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Comment On: NRC-2009-0337-0092

Combined License Application for Turkey Point Nuclear Plant, Units 6 and 7; Reopening of Comment Period

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General Comment

See attached uploaded comments.

Wallace Taylor

Attachments

Turkey Point EIS comments

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July 13, 2015

Cindy Bladey, Chief,
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Washington, DC 20555-0001

Docket ID: NRC-2009-0337

Dear Ms. Bladey:

The following comments are submitted on behalf of the Nuclear Free Campaign of the Sierra Club regarding the Draft Environmental Impact Statement (DEIS) for the combined operating license for the Turkey Point Nuclear Plant, Units 6 and 7. The Sierra Club is the nation's largest grassroots environmental organization with over 600,000 members. The Sierra Club supports sustainable energy alternatives (renewable energy and energy efficiency) that do not harm the environment. The Sierra Club opposes nuclear power because its fuel cycle from uranium mining to spent radioactive fuel poses grave dangers to the environment. In addition, reliance on nuclear power unjustifiably delays the beneficial transition to clean and renewable energy sources.

The current focus on energy policy that relies on clean, safe and renewable sources makes it imperative that NRC evaluate the environmental impacts of nuclear power reactors in a different way than has been done in the past. Our comments will address the DEIS in this context.

Purpose and Need

The alleged purpose and need for this project expressed in § 1.3 of the DEIS is the asserted increased demand for electrical power and the asserted need for additional

baseload generation. But the DEIS does not question these assertions and instead simply accepts the assertions made by the utility. This is an abdication of the NRC's duty under NEPA. The agency has a duty under the law to exercise a degree of skepticism in dealing with self-serving statements, especially ones with no supporting data, from the prime beneficiary of the project. Simmons v. U.S. Army Corps of Engineers, 120 F.3d 664 (7th Cir. 1997).

The purpose and need statement is an important part of an EIS. The purpose and need statement "necessarily dictates the range of 'reasonable' alternatives." Carmel-By-The-Sea v. U.S. Dep't. of Transp., 123 F.3d 1142 (9th Cir. 1997). The courts will defer to the agency's statement of purpose and need if that statement is reasonable. A reviewing court must determine whether the agency's definition of the purpose and need is reasonable, whether the agency has discussed in detail the alternatives, and whether the discussion of the alternatives is reasonable in light of the particular goals and objectives. Citizens Against Burlington, Inc. v. Busey, 938 F.2d 190 (D.C. Cir. 1991). Furthermore:

[A]n agency may not define the objectives of its action in terms so unreasonably narrow that only one alternative from among the environmentally benign ones in the agency's power would accomplish the goals of the agency's action, and the EIS would become a foreordained formality. . . . Nor may an agency frame its goals in terms so unreasonably broad that an infinite number of alternatives would accomplish those goals and the project would collapse under the weight of the possibilities.

Id. at 196.

It is our position that nuclear power is not the energy of the future. Renewable energy and greater energy efficiency will address our energy needs. We have already seen significant decreases in the demand for energy, indicating that consumers are using energy more efficiently and obtaining it from renewable sources. There must be a discussion of the purpose and need for the Turkey Point licenses in light of these facts.

Problems with the AP 1000

The reactors proposed for Turkey Point 6 and 7 are Westinghouse AP1000 reactors. The AP1000 design received approval from the NRC, but not without objection from the NRC technical staff and among the NRC Commissioners themselves.

John Ma, a senior structural engineer at the NRC, after reviewing the plans for the AP1000, had the following comments:

The proposed connection and air inlet and tension ring have constructability problems, such as steel rod alignment, aggregate size, air entrapment, bleed water accumulation, and design implications, such as elongation in rods, shear friction transfer, and compression force transfer. The [NRC] staff has no confidence that a potential success of carefully mockup tests would be replicated during construction.

[T]here are major problems associated with the analysis and design of this shield building, such as the highly irregular configurations, stiffness variations, and unknown behavior of the SC modules. These problems cannot be easily eliminated or resolved. The single most important treatment for the problems is to design and build ductility into these SC modules so that it could compensate for, or overcome, these problems.

The ACI Building Code requires ductility to be designed into a structural module and a structure commensurate with the seismic risk or required seismic structure performance. . . . the [AP1000] submittal on the tornado missiles, and the staff's acceptance, are based on the assumption that the SC wall module behaved identical to RC wall modules and as ductile as RC wall modules, If the staff allows the brittle SC wall module to be used as part of the shield building wall, then the staff's evaluation on the adequacy of the wall for tornado missiles would have to be re-evaluated based on the actual brittle failure material property of the SC wall module #2.

10 C.F.R. 50.55a(a)(1) and 10 C.F.R. Part 50, Appendix A, GDC 1, "Quality Standards and Records," requires the shield building to be designed to quality standards commensurate with the importance of the safety functions to be performed. The AP1000 shield building, in addition to the shielding purpose, also performs a containment cooling function by using the 6.7 million pounds of water in the passive containment cooling water storage tank (PCCWST) on top of the shield building. However, the [NRC] lowered its acceptance standard for AP1000 shield building than for that of other types of shield buildings, which are designed in accordance with the ACI Code requirements. This action is not consistent with the intent or requirements of 10 C.F.R. 50.55a(a)(1) and 10 C.F.R. Part 50, Appendix A, GDC 1.

pbadupws.nrc.gov/ML1033/ML103370648.pdf.

In addition, Edwin S. Lyman, a senior staff scientist at the Union of Concerned Scientists, said the following about the AP1000:

In the absence of regulatory requirements, new reactors simply will not be designed with a sufficiently robust capacity to withstand events beyond the current design basis, because if they were, they would likely be too expensive to compete with reactors that meet only minimum standards.

For example, Westinghouse has claimed that its AP1000 reactor would be able to withstand a station blackout for 72 hours. The AP1000 is a light water reactor with passive safety features, which means that its design-basis cooling functions do not require the use of active systems like motor-driven pumps, relying only on gravity-driven systems and natural convection cooling. The plant is able to maintain core cooling without electrical power because it has a large tank of water above the reactor vessel and other systems that passively provide coolant flow for 72 hours.

After 72 hours, however, the tank needs to be replenished - a task that requires electricity and operator actions. The AP1000 would not have been in a

better position to withstand a 10-day station blackout than the Mark I boiling water reactors at Fukushima Daiichi. Also, Westinghouse was only required to show that the passive cooling systems would work in design-basis events, so there is no basis for assuming they would be able to work after a beyond-design-basis natural disaster. And the NRC does not require the active equipment that would be needed after the 72-hour period to be safety-related, so there would be no guarantee that it would be available and reliable after either design-basis or beyond-design-basis events. The AP1000 or any other new design is only as robust as the set of requirements that it must meet.

Edwin S. Lyman, Surviving the One-Two Nuclear Punch: Assessing the Risk and Policy in a Post-Fukushima World, Bulletin of the Atomic Scientists, at thebulletin.sagepub.com.

Another expert, Arnold Gundersen, a nuclear engineer with Fairewinds Energy Education, issued a report in 2010 warning of the dangers with the AP1000. He expressed four concerns as follows:

- Recent experience with the current generation of nuclear reactors shows that containment corrosion, cracking, and leakage are far more prevalent and serious than anticipated by the U.S. Nuclear Regulatory Commission (NRC) in establishing its regulatory program for the safe operation of nuclear reactors.
- By design, the AP1000 containment has an even higher vulnerability to corrosion than containment systems of current reactor designs because the outside of the AP1000 containment is subject to a high-oxygen and high-moisture environment conducive to corrosion and is prone to collect moisture in numerous inaccessible locations that are not available for inspection.
- By design, the AP1000 containment has an even higher vulnerability to unfiltered unmonitored leakage than the current generation containment system designs, and it lacks the defense in depth of existing structures. While the AP1000 is called an *advanced passive system*, in fact the containment design and structures immediately outside the containment are designed to

create a chimney-like effect and draw out any radiation that leaks through the containment into the environment. Such a system will also facilitate the more efficient release of unfiltered, unmonitored radiation from any cracks or holes that might develop in the containment.

- Finally, a leakage path exists that is not bounded by any existing analysis and will be more severe than those previously identified by Westinghouse in its AP1000 application and various revisions.

Mr. Gunderson concludes, therefore:

Four contributing factors will increase the consequences of an accident in which the containment leaks radiation directly into the annular gap.

- First, more radiation is likely to be released than previously analyzed.
- Second, radiation will be released sooner than in other scenarios because the hole or leakage path exists prior to the accident.
- Third, radioactive gases entering this gap are not filtered or delayed.
- Fourth, moisture and oxygen, routinely occurring between the containment and the shield building in the AP1000 design, exacerbates the likelihood of larger than design basis containment leaks.

www.nonukesyall.org/20100407-ap1000-gundersen-containment-report.pdf.

The GEIS must include a fair discussion of the impacts of the defects in the AP1000.

Radioactive Spent Fuel

The GEIS improperly relies on the legally deficient Continued Spent Fuel Storage Rule and Continued Spent Fuel Storage GEIS.

Pursuant to the remand in New York v. NRC, 681 F.3d 471 (D.C. Cir. 2012), the NRC has promulgated a rule on the

continued storage of spent nuclear fuel. The agency also issued a generic environmental impact statement (GEIS) in connection with that rule. The rule and the GEIS have been challenged by several parties in the United States Court of Appeals for the District of Columbia Circuit. The Sierra Club is an amicus curiae in that proceeding.

Because of the inadequacies of the continued storage rule and GEIS, the NRC lacks a lawful basis under NEPA for licensing the Turkey Point reactors. The rule and the GEIS suffer from the following failures:

- In blatant violation of NEPA and the Court's decision in New York v. NRC, 681 F.3d 471 (D.C. Cir. 2012), the Continued Storage GEIS fails to examine the probability and consequences of failure to site a repository. Instead of examining the risk of failing to site a repository, the GEIS rationalizes the risk away by arbitrarily assuming that spent fuel will be protected by "institutional controls" for an infinite period of time at reactor sites. This assumption is not only absurd and inconsistent with the Nuclear Waste Policy Act, but it also defeats the Court's purpose of forcing the NRC to reckon with the environmental consequences of its failure to site a repository.
- The GEIS fails to acknowledge that the Continued Storage Rule is a licensing action, and therefore, it distorts the statement of purpose and need for the rule as relating to administrative rather than environmental concerns. As a result, the GEIS also mischaracterizes the alternatives that must be considered. Instead of evaluating alternatives related to storage and disposal of spent fuel, the GEIS examines alternatives related to the administrative question of how to prepare an EIS. The result is a farcical cost-benefit analysis that utterly fails to address alternatives for avoiding or mitigating the environmental impacts of storing spent fuel or siting a repository.
- The GEIS' analysis of the environmental impacts of extended spent fuel storage ignores the fact that the NRC knows very little about the behavior of spent fuel in long-term or indefinite storage conditions, especially the potentially significant

effects of long-term dry cask storage on high burnup fuel integrity. In violation of NEPA, the NRC makes no attempt to quantify these uncertainties.

- The GEIS fails to fully consider the environmental impacts of spent fuel pool leaks and fires. In violation of NEPA, the GEIS relies on incomplete data, adopts a flawed concept of risk and ignores a range of causes for accidents.

- In violation of NEPA, the GEIS makes no attempt to show how the environmental impacts associated with the Continued Storage Rule will be quantified and incorporated into cost-benefit analyses for nuclear reactors. Although spent fuel disposal and long-term storage costs are high enough to tip the balance of a cost-benefit analysis for reactor licensing away from licensing, nowhere does the NRC explain how it will take these costs into account in reactor licensing decisions.

- In violation of NEPA, the GEIS fails to support the limited conclusions in the Continued Storage Rule and GEIS regarding the technical feasibility of spent fuel disposal.

- The NRC has splintered the analysis of environmental impacts associated with storage and disposal of spent fuel into an array of safety findings and environmental analyses. While the issues covered by these separate findings and analyses overlap and involve cumulative impacts, the NRC refuses to integrate them. The NRC also refuses to correct inconsistencies between them.

The DEIS should also discuss the impacts and benefits of hardened on sight storage (HOSS). Although HOSS is not the perfect solution to the radioactive waste problem, it is the best solution to a bad situation. There actually is no permanent solution to the existence of approximately 70,000 tons of radioactive waste currently stored at reactor sites. But HOSS is a much better alternative than the groundless hope expressed in the Continued Storage Rule that this waste can be stored in pools and dry casks essentially forever. Therefore, a discussion of HOSS in the GEIS is required.

Alternatives

An EIS must discuss reasonable alternatives "to the proposed action." 42 U.S.C. § 4332(2)(C)(iii). The alternatives analysis is the "heart of the environmental impact statement." 40 C.F.R. § 1502.14. NEPA demands that the agency "rigorously explore and objectively evaluate all reasonable alternatives." 40 C.F.R. § 1502.14. The "existence of a viable but unexamined alternative renders an environmental impact statement inadequate." Resources Ltd. v. Robertson, 35 F.3d 1300, 1307 (9th Cir. 1994). An alternative can be reasonable if it avoids the environmental harm better than another alternative. Surfrider Foundation v. Dalton, 989 F.Supp. 1309 (S.D. Cal. 1998), aff'd per curiam, 196 F.3d 1057 (9th Cir. 1998).

A reasonable alternative to the construction of Turkey Point 6 and 7 is reliance on renewable energy and energy efficiency. The DEIS makes only passing reference to energy efficiency, §9.2.1.3. Renewable energy is passed off with very little discussion as being unable to provide adequate power. §§ 9.2.3.2, 9.2.3.3. This is not the "substantial treatment" of alternatives required by 40 C.F.R. § 1502.14(b).

In fact, renewable energy and energy efficiency are reasonable alternatives that would provide sufficient power.

Numerous studies have shown that renewable energy and energy efficiency can satisfy all of our electricity demand. In 2007, Mark Jacobson and Cristina Archer, from Stanford University, published an article showing how wind power, when interconnected with adequate transmission infrastructure, can replace conventional baseload power. Christina Archer and Mark Jacobson, Supplying Baseload Power and Reducing Transmission Requirements by Interconnecting Wind Farms, Journal of Applied Meteorology and Climatology, v. 46, Nov. 2007.

In 2009, Mark Jacobson reviewed solutions to global warming, air pollution and energy security. Mark Jacobson, Review of Solutions to Global Warming, Air Pollution, and Energy Security, Energy & Environmental Science, v. 2, p. 148-173, 2009. Professor Jacobson concluded that wind energy was the best solution, with other renewable sources coming in just below wind. Nuclear power was ranked lower

than any of the renewable sources. It is important to note that Professor Jacobson was considering the impacts of energy sources on a number of environmental values, such as global warming, air pollution, energy security, water supply, land use, wildlife, resource availability, thermal pollution, water pollution, nuclear proliferation, and undernutrition. This is an important point that underscores our previous comments that the EPA must consider the impacts of energy sources beyond just the carbon content of emissions from a specific source.

With respect to just climate-relevant emissions, however, the aforementioned article has this to say about nuclear power:

Nuclear power plant emissions include those due to uranium mining, enrichment, and transport and waste disposal as well as those due to construction, operation, and decommissioning of the reactors. We estimate the lifecycle emissions of new nuclear power plants as 9-70 g CO₂e kWh⁻¹, with the lower number from an industry estimate and the upper number slightly above the average of 66 g CO₂e kWh⁻¹ from a review of 103 new and old lifecycle studies of nuclear energy. Three additional studies estimate mean lifecycle emissions of nuclear reactors as 59, 16-55, and 40 g CO₂e⁻¹, respectively; thus, the range appears within reason.

In 2011, Mark Jacobson and another colleague carried their research further to show how all global energy needs can be supplied by renewable energy, referred to by Jacobson et al. as wind, water and sun (WWS). Mark Jacobson and Mark Delucchi, Providing All Global Energy with Wind, Water, and Solar Power, Part I: Technologies, Energy Resources, Quantities and Areas of Infrastructure, and Materials, Energy Policy, v. 39, p. 1154-1169, 2011; Mark Jacobson and Mark Delucchi, Providing All Global Energy with Wind, Water, and Solar Power, Part II: Reliability, System and Transmission Costs, and Policies, Energy Policy, v. 39, p. 1170-1190, 2011. Importantly, for our comments, the article had this to say about nuclear power:

For several reasons we do not consider nuclear energy (conventional fission, breeder reactors, or fusion) as a long-term global energy source. First, the growth of nuclear energy has historically increased the ability

of nations to obtain or enrich uranium for nuclear weapons, and a large-scale worldwide increase in nuclear energy facilities would exacerbate this problem, putting the world at greater risk of a nuclear war or terrorism catastrophe. The historic link between energy facilities and weapons is evidenced by the development or attempted development of weapons capabilities secretly in nuclear energy facilities in Pakistan, India, Iraq, Iran and to some extent North Korea. Feiveson (2009) writes that "it is well understood that one of the factors leading several countries now without nuclear power programs to express interest in nuclear power is the foundation that such programs could give them to develop weapons. Kessides (2010) asserts, "a robust global expansion of civilian nuclear power will significantly increase proliferation risks unless the current non-proliferation regime is substantially strengthened by technical and institutional measures and its international safeguards system adequately meets the new challenges associated with a geographic spread and an increase in the number of nuclear facilities". Similarly, Miller and Sagan (2009) write, "It seems almost certain that some new entrants to nuclear power will emerge in the coming decades and that the organizational and political challenges to ensure the safe and secure spread of nuclear technology into the developing world will be substantial and potentially grave."

If the world were converted to electricity and electrolytic hydrogen by 2030, the 11.5 TW in resulting power demand would require ~ 15,800 850 MW nuclear power plants, or one installed every day for the next 43 years. Even if only 5% of these were installed, that would double the current installations of nuclear power worldwide. Many more countries would possess nuclear facilities, increasing the likelihood that these countries would use the facilities to hide the development of nuclear weapons as has occurred historically.

Second, nuclear energy results in 9-25 times more carbon emissions than wind energy, in part due to emissions from uranium refining and transport and reactor construction, in part due to the longer time required to site, permit, and construct a nuclear

plant compared with a wind farm (resulting in greater emissions from the fossil-fuel electricity sector during this period, and in part due to the greater loss of soil carbon due to the greater loss in vegetation resulting from covering the ground with nuclear facilities relative to wind turbine towers, which cover little ground. Although recent construction times worldwide are shorter than the 9-year median construction times in the U.S. since 1970, they still averaged 6.5 years worldwide in 2007, and this time must be added to the site permit time (~3 years in the U.S.) and construction permit and issue time (~3 years). The overall historic and present range of nuclear planning-to-operation times for new nuclear plants has been 11-19 years, compared with an average of 2-5 years for wind and solar installations. Feiversen (2009) observes that "because wind turbines can be installed much faster than could nuclear, the cumulative greenhouse gas savings per capital invested appear likely to be greater for wind." The long time required between planning and operation of a nuclear power plant poses a significant risk to the Arctic sea ice. Sea ice records indicate a 32% loss in the August 2010 sea ice area relative to the 1979-2008 mean. Such rapid loss indicates that solutions to global warming must be implemented quickly. Technologies with long lead times will allow the high-albedo Arctic ice to disappear, triggering more rapid positive feedbacks to warmer temperatures by uncovering the low-albedo ocean below.

Third, conventional nuclear fission relies on finite stores of uranium that a large-scale nuclear program with a "once through" fuel cycle would exhaust in roughly a century. In addition, accidents at nuclear power plants have been either catastrophic (Chernobyl) or damaging (Three-Mile Island) [of course, this was before Fukushima], and although the nuclear industry has improved the safety and performance of reactors, and has proposed new (but generally untested) "inherently" safe reactor designs, there is no guarantee that the reactors will be designed, built, and operated correctly. For example, Pacific Gas and Electric Company had to redo some modifications it made to its Diablo Canyon nuclear power plant after the original work was done backwards, and French nuclear regulators recently told the firm Areva to

correct a safety design flaw in its latest-generation reactor. Further, catastrophic scenarios involving terrorist attacks are still conceivable. Even if the risks of catastrophe are very small, they are not zero, whereas with wind and solar power, the risk of catastrophe is zero. Finally, conventional nuclear power produces radioactive waste, which must be stored for thousands of years, raising technical and long-term cost questions.

There were two related reports issued in 2011 by the American Council for an Energy-Efficient Economy. R. Neal Elliott, Rachel Gold, and Sara Hayes, Avoiding a Train Wreck: Replacing Old Coal Plants With Energy Efficiency, 2011; Dan York and Martin Kushler, The Old Model Isn't Working: Creating the Energy Utility for the 21st Century, 2011. These reports emphasized the benefits of energy efficiency in replacing fossil fuels. The first report made the following findings:

The untapped potential for increased efficiency savings is massive, with the projected range of available efficiency consistently falling within (or exceeding) the range of estimated capacity needed to address forecasted coal retirement.

[T]he average cost to a utility for energy efficiency measures is 2.5 cents per kWh, in comparison to new generation sources, which can range from 6 to 15 cents per kWh.

One . . . analysis estimated that by 2018 new energy efficiency programs could decrease summer peak capacity demand by 20,000 MW of the 40,000 MW that may be needed. An ACEEE meta-analysis of 48 studies on the potential for energy efficiency in the U.S. indicates that given the right choices and investments, the U.S. could cost-effectively reduce energy consumption by 20 to 30% or more over the course of the next 20 years.

States and localities that invest in efficiency profit from a range of secondary economic benefits as well. Energy efficiency investments directly reduce utility bills and operating costs for consumers. This effectively reduces dollars spent for the purchase of fuel and the costs of operating a coal plant, and redirects those dollars into new jobs in other sectors of the local economy. Most of these sectors create more local jobs than the fossil-fueled electric generating sector where significant dollars flow out of the local economy. In addition, utilizing energy efficiency resources to enable the retirement of older coal plants helps reduce risk by significantly reducing the amount of future costs that ratepayers would face if a policy to impose a cost for carbon emissions was enacted.

Efficiency can be deployed quickly.

The second ACEEE report describes how a new public utility model can implement energy efficiency programs for the benefit of all. So, energy efficiency is practical, achievable, and decreases the reliance on fossil fuels and nuclear power.

Another source considering the ability of renewable energy and energy efficiency to provide all needed electric power, is Arjun Makhijani, Carbon-Free and Nuclear-Free: A Roadmap for U.S. Energy Policy, 2007, available for download at www.ieer/carbon-free/. In that book Dr. Makhijani shows how:

It is technologically and economically feasible to phase out CO₂ emissions and nuclear power at the same time. The analysis in this report indicates that it can be done at reasonable cost by 2050.

Dr. Makhijani describes a nuclear-free and carbon-free energy future as follows:

The U.S. renewable energy resource base is vast and practically untapped. Available wind energy resources in 12 Midwestern and Rocky Mountain states equal about 2.5 times the entire electricity production of the United States. North Dakota, Texas, Kansas, South

Dakota, Montana, and Nebraska each have wind energy potential greater than the electricity produced by all 103 [in 2007] U.S. nuclear power plants. Solar energy resources on just one percent of the area of the United States are about three times as large as wind energy, if production is focused in the high insolation areas in the Southwest and West.

Just the parking lots and rooftops in the United States could provide most of the U.S. electricity supply. This also has the advantage of avoiding the need for transmission line expansion, though some strengthening of the distribution infrastructure may be needed. Wind energy is already more economical than nuclear power. In the past two years, the costs of solar cells have come down to the point that medium-scale installations, . . . , are economical in sunny areas, since they supply electricity mainly during peak hours.

The main problem with wind and solar energy is intermittency. This can be reduced by integrating wind and solar energy together into the grid - for instance, wind energy is often more plentiful at night. Geographic diversity also reduces the intermittency of each source and for both combined.

Finally, the book summarizes the analysis with 12 recommendations for a clean and renewable energy future:

1. Enact a physical limit of CO₂ emissions for all large users of fossil fuels (a "hard cap") that steadily declines to zero prior to 2060, with the time schedule being assessed periodically for tightening according to climate, technological, and economic developments. The cap should be set at the level of some year prior to 2007, so that early implementers of CO₂ reductions benefit from the setting of the cap. Emission allowances would be sold by the U.S. government for use in the United States only. There would be no free allowances, no offsets and no international sale or purchase of CO₂ allowances. The estimated revenues - approximately \$30 to \$50 billion per year - would be used for demonstration plants, research and development, and worker and community transition.

2. Eliminate all subsidies and tax breaks for fossil fuels and nuclear power (including guarantees for nuclear waste disposal from new power plants, loan guarantees, and subsidized insurance).
3. Eliminate subsidies for biofuels from food crops.
4. Build demonstration plants for key supply technologies, including central station solar thermal with heat storage, large- and intermediate-scale solar photovoltaics, and CO₂ capture in microalgae for liquid fuel production (and production of a high solar energy capture aquatic plants, for instance in wetlands constructed at municipal wastewater systems).
5. Leverage federal, state and local purchasing power to create markets for critical advanced technologies, including plug-in hybrids.
6. Ban new coal-fired power plants that do not have carbon storage.
7. Enact at the federal level high efficiency standards for appliances.
8. Enact stringent building efficiency standards at the state and local levels, with federal incentives to adopt them.
9. Enact stringent efficiency standards for vehicles and make plug-in hybrids the standard U.S. government vehicle by 2015.
10. Put in place federal contracting procedures to reward early adopters of CO₂ reductions.
11. Adopt vigorous research, development, and pilot plant construction programs for technologies that could accelerate the elimination of CO₂, such as direct electrolytic hydrogen production, solar hydrogen production (photolytic, photochemical, and other approaches), hot rock geothermal power, and integrated gasification combined cycle plants using biomass with a capacity to sequester the CO₂.
12. Establish a standing committee on Energy and Climate under the U.S. Environmental Protection Agency's Science Advisory Board.

The foregoing discussion makes it clear that there are numerous ways to get to a clean and renewable energy future without nuclear power.

The foregoing discussion also emphasizes that renewable energy requires expansion of the transmission grid. Expanded transmission is occurring right now. The Federal

Energy Regulatory Commission (FERC) has over the past few years adopted policies to promote expansion of transmission lines. The most recent FERC action is Order 1000 adopted on July 21, 2011. The Order summarizes its contents as follows:

With respect to transmission planning, this Final Rule: (1) requires that each public utility transmission provider participate in a regional transmission planning process that produces a regional transmission plan; (2) requires that each public utility transmission provider amend its OATT to describe procedures that provide for the consideration of transmission needs driven by public policy requirements in the local and regional transmission planning processes; (3) removes from Commission-approved tariffs and agreements a federal right of first refusal for certain new transmission facilities; and (4) improves coordination between neighboring transmission planning regions for new Docket No. RM10-23-000 - 2 - interregional transmission facilities. Also, this Final Rule requires that each public utility transmission provider must participate in a regional transmission planning process that has: (1) a regional cost allocation method for the cost of new transmission facilities selected in a regional transmission plan for purposes of cost allocation; and (2) an interregional cost allocation method for the cost of certain new transmission facilities that are located in two or more neighboring transmission planning regions and are jointly evaluated by the regions in the interregional transmission coordination procedures required by this Final Rule. Each cost allocation method must satisfy six cost allocation principles.

There are also regional transmission planning organizations that monitor and regulate access to the grid. These organizations can ensure that renewable energy is available from the sources that are producing power at a certain time. This will address the issue of intermittency.

The issues of grid coordination and intermittency were addressed in a report in 2010. George Crabtree and Jim Misewich, Integrating Renewable Resources on the Grid, 2010, found at www.aps.org/policy/reports/popa-reports/

upload/integratingelec.pdf. The report summarized its conclusions as follows:

The demand for carbon-free electricity is driving a growing movement of adding renewable energy to the grid. Renewable Portfolio Standards mandated by states and under consideration by the federal government envision a penetration of 20-30% renewable energy in the grid by 2020 or 2030. The renewable energy ultimately could grow well beyond these initial goals.

The grid faces two new and fundamental technological challenges in accommodating renewables: location and variability. Renewable resources are concentrated at mid-continent far from population centers, requiring additional long distance, high-capacity transmission to match supply with demand. The variability of renewables due to the characteristics of weather is high, up to 70% for daytime solar due to passing clouds and 100% for wind on calm days, much larger than the relatively predictable uncertainty in load that the grid now accommodates by dispatching conventional resources in response to demand.

Solutions to the challenges of remote location and variability of generation are needed. The options for DC transmission lines, favored over AC lines for transmission of more than a few hundred miles, need to be examined. Conventional high voltage DC transmission lines are a mature technology that can solve regional transmission needs covering one- or two-state areas. Conventional high voltage DC has drawbacks, however, of high loss, technically challenging and expensive conversion between AC and DC, and the requirement of a single point of origin and termination. Superconducting DC transmission lines lose little or no energy, produce no heat, and carry higher power density than conventional lines. They operate at moderate voltage, allowing many "on-ramps" and "off-ramps" in a single network and reduce the technical and cost challenges of AC and DC conversion. A network of superconducting DC cables overlaying the existing patchwork of conventional transmission lines would create an interstate highway system for electricity that moves large amounts of renewable electric power efficiently over long distances from source to load. Research and development is needed to identify the

technical challenges associated with DC superconducting transmission and how it can be most effectively deployed.

The challenge of variability can be met (i) by switching conventional generation capacity in or out in response to sophisticated forecasts of weather and power generation, (ii) by large scale energy storage in heat, pumped hydroelectric, compressed air or stationary batteries designed for the grid, or (iii) by national balancing of regional generation deficits and excesses using long distance transmission. Each of these solutions to variability has merit and each requires significant research and development to understand its capacity, performance, cost and effectiveness. The challenge of variability is likely to be met by a combination of these three solutions; the interactions among them and the appropriate mix needs to be explored.

The long distances from renewable sources to demand centers span many of the grid's physical, ownership and regulatory boundaries. This introduces a new feature to grid structure and operation: national and regional coordination. The grid is historically a patchwork of local generation resources and load centers that has been built, operated and regulated to meet local needs. Although it is capable of sharing power across moderate distances, the arrangements for doing so are cumbersome and inefficient. The advent of renewable electricity with its enormous potential and inherent regional and national character presents an opportunity to examine the local structure of the grid and establish coordinating principles that will not only enable effective renewable integration but also simplify and codify the grid's increasingly regional and national character.

One final point needs to be made here. The electric utilities and energy companies assert that in order to provide baseload power they have to use coal, natural gas or nuclear power. The GEIS adopts this assertion. But baseload as viewed by the utilities and power companies is an outdated concept. They are stuck in the narrow view of electric power coming from power plants. But rather than referring to the term baseload we are really talking about energy and capacity. Energy is the total amount of

electricity that is being supplied to consumers. Capacity is the highest level of electricity that can be supplied at any one time to meet peak demand. As discussed above, renewable energy and energy efficiency can supply the energy and capacity needed to serve our needs.

Renewable energy has been making great strides in the last few years. It is fast becoming an increasing share of the energy mix and its cost is significantly decreasing. A recent publication describes the renewable energy landscape as follows:

The American investment in wind energy continues to pay off in the form of reduced costs, improved efficiency, and lower prices for consumers. The beginning of 2014 marked a record wave of new construction, and the American Wind Energy Association reported that wind power continues to lead the way in affordable, reliable renewable energy.

"In many parts of the country today [...] wind is the most economic form of new energy generation," as NextEra Energy Chief Financial Officer Moray P. Dewherst said in a recent earnings call.

Investments in technological advancements and stable policy have helped drive down the cost of wind energy by 43% in four years, and the industry remains on schedule to grow to supply 20% of the U.S. Power grid by 2030, and beyond.

Wind energy prices and wind energy costs have dropped sharply in recent years. . . . DOE Wind Technologies Market Report 2012 confirms that the cost of wind energy has declined by 43% over the last four years.

As the report explains:

1. The capital cost to develop wind power continues to drop
2. The average cost to purchase electricity provided by wind is falling
3. The productivity of wind turbines continues to increase

4. 70% of the value of wind turbines installed in the U.S. now carries a "Made-in-the-USA" label

Zero-fuel-cost wind energy directly displaces the output of the most expensive and least efficient power plants currently operating. . . .

Significant water savings come along with those for fuel. . . .

More than a dozen studies conducted by independent grid operators, state governments, academic experts, and others have found that wind energy benefits consumers by reducing electricity prices, and utilities are taking note:

"Wind prices are extremely competitive right now, offering lower costs than other possible resources, like natural gas plants," David Sparby, President and CEO of Xcel Energy's Northern States Power, announcing 600 MW of new wind power contracts in 2013.

"The expansion is planned to be built at no net cost to the company's customers and will help stabilize electric rates over the long term by providing a rate reduction totaling \$10 million per year by 2017, commencing with a \$3.3 million reduction in 2015." MidAmerican Energy Co., 2013 press release, after the Iowa Utilities Board approved the addition of 1,050 MW of wind generation in Iowa.

Cost savings with wind power are apparent across the country. Newly released DOE data shows that consumers in the states that use the most wind energy have fared far better than consumers in states that use less wind energy.

[In 2013] photovoltaic (PV) installations continued to proliferate, increasing 41% over 2012 to reach 4,751 MW, and 410 MW of concentrating solar power (CSP) plants also came online. Solar was the second-largest source of new electricity generating capacity in the U.S., exceeded only by natural gas. And the

cost to install solar fell throughout the year, with average system prices ending the year 15% below the mark set at the end of 2012.

Increasingly, solar is not bound by its cost, but rather by its role in the electricity sector. And as solar continues along its path toward the mainstream, its integration with the broader electricity market from a technical, market and regulatory perspective will become one of the most important issues in the industry.

Key Figures:

- The U.S. installed 4,751 MW of solar PV in 2013, up 41% over 2012 and nearly fifteen times the amount installed in 2008.
- There is now a total of 12.1 GW of PV and 918 MW of CSP operating in the U.S.
- More solar has been installed in the U.S. in the last eighteen months than in the 30 years prior.
- Solar accounted for 29% of all new electricity generation capacity in 2013, up from 10% in 2012. This made solar the second-largest source of new generating capacity behind natural gas.
- The wave of concentrating solar power installations slated for completion at the end of 2013 into 2014 kicked off with the 280 MW Solana project and the Genesis Solar project's initial 125 MW phase. In early 2014, BrightSource's notable Ivanpah project also began operating and SolarReserve's Crescent Dunes began commissioning.
- Each year approximately 30,000 solar water heating and cooling (SHC) systems are installed in the U.S., generating an estimated \$435 million in annual revenue. There is currently 9 GWth of SHC capacity installed in the U.S., and the country ranks 36th in the world in installed capacity relative to its population.

For 2014, our forecast calls for 26% overall growth in the U.S. solar market.

American Council On Renewable Energy, The Outlook For Renewable Energy in America, 2014.

As further evidence of the viability of renewable energy, over half of the states have renewable electricity standards that require a certain amount of the power produced in the state to be generated by renewable energy.

Another aspect of renewable energy should not be overlooked - distributed generation (DG). Distributed generation is the generation of electricity from sources near the point of consumption. American Council for an Energy-Efficient Economy, www.aceee.org/topics/distributed-generation. In almost all cases, distributed generation is an energy production facility, primarily solar and wind, owned by the entity consuming the power. Over the past few years the installation of distributed generation facilities has increased and the cost of those power sources, especially solar, has decreased. In addition, states have passed laws and regulations making distributed generation more affordable and more accessible.

The Department of Energy issued a report highlighting the benefits of distributed generation:

DG offers potential benefits to electric system planning and operations. On a local basis there are opportunities for electric utilities to use DG to reduce peak loads, to provide ancillary services such as reactive power and voltage support, and to improve power quality.

DG can also be used to decrease the vulnerability of the electric system There are many examples of customers who own and operate facilities in these sectors who are using DG to maintain operations when the grid is down during weather-related outages and regional blackouts.

Under certain circumstances, and depending on the assumptions, DG can also have beneficial effects on

land use and needs for rights-of-way for electric transmission and distribution.

U.S. Department of Energy, The Potential Benefits of Distributed Generation and Rate-Regulated Issues That May Impede Their Expansion, 2007.

States can do much to encourage and support distributed generation. These efforts would include tax credits, net metering requirements, and feed-in tariffs. States can adopt, and many states have adopted, interconnection standards that make it easier for distributed generation facilities to connect to the electric grid.

Energy efficiency, likewise, has clearly demonstrated its reliability, efficacy and cost effectiveness. In fact, energy efficiency is the most readily available and least expensive way to reduce our dependence on fossil fuels and to meet energy capacity needs. R. Neal Elliott, Rachel Gold, and Sara Hayes, Avoiding a Train Wreck: Replacing Old Coal Plants With Energy Efficiency, 2011.

A recent report by the International Energy Agency, Capturing the Multiple Benefits of Energy Efficiency, 2014, describes the viability of energy efficiency as follows:

As energy efficiency continues to gain attention as a key resource for economic and social development across all economies, understanding its real value is increasingly important. The multiple benefits approach to energy efficiency policy seeks to expand the perspective of energy efficiency beyond the traditional measures of reduced energy demand and lower greenhouse gas (GHG) emissions by identifying and measuring its impacts across many different spheres.

The term "multiple benefits" aims to capture a reality that is often overlooked: investment in energy efficiency can provide many different benefits to many different stakeholders. Whether by directly reducing energy demand and associated costs (which can enable investment in other goods and services) or facilitating the achievement of other objectives (e.g., making indoor environments healthier or boosting industrial productivity), recent research acknowledges the enormous potential of energy

efficiency. [Energy efficiency has a] role as a major contributor to strategic objectives across five main themes: enhancing the sustainability of the energy system, economic development, social development, environmental sustainability and increasing prosperity.

Energy efficiency is taking its place as a major energy resource in the context of national and international efforts to achieve sustainability targets. This reflects a paradigm shift that is beginning to give credence to actions on both the supply and the demand side in the quest to achieve economic growth while supporting energy security, competitiveness and environmental sustainability.

In effect, attention to energy efficiency has begun to evolve, progressing from the lack of visibility inherent in its identification as "the hidden fuel" (i.e., measured and valued only as the negative quantity of energy not used) to an increasing recognition of its role as the "first fuel." Energy use avoided by International Energy Agency (IEA) member countries in 2010 (generated from investments over the preceding 1974 to 2010 period), was larger than actual demand met by any other single supply-side resource, including oil, gas, coal, and electricity - making energy efficiency the largest or "first" fuel.

Another recent report by the American Council for an Energy-Efficient Economy was based on a study to assess the costs of energy efficiency programs and cost effectiveness of those programs from 2009 to 2012. Maggie Molina, The Best Value for America's Energy Dollar: A National Review of the Cost of Utility Energy Efficiency Programs, 2014. The study reviewed energy efficiency programs in 20 states. The finding was that each dollar invested by utilities and participants in energy efficiency measures yields \$1.24 to \$4.00 in benefits. The study concluded:

In summary, the results of this analysis clearly demonstrate that energy efficiency programs are the least-cost resource option available to utilities. . . . [E]lectricity efficiency programs, at a range of about 2 to 5 cents per kWh and an average of 2.8 cents

per kWh, are about one half to one third the levelized cost of alternative new electricity resource options.

All of this should have been discussed and analyzed in the DEIS.

Unavoidable Impacts

Chapter 10 of the DEIS purports to examine the unavoidable impacts of constructing Turkey Point reactors 6 and 7. Obviously, one of the unavoidable impacts of constructing a nuclear reactor is the production of radioactive waste in the form of spent nuclear fuel, as discussed previously in these comments.

The DEIS characterizes the impact of the radioactive waste as "SMALL." DEIS, Table 10-2 at p. 10-12. It is clear that no one else considers the impact to be small.

Radioactive waste in the form of spent fuel is a dangerous long-term problem. As the court described it in New York v. NRC, supra, at 474:

After four to six years of use in a reactor, nuclear fuel rods can no longer efficiently produce energy and are considered "spent nuclear fuel" ("SNF"). Blue Ribbon Commission on America's Nuclear Future, Report to the Secretary of Energy 10-11 (2012). Fuel rods are thermally hot when removed from reactors and emit great amounts of radiation - enough to be fatal in minutes to someone in the immediate vicinity. Id. Therefore, the rods are transferred to racks within deep, water-filled pools for cooling and to protect workers from radiation. After the fuel has cooled, it may be transferred to dry storage, which consists of large concrete and steel "casks." Most SNF, however, will remain in spent-fuel pools until a permanent disposal solution is available. Id. at 11.

Even though it is no longer useful for nuclear power, SNF poses a dangerous, long-term health and environmental risk. It will remain dangerous "for time spans seemingly beyond human comprehension." Nuclear Energy Inst., Inc. v. EPA, 373 F.3d 1251, 1258 (D.C. Cir. 2004) (per curiam). Determining how to dispose of the growing volume of SNF, which may reach 150,000

metric tons by the year 2050, is a serious problem. See, Blue Ribbon Commission, *supra*, at 14. And it is clear that no one really knows what to do with that waste. Again, quoting from New York v. NRC, *supra*, at 474:

The delay [in finding a permanent repository] has required plants to expand storage pools and to pack SNF more densely within them. The lack of progress on a permanent repository has caused considerable uncertainty regarding the environmental effects of temporary SNF storage and the reasonableness of continuing to license and relicense nuclear reactors. (emphasis added).

In addition, the Blue Ribbon Commission on America's Nuclear Future has said that we may already be at a point where more than one permanent repository is necessary. As noted in New York v. NRC, at this point there is no possibility of finding even one permanent repository in sight. Thus, as we continue to make more spent fuel, the problem becomes worse. The only sensible course of action is to stop making more spent fuel. This is the context in which the analysis of unavoidable impacts should have been conducted.

Inadequate Analysis of Geologic Characteristics

Section 2.3.1.2 of the DEIS describes the geology at the Turkey Point site as permeable limestone and sandstone, with tectonic fault and karst collapse structures. This creates a serious safety risk that has been recognized by the NRC. In fact, the NRC does have guidance on siting nuclear reactors in karst terrain. A.G. Franklin, D.M. Patrick, D.K. Butler, W.E. Strohm, Jr., and M.E. Hynes-Griffin, Foundation Considerations in Siting of Nuclear Facilities in Karst Terrains and Other Areas Susceptible to Ground Collapse (May 1981). That document first describes the collapse mechanism of karst as follows:

An understanding of the mechanisms of sinkhole development and contributing or modifying factors is essential in evaluating the degree of hazard. The development of sinkholes, often by sudden collapse of the ground surface, is related to stratigraphy, groundwater lowering, and erosion of overburden soils into solution features. . . . Roof collapse of

cavities near the bedrock surface by increased solution or increased roof loading results in dropout of shallow overburden. While solution enlargement of cavities and weakening of the roof structure is a relatively slow process, collapse occurs suddenly. Sinkhole enlargement, sometimes to several hundred feet in diameter, progresses rapidly by erosion of overburden soils into open voids by surface drainage, especially during heavy rains. However, the most common development of sinkholes endangering structures is the collapse of cavities in relatively thick cohesive soil overburden. Downward seepage causes progressive raveling and erosion of cohesive soils bridging solution slots or fissures in the limestone bedrock. Upward enlargement of the soil cavity, to a diameter sometimes larger than 100 ft in clays, continues as long as eroding soil is carried away by circulating groundwater in the bedrock openings. Otherwise, the process stops by clogging of openings with soft, wet soils. Roof collapse, forming a dropout, occurs when the roof load exceeds the shear strength of the roof soil. In sandy soils sand raveling into solution fissures progresses into funnel-shaped surface depressions that may be over 100 ft in diameter.

The guidance document then goes on to discuss the proper evaluation of the underlying geology before siting a nuclear reactor:

For major structures, a complete geologic profile, showing all solution features, quality and condition of overburden and bedrock, and groundwater conditions, is necessary in evaluating foundation problems and treatment alternatives. All cavities bridged by overburden should be either grouted or excavated and backfilled, depending on the depth of overburden. For shallow overburden where excavation is carried to the bedrock surface, the distribution of solid rock zones, compressibility and erosion resistance of infilling materials, and depth of infilling materials in solution-widened joints require evaluation to determine:

a. Required excavation and type of backfill to replace soft or compressible materials.

b. Choice of foundation type, such as mat, spread footings, piles, or caissons (piers).

c. Requirements for checking conditions exposed by the excavation and verifying soundness of rock below foundation elements after excavation.

For deep overburden, the type and amount of infilling materials in solution features require evaluation to determine whether grouting would be an effective treatment.

All solution features in the bedrock surface must be well defined and evaluated to determine the feasibility of treatment to provide a competent foundation. Cavities bridged by overburden, filled solution channels, soft soil zones between limestone pinnacles, and other solution features should be either grouted or excavated and backfilled with concrete or compacted soil, depending on the type of structure and foundation. Extensive surface and subsurface drainage control measures (drainage ditches, subdrains) may be required to prevent infiltration and downward migration of surface water.

The guidance document also warns that cavities below bedrock surface must be defined and evaluated to assess their effect on cavity stability. Natural cavities below bedrock surface can increase in size by dissolution of the carbonate rock, progressive spalling or fall-in of roof rock, or by erosion of infilling materials. In addition, cavities within the influence zone of structure loading should be evaluated for stability. There is no indication that any of this will be adequately considered prior to construction of the proposed Turkey Point reactors.

The structural stability of the Turkey Point reactors is not the only issue that must be addressed. The other problem caused by constructing a nuclear reactor on karst terrain is that leaks from the reactor are carried through the cavities in the rock formation into the groundwater. The contaminated groundwater would find its way to nearby water bodies. And leaks from nuclear reactors, especially of radioactive tritium, are common. Tritium, which is a radioactive form of hydrogen, has leaked from at least 48

reactor sites. Leaks from at least 37 of those facilities contained concentrations exceeding the federal drinking water standard, sometimes at hundreds of times the limit.

Tritium moves through the soil quickly, and when it is detected it often indicates the presence of more powerful radioactive isotopes that are often spilled at the same time. For example, cesium-137 combined with tritium at Fort Calhoun in 2007. Strontium-90 was discovered with tritium in 2005 at Indian Point. The primary cause of these leaks is the corrosion and degradation of underground pipes that have been buried under the reactors for 30-40 years. When a 40-year license for Turkey Point is being proposed, the facts must be considered in the DEIS.

These issues must be examined more thoroughly in the DEIS.

Conclusion

Licensing a new nuclear reactor is a serious commitment to a technology that is expensive, environmentally troubling, and not consistent with our energy future. The DEIS for Turkey Point Units 6 and 7 does not adequately address the issues that would properly focus the impacts of nuclear energy in relation to more beneficial sources of energy. For the reasons stated in these comments, the DEIS needs to be revised.

Respectfully Submitted,

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