy companies and would not affect their farming practices dramatically. Instead of the federal government subsidizing farmers for low-yield crop production, farmers can be generating energy that would provide a stable source of financial income to their farms.

Land Use and Water Resources:

There is no doubt that changes in land use alters the Earth's albedo and is a major contributing factor to climate change. Though the spread of urbanization and the decrease of trees and plants (green spaces) we eliminate sequestration sources for the GHG CO₂. In 1997, the construction industry topped the list of annual electrical sales at roughly \$850 billion [2]. This was in comparison to 16 other industrial sectors that included the food industry, financial institutions, as well as air transportation. Local engineers could work to redesign cities to be not only energy efficient, but also efficient in their land use through appropriate zoning. With the vacancy rates among office, retail, and industrial sectors at an average of 11.3% [12], many commercial properties remain vacant while developers construct new buildings to sell or lease contributing to urban sprawl. Local zoning commissioners along with Land Use and Development Committees made up of local citizens should regulate new commercial

construction by developers. Additionally, through legislation they can encourage new businesses to occupy and renovate existing structures. This will decrease the energy that the construction industry, the cost it takes to heat/cool vacant buildings, and creates an area that is economically efficient and visually appealing to citizens. Local governments could also work to acquire certain vacant properties to convert back to green space for parks and bike trails for the community.

According to the Pew Center for Global Climate Change, commercial, residential, and industrial buildings combined produce 43% of US CO₂ emissions [13]. These emissions are generated in large part through the process of heating (space and water), cooling, and lighting. Currently, only 11 states have Leadership in Energy and Environmental Design (LEED) standard certification required for state buildings and/or state-funded buildings [14]. There should be federal legislation that requires *all* federal, state, and state-funded buildings (including schools and universities) to be LEED green-building certified structures. Also, there are still 12 states that do not have any energy codes for residential properties [14]. Green-building should become the modern practice for all new construction whether it is commercial or residential with energy standards and codes in every state that is regulated at a federal level. The future goal should be to have as many zero net emission structures, starting with government buildings. Americans that own residential structures and choose to convert their buildings into meet the standards of green-building could be offered a federal or state tax credit as an incentive to renovate. Architects and engineers should be encouraged to continue finding more ways for our built environment to become more environmentally friendly, such as developing new types of building materials and using passive water collection for non-potable water usage for toilets and outdoor watering.

Global warming due to GHG emission directly impact global water resources [15] and with the increase in human population and economic development, policies involving climate change should also address this depleting resource. The federal government must create a policy that shifts the cultural climate on this issue from a water “right” to “privilege.” No one, state, or region should have the ability to sell their water resources for financial benefit. Instead, there should be a system in place to increase conservation of water through incentives and benefits to individuals and businesses.

Waste Production and Reduction:

According to the EPA, between the years of 1985 and 2005 the number of curbside recycling programs went from one to almost 9,000 [16]. The current impact of this national recycling effort has decreased the GHG emissions by the equivalent of the emissions from 40.3 million cars annually [16]. These emissions are produced through both the extraction and the disposal of the waste. With a national plan to increase the recycling of waste material we can

further increase this already sizable impact on GHG emissions. Even though there are almost 9,000 curbside recycling programs in the nation, if you look at individual communities, curbside programs come and go depending on the waste and recycling companies in the area. The average American wants things that are simple, easy to use, as well as cost efficient. If there is no curbside pick up they are less likely to find drop off sites for recyclable waste. A comprehensive plan is needed to both educate Americans and to facilitate the merge or collaboration of waste and recycling companies. Curbside recycle and waste pick up should be available in every city and occur on the *same day*. Trash removal bills should increase due to the negative environmental impact and promotional programs can exist where households can then decrease their waste bill by increasing their recycled material. The federal government can even subsidize programs in areas so homeowners can eliminate their trash removal bill for a year by increasing their recyclables by a certain amount. Also, a print campaign in newspapers can be implemented to educate Americans on how to start their own compost piles to decrease waste and describe the types of products that are readily recyclable in most areas. In the future, the goal for recycling should be that every household uses their 40, 60, or 90 gallon trash container for their recycle pick up and their 4, 16, or 22 gallon recycle container for their trash pick up. By both education and financial incentives, we can make recycling part of today's society where it is simple, easy, and more importantly a *habit* for every American.

Recently, two Colorado based companies got together to use waste from one company as an ingredient to generate another product by a second company. The New Belgium Brewery Company, in Fort Collins, produces CO₂ as a by-product of the fermentation process in beer making. They have been approached by the Boulder based company, Solix Biofuels Inc., to use the excess CO₂ in photo bioreactors to grow and cultivate algae for biodiesel production [17]. More companies in the United States that make, manufacture, and process goods could be exploring options to collaborate with each other in similar ways as these two companies have demonstrated.

Conclusions:

With a comprehensive plan established and regulated by the federal government that addresses issues at local, state, and federal levels, the US will lead the global community towards a 100% sustainable lifestyle. Policy should address the major contributors of GHG emissions: energy type, use, and consumption, land-use and the built environment, as well as waste production and reduction. The federal government should work towards standardizing efforts and legislation in all states in addition to coordinating with energy companies on making renewable energy sources available in all regions of the country. Through incentives and benefits Americans will be encouraged to recycle, conserve water resources, and become energy efficient, which will develop into habits - consistent over time and taught to future generations.

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