PPE Plastics Industry Forum

March, 2009

PPE has decided to publish an occasional news forum which we feel will be of special interest to our many friends and customers in our Plastics Industry. The first essential article we chose for this forum is absolutely of special interest as electric power is the primary source of energy required to operate a plastics manufacturing facility. Remember the phoney shortages in the state of California several years ago? Molders ran from the state in droves.

Needless to say, in the future those shortages will be real if something aggressive isn't done quickly.

In August of 2003 when a fallen tree branch in Ohio can cause the largest widespread blackout in U.S. history we definitely have a problem now! Ten million in Canada and forty million in eight U.S. states were affected. Wait until we all arrive home at 6:00 P.M. and plug in our electric cars. You'll see a real black out!

We are also seriously concerned about the abuse and criticism our Plastics Industry has realized and sustained for many years which must come to a stop. More about that later. We hope you enjoy this information passed on to you and if you agree something should be done, contact your Congressman or Senator today!

Your Editor, Ed Kuchar Sr.
President

The Case for Terrestrial (a.k.a. Nuclear) Energy

by William Tucker, Journalist

WILLIAM TUCKER is a veteran journalist. Educated at Amherst College, his work has appeared in Harper's, the Atlantic Monthly, the American Spectator, the Weekly Standard, National Review, Reason, the New Republic, Reader's Digest, the Wall Street Journal, and many other publications. His articles have won the John Hancock Award, the Gerald Loeb Award, the Amos Tuck Award, and he was a finalist for the National Magazine Award. His books include Progress and Privilege: America in the Age of Environmentalism; Vigilante: The Backlash Against Crime in America; and The Excluded American: Homelessness and Housing Policies, which won the Mencken Award. His forthcoming book is entitled Terrestrial Energy: How a Nuclear-Solar Alliance Can Rescue the Planet.

The following is adapted from a lecture delivered at Hillsdale College on January 29, 2008, during a conference on "Free Markets and Politics Today," co-sponsored by the Center for Constructive Alternatives and the Ludwig von Mises Lecture Series.

There have been a host of debates this year between the Democratic and Republican candidates for president. Many of these candidates believe that among our top priorities is to address global warming by reducing carbon emissions. All or most seem to agree that decreasing America's energy dependence is another. Yet few if any of the candidates have mentioned that nuclear energy - or as I prefer, terrestrial energy - could serve both these ends.

Right now there are 103 operating nuclear reactors in America, but most are owned by utilities (which also own coal plants). The few spin-offs that concentrate mainly on nuclear - Entergy, of Jackson, Mississippi, and Exelon, of Chicago - are relatively small players. As for the nuclear infrastructure, it hardly exists. There is only one steel company in the world today that can cast the reactor vessels (the 42-foot, egg-shaped containers at the core of a reactor): Japan Steel Works. As countries around the world begin to build new reactors, the company is now back-ordered for four years. Unless some enterprising American steel company takes an interest, any new reactor built in America will be cast in Japan.

This is an extraordinary fate for what was once regarded as an American Technology. France, China, Russia, Finland, and Japan all perceive the enormous opportunity that nuclear energy promises for reducing carbon emissions and relieving the world's energy problems as reflected in recent soaring oil prices. Yet in America, we remain trapped in a Three Mile Island mentality, without even a public discussion of the issue. As folk singer Ani DiFranco puts it, the structure of the atom is so perfect that it is "blasphemy / To use it to make bombs / Or electricity."

It is time to step back and question whether this prejudice makes sense.

Fossil Fuels

All living things exist by drawing energy from their environment and discarding part of it as "waste," so there is nothing inherently shameful about energy consumption. Almost all our energy derives ultimately from the sun. Plants store solar energy by transforming it into large carbon-chain molecules (the process we call photosynthesis). The entire animal kingdom draws it's energy from this process by "eating" this stored solar energy. About 750,000 years ago, early humans discovered that they could also draw solar energy from a chain reaction we call "fire". When heated, the stored energy in carbon chains is released. This heat energy can break down other carbon chains, which causes combustion. Fire has been the principle source of energy throughout most human history. When historian William Manchester wrote a book about the Middle Ages called A World Lit Only By Fire, he was describing the world of only 700 years ago.

All this began to change about 400 years ago when human beings discovered an older source of stored solar energy - coal. Our most common fossil fuel, coal is the compressed remains of vegetable matter that covered the earth 300-400 million years ago. Coal is superabundant and we will probably never run out of it. It was the fuel of the Industrial Revolution, and it is still the world's largest source of energy. It is also the most environmentally destructive substance ever utilized. The EPA estimates that it kills 30,000 Americans each year through lung diseases (and in China it is doing far worse). It is also the world's principal source of carbon dioxide emissions.

Oil, another fossil fuel, is rarer and is believed to be the remains of organisms that lived in shallow seas during the age of the dinosaurs. It was first drilled in 1859, but was used only for lighting and lubrication until the invention of the automobile. Now it constitutes 40 percent of our energy consumption and is perhaps the most difficult fuel to replace. American oil production peaked in 1970 and is now declining rapidly - a fact that explains much of our subsequent foreign policy. The Arab oil embargo occurred three years following the peak, when the producing states realized we were vulnerable. The question now is whether world production will reach a similar peak and decline. As Matthew Simmons has written: "We won't know until we see it in the rearview mirror." If it does come, it may not look much different from the quadrupling of oil prices we have witnessed in the last three years.

Natural gas is generally considered the most environmentally benign of the fossil fuels. It gives off little pollution and only about half the greenhouse gas of coal. Natural gas was put under federal regulation in the 1950's, so that by the 1970's we were experiencing a supply shortage. Deregulation in the '80s led to almost unlimited supplies in the '90s. Then we began the fateful practice of using gas to produce electricity, resulting in a price crunch and the loss of many gas-dependent industries, such as fertilizer and plastics factories, which have since moved to Mexico and Saudi Arabia to be near supplies. Now American gas production seems to have peaked and we are importing 15 percent of our consumption from Canada.

Huge gas supplies have been discovered in Russia and the Middle East, but will not do us much good since gas cannot be easily transported over water. Thus China, India and Europe will be able to buy pipeline gas much more cheaply and are already out-competing us on the world market.

Alternative Fuels

Given the precarious state of these fossil fuels, people have begun talking of "alternative" and "renewable" fuels - water, sun and wind. The term "renewable" is somewhat misleading: no energy is "renewable" insofar as energy cannot be recycled (this is the Second Law of Thermodynamics). The term "renewable" usually describes tapping flows of solar energy that are supposedly "free." But coal and oil in the ground are also free. It just takes work - and energy - to recover them. So, too, solar "renewables" can only be gathered at a cost. They are often limited and may require extravagant use of other resources - mainly land.

What about water? Hydroelectricity is a form of solar energy. The sun evaporates water, which falls as rain and then flows back to the sea, creating kinetic energy. Rivers have been tapped since Roman times and, beginning in the 19th century, dams were built to store this solar energy. Hydroelectric dams provided 30 percent of our electricity in the 1930s, but the figure has declined to ten percent. And all the good dam sites are now taken.

What about wind? Wind energy has captured the imagination of the public and is touted by many as the fastest growing energy source in the world. All of this is driven by government mandates - tax credits and "renewable portfolio" laws that require utilities to buy non-fossil sources of power. The problem with wind is that it is completely unpredictable. Our electrical grid is one giant machine interconnected across the country, in which voltage balances must be carefully maintained in order to avoid damaging electrical equipment or losing data on computer circuits. Wind irregularities can be masked up to around 20 percent, but after that they become too disruptive. At best, therefore, wind will only be able to provide the 20 percent "spinning reserve" carried by all utilities. In addition, windmills are large and require lots of land. The biggest now stand 65 stories tall - roughly the height of New York's Trump Tower - and produce only six megawatts, or about 1/200th the output of a conventional power plant. In the East, most are sited on mountaintops, since that is where the wind blows strongest.

What about the sun? Solar energy is very diffuse. A square-meter card table receives enough sunlight to run only four 100-watt electric bulbs. At best, solar could provide our indoor lighting, which consumes about ten percent of our electricity. But keep in mind: gathering and storing solar energy requires vast land areas.

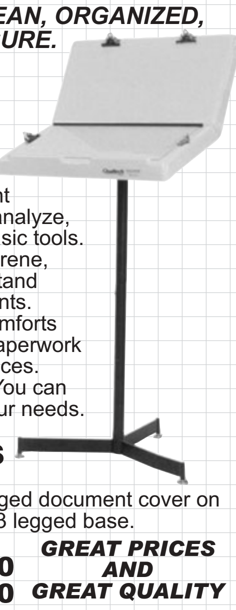
Sunshine can be harnessed directly in two ways - as thermal heat or through photovoltaics, the direct production of electricity. In the 1980s, California built a Power Tower that focused hundreds of mirrors on a single point to boil water to drive a turbine. The facility covered one-fifth of a square mile and produced ten megawatts. It was eventually closed down as uneconomical. Last year, when Spain opened an identical Power Tower in Seville, U.S. News and World Report ran a cover story hailing it as a "Power Revolution." That facility, of course, is completely subsidized by the government.

Photovoltaic cells have more promise. They are thin wafers where solar radiation knocks the electrons off silicon atoms, producing an electric current. At present, an installation about half the size of a football field could power one suburban home - when the sun shines of course. The problem is that photovoltaics are enormously expensive; using them to provide one-quarter of an average home's electricity requires investing around $35,000. Their greatest benefit is that they are able to provide electricity precisely when it is most needed - on hot summer afternoons when air conditioning produces peak loads.

Nuclear or Terrestrial Energy

There is one other form of alternative energy often mistakenly grouped with solar: Geothermal energy. Geothermal is produced when the natural heat of the earth comes in contact with groundwater. This can produce geysers and "fumaroles" - steam leaks that are now being harnessed to produce electricity.

Where does the heat come from? Temperatures at the earth's core reach 7000 degrees Centigrade, hotter than the surface of the sun. Some of this heat comes from gravitational pressures and the leftover heat from the collisions of astral particles that led to the formation of the earth. But at least half of it (we don't know the precise percentage) comes from the radioactive breakdown of thorium and uranium within the earth's mantle. This is "terrestrial energy" and a nuclear reactor is simply the same process carried out in a controlled environment. In order to harness terrestrial energy in the form of uranium isotopes, we mine it, bring it to the surface, concentrate it, and initiate a chain reaction that releases stored energy in the form of heat - the very same process that is used to harness solar energy from coal.



When Albert Einstein signed the letter to President Roosevelt informing him of the discovery of nuclear energy, he turned to some fellow scientists and said: "For the first time mankind will be using energy not derived from the sun." This possibility emerged in 1905, when Einstein posited that energy and matter are different forms of the same thing and that energy could be converted to matter and matter to energy (as reflected in the famous equation $E=mc^2$). The co-efficient, c^2, is the speed of light squared, which is a very, very large number. What it signifies is that a very, very small amount of matter can be converted into a very, very large amount of energy. This is good news in terms of our energy needs and the environment. It means the amount of fuel required to produce an equivalent amount of energy is now approximately two million times smaller.

Consider: At an average 1,000 megawatt coal plant, a train with 110 railroad cars, each loaded with 20 tons of coal, arrives every five days. Each carload will provide 20 minutes of electricity. When burned, one ton of coal will throw three tons of carbon dioxide into the atmosphere. We now burn 1 billion tons of coal a year - up from 500 million tons in 1976. This coal produces 40 percent of our greenhouse gases and 20 percent of the world's carbon emissions.

By contrast, consider a 1000 megawatt nuclear reactor. Every two years a fleet of flatbed trucks pull up to the reactor to deliver a load of fuel rods. These rods are only mildly radioactive and can be handled with gloves. They will be loaded into the reactor, where they will remain for six years (only one-third of the rods are replaced at each refueling). The replaced rods will be removed and transferred to a storage pool inside the containment structure, where they can remain indefinitely (three feet of water blocks the radiation). There is no exhaust, no carbon emissions, no sulfur sludge to be carted away hourly and heaped into vast dumps. There is no release into the environment.

The fuel rods come out looking exactly as they did going in, except they are now more highly radioactive. There is no air pollution, no water pollution, and no ground pollution.

Objections to Nuclear Energy

What are the potential problems with nuclear power?

First, some fear that a nuclear reactor might explode. But this is impossible. Natural uranium is made of two isotopes - U-235 and U-238 (the latter having three more neutrons). Both are radioactive - meaning they are constantly breaking down into slightly smaller atoms - but only U-235 is fissile, meaning it will split almost in half with a much larger release of energy. Because U-235 is more highly radioactive, it has almost all broken down already, so that it now makes up only seven-tenths of a percent of the world's natural uranium. In order to set off a chain reaction, natural uranium must be "enriched" so that U-235 makes up a larger percentage. Reactor grade uranium - which will simmer enough to produce a little heat - is three percent U-235. In order to get to bomb grade uranium - the kind that will explode - uranium must be enriched to 90 percent U-235. Given this fact, there is simply no way that a reactor can explode.

On the other hand, a reactor can "melt down." This is what happened at Three Mile Island. A valve stuck open and a series of mistakes led the operators to think the core was overflowing when it was actually short of cooling water. They further drained the core and about a third of the core melted from the excess heat. But did this result in a nuclear catastrophe? Hardly. The public was disconcerted because no one was sure what was happening. But in the end the melted fuel stayed within the reactor vessel. Critics had predicted a "China syndrome" where the molten core would melt through the steel vessel, then through the concrete containment structure, then down into the earth where it would hit groundwater, causing a steam explosion that would spray radioactive material across a huge area. In fact, the only radioactive debris was a puff of steam that emitted the same radiation as a single chest x-ray. Three Mile Island was an industrial accident. It bankrupted the utility, but no one was injured.

This of course was not the case in Chernobyl, where the Soviet designers didn't even bother building a concrete containment structure around the reactor vessel. Then in 1986, two teams of operators became involved in a tussle over use of the reactor and ended up overheating the core, which set fire to the carbon moderator that facilitates the chain reaction. (American reactors don't use carbon moderators.) The result was a four-day fire that spewed radioactive debris around the world. More fallout fell on Harrisburg, Pennsylvania, from Chernobyl then from Three Mile Island. With proper construction such a thing could never happen.

Another objection to nuclear power is the supposed waste it produces. But that is a mischaracterization. A spent fuel rod is 95 percent U-238. This is the same material we can find in a shovel full of dirt from our back yards. Of the remaining five percent, most is useful, but small amounts should probably be placed in a repository such as Yucca Mountain. The useful parts - uranium-235 and plutonium (a man-made element produced from U-238) can be recycled as fuel. In fact, we are currently recycling plutonium from Russian nuclear missiles. Of the 20 percent of our power that comes from nuclear sources, half is produced from recycled Russian bombs. Many of the remaining isotopes are useful in industry or radiological medicine - now used in 40 percent of all medical procedures. It is only cesium-137 and strontium-90, which have half-lives of 28 and 30 years, respectively, that need to be stored in protective areas.

Unfortunately, federal regulations require all radioactive by-products of nuclear power plants to be disposed of in a nuclear waste repository. As a result, more than 98 percent of what will go into Yucca Mountain is either natural uranium or useful material. Why are we wasting so much effort on such a needless task? Because in 1977, President Carter decided to outlaw nuclear recycling. The fear then was that other countries would steal our plutonium to make nuclear bombs. (India had just purloined plutonium from a Canadian-built reactor to make its bomb.) This has turned out to be a false alarm. Countries that have built bombs have either drawn plutonium from their own reactors or - as Iran is trying to do now - enriched their own uranium. Canada, Britain, France and Russia are all recycling their nuclear fuel. France has produced 80 percent of it's electricity with nuclear power for the last 25 years. It stores all it's high-level "nuclear waste" in a single room at Le Havre.

Conclusion

The U.S. currently gets 50 percent of it's electricity from coal and 20 percent from nuclear reactors. Reversing these percentages should become a goal of both global warming advocates and anyone who wants to reduce America's dependence on foreign oil (the latter since a clean, expanded electrical grid could anchor a fleet of hydrogen or electric cars). Contrary to what some critics charge, this would not require massive subsidies or direct intervention by the government. Indeed, the nuclear industry has gone through an astounding revival over the past decade. The entire fleet of 103 reactors is up and running 90 percent of the time. Reactors are making money hand-over-fist - so much so that the attorney general of Connecticut recently proposed a windfall profits tax on them! The industry is poised for new construction, with proposals for four new reactors submitted to the Nuclear Regulatory Commission and almost 30 waiting in the wings.

The rest of the world is rapidly moving toward nuclear power. France, Russia and Japan are not only going ahead with their own nuclear programs, but selling their technology in the developing world. America, which once dominated this technology, is being left behind. The main culprit is public fear. Nuclear technology is regarded as an illegitimate child of the atomic bomb, a Faustian bargain, a blasphemous tinkering with nature. It is none of these. It is simply a natural outgrowth of our evolving understanding of the universe. The sun has been our prime source of energy throughout human history, but energy is also generated in the earth itself. It is time to avail ourselves of this clean, safe terrestrial energy. ■

Even Lee Iacocca formerly of Chrysler is quoted in AARP magazine saying: "I want an electric grid that you can plug your car into. And I would start looking at nuclear power again. We smashed the atom first. What happened? We turned nuclear energy over to the lawyers. The rest of the world turned it over to the engineers."

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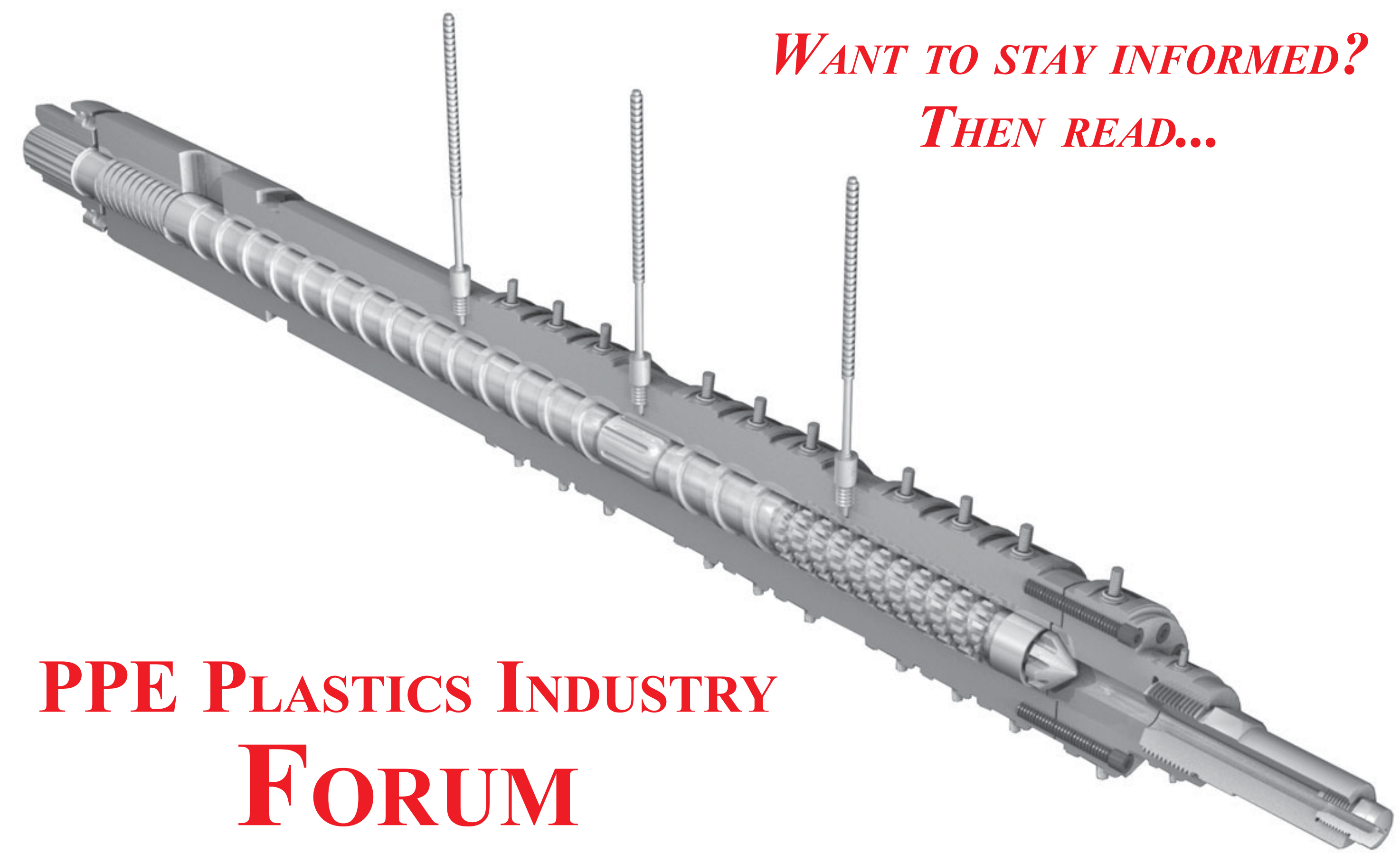

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