ENERGY OF THE FUTURE: NUCLEAR VS OTHER SOURCES

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Annotation

Everybody knows that we live in a time of energy crisis. The World's Fossil Fuels are a finite resource that will be consumed within 500 years at present and projected future rates of consumption. In addition these are often accompanied by substantial pollutants and of course their major waste by-product, carbon-dioxide gas, is the major Greenhouse emission of concern [1, 2]. Of course every energy source has its advantages and disadvantages. The goal of the work was a comparing nuclear power with other energy sources and the proof that this type of energy is most beneficial to humanity. Objective was detection superiority of nuclear power over other types of energy sources on the following points:

- Cost;
- Efficiency;
- Safety;
- Environmental.

Key words: nuclear energy, power plant, hydrocarbon, fossil fuel, renewable sources, biomass.

In the last years, people have searched for alternatives, pouring billions of dollars into windmills, solar panels, and biofuels. We've designed fantastically efficient lightbulbs, air conditioners, and refrigerators. 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 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. Scientists have proved that a coal-fired plant releases 100 times more radioactive material than an equivalent nuclear reactor. (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 [3].

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, nuclear 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 [3, 4].

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 [3].

Hydrocarbon energy is obvious disadvantages. How can we solve this problem? There are two choices. The first is renewable energy sources such as wind, water, solar, or biomass. All of them are attractive but powerless. They aren't able to produce enough power [5]. For example, One Nuclear Power Plant produces 1000 megawatts per hour. You would need 60,000 acres and 2400 to 2800 wind turbines to equal 1,000 megawatts. Also you need 5,000 acres of solarpanels to equal 1,000 megawatts of electricity. Those solar panels only work at peak power levels during the sunny times, so, on average, they only put out about 25% of their rated capacity. That means you really need 20,000 acres of solar panels to generate 1,000 megawatts of electricity per hour, on average. 20,000 acres is 31.25 square miles [6].

The decline would be even worse without hydropower, which accounts for 92 percent of the world's renewable electricity. But this type of energy is under attack from environmentalists trying to protect wild fish populations.

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.

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 [3].

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, in north-west Russia reaches 42% and about 18% countrywide, in 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 [3].

What about price of electricity of different sources? 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 [3].

Of all the energy sources discussed here, Nuclear Fission Power is the lowest-cost form of non-greenhouse energy production. The second-generation reactors currently operating at World's best-practice level consistently produce low-cost electricity with no greenhouse gas emissions at high reliability. The French decision to go all - Nuclear has paid-off handsomely and Sweden has the almost the lowest priced electricty in Europe. Furthermore, Denmarks' Greenhouse Gas emissions per capita are substantially greater than both France and Sweden since the Danes use coal power for the majority of their electricity needs even with their commitment to Wind Power.

In the the longer term advanced reactors, fusion-fission hybrids and accelerator driven systems that efficiently use the World's abundant Thorium and Uranium reserves have the capability to power a planet-wide advanced civilization essentially indefinitely. They also have the capability to generate energy from and dispose of the long-lived transuranic waste. However this technology will always require strict safe-guards and independent oversight [1].

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