

New political resolve and improving energy technologies point the way to a brighter future. New President and Congress take notice.

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The global distribution of fossil energy greatly mismatches its consumption, creating geopolitical uncertainties in its availability and price. This simple fact deeply stresses our defense and foreign policies, and confounds our ability to derive an effective energy policy. However, our new and improved political resolve, mixed with improving energy technologies now allows us to begin solving our national energy problems in a sustainable way.

Election Day 2008 stood between two other significant dates; both linked to most of the issues politicians and citizens have been debating in the long run-up to the election. Both are anniversaries of related events from 1973.

October 17, 2008 was the 35th anniversary of the Arab OPEC (OAPEC) oil embargo of the US and other nations who sided with Israel in the Yom Kippur War of 1973. OAPEC nations began a progressive embargo that ran up the world price of oil by 300 percent in five months from less than \$3 a barrel to \$12 a barrel. At the same time, availability was uncertain, leading to panic and long gas lines.

November 7, 2008 was 35th anniversary of Project Independence, a Federal program announced by President Nixon 21 days into this crisis, and restated later in his State of the Union Address with: "At the end of this decade, in the year 1980, the United States will not be dependent on any other country for the energy." In 1973, the United States imported one-third of its oil; today it imports two-thirds of its oil.

The 1973 embargo shook up our nation's economy and we took our first shot at long-term energy solutions. Energy R&D budgets increased about 500 percent in five years, the Department of Energy was formed; independence was the goal. However, we are in this situation today because we failed to stay that course of action. As oil prices fell in 1981, the illusion of some kind of energy stability led us to lose our resolve.

Our inadequate political will to solve our energy problems can be seen in something unknown to most Americans; the insufficient degree of attention the U.S. Department of Energy (DOE) is required to pay to developing energy solutions. Since budgets signal priorities, an historical look at the DOE budget will shed some light on this sad situation.

The DOE budget request to Congress for 2009 is \$24.25 billion. Of that, \$17.6 billion, or 72 percent will go to defense nuclear weapons development and weapons project cleanup. For ALL energy programs, efficiency, renewable and non-renewable supply, fusion, basic sciences, nuclear power plant waste, and the strategic petroleum reserve we will budget a mere \$6.1 billion or 25 percent.

The 25 percent for next year is the highest it has been since the 1970s. The Department of Energy budget has typically been less than 15 percent for energy research and development. Still, at 25 percent, the priorities to DOE for developing energy solutions are far too low to focus the Department on effective energy programs required for the challenges our country faces today. Incredibly, the \$6.1 billion amount for 2009 is only 65 percent of the \$9.4 billion spent on energy in DOE's first year, 1978; both are in 2008 dollars.

Congress was roundly criticized last summer for recessing without passing energy legislation to offset the impact of pump prices in excess of \$4.00 a gallon. Every day legislative and presidential candidates point out the huge importance of energy independence for the USA and the world. Add to the mix the improvements in energy related technologies since 1973 and we may have finally illuminated the opportunity for our country to carefully map out its energy future and finally become less vulnerable to the geopolitics and geophysics of fossil fuels.

This is America's second chance to get this right, it's very doubtful there will be a third without unprecedented hardship.

The imperative for our government is to finally make long-term, strategic policies and investments in alternative, renewable energy sources while separating the permanent solutions from the short-term patches. In doing so, we will be far less susceptible to security risks and serious economic hardships from unstable oil prices. This has been an obvious fact for 35 years, but again prices are seeing a temporary fall. The hope is we will remember this time that falling gas prices will never protect us from an oil price or supply calamity that can occur at any time for any reason.

Today's suite of energy related technologies is smaller than it could have been had we maintained focus on energy solutions, but we have a far better technology foundation than we did 35 years ago. The 1970s' hope of giant magnetic or laser fusion reactors has given way to tiny nano materials. Orbiting fleets of solar power satellites are out, and rooftop photovoltaics are in. Coal-based syn fuels now share the stage with renewable bio-fuels.

While we were all learning our energy security lessons, the demand for environmental and economic sustainability also became more closely linked to the solutions for energy. Urban

pollution and the challenge of global climate change have added to the need for a future less reliant on fossil fuels.

World energy demand has increased about 75 percent since 1973, and is expected to double again by 2030. Providing that energy, while meeting important environmental and economic goals, will require extraordinary technological breakthroughs and large private and public investments.

New energy technologies will provide more conveniences in our homes, better performing cars, more efficient factories and office buildings, better ways to do and make things, all while using less fossil fuels, polluting less and not breaking the bank.

Nanotechnology has become a major entry in the mix of technologies we will all rely on to provide the basis for all the world's economies, energy. Nanotechnology is providing new materials to significantly improve the efficiency, cost, performance and utility of energy generation, conversion, storage, and end use. Some of those technologies include solar photovoltaic systems, batteries, super capacitors, fuel processors, fuel cells, electrolyzers and light sources.

On the supply side, wind and solar power have come of age and are rapidly growing in the marketplace. Increasing output of unsustainable, conventional fossil resources will provide short term relief, and help grow economies of developing countries, but the imperative to develop renewable sources is much greater than it was 35 years ago.

On the demand side, hybrid, plug-in hybrid, battery and hydrogen fuel cell cars can evolve to zero out oil consumption. New white-light LEDs for lighting can dramatically reduce the energy demand, and its cost in homes, offices and factories. Better batteries will enable more efficient homes and vehicles.

There is clearly no magic bullet that will make our global energy supply abundant, clean, reliable, economical, perpetual and stable. Rather there is a growing arsenal of improving and new technologies we will tap from to finally meet President Nixon's goal of energy independence, albeit a little later than 1980.

Market forces have consistently proven to be inadequate in creating the energy solutions we need quickly enough. There is no question that our next president and Congress will have to provide unprecedented leadership in focusing attention on long-term solutions and top-level policies for energy independence.

At the same time industry needs to step up to the plate and recognize that its next best hope for growth is in sustainable energy.

Energy assurance and defense have similar effects on our national security, economy and well being. Strong cooperation between government and industry is as vital to solving our energy dilemma as it is for assuring national defense. A redesigned Department of Assured and Sustainable Energy, totally focused on solving energy problems is essential to the economic and physical security of the United States. The distraction of nuclear weapons programs should be moved to a new or different agency within the Federal government.

The Country needs to maintain its resolve to fix this huge problem the way President Nixon meant to fix it 35 years ago; only this time with more urgency and better technology.

About the author:

Glenn Rambach is a recognized leader in the advanced energy research sector since 1974. Motivated by the need for energy independence, security, and clean energy systems, his research has included diesel combustion systems, laser fusion, hydrogen production and storage, fuel cell system designs and integrated renewable energy systems using storage.



Mr. Rambach developed optimization methods for design and operation of intermittent renewable energy systems where energy storage provides on-demand power, and his 5-kW wind-solar-hydrogen-fuel cell facility still operates at the University of Nevada, DRI in Reno. Mr. Rambach has worked as a research engineer at Stanford University and spent 20 years at the Livermore and Sandia National Labs. Previously, Mr. Rambach served as Director of Engineering at Texaco Ovonic Fuel Cells, Director of New Technology at Tenneco Automotive. Most recently, Mr. Rambach completed R&D contracts supporting a nuclear company and a defense contractor in the areas of hydrogen economics, very large scale hydrogen production and transport, and synthetic hydrocarbon fuels.

Early in his career he led experimental research in the fundamentals of combustion at Stanford and the Sandia Combustion Research facility. Mr. Rambach has written numerous papers and given presentations on technical, policy and strategy issues for advanced energy devices, systems and marketing. He has two solid oxide fuel cell patents, is the inventor of a high-pressure cryogenic hydrogen fuel tank and is a co-developer of the first x-ray laser. Mr. Rambach received his BS in Aerospace Engineering from Cal Poly University and his MS in Aerospace Engineering from Princeton University (Thesis on Fundamentals of Emulsified Diesel Fuels).

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