A New Manhattan Project
for
Clean Energy Independence

Seven "Grand Challenges"
for
the next five years

Plug-in electric cars and trucks

carbon capture

solar power

nuclear waste

advanced biofuels

green buildings

fusion

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History . . .

In 1942, President Franklin D. Roosevelt asked Sen. Kenneth McKellar, the Tennessean who chaired the Appropriations Committee, to hide $2 billion in the appropriations bill for a secret project to win World War II.

Sen. McKellar replied, "Mr. President, I have just one question: where in Tennessee do you want me to hide it?"

That place in Tennessee turned out to be Oak Ridge, one of three secret cities that became the principal sites for the Manhattan Project.

The purpose of the Manhattan Project was to find a way to split the atom and build a bomb before Germany could. Nearly 200,000 people worked secretly in 30 different sites in three countries. President Roosevelt's $2 billion appropriation would be $24 billion today.

According to New York Times science reporter William Laurence, "Into [the bomb's] design went millions of man-hours of what is without doubt the most concentrated intellectual effort in history."

The Goal: victory over blackmail

I am in Oak Ridge today to propose that the United States launch a new Manhattan project: a 5-year project to put America firmly on the path to clean energy independence.

Instead of ending a war, the goal will be clean energy independence – so that we can deal with rising gasoline prices, electricity prices, clean air, climate change and national security – for our country first, and – because other countries have the same urgent needs and therefore will adopt our ideas – for the rest of the world.

By independence I do not mean that the United States would never buy oil from Mexico or Canada or Saudi Arabia. By independence I do mean that the United States could never be held hostage by any country for our energy supplies.

In 1942, many were afraid that the first country to build an atomic bomb could blackmail the rest of the world. Today, countries that supply oil and natural gas can blackmail the rest of the world.

Not a new idea

A new Manhattan Project is not a new idea – but it is a good idea and fits the goal of clean energy independence.

The Apollo Program to send men to the moon in the 1960s was a kind of Manhattan Project. Presidential candidates John McCain and Barack Obama have called for a Manhattan Project for new energy sources. So have former House Speaker Newt Gingrich, Democratic National Committee chairman Howard Dean, Sen. Susan Collins of Maine and Sen. Kit Bond of Missouri – among others.

And, throughout the two years of discussion that led to the passage in 2007 of the America COMPETES Act, several participants suggested that focusing on energy independence would force the kind of investments in the physical sciences and research that the United States needs to maintain its competitiveness.

a new Overwhelming challenge ...

The overwhelming challenge in 1942 was the prospect that Germany would build the bomb and win the war before America did.

The overwhelming challenge today, according to National Academy of Sciences president Ralph Cicerone, in his address last week to the Academy's annual meeting, is to discover ways to satisfy the human demand for and use of energy in an environmentally satisfactory and affordable way so that we are not overly dependent on overseas sources.

Cicerone estimates that this year Americans will pay $500 billion overseas for oil – that's $1,600 for each one of us – some of it to nations that are hostile or even trying to kill us by bankrolling terrorists. Sending $500 billion abroad weakens our dollar. It is half our trade deficit. It is forcing gasoline prices toward $4 a gallon and crushing family budgets.

Then there are the environmental consequences. If worldwide energy usage continues to grow as it has, humans will inject as much CO2 into the air from fossil fuel burning between 2000 and 2030 as they did between 1850 and 2000. There is plenty of coal to help achieve our energy independence, but there is no commercial way (yet) to capture and store the carbon from so much coal burning – and we have not finished the job of controlling sulfur, nitrogen, and mercury emissions.

the Manhattan Project model fits today

In addition to the need to meet an overwhelming challenge, other characteristics of the original Manhattan Project are suited to this new challenge:

- It needs to proceed as fast as possible along several tracks to reach the goal. According to Don Gillespie, a young engineer at Los Alamos during World War II, the "entire project was being conducted using a shotgun approach, trying all possible approaches simultaneously, without regard to cost, to speed toward a conclusion."

- It needs presidential focus and bipartisan support in Congress.

- It needs the kind of centralized, gruff leadership that Gen. Leslie R. Groves of the Army Corps of Engineers gave the first Manhattan Project.

- It needs to "break the mold." To borrow the words of Dr. J. Robert Oppenheimer in a speech to Los Alamos scientists in November of 1945, the challenge of clean energy independence is "too revolutionary to consider in the framework of old ideas."

- Most important, in the words of George Cowan as reported in the excellent book edited by Cynthia C. Kelly, "…The Manhattan Project model starts with a small, diverse group of great minds."

I said to the National Academies when we first asked for their help on the America COMPETES Act in 2005, "In Washington, D.C., most ideas fail for lack of the idea."

the America COMPETES model fits, too

There are some lessons, too, from America COMPETES.

Remember how it happened. Just three years ago – in May 2005 – a bipartisan group of us asked the National Academies to tell Congress in priority order the 10 most important steps we could take to help America keep its brainpower advantage.

By October, the Academies had assembled a "small diverse group of great minds" chaired by Norm Augustine which presented to Congress and to the President 20 specific recommendations in a report called "Rising Above the Gathering Storm." We considered proposals by other competitiveness commissions.

Then, in January 2006, President Bush outlined his American Competitiveness Initiative to double over 10 years basic research budgets for the physical sciences and engineering. The Republican and Democratic Senate leaders and 68 other senators sponsored the legislation. It became law by August 2007, with strong support from Speaker Pelosi and the President.

Not elected to take a Vacation this year

Combining the model of the Manhattan Project with the process of the America COMPETES Act has already begun. The National Academies have underway an "America's Energy Future" project that will be completed in 2010. Ralph Cicerone has welcomed sitting down with a bipartisan group to discuss what concrete proposals we might offer earlier than that to the new president and the new Congress. Energy Secretary Sam Bodman and Ray Orbach, the Energy Department's Under Secretary for Science, have said the same.

The presidential candidates seem ready. There is bipartisan interest in Congress. Congressman Bart Gordon, Democratic Chairman of the Science Committee in the House of Representatives – and one of the original four signers of the 2005 request to the National Academies that led to the America COMPETES Act – is here today to offer his ideas. Congressman Zach Wamp, a senior member of the House Appropriations Committee who played a key role in the America COMPETES Act, is co-host for this meeting.

I have talked with Sens. Jeff Bingaman and Pete Domenici, the chairman and senior Republican on the Energy Committee who played such a critical role in America COMPETES, and to Sen. Lisa Murkowski, who likely will succeed Sen. Domenici as the senior Republican on the Energy Committee.

Some say a presidential election year is no time for bipartisan action. I can't think of a better time. Voters expect presidential candidates and candidates for Congress to come up with solutions for $4 gasoline, clean air and climate change, and the national security implications of our dependence on foreign oil. The people didn't elect us to take a vacation this year just because there is a presidential election.

So how to proceed?

A few grand challenges – Sen. Bingaman's first reaction to the idea of a new Manhattan Project was that instead we need several mini-Manhattan Projects. He suggested as an example the "14 Grand Challenges for Engineering in the 21st Century" laid out by former MIT President Chuck Vest, the president of the National Institute of Engineering – three of which involve energy. I agree with Sen. Bingaman and Chuck Vest.

Congress doesn't do "comprehensive" well, as was demonstrated by the collapse of the comprehensive immigration bill. Step-by-step solutions or different tracks toward one goal are easier to digest and have fewer surprises. And, of course, the original Manhattan Project itself proceeded along several tracks toward one goal.

Here are my criteria for choosing several grand challenges:

- ***Grand consequences, too*** – The United States uses 25 percent of all the energy in the world. Interesting solutions for small problems producing small results should be a part of some other project.

- ***Real scientific breakthroughs*** – This is not about drilling offshore for oil or natural gas in an environmentally clean way or building a new generation of nuclear power plants, both of which we already know how to do – and, in my opinion, should be doing.

- ***Five years*** – Grand challenges should put the United States within five years firmly on a path to clean energy independence so that goal can be achieved within a generation.

- ***Family Budget*** – Solutions need to fit the family budget, and costs of different solutions need to be compared.

- ***Consensus*** – The Augustine panel that drafted the "Gathering Storm" report wisely avoided some germane topics, such as excessive litigation, upon which they could not agree, figuring that Congress might not be able to agree either.

Seven Grand Challenges:

Plug-in electric cars and trucks

carbon capture

solar power

nuclear waste

advanced biofuels

green buildings

fusion

Here is where I invite your help. Rather than having members of Congress proclaim these challenges, or asking scientists alone to suggest them, I believe there needs to be preliminary discussion – including about whether the criteria are correct. Then, Congress can pose to scientists questions about the steps to take to achieve the grand challenges.

To begin the discussion, I suggest asking what steps Congress and the federal government should take during the next five years toward these seven grand challenges so that the United States would be firmly on the path toward clean energy independence within a generation:

1 ***Make plug-in hybrid vehicles commonplace.*** In the 1960s, H. Ross Perot noticed that when banks in Texas locked their doors at 5 p.m., they also turned off their new computers. Perot bought the idle nighttime bank computer capacity and made a deal with states to manage Medicare and Medicaid data. Banks made money, states saved money, and Perot made a billion dollars.

Idle nighttime bank computer capacity in the 1960s reminds me of idle nighttime power plant capacity in 2008. This is why:

- The Tennessee Valley Authority has 7,000-8,000 megawatts – the equivalent of seven or eight nuclear power plants or 15 coal plants – of unused electric capacity most nights.

- Beginning in 2010 Nissan, Toyota, General Motors and Ford will sell electric cars that can be plugged into wall sockets. FedEx is already using hybrid delivery trucks.

- TVA could offer "smart meters" that would allow its 8.7 million customers to plug in their vehicles to "fill up" at night for only a few dollars, in exchange for the customer paying more for electricity between 4 p.m. and 10 pm. when the grid is busy.

- Sixty percent of Americans drive less than 30 miles each day. Those Americans could drive a plug-in electric car or truck without using a drop of gasoline. By some estimates, there is so much idle electric capacity in power plants at night that over time we could replace three-fourths of our light vehicles with plug-ins. That could reduce our overseas oil bill from $500 billion to $250 billion – and do it all without building one new power plant.

- In other words, we have the plug. The cars are coming. All we need is the cord.

Too good to be true? Haven't U.S. presidents back to Nixon promised revolutionary vehicles? Yes, but times have changed. Batteries are better. Gas is $4. We are angry about sending so many dollars overseas, worried about climate change and clean air. And, consumers have already bought one million hybrid vehicles and are waiting in line to buy more – even without the plug-in. Down the road is the prospect of a hydrogen fuel-cell hybrid vehicle, with two engines – neither of which uses a drop of gasoline. Oak Ridge is evaluating these opportunities.

Still, there are obstacles. Expensive batteries make the additional cost per electric car $8,000-$11,000. Smart metering is not widespread. There will be increased pollution from the operation of coal plants at night. We know how to get rid of those sulfur, nitrogen, and mercury pollutants (and should do it), but haven't yet found a way to get rid of the carbon produced by widespread use in coal burning power plants. Which brings us to the second grand challenge:

2 ***Make carbon capture and storage a reality for coal-burning power plants.*** This was one of the National Institute of Engineering's grand challenges. And there may be solutions other than underground storage, such as using algae to capture carbon. Interestingly, the Natural Resources Defense Council argues that, after conservation, coal with carbon capture is the best option for clean energy independence because it provides for the growing power needs of the U.S. and will be easily adopted by other countries.

3 ***Make solar power cost competitive with power from fossil fuels.*** This is a second of the National Institute's grand challenges. Solar power, despite 50 years of trying, produces one one-hundredth of one percent of America's electricity. The cost of putting solar panels on homes averages $25,000-$30,000 and the electricity produced, for the most part, can't be stored. Now, there is new photovoltaic research as well as promising solar thermal power plants, which capture the sunlight using mirrors, turn heat into steam, and store it underground until the customer needs it.

4 ***Safely reprocess and store nuclear waste.*** Nuclear plants produce 20 percent of America's electricity, but 70 percent of America's clean electricity – that is, electricity that does not pollute the air with mercury, nitrogen, sulfur, or carbon. The most important breakthrough needed during the next five years to build more nuclear power plants is solving the problem of what to do with nuclear waste. A political stalemate has stopped nuclear waste from going to Yucca Mountain in Nevada, and $15 billion collected from ratepayers for that purpose is sitting in a bank. Recycling waste could reduce its mass by 90 percent, creating less stuff to store temporarily while long-term storage is resolved.

5 ***Make advanced biofuels cost-competitive with gasoline.*** The backlash toward ethanol made from corn because of its effect on food prices is a reminder to beware of the great law of unintended consequences when issuing grand challenges. Ethanol from cellulosic materials shows great promise, but there are a limited number of cars capable of using alternative fuels and of places for drivers to buy it. Turning coal into liquid fuel is an established technology, but expensive and a producer of much carbon.

6 ***Make new buildings green buildings.*** Japan believes it may miss its 2012 Kyoto goals for greenhouse gas reductions primarily because of energy wasted by inefficient buildings. Many of the technologies needed to do this are known. Figuring out how to accelerate their use in a decentralized society is most of this grand challenge.

7 ***Provide energy from fusion.*** The idea of recreating on Earth the way the sun creates energy and using it for commercial power is the third grand challenge suggested by the National Institute of Engineering. The promise of sustaining a controlled fusion reaction for commercial power generation is so fantastic that the five-year goal should be to do everything possible to reach the long-term goal. The failure of Congress to approve the President's budget request for U.S. participation in the International Thermonuclear Experimental Reactor – the ITER Project – is embarrassing.

Anything is possible.

This country of ours is a remarkable place.

Even during an economic slowdown, we will produce this year about 30 percent of all the wealth in the world for the 5 percent of us who live in the United States.

Despite "the gathering storm" of concern about American competitiveness, no other country approaches our brainpower advantage – the collection of research universities, national laboratories and private-sector companies we have.

And this is still the only country where people say with a straight face that anything is possible – and really believe it.

These are precisely the ingredients that America needs during the next five years to place ourselves firmly on a path to clean energy independence within a generation – and in doing so, to make our jobs more secure, to help balance the family budget, to make our air cleaner and our planet safer and healthier – and to lead the world to do the same.

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