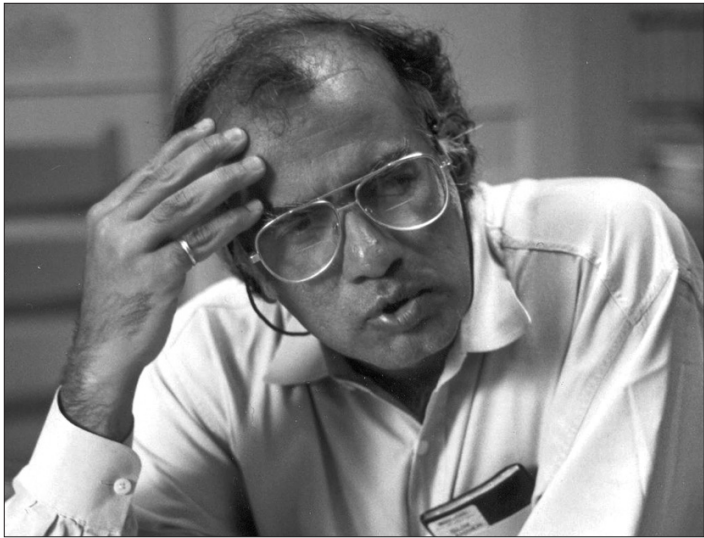


# Roadmap for a Carbon-Free / Nuclear-Free World

A PRESENTATION BY



published the book because we were obligated to do so. Time proved us right because President Carter actually adopted our book and its energy policies.

Some people say we have a climate problem. Why is this a problem? Climate change models in 2007 showed a major increase in Arctic

ice melting. It was about the same for 2008. Typically, Arctic ice recovers during the winter, but today the ice is not very thick. It used to be a few meters thick, and now it is only 1 meter thick. That means that more ice is melting over the summer. If the Arctic Ocean heats up for a good portion of the year, you increase the chance of the Greenland ice sheet melting, and then sea level rises. So when we tell

you that the rise is so many centimeters, it means you will lose so many miles off the coast of Florida, Bangladesh, and Indonesia, to name a few.

## ENERGY

In Washington, when we talk energy, everybody talks a different problem and only wants to solve that one problem. Some people say energy independence, and then they want to turn coal into liquid. Coal into liquid can create carbon dioxide emissions, which is not very good for the climate. Other people say energy independence, and say we should turn corn into ethanol, and mandate it in our cars instead of gasoline. But this can, and did, result in a food crisis.

## NUCLEAR

Some people say energy independence, and want to build nuclear power plants. Why not nuclear power? Nuclear power is a proliferation headache. In order to address climate change by building nuclear power plants and displacing coal, you would have to build about one reactor

a week for 40–50 years somewhere in the world. And in order to do that, you have to fuel it. It will have to be reactors like the ones we have today, but today's reactors take a very long time to build, and cost a lot of money. Assuming these nuclear plants are built, you would have to build two or three uranium enrichment plants every year somewhere in the world to meet the demand for fuel. Enrichment plants like the centrifuge uranium enrichment plant the Iranians are building have caused a giant diplomatic and military crisis in the world. And of course, there is the enrichment plant here in New Mexico.

The nuclear proliferation problem is a plutonium button, the amount from which a bomb can be made. Every nuclear reactor makes about 250 kilograms of plutonium.

Depending on how sophisticated you are, you can make between 30–50 bombs with it — from each reactor every year. So if you built 3,000 reactors, do the math: 30 times 3,000 equals 90,000 bombs that could be produced each year from the plutonium in nuclear reactors.

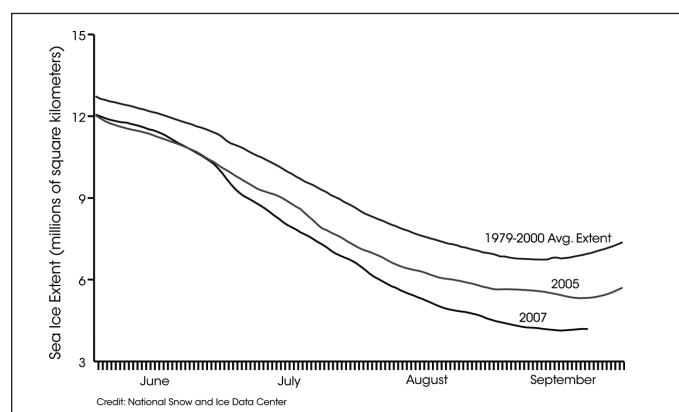
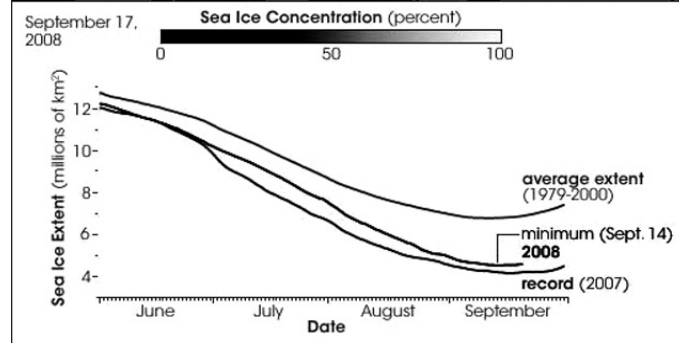
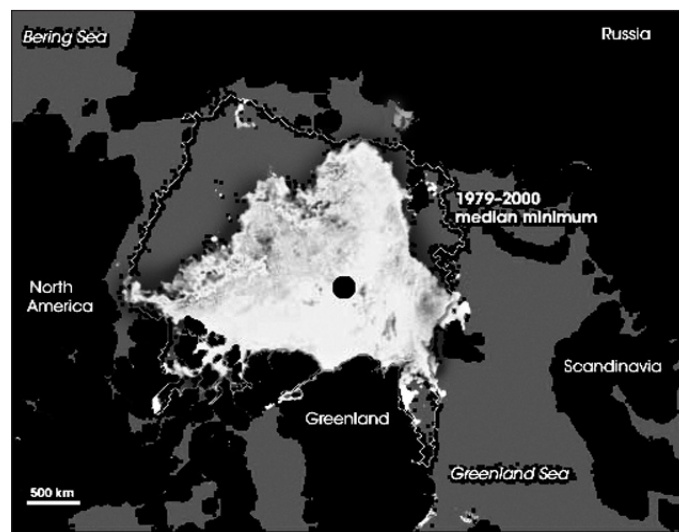
We're told we have to be like the French — they get 80% of their electricity from nuclear energy. The French nuclear system nationalized their utilities and reprocessing companies. What do they do with their waste? They take their waste and reprocess it in a giant chemical factory on the Normandy peninsula at La Hague, extracting the plutonium for reuse as fuel. So the French recycle their waste. Now as future lawyers, you understand there can be fractional truths. This statement "the French recycle their waste" contains less than 1% of the truth, because when you take the plutonium and make it into fuel, the plutonium is just 1% of the waste. When you use it as a fuel, that fuel breeds more plutonium. So the spent fuel has actually more plutonium than the original (2–3% plutonium).

What happens with the other 99% of fuel? Well 4% are fission products that are trapped in the cask and are accumulating there, like the waste in U.S. nuclear reactor plants. And what do you do with that? You must discard it in a waste repository. And when it comes to deep geological disposal, the French are just as allergic to having nuclear waste in their backyards as anybody else. Another problem is that the French discharge 100 million gallons of radioactive waste into the English Channel every year. The English Channel flows all the way to the Arctic. Twelve Western European countries have asked them to stop, but they won't.

While it is literally true that the French recycle their waste — they feel that more than 90% of it is energy that is available, and it is not waste, it is a resource, most is Uranium-238. In order to make it into a fuel and use it, you have to convert it into plutonium in a breeder reactor. Worldwide we have spent \$100 billion on trying to make breeder reactors work. The French built the largest breeder reactor in the world — 1,250 Megawatts — but it only operated for 14 years at 7% capacity before they closed it down. This is not sterling performance.

**EDITOR'S NOTE:** The following was taken in part from a presentation by Dr. Arjun Makhijani at the University of New Mexico's School of Law on September 18, 2008. Dr. Makhijani is touring the country discussing his book *Carbon-Free and Nuclear-Free: A Roadmap for U.S. Energy Policy*. (See review in *Voices from the Earth*, Winter 2007.) Dr. Makhijani founded the Institute for Energy and Environmental Research (IEER) in 1987. He has published numerous articles in newspapers such as the *Washington Post* and *The Progressive*, and has appeared on ABC News, CBS News, National Public Radio (NPR), and *60 Minutes*. He is also the author of the book *The Nuclear Obsession*.

I want to tell you a little bit about myself. I graduated as an engineer from the University of Bombay. I got my Masters at Washington State University, and my doctorate at the University of California-Berkeley. I found my way to Washington, D.C. and began working for David Freeman from 1972–1974. David is considered the father of energy policy in this country. He first began worrying about oil imports when he worked in the White House in 1960s, and persuaded the Ford Foundation to give him \$4 million to set up their energy policy project. It was a visionary project which asked questions like: Can we do the same thing with less energy? Can we be more efficient? What will it take to have the same economic growth and economic parameters to make everybody more comfortable, but not import so much oil, and so on. We produced a book during the middle of the first energy crisis postulating that you can have economic growth without energy growth, because we (Americans) were so inefficient. Many people thought we were very nutty, including the president of Mobil Oil Corporation, who was on our advisory board. He also wrote a very vigorous dissent to our book. But we



Mini panels above



Southern California 600,000-square-foot Southern California



Desert Sky Wind Farm (www.edjack.com)



# Nuclear-Free U.S. Energy Policy

DR. ARJUN MAKHIJANI



the visitor parking lot at Springs Preserve in Las Vegas, Nevada.



Edison installed "thin film" solar photovoltaic panels on a rooftop of a Fontana warehouse. Photo courtesy of Edison.



farm in West Texas. Photo courtesy of Edward Jackson

The view of proliferists like J. Robert Oppenheimer, when he heard the U.S. might sign a nuclear weapons treaty, is:

We know very well what we would do if we signed such a [nuclear weapons] convention: we would not make atomic weapons, at least not to start with, but we would build enormous plants, and we would call them power plants — maybe they would produce power: we would design these plants in such a way that they could be converted with the maximum ease and the minimum time delay to the production of atomic weapons, saying, this is just in case somebody two-times us.

Today the government is bailing everyone out, and one of the current energy bills is a loan guarantee to build nuclear power plants for anyone without going back to Congress to authorize it. Wall Street doesn't like nuclear power

plants — they won't finance it. But in a free market, you should finance it. The wind power people are not having a problem with financing. The nuclear power people can ask for the same production tax credit as the wind people.

Nuclear waste: we still don't know what to do with it, and nobody has a good solution for it. Uranium and other fission products have half lives in the billions of years. It is not right for us to enjoy the benefits of nuclear energy, and kick the plutonium problem down the road to our kids. The government says we are going to put the nuclear waste in Yucca Mountain, Nevada because it is very remote, and nobody's there. Well, there was nobody in Las Vegas 200 years ago, either. Let me ask, who drinks pomegranate juice here as a health drink? Twenty miles from Yucca Mountain is the Amargosa Valley. The water from the aquifer that flows underneath Yucca Mountain is being used to grow pomegranates there.

## ALTERNATIVE ENERGY

A few of you have probably heard that the U.S. is the Saudi Arabia of wind. That's wrong. The wind energy resource in this country is roughly equal to the oil production of *all* the OPEC countries put together. The wind energy resource in just part of the U.S. is equal to about two times the total energy production of the U.S.

Offshore wind potential along the east coast of the United States is about 300,000 megawatts. So, while the land wind potential is here (southwest), we should be building offshore infrastructure in the east. In the Gulf of Mexico it might be more difficult, because I don't think existing wind turbines can withstand the force of hurricanes greater than Category 3. So far, offshore wind turbines in Europe haven't blown their blades off.

What about Solar Energy? Our solar energy resource is very big. We can generate all the energy that is used in the U.S. on about 1/8 the area of the state of Nevada. Less than 10% of the state of New Mexico can produce all the electricity required for the entire U.S. I'm not advocating that it be done in these centralized ways, but this brings me to my first bumper sticker: "Parking lots are the answer." There are so many parking lots and roof tops in this country that we can actually generate enough electricity without requiring any new land. A parking lot at the U.S. Naval Base-San Diego produces 750 kilowatts. You can park in the shade, and if you have an electric car, you can plug it in. There are so many parking lots and roof tops in this country that we can actually generate enough electricity without requiring any new land.

I have another bumper sticker for liquid and gaseous fuels: "Weeds are the answer." We are making fuel from micro-algae. It is much better than corn-based fuels. But this technology is not completely commercial yet; it will take a few years. You can squeeze some micro-algae, and it will give you biodiesel just like peanuts or soybeans. Why are we doing it? Because algae grows so fast. You can also grow it in wastewater where it will suck up excess nutrients. The south and southeast is important biomass land. You can use biomass in integrated gasification power plants to generate electricity with existing technology. It may be somewhat on the expensive side — it is somewhat more expensive than coal.

If you put a price on coal and CO<sub>2</sub> emissions, it may be profitable for states like Illinois to buy energy from states like New Mexico, rather than to trying to make renewable energy over there. Although I do know that the most advanced country in solar is one of the most miserable places for solar: Germany. The rainforest in Washington State has better solar potential than Germany.

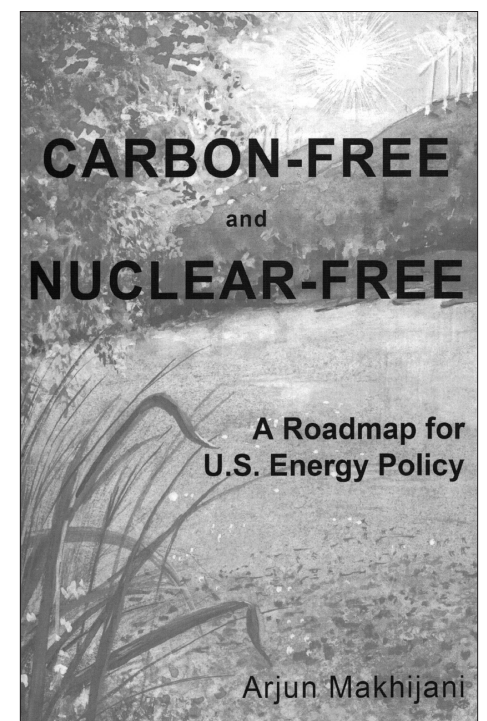
## ENERGY EFFICIENCY

Energy consumption in the average house is 58,000btu per square foot per year, but the Hanover house in New Hampshire uses 8,300btu per square foot per year. What is so special about Hanover house, and what did it cost? Only one thing is special about Hanover house: it has a large solar water heater and a 1000-gallon underground storage tank for hot water. For the most part this provides for their hot water and space heating needs. Everything else comes from electricity sold at the grid. It doesn't have anything special other than thoughtful building design, such as south-facing windows. It was constructed using good building practices and cost \$111 per square foot.

I had a long conversation with a custom builder in Texas about the extra costs involved to reduce the energy requirements of a house by 50%, compared to standard new building practices? He said nothing extra, it costs about the same. The differences are where you are building it and how you are orienting it. Builders do cookie-cutter housing developments: if you want fancy, you pay for it; but if you want it efficient, it costs nothing extra, just supervision on orientation.

We need to add efficiency standards for building. The American Institute of Architects say that all new buildings should be 0 net energy by 2030. If we get that done, the amount of energy we require will be less. While we are making headway in the new building sector, existing

buildings need improvement. I don't assume that we are going to get down to 8,300btu per square foot in existing buildings, but we need to recognize the need to improve efficiency in existing buildings. We need to improve building efficiency at the time of sale, so that costs can be rolled into the market. You can probably improve the efficiency of an existing building by 30–40%, with energy efficient appliances, air conditioners, etc.



## ENERGY TRANSMISSION

I do think that we should give more attention to the development of our national grid. We need a new law that would allow investors to recover interstate transmission investments. We deregulated electricity without attending to the problem of the commons of electricity, which is transmission. In my book I propose a distributed smart grid to allow more generation and decentralization. Having solar panels in parking lots doesn't mean that the owner of the parking lot has to own them. Everything in my book is based on either existing technology, or technology that has been technically demonstrated and can become commercialized in less than ten years.

I don't want to say the federal government is without vision, but we know we have states with vision. We know we have states with leadership. We know we have state governments that recognize renewable energy technologies. I think if New Mexico stepped up on this, you could have revenues from renewable energies the way you do from oil and gas today. 🦅