

## SECTION 5 - NUCLEAR POWER

### Nuclear Generation in Virginia

- There are four nuclear units in operation in Virginia. All four are operated by Dominion.
- Two units are located at the North Anna Power Station in Louisa County and two are located at the Surry Power Station in Surry County. These two nuclear plants provided 38 percent of the net electricity generated in Virginia during 2013.<sup>1</sup>
  - Dominion owns an 88.4 percent share of the North Anna Station. The Old Dominion Electric Cooperative (ODEC) owns the remaining 11.6 percent share.
  - Dominion owns 100 percent of the Surry Station.
  - Generally, the Nuclear Regulatory Commission (NRC) issues licenses for reactors to operate for up to 40 years. The NRC extended both Surry's and North Anna's operating licenses in 2003 for an additional 20 years (60 years total).<sup>2</sup> Both plants have the potential for extending their operating license another 20 years, for a total of 80 years.
  - North Anna generates 1,892 megawatts from its two units — enough electricity to power 450,000 homes<sup>3</sup>. Surry Power Station generates 1,676 megawatts of electric power from its two nuclear reactors — enough electricity to power 420,000 homes<sup>4</sup>.
- North Anna employs 960 employees and Surry currently employs 965 employees at an average salary (exclusive of benefits) of more than \$80,000 per year.

Table 5-1: Virginia's Nuclear Generating Units and Startup Dates<sup>5</sup>

Unit Name	Year	End of Operating License Term
Surry Unit 1	1972	2032
Surry Unit 2	1973	2033
North Anna Unit 1	1978	2038
North Anna Unit 2	1980	2040

- Dominion has made operating and capital improvements to the plants that have reduced down time for refueling and repairs, increased plant efficiency, and improved uprates that have increased their generating capacity in excess of 150 megawatts<sup>6</sup>. Operating capacity for the four units in Virginia in 2013 ranged from

<sup>1</sup> Energy Information Administration, Virginia State Profile and Energy Estimates: Quick Facts

<sup>2</sup> National Regulatory Commission, Nuclear Reactors, License Renewal, Overview

<sup>3</sup> Dominion North Anna Power Station, <https://www.dom.com/about/stations/nuclear/north-anna/>

<sup>4</sup> Dominion Surry Power Station, <https://www.dom.com/about/stations/nuclear/surry/>

<sup>5</sup> <http://www.eia.doe.gov>

<sup>6</sup> 150 megawatts is reflective of summer net performance

77.7 to 96.9 percent with an average of 90.1 percent<sup>7</sup>. Nuclear power is considered baseload power, meaning it is designed to run around the clock.

- In addition to its nuclear generation plants at Surry and North Anna, Virginia hosts a number of nuclear-powered naval vessels, including aircraft carriers, other surface vessels, and attack and ballistic missile submarines.
- Electricity production costs of nuclear power plants are the lowest of any baseload power source, with nuclear at 2.40 cents/kW-hr, coal at 3.27 cents/kW-hr, natural gas at 3.40 cents/kW-hr, and petroleum at 22.48 cents/kW-hr.<sup>8</sup>
- Nuclear power has no carbon emissions and no other air emissions.

## Used Nuclear Fuel Management

- According to the Nuclear Waste Policy Act of 1982, amended in 1987, the U.S. Department of Energy (US DOE) is obligated to take used nuclear fuel from the North Anna and Surry sites.
- The Nuclear Waste Fund, created by fees paid by US nuclear power plants since 1983 and with more than \$35 billion to date, is the mechanism that was used to finance the design, licensing, construction and management of a suitable repository at the Yucca Mountain site in Nevada.
- On June 2008, the US DOE completed the Yucca Mountain repository license application, and submitted it to the NRC for their review. On March 2010, the US DOE withdrew the license application and created the Blue Ribbon Commission for America's Nuclear Future (BRC) to evaluate potential paths forward for the long term management of used nuclear fuel. On September 2011 the NRC stopped the review of the Yucca Mountain license application<sup>9</sup>, a decision that was reversed in August 2013 by the US Court of Appeals for the DC Circuit<sup>10</sup>. The BRC issued its final report on January 2012<sup>11</sup>. The US DOE review of the BRC recommendations resulted in a January 2013 report<sup>12</sup> that details the steps of a new program that will be implemented over the next 10 years. This plan culminates with the availability of a geologic repository for the long-term storage of used nuclear fuel by 2048.
- A US Court of Appeals has ruled that the US DOE must stop collecting nuclear waste fees from utilities until it decides how used nuclear fuel is to be managed<sup>13</sup>.
  - Used nuclear fuel is currently stored at the North Anna and Surry sites in the spent fuel pools and in dry storage casks and will continue to be stored at North Anna and Surry until the U.S. Government is able to fulfill its obligation to the U.S. nuclear industry.

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<sup>7</sup> <http://www.eia.doe.gov>

<sup>8</sup> <http://www.nei.org/Knowledge-Center/Nuclear-Statistics/Costs-Fuel,-Operation,-Waste-Disposal-Life-Cycle/US-Electricity-Production-Costs>

<sup>9</sup> <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-yucca-license-review.html>

<sup>10</sup> [http://www.world-nuclear-news.org/WR-US\\_court\\_rules\\_on\\_Yucca\\_Mountain-1408137.html](http://www.world-nuclear-news.org/WR-US_court_rules_on_Yucca_Mountain-1408137.html)

<sup>11</sup> <http://cybercemetery.unt.edu/archive/brc/20120620211605/http://brc.gov/>

<sup>12</sup> <http://energy.gov/sites/prod/files/Strategy%20for%20the%20Management%20and%20Disposal%20of%20Used%20Nuclear%20Fuel%20and%20High%20Level%20Radioactive%20Waste.pdf>

<sup>13</sup> <http://www.world-nuclear-news.org/WR-Court-orders-halt-to-nuclear-waste-fees-2011134.html>

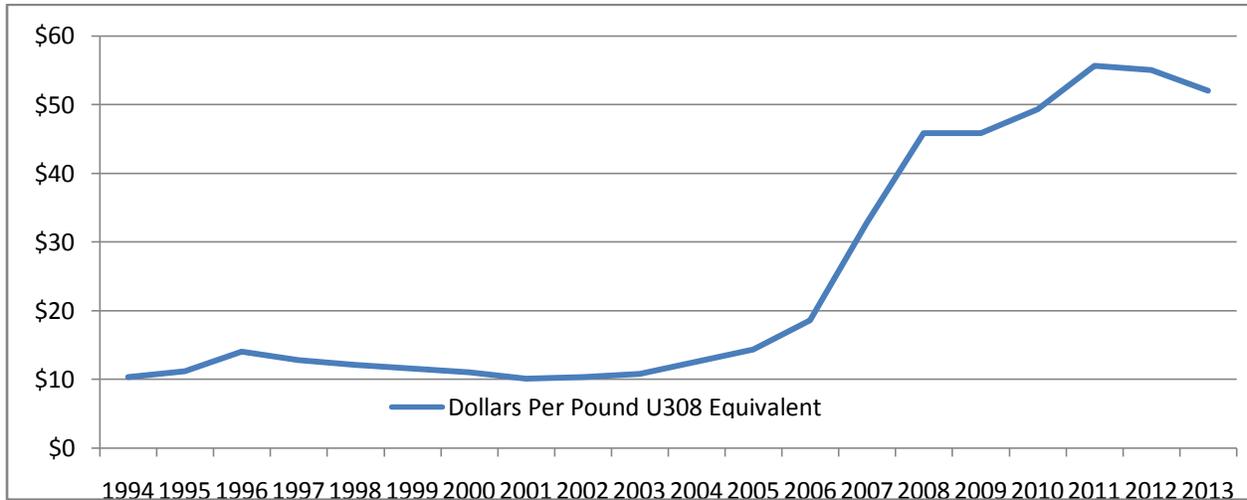
## Nuclear Plant Siting and Construction

- Nuclear power plant siting is largely regulated through the licensing process of the Nuclear Regulatory Commission (NRC). Licensing requirements have been streamlined since plants were licensed in the 1960s and 1970s. Nuclear utilities now can receive an early site permit, followed by a combined construction-operating permit.
- Dominion has received its early site permit for the proposed third North Anna unit.
- Dominion's combined construction-operating permit application is pending before the NRC.
- Nuclear plant permitting and construction can take up to 8-10 years.
- Time and budget experience with new plant construction, overseas, has been mixed.
- Shared risk between utilities and project design and construction firms supports financing new nuclear projects.
- State and federal incentives, including a higher rate of return under Virginia law for utility investments in new nuclear power plants and federal loan guarantees, may help mitigate the financial risk.
- U.S. nuclear reactor manufacturing capability is growing to meet national and international demand. New facilities include the Westinghouse-Chicago Bridge and Iron plant in Lake Charles, Louisiana.
- Nuclear plants are major construction projects, involving thousands of construction workers. North Anna 3 would be one of the largest construction projects in Virginia history.

## Nuclear Fuel Costs

- The average purchase price of uranium oxide was consistently below \$20/pound until the mid-2000s. Since then, the average purchase price has increased to just above \$50/pound, but is expected to return to a lower price level, as shown in Figure 5-1. The current spot market for uranium oxide is at \$29/pound.

**Figure 5-1: Weighted-Average Price of Uranium Purchased by Owners and Operators of U.S. Civilian Nuclear Power Reactors, 1994-2013 (dollars per pound U3O8 equivalent)<sup>14</sup>**



- The current market for nuclear fuel (i.e. prices for new contracts) is under downward price pressure and is expected to stay this way for the near-term.
  - Changes in spot nuclear fuel cost have a limited impact on the cost of nuclear generated electricity. Nuclear fuel is generally purchased through long-term contracts and amortized over multiple years. In addition, fuel costs are a smaller percentage of total nuclear power cost than with other technologies (approximately 30 percent versus 78 percent and 89 percent for coal and gas, respectively).<sup>15</sup>

## Uranium Mining

- Currently, over 90 percent of uranium used in commercial nuclear reactors in the United States is imported.<sup>16</sup>

A uranium oxide resource has been identified in Pittsylvania County, in the southern region of Virginia. The resource is estimated to contain 119 million pounds of uranium oxide (at a 0.025 percent uranium oxide cutoff).

Since 1983, Virginia has had a moratorium on uranium mining. It is expected that the moratorium will remain in place for the foreseeable future.

A number of studies have been conducted and published related to uranium mining in Virginia. These include:

<sup>14</sup> <http://www.eia.doe.gov>

<sup>15</sup> <http://www.world-nuclear.org/info/Economic-Aspects/Economics-of-Nuclear-Power/>

<sup>16</sup> <http://www.eia.doe.gov>

- The National Academy of Sciences study, commissioned by the Virginia Coal and Energy Commission
- Chmura Economics and Analytics Socioeconomic Study, commissioned by the Virginia Coal and Energy Commission
- RTI Socioeconomic Study, commissioned by the Danville Regional Foundation
- Michael Baker Corporation Study, commissioned by the City of Virginia Beach
- Michael-Moran Associates, LLC study, commissioned by the Roanoke River Basin Association
- Hazen and Sawyer/Tetra Tech study, commissioned by Fairfax Water

**Figure 5-2: Map of Coles Hill Uranium Deposit**

