Testimony for the Committee on Energy, Utilities, Technology and Communications, Minnesota State Senate, in support of maintaining the moratorium on new nuclear reactors
Delivered by Lisa Ledwidge, Outreach Director of the Institute for Energy and Environmental Research Representing Arjun Makhijani, Ph.D., President of the Institute for Energy and Environmental Research
March 2, 2010

My name is Lisa Ledwidge. I live in Minneapolis MN. I am the Outreach Director of the Institute for Energy and Environmental Research. IEER is a non-profit technical institute that provides the public and policy-makers with thoughtful, clear, and sound scientific and technical studies on a wide range of issues including energy.

Chair Prettner-Solon, members of the committee, thank you for the opportunity to speak to you today. I am speaking on behalf of Arjun Makhijani, the president of IEER, who unfortunately could not be here today. He has a distinguished record of doing studies on energy issues and more generally of doing science in the public interest. That record was recognized in 2007, when he was elected a Fellow of the American Physical Society, an honor accorded to at most one-half of one percent of its members. His CV is attached. I prepared this testimony under Dr. Makhijani’s guidance. In the event that you have questions that I am not able answer here, Dr. Makhijani and I will provide answers to the committee for the record as soon as possible after this hearing.

We will focus on some of nuclear power’s economic and waste considerations that we hope will inform your vote on the bill before you.

Nuclear power is too expensive and too risky

In 2007, Jeffrey Immelt, the CEO of General Electric was quoted in the Financial Times:

"If you were a utility CEO and looked at your world today, you would just do gas and wind," Mr Immelt says. "You would say [they are] easier to site, digestible today [and] I don't have to bet my company on any of this stuff. You would never do nuclear. The economics are overwhelming." [Emphasis added]¹

While General Electric sells all three types of power plants (nuclear, gas turbines, wind), Mr. Immelt was arguing for loan guarantees for nuclear because only nuclear power requires

---

betting the whole company and more on the success of a project. It illustrates why Wall Street won’t touch nuclear projects with a ten-foot pole. They are, after all, reminders of the sorry history of cost overruns, rate hikes, and bond defaults of the 1980s that led Forbes to call nuclear power "the largest managerial disaster in business history."2

The problems that Minnesota could face if it lifts the moratorium and starts down the nuclear road can be illustrated by what is happening right now in places like Florida and San Antonio, Texas.

In Florida, two utilities – Progress Energy and Florida Power and Light (FPL) – have announced nuclear projects of two reactors each. Progress Energy’s market capitalization on March 1, 2010 at 1 pm was about $10.9 billion,3 which is less than two-thirds of the $17 billion price tag of the project. This is betting far more than the company. The FPL project, which involves the same reactors but a lower transmission cost estimate, is somewhat better, but even there the company, one of the largest private electric companies in the United States, has a market capitalization of about $19.5 billion,4 not much more than the $14 billion estimated cost of the project, before unforeseen delays and cost escalations, which have been common in the past.

Since Wall Street won’t finance the projects, the Florida state legislature has allowed both utilities to collect money in advance from ratepayers for the projects without any promise in return that the projects will be completed or that ratepayers will get any electricity. This is like giving an advance to a builder for a house without any assurance that he will build the house and give you the keys. Florida ratepayers began their revolt almost as soon as the utilities started collecting money for these projects. It increases energy costs for businesses; they must either swallow these increases or, even tougher, pass them on to their customers in the middle of a recession. As a result, even large businesses and industries – in Florida and Georgia – are now beginning to oppose these advance payments, according to an article in The Washington Post:

The utilities' gains [advance payments] are the consumers' losses -- and businesses such as the Georgia Industrial Group and the Georgia Textile Manufacturing Association have joined consumer and environmental groups in combating the state laws and higher rates.

In Florida, PCS Phosphate, which has a fertilizer plant that uses about 1 percent of Progress Energy's output, told the Public Service Commission that new rate increases "will substantially affect" the company "by directly increasing the cost of power."5

---

2 http://www.time.com/time/nation/article/0,8599,1888119,00.html
3 http://finance.yahoo.com/q?s=PgN, viewed at 1:00 pm, March 1, 2010.
Ratepayer anger has resulted in the Florida Public Service Commission denying further rate increases to Progress Energy and FPL, putting both projects in jeopardy. FPL responded by suspending further investment in its nuclear project and now seems to be headed in a direction of relying on renewable electricity sources for company revenue growth.\(^6\) If the Progress Energy project is also abandoned, it is unclear whether ratepayers will get any of their money back – so far $196.6 million.\(^7\) But the stance of utilities is clear. According to a Progress Energy spokesperson, “[w]ithout this legislation [allowing collection of advance payments from ratepayers], we would not be considering building new nuclear generation in Florida.”\(^8\)

A similar story is unfolding in San Antonio, Texas. There, the municipal utility, CPS Energy, took a 50 percent stake in a two-reactor project, whose cost has already jumped from an initially stated $5.4 billion in 2007 to $18.2 billion as of the end of 2009.\(^9\) Such escalations were not hard to foresee. In March 2008, when the company that initiated the project, NRG, put it at $6 billion to $7 billion, Dr. Makhijani estimated that the cost would be much higher – $12 billion to $17.5 billion, even in the absence of cost escalations and delays. CPS Energy’s share of the project is greatly in excess of the net value of its entire electrical generation, transmission and distribution assets. In the past three years CPS Energy aggressively pursued the nuclear project (on which it has spent about $370 million of ratepayer money\(^10\)) as well as renewables and it has also tried to complete prior generating projects. The result has been a rate increase and overcapacity. This AAA-rated utility is now in financial difficulties even before a license has been granted. The nuclear cost increases and associated controversies have caused a scandal and the resignation of the Board’s Chair. CPS Energy is now on a course to stop spending any more money on the project and to reduce its share from 50 percent to 7.625 percent. It is far from clear that the project will be completed. It has no loan guarantees as yet. Nuclear tends to marginalize efficiency and renewables – especially since it ties up so much capital for a decade without any revenue inflow.

The San Antonio example illustrates that you pursue all options at your peril. CPS is now increasing rates, and it is saddled with overcapacity even without the nuclear plant.

The so-called “nuclear renaissance” is already fading. We have been here before. After the start of the energy crisis in October 1973, none of the reactors ordered – more than 100 in all – was completed. Demand was overestimated; efficiency and cost were underestimated at great


cost to ratepayers, bondholders, and industry, which suffered needlessly higher electricity rates as a result.

A similar situation is evolving now, but more rapidly. The ratio of electricity growth per unit of economic growth is falling so low that electricity growth is fading altogether. Before 1973, the ratio of electricity growth to gross domestic product growth was about 2 to 1; between 1973 and 1993 it was about one to one. From 1993 to 2000, it was about two-thirds to one. In the past decade, before the onset of the present recession in 2008, it was only 0.55 to one. Any serious carbon-restraining legislation that gets passed at the federal level would include stringent building efficiency standards. And buildings account for 70% of electricity demand. For instance, the Waxman-Markey bill passed by the US House would require new residential and commercial buildings to in 20 years be 70% more efficient relative to today. So it is likely that per capita electricity growth will continue this downward trend in relation to growth overall.

In this context, a long-lead time, capital intensive power plant can be ruinous. While wind turbines are capital intensive, they can be built quickly – typically in about two years. If a wind farm is half-complete, you get half the electricity from the completed turbines. If a nuclear power plant is half complete, typically you get nothing but the bills. Even twin reactor projects are phased so that they are completed close on one-another’s heels. And while some may proclaim that small, modular reactors could address these issues, this is akin to whistling in the dark. None of these reactors has been certified. Indeed, there isn’t even an application for certification.

**Nuclear waste**

Spent fuel is now being stored in 34 dry-cask storage units at Minnesota’s two nuclear power plants, with additional amounts in the reactors’ spent fuel pools. It is uncertain when – or if – Minnesota’s nuclear waste will leave the state. Yucca Mountain has been de-funded and may never open.

Reprocessing does not solve the problem. Rather, it increases the volume of waste to be disposed of in a repository by about six times, even though the high-level waste volume is somewhat decreased.\(^{11}\) This counterintuitive result derives from the large increase in plutonium-contaminated waste generated in reprocessing operations and plutonium fuel fabrication that must be disposed of in a deep geologic repository.

Some point to France’s nuclear program as one the US should emulate. IEER has studied the French program in detail and we can assure you that it is not free of problems. The French are also struggling in their search for a repository. French reprocessing operations discharge about 100 million gallons of liquid radioactive waste into the English Channel every year which,

---

together with British reprocessing discharges, have contaminated seafood all the way to the Arctic. Twelve European countries have asked the French and British to stop but they refuse. Reprocessing increases nuclear power’s costs by about two cents per kilowatt hour above the cost of uranium fuel resulting in nearly $1 billion extra fuel costs each year for reprocessed fuel for less than ten percent reduction in uranium requirements. Overall, even repeated reprocessing and re-enrichment of the recovered uranium would result in only about 6 percent of the uranium in the original fresh fuel from being used for energy generation, of which over 4 percent occurs without any reprocessing at all. Overall, France only reuses about one percent of the original spent fuel as fuel.

There is another consideration about waste that might bear on the decision whether or not to lift the moratorium. In the mid-1980s, before the US Congress designated Yucca Mountain as the site to receive the country’s commercial nuclear waste, 31 states were identified by the Dept of Energy as potentially geologically suitable candidates for a second repository site – including eight sites in Minnesota.

It is possible that the results of this search will be used in the future and that, of the 31 previously identified states, the federal government might consider a state that has repealed a nuclear moratorium more favorably compared to, say, Vermont, in which the state senate last week voted decisively to shut down the state’s only nuclear plant in 2012.

**Lessons for Minnesota**

As Peter Bradford points out in his written testimony, nothing presently prevents discussion of nuclear energy in Minnesota. The function of the moratorium is not to prevent debate, which is already occurring, but to protect Minnesota businesses and households from the kinds of problems that have already emerged in other places before a single new nuclear reactor construction and operating license has been granted. Do we want to invite the same kinds of problems as those in Florida here in Minnesota? Xcel Energy has a market capitalization about the same as that of Progress Energy – 9.6 billion dollars as of March 1, 2010. Do we want consuming businesses to be at loggerheads with our electric utilities? Indeed, the problems could be worse, since Minnesota stands no chance of getting federal loan guarantees at present with 26 projects ahead of it.

Minnesota is already a leader in renewable energy and a leader in climate protection. Continuation on this course could create a large number of jobs not only for the in-state energy sector, but for export. The German solar energy industry is an excellent example of the potential. Germany has become a world leader in export of solar photovoltaic technology, even

---

though its own potential for solar PV is not very good. Indeed, it is emerging as a leader in concentrating solar PV, which requires frequent clear skies, which Germany does not have.

Minnesota loses nothing by keeping the moratorium in place and simply waiting for a few years to see how the so-called “nuclear renaissance,” which consists largely of payments from ratepayers to utilities and a lot of paperwork, plays out elsewhere. And Minnesota will gain a lot by focusing on jobs in efficiency and renewables that are here today. We have these two birds in hand. Please don’t exchange them for one in the bush.

Attached:
CV for Arjun Makhijani, Ph.D.
A recognized authority on energy issues, Dr. Makhijani is the author and co-author of numerous reports and books on energy and environment related issues, including two published by MIT Press. He was the principal author of the first study of the energy efficiency potential of the US economy published in 1971. He is the author of *Carbon-Free and Nuclear-Free: A Roadmap for U.S. Energy Policy* (2007).

In 2007, he was elected Fellow of the American Physical Society. He was named a Ploughshares Hero, by the Ploughshares Fund (2006); was awarded the Jane Bagley Lehman Award of the Tides Foundation in 2008 and the Josephine Butler Nuclear Free Future Award in 2001; and in 1989 he received The John Bartlow Martin Award for Public Interest Magazine Journalism of the Medill School of Journalism, Northwestern University, with Robert Alvarez. He has many published articles in journals and magazines as varied as *The Bulletin of the Atomic Scientists, Environment, The Physics of Fluids, The Journal of the American Medical Association*, and *The Progressive*, as well as in newspapers, including the *Washington Post*.

Dr. Makhijani has testified before Congress, and has appeared on ABC World News Tonight, the CBS Evening News, CBS 60 Minutes, NPR, CNN, and BBC, among others. He has served as a consultant on energy issues to utilities, including the Tennessee Valley Authority, the Edison Electric Institute, the Lawrence Berkeley Laboratory, and several agencies of the United Nations.

**Education:**

- Bachelor of Engineering (Electrical), University of Bombay, Bombay, India, 1965.
Current Employment:

- 1987-present: President and Senior Engineer, Institute for Energy and Environmental Research, Takoma Park, Maryland. (part-time in 1987).

Other Long-term Employment

- 1984-88: Associate Professor, Capitol College, Laurel, Maryland (part-time in 1988).
- 1983-84: Assistant Professor, Capitol College, Laurel, Maryland.
- 1975-87: Independent consultant (see page 2 for details)
- 1972-74: Project Specialist, Ford Foundation Energy Policy Project. Responsibilities included research and writing on the technical and economic aspects of energy conservation and supply in the U.S.; analysis of Third World rural energy problems; preparation of requests for proposals; evaluation of proposals; and the management of grants made by the Project to other institutions.
- 1969-70: Assistant Electrical Engineer, Kaiser Engineers, Oakland California. Responsibilities included the design and checking of the electrical aspects of mineral industries such as cement plants, and plants for processing mineral ores such as lead and uranium ores. Pioneered the use of the desk-top computer at Kaiser Engineers for performing electrical design calculations.

Professional Societies:

- Institute of Electrical and Electronics Engineers and its Power Engineering Society
- American Physical Society (Fellow)
- Health Physics Society
- American Association for the Advancement of Science

Awards and Honors:

- The John Bartlow Martin Award for Public Interest Magazine Journalism of the Medill School of Journalism, Northwestern University, 1989, with Robert Alvarez
- The Josephine Butler Nuclear Free Future Award, 2001
- Ploughshares Hero, Ploughshares Fund, 2006
- Elected a Fellow of the American Physical Society, 2007, “For his tireless efforts to provide the public with accurate and understandable information on energy and environmental issues”
- Jane Bagley Lehman Award of the Tides Foundation, 2007/2008
Invited Faculty Member, Center for Health and the Global Environment, Harvard Medical School: Annual Congressional Course, Environmental Change: The Science and Human Health Impacts, April 18-19, 2006, Lecture Topic: An Update on Nuclear Power - Is it Safe?

Consulting Experience, 1975-1987
Consultant on a wide variety of issues relating to technical and economic analyses of alternative energy sources; electric utility rates and investment planning; energy conservation; analysis of energy use in agriculture; US energy policy; energy policy for the Third World; evaluations of portions of the nuclear fuel cycle.

Partial list of institutions to which I was a consultant in the 1975-87 period:

- Tennessee Valley Authority
- Lower Colorado River Authority
- Federation of Rocky Mountain States
- Environmental Policy Institute
- Lawrence Berkeley Laboratory
- Food and Agriculture Organization of the United Nations
- International Labour Office of the United Nations
- United Nations Environment Programme
- United Nations Center on Transnational Corporations
- The Ford Foundation
- Economic and Social Commission for Asia and the Pacific
- United Nations Development Programme

Languages: English, French, Hindi, Sindhi, and Marathi.

Reports, Books, and Articles (Partial list)

(Newsletter, newspaper articles, excerpts from publications reprinted in books and magazines or adapted therein, and other similar publications are not listed below)


Saleska, S., and A. Makhijani, *To Reprocess or Not to Reprocess: The Purex Question - A Preliminary Assessment of Alternatives for the Management of N-Reactor Irradiated Fuel at the*


Makhijani, A., Bernd Franke, and Hisham Zerriffi, *Preliminary Partial Dose Estimates from the Processing of Nuclear Materials at Three Plants during the 1940s and 1950s*, Institute for Energy and Environmental Research, Takoma Park, September 2000. (Prepared under contract to the newspaper USA Today.)


Institute for Energy and Environmental Research, *Lower Bound for Cesium-137 Releases from the Sodium Burn Pit at the Santa Susana Field Laboratory*, IEER, Takoma Park, Maryland, January 13, 2005. (Authored by A. Makhijani and Brice Smith.)

Institute for Energy and Environmental Research, *Iodine-131 Releases from the July 1959 Accident at the Atomics International Sodium Reactor Experiment*, IEER, Takoma Park, Maryland, January 13, 2005. (Authored by A. Makhijani and Brice Smith.)


