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From: <SLKalee@aol.com>
To: <millstoneEIS@nrc.gov>
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Do you believe that true costs are considered when assessments, such as the one you are about to read of, are done? Pollution from mining, transportation, processing, waste products and their disposal as well as the health and environmental costs, etc. make up those unaccounted for costs. If we really want to cut C02 emissions we need to look at the big picture, wind, solar, geothermal, bio-diesel, methane from dumps used as a fuel source, forest conservation, green building, etc.

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If we take a nuclear power plant off line, clearly any wind generated power will not make a dent in the C02 until there is more electricity produced from the wind source than by the nuclear power plant...and don't forget those hidden costs. How much C02 is produced in the processing, and other the other steps mentioned before? Have you ever heard of someone getting cancer from a wind generator or its by-products? How about the danger of a terrorist attack on a wind generator (shades of Don Quixote)? Is there a Price Anderson Bill to cover the insurance for wind generators and do we find an exclusion in our home insurance policies for damage caused by an accident or an attack upon a wind generator? And one last question, is there a good evacuation plan in case of a major problem with a wind generator?

Larry Kaley

From:
http://www.wired.com/wired/archive/13.02/nuclear.html

Nuclear Now!
How clean, green atomic energy can stop global warming
By Peter Schwartz and Spencer ReissPage

Peter Schwartz (peter_schwartz@ gbn.com) is chair of Global Business Network, a scenario-planning firm. Contributing editor Spencer Reiss (spencer@ upperroad.net) wrote about pebble-bed nuclear reactors in issue 13.01. Additional research by Chris Coldewey.

On a cool spring morning a quarter century ago, a place in Pennsylvania called Three Mile Island exploded into the headlines and stopped the US nuclear power industry in its tracks. What had been billed as the clean, cheap, limitless energy source for a shining future was suddenly too hot to handle.

In the years since, we've searched for alternatives, pouring billions of dollars into windmills, solar panels, and biofuels. We've designed fantastically efficient lightbulbs, air conditioners, and refrigerators. We've built enough gas-fired generators to bankrupt California. But mainly, each year we hack 400 million more tons of coal out of Earth's crust than we did a quarter century before, light it on fire, and shoot the proceeds into the atmosphere.

The consequences aren't pretty. Burning coal and other fossil fuels is driving climate change, which is blamed for everything from western forest

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fires and Florida hurricanes to melting polar ice sheets and flooded Himalayan hamlets. On top of that, coal-burning electric power plants have fouled the air with enough heavy metals and other noxious pollutants to cause 15,000 premature deaths annually in the US alone, according to a Harvard School of Public Health study. Believe it or not, a coal-fired plant releases 100 times more radioactive material than an equivalent nuclear reactor - right into the air, too, not into some carefully guarded storage site. (And, by the way, more than 5,200 Chinese coal miners perished in accidents last year.)

Burning hydrocarbons is a luxury that a planet with 6 billion energy-hungry souls can't afford. There's only one sane, practical alternative: nuclear power.

We now know that the risks of splitting atoms pale beside the dreadful toll exacted by fossil fuels. Radiation containment, waste disposal, and nuclear weapons proliferation are manageable problems in a way that global warming is not. Unlike the usual green alternatives - water, wind, solar, and biomass - nuclear energy is here, now, in industrial quantities. Sure, nuke plants are expensive to build - upward of $2 billion apiece - but they start to look cheap when you factor in the true cost to people and the planet of burning fossil fuels. And nuclear is our best hope for cleanly and efficiently generating hydrogen, which would end our other ugly hydrocarbon addiction - dependence on gasoline and diesel for transport.

Some of the world's most thoughtful greens have discovered the logic of nuclear power, including Gaia theorist James Lovelock, Greenpeace cofounder Patrick Moore, and Britain's Bishop Hugh Montefiore, a longtime board member of Friends of the Earth (see "Green vs. Green," page 82). Western Europe is

quietly backing away from planned nuclear phaseouts. Finland has ordered a big reactor specifically to meet the terms of the Kyoto Protocol on climate change. China's new nuke plants - 26 by 2025 - are part of a desperate effort at smog control.

Even the shell-shocked US nuclear industry is coming out of its stupor. The 2001 report of Vice President Cheney's energy task force was only the most high profile in a series of pro-nuke developments. Nuke boosters are especially buoyed by more efficient plant designs, streamlined licensing procedures, and the prospect of federal subsidies.

In fact, new plants are on the way, however tentatively. Three groups of generating companies have entered a bureaucratic maze expected to lead to formal applications for plants by 2008. If everything breaks right, the first new reactors in decades will be online by 2014. If this seems ambitious, it's not; the industry hopes merely to hold on to nuclear's current 20 percent of the rapidly growing US electric power market.

That's not nearly enough. We should be shooting to match France, which gets 77 percent of its electricity from nukes. It's past time for a decisive leap out of the hydrocarbon era, time to send King Coal and, soon after, Big Oil shambling off to their well-deserved final resting places - maybe on a nostalgic old steam locomotive.

Besides, wouldn't it be a blast to barrel down the freeway in a hydrogen Hummer with a clean conscience as your copilot? Or not to feel like a planet

killer every time you flick on the A/C? That's how the future could be, if only we would get over our fear of the nuclear bogeyman and forge ahead - for real this time - into the atomic age.

The granola crowd likes to talk about conservation and efficiency, and surely substantial gains can be made in those areas. But energy is not a luxury people can do without, like a gym membership or hair gel. The developed world built its wealth on cheap power - burning firewood, coal, petroleum, and natural gas, with carbon emissions the inevitable byproduct.

Indeed, material progress can be tracked in what gets pumped out of smokestacks. An hour of coal-generated 100-watt electric light creates 0.05 pounds of atmospheric carbon, a bucket of ice makes 0.3 pounds, an hour's car ride 5. The average American sends nearly half a ton of carbon spewing into the atmosphere every month. Europe and Japan are a little more economical, but even the most remote forest-burning peasants happily do their part.

And the worst - by far - is yet to come. An MIT study forecasts that worldwide energy demand could triple by 2050. China could build a Three Gorges Dam every year forever and still not meet its growing demand for electricity. Even the carbon reductions required by the Kyoto Protocol - which pointedly exempts developing countries like China - will be a drop in the atmospheric sewer.

What is a rapidly carbonizing world to do? The high-minded answer, of course, is renewables. But the notion that wind, water, solar, or biomass will save the day is at least as fanciful as the once-popular idea that nuclear energy would be too cheap to meter. Jesse Ausubel, director of the human environment program at New York's Rockefeller University, calls renewable energy sources "false gods" - attractive but powerless. They're capital- and land-intensive, and solar is not yet remotely cost-competitive. Despite all the hype, tax breaks, and incentives, the proportion of US electricity production from renewables has actually fallen in the past 15 years, from 11.0 percent to 9.1 percent.

The decline would be even worse without hydropower, which accounts for 92 percent of the world's renewable electricity. While dams in the US are under

attack from environmentalists trying to protect wild fish populations, the Chinese are building them on an ever grander scale. But even China's autocrats can't get past Nimby. Stung by criticism of the monumental Three Gorges project - which required the forcible relocation of 1 million people - officials have suspended an even bigger project on the Nu Jiang River in the country's remote southwest. Or maybe someone in Beijing questioned the wisdom of reacting to climate change with a multibillion-dollar bet on rainfall.

Solar power doesn't look much better. Its number-one problem is cost: While the price of photovoltaic cells has been slowly dropping, solar-generated electricity is still four times more expensive than nuclear (and more than five times the cost of coal). Maybe someday we'll all live in houses with photovoltaic roof tiles, but in the real world, a run-of-the-mill 1,000-megawatt photovoltaic plant will require about 60 square miles of panes alone. In other words, the largest industrial structure ever built.

Wind is more promising, which is one reason it's the lone renewable attracting serious interest from big-time equipment manufacturers like General Electric. But even though price and performance are expected to improve, wind, like solar, is inherently fickle, hard to capture, and widely dispersed. And wind turbines take up a lot of space; Ausubel points out that the wind equivalent of a typical utility plant would require 300 square miles of turbines plus costly transmission lines from the wind-scoured fields of, say, North Dakota. Alternatively, there's California's Altamont Pass, where 5,400 windmills slice and dice some 1,300 birds of prey annually.

What about biomass? Ethanol is clean, but growing the amount of cellulose required to shift US electricity production to biomass would require farming - no wilting organics, please - an area the size of 10 Iowas.

Among fossil fuels, natural gas holds some allure; it emits a third as much carbon as coal. That's an improvement but not enough if you're serious about

rolling back carbon levels. Washington's favorite solution is so-called clean coal, ballyhooed in stump speeches by both President Bush (who offered a $2 billion research program) and challenger John Kerry (who upped the ante to $10 billion). But most of the work so far has been aimed at reducing acid rain by cutting sulphur dioxide and nitrogen oxide emissions, and more recently gasifying coal to make it burn cleaner. Actual zero-emissions coal is still a lab experiment that even fans say could double or triple generating costs. It would also leave the question of what to do with 1 million tons of extracted carbon each year.

By contrast, nuclear power is thriving around the world despite decades of obituaries. Belgium derives 58 percent of its electricity from nukes, Sweden 45 percent, South Korea 40, Switzerland 37 percent, Japan 31 percent, Spain 27 percent, and the UK 23 percent. Turkey plans to build three plants over the next several years. South Korea has eight more reactors coming, Japan 13, China at least 20. France, where nukes generate more than three-quarters of the country's electricity, is privatizing a third of its state-owned nuclear energy group, Areva, to deal with the rush of new business.

The last US nuke plant to be built was ordered in 1973, yet nuclear power is growing here as well. With clever engineering and smart management, nukes have steadily increased their share of generating capacity in the US. The 103 reactors operating in the US pump out electricity at more than 90 percent of capacity, up from 60 percent when Three Mile Island made headlines. That increase is the equivalent of adding 40 new reactors, without bothering anyone's backyard or spewing any more carbon into the air.

So atomic power is less expensive than it used to be - but could it possibly be cost-effective? Even before Three Mile Island sank, the US nuclear industry was foundering on the shoals of economics. Regulatory delays and billion-dollar construction-cost overruns turned the business into a financial nightmare. But increasing experience and efficiency gains have changed all that. Current operating costs are the lowest ever - 1.82 cents per kilowatt-hour versus 2.13 cents for coal-fired plants and 3.69 cents for natural gas. The ultimate vindication of nuclear economics is playing out in the stock market: Over the past five years, the stocks of leading nuclear generating companies such as Exelon and Entergy have more than doubled. Indeed, Exelon is feeling so flush that it bought New Jersey's Public

Service Enterprise Group in December, adding four reactors to its former roster of 17.

This remarkable success suggests that nuclear energy realistically could replace coal in the US without a cost increase and ultimately lead the way to a clean, green future. The trick is to start building nuke plants and keep building them at a furious pace. Anything less leaves carbon in the climatic driver's seat.

A decade ago, anyone thinking about constructing nuclear plants in the US would have been dismissed as out of touch with reality. But today, for the first time since the building of Three Mile Island, new nukes in the US seem
possible. Thanks to improvements in reactor design and increasing encouragement from Washington, DC, the nuclear industry is posed for unlikely revival. "All the planets seem to be coming into alignment," says David Brown, VP for congressional affairs at Exelon.

The original US nuclear plants, built during the 1950s and '60s, were descended from propulsion units in 1950s-vintage nuclear submarines, now known as generation I. During the '80s and '90s, when new construction halted in the US, the major reactor makers - GE Power Systems, British-owned Westinghouse, France's Framatome (part of Areva), and Canada's AECL - went after customers in Europe. This new round of business led to system improvements that could eventually, after some prototyping, be deployed back in the US.

By all accounts, the latest reactors, generation III+, are a big improvement. They're fuel-efficient. They employ passive safety technologies, such as gravity-fed emergency cooling rather than pumps. Thanks to standardized construction, they may even be cost-competitive to build - $1,200 per kilowatt-hour of generating capacity versus more than $1,300 for the latest low-emission (which is not to say low-carbon) coal plants. But there's no way to know for sure until someone actually builds one. And even then, the first few will almost certainly cost more.

Prodded by the Cheney report, the US Department of Energy agreed in 2002 to pick up the tab of the first hurdle - getting from engineering design to working blueprints. Three groups of utility companies and reactor makers have stepped up for the program, optimistically dubbed Nuclear Power 2010. The government's bill to taxpayers for this stage of development could top $500 million, but at least we'll get working reactors rather than "promising technologies."

But newer, better designs don't free the industry from the intense public oversight that has been nuclear power's special burden from the start. Believe it or not, Three Mile Island wasn't the ultimate nightmare; that would be Shoreham, the Long Island power plant shuttered in 1994 after a nine-year legal battle, without ever having sold a single electron. Construction was already complete when opponents challenged the plant's application for an operating license. Wall Street won't invest billions in new plants ($5.5 billion in Shoreham's case) without a clear path through the maze of judges and regulators.

Shoreham didn't die completely in vain. The 1992 Energy Policy Act aims to forestall such debacles by authorizing the Nuclear Regulatory Commission to

issue combined construction and operating licenses. It also allows the NRC to pre-certify specific reactor models and the energy companies to bank preapproved sites. Utility executives fret that no one has ever road-tested the new process, which still requires public hearings and shelves of supporting documents. An idle reactor site at Browns Ferry, Alabama, could be an early test case; the Tennessee Valley Authority is exploring options to refurbish it rather than start from scratch.

Meanwhile, Congress looks ready to provide a boost to the nuclear energy industry. Pete Domenici (R-New Mexico), chair of the Senate's energy committee and the patron saint of nuclear power in Washington, has vowed to revive last year's energy bill, which died in the Senate. Earlier versions included a 1.85 cent per-kilowatt-hour production tax credit for the first half-dozen nuke plants to come online. That could add up to as much as $8 billion in federal outlays and should go a long way toward luring Wall Street back into the fray. As pork goes, the provision is easy to defend. Nuclear power's extraordinary startup costs and safety risks make it a special case for government intervention. And the amount is precisely the same bounty Washington spends annually in tax credits for wind, biomass, and other zero-emission kilowattage.

Safer plants, more sensible regulation, and even a helping hand from Congress - all are on the way. What's still missing is a place to put radioactive waste. By law, US companies that generate nuclear power pay the Feds a tenth of a cent per kilowatt-hour to dispose of their spent fuel. The fund - currently $24 billion and counting - is supposed to finance a permanent waste repository, the ill-fated Yucca Mountain in Nevada. Two decades ago when the payments started, opening day was scheduled for January 31, 1998. But the Nevada facility remains embroiled in hearings, debates, and studies, and waste is piling up at 30-odd sites around the country. Nobody will build a nuke plant until Washington offers a better answer than "keep piling."

At Yucca Mountain, perfection has been the enemy of adequacy. It's fun to discuss what the design life of an underground nuclear waste facility ought to be. One hundred years? Two hundred years? How about 100,000? A quarter of a million? Science fiction meets the US government budgeting process. In court!

But throwing waste into a black hole at Yucca Mountain isn't such a great idea anyway. For one thing, in coming decades we might devise better disposal methods, such as corrosion-proof containers that can withstand millennia of heat and moisture. For another, used nuclear fuel can be recycled as a source for the production of more energy. Either way, it's clear that the whole waste disposal problem has been misconstrued. We don't need a million-year solution. A hundred years will do just fine - long enough to let the stuff cool down and allow us to decide what to do with it.

The name for this approach is interim storage: Find a few patches of isolated real estate - we're not talking about taking it over for eternity - and pour nice big concrete pads; add floodlights, motion detectors, and razor wire; truck in nuclear waste in bombproof 20-foot-high concrete casks. Voilà: safe storage while you wait for either Yucca Mountain or plan B.

Two dozen reactor sites around the country already have their own interim facilities; a private company has applied with the NRC to open one on the

Goshute Indian reservation in Skull Valley, Utah. Establishing a half-dozen
federally managed sites is closer to the right idea. Domenici says he'll introduce legislation this year for a national interim storage system.

A handful of new US plants will be a fine start, but the real goal has to be dethroning King Coal and - until something better comes along - pushing nuclear power out front as the world's default energy source. Kicking carbon cold turkey won't be easy, but it can be done. Four crucial steps can help increase the momentum: Regulate carbon emissions, revamp the fuel cycle, rekindle innovation in nuclear technology, and, finally, replace gasoline with hydrogen.

. Regulate carbon emissions. Nuclear plants have to account for every radioactive atom of waste. Meanwhile, coal-fired plants dump tons of deadly refuse into the atmosphere at zero cost. It's time for that free ride to end, but only the government can make it happen.

The industry seems ready to pay up. Andy White, CEO of GE Energy's nuclear division, recently asked a roomful of US utility executives what they thought about the possibility of regulating carbon emissions. The idea didn't faze them. "The only question any of them had," he says, "was when and how much."

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