

## **CRITICAL NATIONAL NEED IDEA**

Critical National Need Idea Title: Hydrogen Energy Research to Fight Greenhouse Gases

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## **A- Maps to Administration Guidance**

The Clean Energy Research & Education Institute (CEREI) is pleased to submit this white paper in response to TIP's recent announcement for review. CEREI is proposing to address the complex environmental challenges of modern time that are the human induced-greenhouse gas (GHG) emissions that increasingly are responsible for global warming and climate change. As global warming has become a major issue, we believe that alternative solutions require long-term and high-risk scientific research in environmentally friendly energy sources. Our approach to this critical issue is to develop cost-effective renewable energy technologies and advanced energetic nano-materials to help reduce GHG emissions mainly from our transportation sector (that accounts for a third of GHG emissions in the US), ensure our energy independence and improve energy efficiency. In addition, our economy which overwhelmingly relies on fossil fuels (limited resources) that are widely imported from politically unstable and/or hostile countries puts our security at high risk. Our current system of energy supply (from oil pipelines to the electric grids) is vulnerable, and poses a serious threat to our security, public health and the environment. Ultimately, these issues we are currently facing are to be addressed and fought, and need more attention.

In the past decades, many voices have been raised across the country to become advocates for our energy security and the fight against global warming and GHG emissions. These national efforts have increasingly driven more supports and voices to the cause, which is now one of the top priorities in the nation. The incoming administration has pledged to be a supporting voice for this cause, and outlined a comprehensive New Energy for America plan to address the energy issues we mentioned above. A real effort to break our addiction to foreign oil and create a strong clean energy marketplace is imperative. The nation looks forward to more actions and solutions to these societal challenges. Thus, we strongly believe that technological and scientific research investigations in clean and renewable energy sources are needed to be carried out to offer real and appropriate solutions to our major energy related issues: energy security, climate change, global warming, dependence on foreign oil imports, GHG emissions, etc.

We anticipate that our program fits with the TIP's announcement and innovative research programs.

## **B- Justification for Government Attention**

Global warming is the overall increase in the earth's global temperature. It has been shown that such temperature increase is mainly ascribed to the increase in the overall atmospheric GHG concentrations (mainly carbon dioxide), very likely resulting from human activities that include industrial processes, transportation, fossil fuel combustion, deforestation, etc. Scientific evidences clearly show that our planet is increasingly warming. The Intergovernmental Panel on Climate Change (IPCC) [1] has projected that the earth's average temperature is likely to increase by 2.5 - 10.4° F by

2100, with more effects expected in the US, if no cost-effective approaches are taking to reduce GHG emissions. In addition, IPCC has estimated that annual worldwide carbon dioxide emissions to rise from 7.4 billions tons (in 1997) to approximately 20 billions tons by 2100 - an increase of 170%. Although changes in global temperature over years are relatively small, they can significantly induce changes in the climate system and weather patterns; alter our ecosystem and impact human health. Other consequences may include violent tropical storms and hurricanes resulting from warmer ocean water, sea level rise resulting in floods, heat wave, air pollution and increased risk of droughts.

Transportation systems (largely fueled by petroleum) contribute to global warming at a relatively high rate. In the US, they account for a third of the nation's GHG emissions that are increasing at alarming rates. As the US transportation economy grows rapidly, one could imagine how increasingly GHG emissions and their consequences would be on national scale as well as on worldwide scale. Estimations show that GHG emissions from our nation's transportation systems will increase by 36% by 2020.

Ultimately, the issues our nation is facing in the transportation sector are to be fought by significantly reducing GHG emissions from that sector. A variety of options are available to achieve this goal, such as improve vehicle energy efficiency (high miles per gallon), improve public transportation systems, etc. However, we believe that more reliable and alternative solutions recommend shifting from the overwhelmingly traditional petroleum powered transportation sector to a GHG emission-free fuel powered transportation system. To meet the energetic challenges in our nation's transportation systems, advanced scientific research efforts are needed to be deployed to, effectively address them, and investigate on alternative fuels to petroleum, such as hydrogen, bio-fuels, etc.

Understanding that global warming constitutes a general concern, and being aware of its devastating effects to the environment, CEREI is to address the above mentioned energetic issues by developing cost-effective fuel cell technologies. CEREI will develop a high quality and multidisciplinary research programs, and drive green economy. Our research investigations will essentially be carried out on hydrogen production, hydrogen energy and fuel cell technologies. Hydrogen is an "ideal" energy carrier that is considered to revolutionize the energy industry. Unlike fossil fuels, hydrogen generates electricity without GHG emissions.

Our research efforts will undoubtedly lead to reduce the US dependence on foreign oil imports, and cut down GHG emissions from our nation's transportation systems by enhancing the production of electric and "cleaner" vehicles running on GHG emissions-free fuels. Our research proposal is also designed to improve domestic energy security by running on clean energy technologies. According to the Energy Information Administration reports, in 2006 renewable energy only represents 9 % of total U.S. energy generation [2]. This clearly shows that more research efforts and federal investments are needed to improve and advance renewable energy technologies for a sustainable energy future. *Our endeavors will lead to transformational results.*

## **C- Essentials for TIP Funding**

We believe that the Energy Information Administration reports on clean energy production [2] should be considered as a warning. Federal, State and local governments and organizations are realizing more and more the threat our current energy production is posing to our security and environment. As a result, the new incoming administration has made of this energy issue a top priority to ensure our energy independence within the next 10 years. It is now clearly understood that the US has to invest more resources and efforts to revolutionize the energy industry to promote and enhance the production of clean and renewable energy. The Department of Energy has been encouraging and investing in renewable energy and energy efficiency research; however, more research funding are imperatively needed to lead to significant results to make this technology cost-effective and viable. It is clear that in the absence of proper research funding, these critical energy issues our nation is facing will not be properly addressed.

## **Reference**

- [1] Intergovernmental Panel on Climate Change, <http://www.ipcc.ch>
- [2] Energy Information Administration (EIA), Monthly Energy Review May 2007, DOE/EIA-0035 (2007/05) (Washington, DC, May 2007) Table 7.2a ([www.eia.doe.gov](http://www.eia.doe.gov))