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Finland's Rational Approach to Nuclear Power

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Finland, much like the United States, is facing growing energy demands.[1] It needs approximately to double its electricity generation capacity in the next 25 years.[2] Finland ranks fifth in the world for per capita electricity consumption, so it has a significant incentive to secure long-term energy solutions.[3]

Unlike many nations—including the United States—that seem to put political correctness ahead of sound policy, Finland is developing a broad mix of environmentally friendly, economically competitive energy sources. Nuclear energy is an important part of that effort. Not only has Finland begun to construct a new, modern 1,600-megawatt reactor, but it is successfully executing a cohesive, workable strategy to manage spent fuel. The United States has done neither.

Olkiluoto 3 will be Finland's fifth power reactor and the first one brought online since 1980. Officials are suggesting that a decision will soon be made to build a sixth reactor.[4] Finland already generates about 28 percent of its electricity from nuclear power, compared to about 20 percent in the U.S.[5]

Why Nuclear in Finland

Nuclear energy is attractive to Finland and the United States because it is environmentally friendly, safe, affordable, and largely domestically produced. Like many other countries, Finland is struggling to reconcile a desire (or mandate) to reduce carbon dioxide emissions while maintaining economic competitiveness. Under the new European Union energy plan, it will be forced to reduce greenhouse gas emis-

Talking Points

- Affordable energy is critical to sustaining economic competitiveness in economies with high labor costs, expensive environmental mandates, and other regulatory expenditures. This is especially true in economies that depend on energy-intensive activities like manufacturing, such as the Finnish and U.S. economies.
- Nuclear energy is attractive to Finland and the United States because it is environmentally friendly, safe, affordable, and largely domestically produced.
- With a new reactor under construction and an approved waste disposition plan, Finland's policy is rational and consistent with the country's economic and national interests.
- Finland is the only country with an approved plan to construct a permanent geologic repository. The cost of constructing, operating, and decommissioning the facility is part of the price of nuclear-generated electricity.
- The cost overruns and time delays associated with Finland's new reactor are not necessarily indicative of nuclear power's future economic viability.

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sions by 20 percent, increase renewable energy by 20 percent, and increase efficiency by 20 percent by 2020.[6]

Meeting such demands will likely cause a spike in energy prices. However, affordable energy is critical to sustaining economic competitiveness in economies with high labor costs, expensive environmental mandates, and other regulatory expenditures. This is especially true in economies that depend on energy-intensive activities like manufacturing, such as the Finnish and U.S. economies. Thus, Finland concluded that access to vast quantities of affordable energy should be a top national priority. Given that nuclear power can provide that energy affordably and with zero carbon dioxide emissions, it was an obvious choice.[7]

Cost Overruns and Nuclear Power

Critics have questioned the economic viability of nuclear power based on delays associated with Finland's reactor.[8] At $1.4 billion over budget and two years behind schedule, Finland's reactor has had its problems.[9] However, these delays and cost overruns are not necessarily indicative of the future economic viability of nuclear power.

Olkiluoto 3 is a first-of-a-kind, large, multibillion-dollar power station. Assigning all of the costs of the first plant to future plants would not be accurate. Construction costs will be reduced as lessons learned from initial construction projects are integrated into future ones.

Some of the overruns are simply a reflection of rising labor and material costs. These increases, which are not unique to the nuclear industry, would affect any project. Building the 3,200 windmills that would be needed to produce the same amount of electricity as Olkiluoto 3 will produce would likely suffer from the same price volatility.[10]

A lack of skilled personnel, shortages of nuclear-qualified components and materials, and inexperienced vendors and subcontractors have also slowed progress.[11] Very few reactors have been ordered over the past three decades, and the industrial base and skill sets are simply not yet available to support the growing demand for commercial nuclear power. Although these risks should have been expected for a project like Olkiluoto 3, they are also correctable and will be resolved by the market over time.

As backlogs are created by new orders, nuclear suppliers will invest to expand capacity. For example, Japan Steel Works has already announced that it will expand its capacity to produce the large forgings used to manufacture reactor components. It is

1. Ministry of Foreign Affairs of Finland, Newsroom Finland, "Pöyry Report Says Finland Needs 8,400 MW by 2030," February 21, 2008, at *http://newsroom.finland.fi/stt/showarticle.asp?intNWSAID=18066* (February 25, 2008).
2. U.S. Department of Energy, Energy Information Administration, "Finland Energy Profile," updated February 19, 2008, at *http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=FI* (February 25, 2008).
3. Mycle Schneider, "The World Nuclear Industry Status Report for 2007," Greens and European Free Alliance, November 2007, p. 25, at *www.energiestiftung.ch/files/atomenergie/07_11_08_wnsr_2007_schneider.pdf* (February 25, 2008).
4. Ministry of Foreign Affairs of Finland, Newsroom Finland, "Finland to Make Decision to Build Sixth Nuke by 2011," January 31, 2008, at *http://newsroom.finland.fi/stt/showarticle.asp?intNWSAID=17863* (February 25, 2008).
5. Organisation for Economic Co-operation and Development, Nuclear Energy Agency, "Nuclear Energy Agency Country Profiles: Finland," updated June 20, 2007, at *www.nea.fr/html/general/profiles/finland.html* (February 25, 2008).
6. Sally McNamara and Ben Lieberman, "The EU's Climate Change Package: Not a Model to Be Copied," Heritage Foundation *WebMemo* No. 1800, February 6, 2008, at *www.heritage.org/Research/EnergyandEnvironment/wm1800.cfm*.
7. Ministry of Foreign Affairs of Finland, "Finland to Make Decision to Build Sixth Nuke by 2011."
8. NukeFree.org, "Atomic Economics," at *www.nukefree.org/facts/uninsurable* (February 25, 2008).
9. Marina Murphy, "Atomic Renaissance Threatened by Critical Skills Shortage," *Science Business*, February 18, 2008, at *http://bulletin.sciencebusiness.net/ebulletins/showissue.php3?page=/548/art/9958* (February 25, 2008).
10. The 3,200 windmills number assumes that each wind turbine can produce 1.5 megawatts and has a capacity factor of 33 percent.
11. Alan Katz, "Finnish Plant Demonstrates Nuclear Power Industry's Perennial Problems," *International Herald Tribune*, September 6, 2007, at *www.iht.com/articles/2007/09/05/bloomberg/bxnuke.php* (February 25, 2008).

the sole supplier of these forgings on the world market. Other companies have made similar announcements to provide expanded uranium enrichment, mining, manufacturing, and used-fuel services. This growth in capacity will eventually meet demand and moderate some of the inflationary pressures that are driving up costs for Finland's newest reactor.

Spent Nuclear Fuel

Like nuclear power plants around the world, Finland's reactors also produce spent nuclear fuel. Finland's four operating reactors produce about 70 tons of spent fuel annually. America's 104 operating reactors produce about 2,000 tons per year. Finland's waste management regime, similar to that of the U.S., is governed by statute that mandates permanent disposition of all nuclear waste.

Finnish law dictates that its nuclear power producers are fully responsible for managing spent fuel until final disposition. The two power companies that operate nuclear power stations in Finland jointly established Posiva Oy, a third entity to oversee waste management. Posiva Oy, along with a network of universities, researchers, and contractors, operates under the supervision of the Radiation and Nuclear Safety Authority in researching, developing, and implementing Finland's nuclear waste activities.

Interim Storage

Spent fuel is highly radioactive when it is removed from the reactor. All radioactive materials decay, but while some lose their radioactivity within fractions of a second, others take billions of years. However, most stabilize within an intermediate period. The radioactivity of spent nuclear fuel falls to about one hundredth of its original levels within a year and to one thousandth of its original levels within 40 years.[12] This characteristic makes interim storage an important element of spent fuel management.

Interim storage is a critical part of Finland's spent nuclear fuel management regime. Although the United States has a *de facto* interim storage system because the federal government has not fulfilled its legal obligation to take possession of and dispose of America's spent fuel, it does not fully integrate interim storage as a part of its spent fuel regime.

In the Finnish system, spent fuel is removed from the reactors and placed in fuel pools, as is done in the U.S., but then it is placed in on-site interim storage facilities where it is left to decay. This has two major advantages.

First, permanent geologic storage is a scarce resource. Although a geologic storage facility's capacity is often expressed in terms of volume, the primary limiting factor is heat load. Radioactive material gives off heat as it decays. The more it has decayed, the less heat it will give off, allowing more to be stored in any one place. Thus, allowing the fuel to decay for a few decades at an interim storage facility would ultimately allow more spent fuel to be placed in a long-term geologic storage facility.

In the U.S., introducing interim storage would allow far more flexibility in how to use Yucca Mountain. However, adding interim storage to the U.S. spent fuel management regime would in no way diminish the vital role of the Yucca Mountain repository. Opening Yucca must remain a top U.S. priority.

Second, interim storage frees cooling pool capacity. When spent fuel rods are removed from the reactors, they are placed in cooling pools. Once a U.S. reactor's pools are full, it would have nowhere else to put spent fuel rods and would essentially be forced to shut down.

This is a problem in the United States, where plants were built with spent fuel pools under the assumption that the spent fuel rods would be removed and disposed of off-site. However, the politics of Yucca Mountain has prevented the U.S. from executing its spent fuel management strategy as planned. U.S. plants are facing the real possibility of filling their cooling pools. Interim storage in the U.S., as is done in Finland, should be part of America's comprehensive spent fuel management regime along with permanent geologic storage.

12. Posiva Oy, "Spent Nuclear Fuel," at *www.posiva.fi/englanti/ydinjate_kaytetty.html* (February 25, 2008).

Permanent Geologic Storage

Finland, like the U.S., plans eventually to place its nuclear waste in a permanent geologic storage facility. Also, Finland's plan to implement a comprehensive spent fuel management regime, like that of the U.S., began in the early 1980s. However, the two countries diverge significantly in their execution of spent fuel strategies. Most notably, Finland has an approved plan with national and local support for a permanent geologic facility, and the U.S. does not.

After spending a decade identifying possible locations, Finland chose four sites as possible locations for the geologic facility. Following environmental impact assessments, Posiva Oy applied in 1999 for permission to move the project forward.

After working with the local community, the government gave permission to move forward with the project by the following year. The decision enjoyed broad support in Finland's parliament, which voted 159 to 3 in favor of the plan. The local council also gave its support to the project. A construction license application should be submitted by 2016, with operations ready to commence by 2020. The facility will have a maximum capacity of 4,000 tons of spent fuel, which is adequate for its current fleet of power reactors.

Today, Finland is the only country in the world with an approved plan to construct a permanent geologic repository.[13] The cost of constructing, operating, and decommissioning the facility is part of the price of nuclear-generated electricity.[14]

Conclusion

Although burdened by high up-front capital costs, financial risk, and difficult politics, Finland recognizes the positive long-term impact of nuclear power. Not only has Finland begun constructing a new reactor, but it has an approved waste disposition plan. Its policy is rational and consistent with the economic and national interests of the nation.

As the U.S. struggles to develop a productive energy policy, it should learn from Finland that nuclear power can have an important role in reconciling the desire to reduce pollution with the need to remain economically competitive. The U.S. should not blindly follow Finnish energy policy simply because Finland is building a reactor. It should, however, recognize the important role that nuclear power can play in meeting America's energy requirements and follow the Finnish example of how to move from talking about nuclear power to actually building nuclear power plants.

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13. U.S. Department of Energy, Office of Civilian Radioactive Waste Management, "Finland's Radioactive Waste Management Program," June 2001, at *www.ocrwm.doe.gov/factsheets/doeymp0410.shtml* (February 25, 2008).
14. For a full cost estimate and jobs description, see Posiva Oy, "Cost of Final Disposal," at *www.posiva.fi/englanti/loppusijoitus_kustannukset.html* (March 14, 2008).