VIRGINIA'S NUCLEAR WORKFORCE NEEDS

Prepared for

Virginia Innovative Nuclear Hub

JUNE 2025

MANGUM economics

804-322-7777

MANGUMECONOMICS.COM

About Mangum Economics, LLC

Mangum Economics is a Glen Allen, Virginia based firm that was founded in 2003. Since then, we have become known as a leader in industry analysis, economic impact assessment, policy and program evaluation, and economic and workforce strategy development. The Mangum Team specializes in producing objective and actionable quantitative economic research that our clients use for strategic decision making in a variety of industries and environments. We know that our clients are unique, and that one size does not fit all. As a result, we have a well-earned reputation for tailoring our analyses to meet the specific needs of specific clients, with a specific audience.

Most of our research falls into four general categories:

- **Economic Development and Special Projects:** The Mangum Team has performed hundreds of analyses of proposed economic development projects. The Mangum Team has also authored multiple economic development plans, including identifying industry recruitment opportunities created by the high-speed MAREA and BRUSA sub-sea cable landings in Virginia Beach.
- **Energy:** The Mangum Team has produced analyses of the economic and fiscal impact of over 29 GW of proposed solar, wind, battery, and hydro projects spanning eighteen states. Among those projects was Dominion's 2.6 GW Coastal Virginia Offshore Wind project off of Virginia Beach. In addition, the Mangum Team has also performed economic and fiscal impact analyses for the natural gas, nuclear, oil, and pipeline industries.
- **Information Technology:** Working with some of the largest names in the business, the Mangum Team has produced analyses of the economic and fiscal impact of data centers at the state and local level across the country.
- **Policy Analysis:** The Mangum Team also has extensive experience in identifying and quantifying the intended and unintended economic consequences of proposed legislative and regulatory initiatives.

The Project Team

Fletcher Mangum, *Founder and CEO*

Brian Kroll, M.A., *Senior Research Analyst*

Table of Contents

Executive Summary

In this report, we provide estimates of the workforce required to support an expansion of the nuclear power industry in Virginia. The most salient findings from that analysis are:

1) **Virginia's demand for electricity is outpacing supply.**
   - An independent forecast commissioned by Virginia's Joint Legislative and Review Commission recently found that demand for electric power in Virginia could double within the next ten years.
   - In February 2023, PJM reported that region-wide the pace at which new generation resources were being brought online would soon be insufficient to keep up with expected retirements and projected demand growth.
2) **Nuclear energy, in combination with renewable and more traditional energy sources, is uniquely positioned to be a key part of the solution to that problem.**
   - Nuclear energy is carbon-free and a baseload power source capable of reliably producing electricity 24 hours a day, seven days a week, regardless of weather conditions or the time of day.
   - Expansion of nuclear power in Virginia will most likely be accomplished through the deployment of Small Modular Reactors (SMRs). SMRs are advanced nuclear reactors that can vary in size from tens of megawatts up to hundreds of megawatts.
   - SMRs have a relatively small physical footprint compared to alternative generation facilities, which means they can be sited in a wide range of locations.
   - SMRs are modular, which means that they can be prefabricated and then shipped to and installed on site.
   - SMRs also provide enhanced safety performance because they rely on passive safety systems where no human intervention or external power is required to shut down the system.
3) **The Nuclear Power Industry already has a significant footprint in Virginia.**
   - BWXT, located in Lynchburg, builds the systems that power the U.S. Navy's nuclear-powered submarine and aircraft carrier fleets, and also supplies components and fuel for commercial reactors around the world.
   - Framatome, also located in Lynchburg, specializes in the design, manufacture, construction, and maintenance of nuclear power systems within the U.S. and internationally.
   - Bechtel, located in Reston, was responsible for constructing Vogtle Units 3 and 4, the first two new nuclear reactors built in the U.S. in over 30 years.

- Newport News Shipbuilding, located in Newport News, is the sole designer, builder, and fueler of nuclear aircraft carriers in the U.S. and one of only two U.S. shipyards capable of designing and building nuclear submarines.

4) **Virginia's capacity to expand its Nuclear Power Industry is contingent on the state's ability to provide the necessary workforce.**

   - According to a report by the U.S. Department of Energy, between 2023 and 2050, nationwide 200 GW of coal-powered baseload generation units are expected to retire and "as utilities begin to retire these fossil assets, advanced nuclear is uniquely positioned to replace [those] assets with a similar electricity profile."
   - The report also estimates that expanding the nuclear power industry to fill that nationwide void will require 275,000 nuclear power workers by 2050 in addition to the 100,000 that are already employed in the industry. That means that nationwide the industry's workforce would need to almost quadruple.

5) **Nuclear Workforce GAP analysis.**

   - We estimate that deployment of one representative 300 MW SMR in Virginia would:
     - Support approximately 305 full-time equivalent jobs annually over a six year construction period, with an average wage of approximately $56,550 a year.
     - Support approximately 141 full-time equivalent jobs annually after the unit became operational, with an average wage of approximately $76,460 a year.
   - Both Dominion Energy and Appalachian Power have publicly announced plans to construct a SMR in Virginia. To assess Virginia's likely nuclear workforce needs, we build on those two announced SMR projects to assume a total of six 300 MW SMR units could be built in Virginia over a 21-year period.
   - Comparing the annual demand for workers necessary to support the deployment of those units, to the pipeline of graduates from Virginia's public and private colleges and universities in programs associated with those occupations, shows that the state could experience several workforce gaps.
   - Among those are shortfalls in trained workers to fill the following occupations:
     - Chemical Technicians.
     - Civil Engineering Technologists and Technicians.
     - Civil Engineers.
     - Computer Network Support Specialists.
     - Electrical Engineers.
     - Environmental Engineers.
     - Heating, Air Conditioning, and Refrigeration Mechanics and Installers.

- Information Security Analysts.
- Network and Computer Systems Administrators.
- Nuclear Engineers.
- Nuclear Technicians.
- Occupational Health and Safety Specialists.
- Stationary Engineers and Boiler Operators.

Introduction

In this report, we provide estimates of the workforce required to support an expansion of the nuclear power industry in Virginia. This report was commissioned by the Virginia Innovative Nuclear Hub (VIN-Hub) and produced by Mangum Economics.

The Issue

Nuclear energy is a clean, baseload energy source, which means that it is carbon-free and is capable of reliably producing electricity 24 hours a day, seven days a week, regardless of weather conditions or the time of day. Virginia is currently facing a combination of trends that are causing its projected demand for electric power to outpace supply. Nuclear energy, in combination with renewable and more traditional energy sources, is uniquely positioned to be a key part of the solution to that problem. However, nuclear energy's ability to play that role is in no small way contingent on Virginia's ability to supply the workforce necessary to support the industry.

Virginia's Demand for Electricity is Outpacing Supply

According to Virginia Electric and Power Company's (Dominion Power's) 2024 Integrated Resource Plan, driven by electrification (*e.g.*, electric vehicles) and construction of new data centers to meet the needs of AI (*e.g.*, ChatGPT) and rapidly expanding consumer services (*e.g.*, self-driving cars, streaming, and GPS), peak electricity demand is growing faster in Dominion's territory than in any other part of the PJM regional transmission organization.[1] An independent forecast commissioned by Virginia's Joint Legislative and Review Commission provided additional support for that assessment, finding that demand for electric power in Virginia could double within the next ten years.[2]

Unfortunately, generation capacity is not keeping pace with that increased demand. In February 2023, PJM reported that region-wide the pace at which new generation resources were being brought online would soon be insufficient to keep up with expected retirements and projected demand growth.[3] And in Virginia specifically, where natural gas powered facilities currently account for approximately 60 percent of the state's generation capacity, the total retirement of those facilities by 2045, as mandated by the 2020 Virginia Clean Energy Act, is also likely to cause available generation capacity to fall behind growing demand.[4]

---

[1] Virginia Electric and Power Company, "2024 Integrated Resource Plan," filed with the Virginia State Corporation Commission, October 15, 2024. PJM is the regional transmission organization that coordinates the movement of electricity through all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, **Virginia**, West Virginia and the District of Columbia.
[2] Joint Legislative and Review Commission, "Data Centers in Virginia," December 9, 2024.
[3] Virginia Electric and Power Company, "2024 Integrated Resource Plan," filed with the Virginia State Corporation Commission, October 15, 2024.
[4] Virginia Department of Energy, "The Commonwealth of Virginia's 2022 Energy Plan," October 3, 2022.

In addition, that looming supply shortage is being further exacerbated by changes in the composition of Virginia's electric generation portfolio. Where intermittent renewable energy facilities such as wind and solar currently account for approximately 5 percent of Virginia's generation capacity, by 2045 they are expected to account for 72 percent.[5] Because the availability of renewable energy is dependent on weather conditions and the time of day, it is not reliably dispatchable. That means it cannot be relied upon to address daily or weather-related spikes in the demand for electricity.

For that reason, absent significant advancements in technology, the integration of such a large volume of intermittent generation capacity will likely be problematic for grid reliability. Although evolving technologies such as battery storage may partly mitigate this issue, the more probable outcome is that Virginia will become more reliant on importing baseload electric power from other states in PJM, many of which will be experiencing their own capacity shortfalls and may not be in a position to supply the additional power.

Advantages of Nuclear Power

As discussed earlier, nuclear energy is carbon-free and a baseload power source capable of reliably producing electricity 24 hours a day, seven days a week, regardless of weather conditions or the time of day. Four of the nation's 94 commercial nuclear reactors are located in Virginia where they have been in operation for over half a century.[6] Nuclear power currently accounts for approximately 30 percent of Virginia's electric power generation.

Expansion of nuclear power in Virginia will most likely be accomplished through the deployment of Small Modular Reactors (SMRs). SMRs are advanced nuclear reactors that can vary in size from tens of megawatts up to hundreds of megawatts. As the name implies, their most salient characteristics are that: 1) they have a relatively small physical footprint compared to alternative generation facilities, which means they can be sited in a wide range of locations, and 2) they are modular, which means that they can be prefabricated and then shipped to and installed on site.

In addition to these advantages, SMRs also provide enhanced safety performance because they rely on passive safety systems where no human intervention or external power is required to shut down the system. Furthermore, because SMRs are factory-built as opposed to constructed on site, construction schedules and costs are minimized, while the accumulated experience gained from standardization ensures that quality is improved.

Finally, it is important to realize that by providing a zero-emission baseload power source to complement intermittent and non-dispatchable sources such as wind and solar, SMRs can play a key role in the transition to clean energy while still maintaining grid reliability – a key consideration given the current trend toward electrification of cars and many other components of modern life. That is why

[5] Virginia Department of Energy, "The Commonwealth of Virginia's 2022 Energy Plan," October 3, 2022.
[6] Data Source: Nuclear Energy Institute.

both the U.S. and Virginia Departments of Energy have identified SMRs as a key part of their goal to develop safe, clean, and affordable nuclear options.

The Nuclear Power Industry Already has a Significant Footprint in Virginia

It is also important to realize that Virginia is already home to several global leaders in the nuclear power industry:

- BWXT, located in Lynchburg, builds the systems that power the U.S. Navy's nuclear-powered submarine and aircraft carrier fleets, and also supplies components and fuel for commercial reactors around the world.
- Framatome, also located in Lynchburg, specializes in the design, manufacture, construction, and maintenance of nuclear power systems within the U.S. and internationally.
- Bechtel, located in Reston, was responsible for constructing Vogtle Units 3 and 4, the first two new nuclear reactors built in the U.S. in over 30 years.
- Newport News Shipbuilding (Huntington Ingalls Industries), located in Newport News, is the sole designer, builder, and fueler of nuclear aircraft carriers in the U.S. and one of only two U.S. shipyards capable of designing and building nuclear submarines (including the nation's newest class of attack submarines, the Virginia class).

In addition, Virginia is also home to two federal facilities – NASA Langley and the Norfolk Naval Shipyard – that are actively engaged in nuclear research and development.

Moreover, as a sample of recent headlines demonstrates, Virginia's nuclear power sector is growing:

- *BWXT team lands $30B federal nuclear contract*, Kate Andrews, Virginia Business, June 14, 2024.
- *Dominion Energy Virginia announced today it is accepting proposals for a first-in-the nation small nuclear reactor at North Anna Power Station in Louisa County*, Virginia Public Media, Patrick Larsen, July 10, 2024.
- *Navy considers four Virginia sites for nuclear energy expansion*, Virginia Department of Energy news release, October 11, 2024.
- *Dominion files energy plan that includes more wind, nuclear*, Virginia Business, Kate Andrews, October 15, 2024.
- *Amazon, Dominion agree to explore nuclear development*, Virginia Business, Courtney Mabeus-Brown, October 30, 2024.
- *Appalachian Power plans small nuclear reactor in Campbell*, Virginia Business, Beth JoJack, November 29, 2024.
- *BWXT wins $2.1B in U.S. Naval Nuclear Propulsion Program contracts*, Virginia Business, Beth JoJack, February 20, 2025.

- *Roanoke/New River Big Deal: Framatome expands for a small modular future*, Virginia Business, Mike Gangloff, February 27, 2025.
- *Lynchburg's BWXT unveils Innovation Campus*, Virginia Business, Beth JoJack, March 26, 2025.

Nuclear Workforce

There is a growing realization that renewable energy alone will be insufficient to provide a carbon-free solution to our exponentially increasing demand for electricity caused by the rapid transition to electrification and our ever-growing dependence on data. That realization is driving an increased interest in nuclear power as our only available carbon-free baseload power source. However, expansion of nuclear power in the U.S. and Virginia is contingent on meeting the industry's need for additional workers.

According to a report by the U.S. Department of Energy, between 2023 and 2050 200 GW of coal-powered baseload generation units are expected to retire.[7] The report further states that, "as utilities begin to retire these fossil assets, advanced nuclear is uniquely positioned to replace [those[assets with a similar electricity profile."[8] But, the report also estimates that doing so will require 275,000 nuclear power workers by 2050 in addition to the 100,000 that are already employed in the industry. Which means the industry's workforce will need to almost quadruple.

To make matters worse, the nuclear power industry is already facing headwinds in meeting its workforce needs. According to the U.S. Department of Energy's 2024 energy employment report, "the nuclear [electric power generation] workforce trends older than the energy workforce average," with a larger proportion of workers at or nearing retirement age.[9] Moreover, the pipeline of recent graduates necessary to replace those retirees is declining. As reported in a recent Wall Street Journal report entitled *Shortfall in Young Engineers Threatens Nuclear Renaissance*, "between 2012 and 2022, the number of students graduating with bachelor's degrees in nuclear engineering in the U.S. fell by 25 percent."[10]

In short, to realistically meet our goals for carbon reduction, the U.S. and Virginia need nuclear power and the nuclear power industry needs trained workers.

Estimated Workforce Needs

In this section, we provide a high-level estimate of the trained workers that will be needed to facilitate the expansion of Virginia's nuclear power industry. We then compare that estimate to the current pipeline of students graduating from associated educational programs to identify potential "gaps"

---

[7] U.S. Department of Energy, "Pathways to Commercial Liftoff: Advanced Nuclear," March 2023.
[8] "Pathways to Commercial Liftoff," p.27.
[9] U.S. Department of Energy, "United States Energy and Employment Report 2024," October 1, 2024, p.39.
[10] Wall Street Journal, "Shortfall in Young Engineers Threatens Nuclear Renaissance," Yusuf Kahn, September 11, 2024.

between demand and supply. The method used to accomplish this analysis is not new and has been successfully employed in multiple other studies.[11]

Demand for Nuclear Workers

Our analysis starts with the development of a detailed staffing matrix for both the construction and operations of a representative 300 MW SMR. Those staffing matrices are based on an extensive review of the existing literature and a list of pertinent references is provided at the end of this report.

Each staffing matrix included data on the specific occupations involved by U.S. Bureau of Labor Statistics (BLS) Standard Occupation Code (SOC) and the estimated number of workers required in each occupation. In the next step of the process, we mapped those occupations into data from BLS on existing employment and average wages in 2024, and data from the Virginia Department of Workforce Development and Advancement on statewide projected annual openings in each occupation between 2020 and 2030.

Based on that analysis, we estimate that:

- Construction of a representative 300 MW SMR will support approximately 305 full time equivalent jobs annually, over a period of approximately six years, and the average wage for those jobs will be approximately $56,550 a year.
- Operation of a representative 300 MW SMR will support approximately 141 full time equivalent jobs annually and the average wage for those jobs will be approximately $76,460 a year.

As shown in the headlines presented earlier, both Dominion Energy and Appalachian Power have announced plans to construct a SMR in Virginia.

Building on those two announced SMR projects, if we assume that:

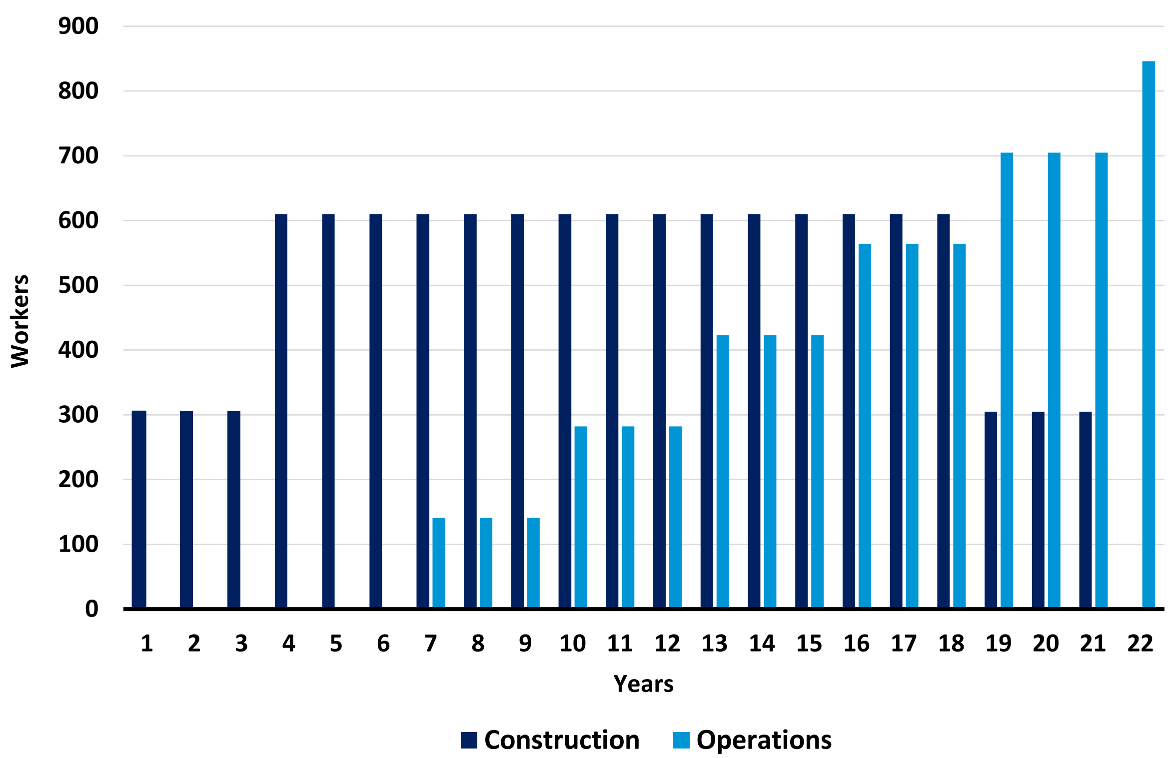
- An additional four SMR projects could be initiated for a total of six over 21 years, with,
- One project initiated every three years,
- The construction period for each project lasting six years, and
- The last of the six SMR projects initiated in year 16 and completed in year 21.

[11] For an excellent exposition of this method see, William J. Drummond and Jan L Youtie, "Occupational Employment, Demand for College Graduates, and Migration: A Statewide View," a report to the Board of Regents, University System of Georgia, 1999. For an example of how this method has been used previously in Virginia see, A. Fletcher Mangum, "System-Wide Needs Assessment for Virginia Education," State Council of Higher Education for Virginia, March 28, 2002, p.90.

Then, as depicted in Figure 1:

- The demand for nuclear construction workers would peak at 610 in year four of the period, remain stable from that point on until the eighteenth year, after which it would decline if no additional projects were initiated.
- The demand for nuclear operations workers would start at 141 in year seven of the period after construction of the first SMR was completed, then grow by an additional 141 workers every three years, reaching 846 workers in year 22, when the last of the six SMRs had been constructed.

Figure 1: Additional Nuclear Workers Necessary to Support Deployment of Six 300 MW SMRs



Supply of Trained Graduates

To estimate the likely supply of trained graduates in Virginia, we use data from the State Council of Higher Education for Virginia (SCHEV) on completions by detailed program area for academic year 2023-2024 for all public and private colleges and universities in Virginia. Those data identify program areas by U.S. Department of Education Classification of Instructional Programs (CIP) Codes and provide detail on the number of students graduating statewide in those programs that year by award level (*e.g.*, certificates, Associate's degrees, Bachelor's degrees, Master's degrees, and Doctoral degrees).

Gap Analysis

In the next step of the analysis, we use a SOC-CIP crosswalk developed jointly by BLS and the U.S. Department of Education to identify the prerequisite education and training programs necessary for entry into each occupation included in the staffing matrices. We then compare the overall annual demand for trained workers in those occupations (***i.e.*, the combined total demand for nuclear workers and workers in all other industries hiring that occupation**) to the annual supply of associated graduates from Virginia public and private colleges and universities to identify potential gaps between the two.

The results of that analysis are presented in Tables 1 and 2 for Nuclear Construction Workers and Nuclear Operations Workers respectively.

In these Tables:

- **Occupation** is the Standard Occupation Code (SOC) title for the occupation being assessed.
- **VA. Avg. Salary** is the average Virginia salary for that occupation in calendar year 2024.[12]
- **Educational Req.** is the typical educational attainment level required for entry in that occupation.[13]
- **Avg. Annual Openings** are the projected average annual openings in that occupation statewide in Virginia for 2020 through 2030, **plus** the average annual additional nuclear workers need to support deployment of six 300 MW SMRs.[14]
- **Certificate, Associates, Bachelors, Masters, Doctorate, and Total** are the degree and non-degree completions associated with that occupation reported by Virginia Private, public, four-year, and two-year colleges and universities in academic year 2023-2024.[15]
- **GAP** is the difference between the pipeline of annual graduates associated with each occupation and the projected average annual openings for that occupation, where a negative number indicates a shortfall of needed graduates.

Table 1 details the results of the gap analysis for the nuclear construction workers that would be required to build six 300 MW SMRs over a 21-year build-out period as identified in our nuclear construction staffing matrix. It is important to note that some of these estimated gaps may be more apparent than real. Recall that the gap analysis compares the overall annual demand for trained workers in each occupation to the annual supply of graduates from Virginia public and private colleges and universities in programs that prepare graduates for that occupation. As detailed in the **Educational Req.** column however, not all of the occupations listed necessarily require a post-secondary degree or certificate and some may be supported by apprenticeship or other workforce training programs.

[12] Data Source: U.S. Bureau of Labor Statistics.
[13] Data Source: U.S. Bureau of Labor Statistics.
[14] Data Source: Virginia Department of Workforce Development and Advancement.
[15] Data Source: State Council of Higher Education for Virginia.

As the data in Table 1 show, the potential shortfalls in the supply of workers in those occupations required in nuclear construction are estimated to be in:

- Electricians (a shortfall of 2,302 graduates).
- First-Line Supervisors of Construction Trades and Extraction Workers (a shortfall of 2,207 graduates).
- Industrial Machinery Mechanics (a shortfall of 1,089 graduates).
- Heating, Air Conditioning, and Refrigeration Mechanics and Installers (a shortfall of 916 graduates).
- Civil Engineers (a shortfall of 521 graduates).
- Construction Managers (a shortfall of 263 graduates).
- Civil Engineering Technologists and Technicians (a shortfall of 150 graduates).
- Structural Iron and Steel Workers (a shortfall of 68 graduates).

Table 2 details the results of the gap analysis for the supply of workers in those occupations required to operate six 300 MW SMRs over a 21-year build-out period as identified in our nuclear operations staffing matrix. Again, it is important to note that some of these estimated gaps may be more apparent than real, because not all of the occupations listed necessarily require a post-secondary degree or certificate.

As the data in Table 2 show, the shortfalls in the supply of trained nuclear operations workers are estimated to be in:

- Laborers and Freight, Stock, and Material Movers, Hand (a shortfall of 7,466 graduates).
- Accountants and Auditors (a shortfall of 3,883 graduates).
- First-Line Supervisors of Mechanics, Installers, and Repairers (a shortfall of 1,506 graduates).
- Network and Computer Systems Administrators (a shortfall of 1,366 graduates).
- General and Operations Managers (a shortfall of 1,156 graduates).
- Information Security Analysts (a shortfall of 1,099 graduates).
- Logisticians (a shortfall of 787 graduates).
- Compliance Officers (a shortfall of 626 graduates).
- Electrical Engineers (a shortfall of 315 graduates).
- Computer Network Support Specialists (a shortfall of 311 graduates).
- Occupational Health and Safety Specialists (a shortfall of 251 graduates).

- Nuclear Engineers (a shortfall of 145 graduates).
- Chemical Technicians (a shortfall of 113 graduates).
- Environmental Engineers (a shortfall of 112 graduates).
- Nuclear Technicians (a shortfall of 100 graduates).
- Stationary Engineers and Boiler Operators (a shortfall of 80 graduates).
- Health and Safety Engineers, Except Mining Safety Engineers and Inspectors (a shortfall of 25 graduates).

Table 1: Gap Analysis for Nuclear Construction Occupations (combined total demand for nuclear construction workers and all other construction workers)

Occupation	VA Avg. Salary	Education Req.	Avg. Annual Openings	Certificate	Associates	Bachelors	Masters	Doctorate	Total Grads	GAP
Civil Engineering Techs	**$74,640**	**Associate's degree**	**188**	14	20	1			**36**	**(150)**
Civil Engineers	**$101,020**	**Bachelor's degree**	**962**			302	113	25	**440**	**(521)**
Construction Managers	**$122,480**	**Bachelor's degree**	**866**	25	62	354	153	7	**602**	**(263)**
Surveyors	**$77,200**	**Bachelor's degree**	**138**	587					**587**	**450**
Brick & Block masons	**$53,960**	**High school diploma or equivalent**	**279**							**N/A**
Control & Valve Installers & Repairers, Except Mechanical Door	**$72,860**	**High school diploma or equivalent**	**85**							**N/A**
Electrical Power-Line Installers & Repairers	**$78,500**	**High school diploma or equivalent**	**304**							**N/A**
Electricians	**$66,630**	**High school diploma or equivalent**	**2,503**	170	25				**195**	**(2,302)**
First-Line Supervisors of Construction Trades & Extraction Workers	**$78,770**	**High school diploma or equivalent**	**2,519**	245	65				**310**	**(2,207)**

Table 1: Gap Analysis for Nuclear Construction Occupations (combined total demand for nuclear construction workers and all other construction workers)

Occupation	VA Avg. Salary	Education Req.	Avg. Annual Openings	Certificate	Associates	Bachelors	Masters	Doctorate	Total Grads	GAP
Helpers--Electricians	$41,840	High school diploma or equivalent	357							N/A
Helpers--Installation, Maint., & Repair Workers	$39,810	High school diploma or equivalent	529							N/A
Helpers--Pipelayers, Plumbers, Pipefitters, & Steamfitters	$39,660	High school diploma or equivalent	350							N/A
Industrial Machinery Mechanics	$65,280	High school diploma or equivalent	1,272	10	14	97	54	6	181	(1,089)
Insulation Workers, Mechanical	$54,940	High school diploma or equivalent	235							N/A
Millwrights	$55,140	High school diploma or equivalent	98	84	285	499	217	20	1,106	1,011
Operating Engineers & Other Construction Equipment Operators	$56,000	High school diploma or equivalent	1,185							N/A
Paving, Surfacing, & Tamping Equipment Operators	$48,250	High school diploma or equivalent	279							N/A

Table 1: Gap Analysis for Nuclear Construction Occupations (combined total demand for nuclear construction workers and all other construction workers)

Occupation	VA Avg. Salary	Education Req.	Avg. Annual Openings	Certificate	Associates	Bachelors	Masters	Doctorate	Total Grads	GAP
Plumbers, Pipefitters, & Steamfitters	$58,820	High school diploma or equivalent	1,801							N/A
Reinforcing Iron & Rebar Workers	$58,860	High school diploma or equivalent	123							N/A
Sheet Metal Workers	$56,580	High school diploma or equivalent	477							N/A
Structural Iron & Steel Workers	$57,630	High school diploma or equivalent	204	34		30	63	1	128	(68)
Welders, cutters, solderers, & brazers	$58,250	High school diploma or equivalent	1,117							N/A
Cement Masons & Concrete Finishers	$50,520	No formal educational credential	386							N/A
Construction Laborers	$42,520	No formal educational credential	3,453							N/A
Floor Layers, Except Carpet, Wood, & Hard Tiles	$49,230	No formal educational credential	56							N/A

Table 1: Gap Analysis for Nuclear Construction Occupations (combined total demand for nuclear construction workers and all other construction workers)

Occupation	VA Avg. Salary	Education Req.	Avg. Annual Openings	Certificate	Associates	Bachelors	Masters	Doctorate	Total Grads	GAP
Helpers--Brick & Block masons, Stone masons, & Tile & Marble Setters	$41,890	No formal educational credential	151							N/A
Helpers--Roofers	$41,340	No formal educational credential	85	25	26	101	78	21	251	168
Roofers	$51,280	No formal educational credential	395							N/A
Heating, Air Cond., & Refrigeration Mechanics & Installers	$61,260	Certificate	1,290	310	59				369	(916)

Table 2: Gap Analysis for Nuclear Operations Occupations (combined total demand for nuclear operations workers and all other operations workers)

Occupation	VA Avg. Salary	Education Req.	Avg. Annual Openings	Certificate	Associates	Bachelors	Masters	Doctorate	Total Grads	Gap
Chemical Techs.	$55,890	Associate's degree	153			33	3	4	40	(113)
Computer Network Support Specialists	$85,490	Associate's degree	649	34	168	108	24	3	337	(311)
Electrical & Electronic Engineering Techs	$87,760	Associate's degree	537	756	109	155			1,019	483
Electro-Mechanical & Mechatronic Techs	$82,580	Associate's degree	53	73	16	30			120	68
Enviro. Engineering Tech.	$53,480	Associate's degree	92							N/A
Nuclear Techs.	$103,960	Associate's degree	102				1		1	(100)
Accountants & Auditors	$95,650	Bachelor's degree	4,868	123	29	589	243		984	(3,883)
Compliance Officers	$85,780	Bachelor's degree	919	2		220	58	12	292	(626)
Electrical Engineers	$124,080	Bachelor's degree	461			92	32	21	145	(315)
Enviro. Engineers	$114,560	Bachelor's degree	115				2		2	(112)
General & Operations Managers	$140,090	Bachelor's degree	5,698	259	410	2,410	1,388	74	4,541	(1,156)

Table 2: Gap Analysis for Nuclear Operations Occupations (combined total demand for nuclear operations workers and all other operations workers)

Occupation	VA Avg. Salary	Education Req.	Avg. Annual Openings	Certificate	Associates	Bachelors	Masters	Doctorate	Total Grads	Gap
Health & Safety Engineers, Except Mining Safety Engineers & Inspectors	$106,080	Bachelor's degree	34	1		0	6	1	8	(25)
Human Resources Managers	$169,190	Bachelor's degree	400	71	176	612	504	99	1,462	1,062
Human Resources Specialists	$86,260	Bachelor's degree	2,690							N/A
Industrial Production Managers	$131,020	Bachelor's degree	200	53	574	551	140	13	1,332	1,133
Information Security Analysts	$136,680	Bachelor's degree	1,969	46			462	362	869	(1,099)
Logisticians	$102,580	Bachelor's degree	1,025			208	20	9	237	(787)
Mechanical Engineers	$105,240	Bachelor's degree	506							N/A
Network & Computer Systems Admin.	$113,980	Bachelor's degree	1,369	0			1	1	2	(1,366)
Nuclear Engineers	$112,970	Bachelor's degree	152		6				6	(145)
Occupation Health & Safety Specialists	$86,980	Bachelor's degree	253				0		0	(251)

Table 2: Gap Analysis for Nuclear Operations Occupations (combined total demand for nuclear operations workers and all other operations workers)

Occupation	VA Avg. Salary	Education Req.	Avg. Annual Openings	Certificate	Associates	Bachelors	Masters	Doctorate	Total Grads	Gap
Training & Developmt. Specialists	$81,200	Bachelor's degree	1,587							N/A
First-Line Supervisors of Mechanics, Installers, & Repairers	$84,540	High school diploma or equivalent	1,530	13	4	8			24	(1,506)
Hazardous Materials Removal Workers	$46,230	High school diploma or equivalent	199							N/A
Helpers--Installation, Maint., & Repair Workers	$39,810	High school diploma or equivalent	526							N/A
Occupation Health & Safety Techs	$59,800	High school diploma or equivalent	56							N/A
Plumbers, Pipefitters, & Steamfitters	$58,820	High school diploma or equivalent	1,795							N/A
Power Plant Operators	$79,000	High school diploma or equivalent	42							N/A
Production, Planning, & Expediting Clerks	$60,970	High school diploma or equivalent	930							N/A
Security Guards	$47,650	High school diploma or equivalent	4,448							N/A

Table 2: **Gap Analysis for Nuclear Operations Occupations (combined total demand for nuclear operations workers and all other operations workers)**

Occupation	VA Avg. Salary	Education Req.	Avg. Annual Openings	Certificate	Associates	Bachelors	Masters	Doctorate	Total Grads	Gap
Shipping, Receiving, & Inventory Clerks	$44,540	High school diploma or equivalent	1,525							N/A
Stationary Engineers & Boiler Operators	$66,460	High school diploma or equivalent	83	2					2	(80)
Instructional Coordinators	$85,310	Master's degree	564							N/A
Laborers & Freight, Stock, & Material Movers, Hand	$41,940	No formal educational credential	7,950	30	67	206	173	8	483	(7,466)
Electrical & Electronics Repairers, Powerhouse, Substation, & Relay	$86,690	Postsecondary nondegree award	77	103	5	0			108	32

References

CIP-SOC Crosswalk:

Bureau of Labor Statistics and the National Center for Education Statistics

Completions Data:

State Council of Higher Education for Virginia
C01A2: Completions, Program Detail

Occupational Employment and Wages:

Bureau of Labor Statistics

SMR Operations Workforce:

Skills and Occupations
Small Modular Reactors (SMRs) in Nuclear Energy: A New Era and Emerging Job Opportunities
MRINETWORK

Advanced Nuclear Technology- Using Technology for Small Modular Reactor Staff Optimization
Electric Power Research Institute

Staffing requirements for future small and medium reactors (SMRs) based on operating experience and projections
International Atomic Energy Agency

Staffing Investigation, New Nuclear in Norway
Kärnkraftsäkerhet och Utbildning AB

Michigan Energy Industry Cluster Workforce Analysis Report
Michigan Center for Data and Analytics and the Michigan Department of Labor and Economic Opportunity

Pathways to Commercial Liftoff: Advanced Nuclear
U.S. Department of Energy

Coronado Generating Station Nuclear Feasibility Study
Gateway for Accelerated Innovation in Nuclear

Small Modular Reactors- An Assessment of Workforce

African Research Universities Alliance, Stellenbosch University, Nuclear Engineering Department, Khalifa University, Grenoble Alpes University

United States Energy & Employment Report 2024
U.S. Department of Energy

Nevada's Clean Energy Sector 2025
Nevada Governor's Office of Economic Development

7 Nuclear Careers that Don't Require and Engineering Degree
U.S. Department of Energy, Office of Nuclear Energy

Growth Forecasts and Trends

Nuclear Workforce Data – A Scenario-based Approach to nuclear workforce planning
Nuclear Skills Strategy Group

Pathways to Commercial Liftoff: Advanced Nuclear
U.S. Department of Energy

2023 Energy Workforce Survey Results
Center for Energy Workforce Development

SMR Construction Workforce:

Skills and Occupations

SMRs in Nuclear Energy- A New Era and Emerging Job Opportunities
MRINETWORK

Nevada's Clean Energy Sector 2025
Nevada Governor's Office of Economic Development

Nuclear Energy Supply Chain Deep Dive Assessment
U.S. Department of Energy

Michigan Energy Industry Cluster Workforce Analysis Report
Michigan Center for Data and Analytics and the Michigan Department of Labor and Economic Opportunity

Growth Forecasts and Trends

Pathways to Commercial Liftoff: Advanced Nuclear
U.S. Department of Energy