

TECH'S IMPACT ON **washington**



Power

SEPTEMBER 2017



INTRODUCTION

Washington state's electricity industry powers nearly 2 million households and more than 200,000 businesses. Technology plays a critical role throughout the state in power generation, transmission, distribution, and consumption. Ninety percent of Washington's electricity comes from hydropower, solar, and wind, compared to just 11 percent nationwide. Renewables, as well as efficient building management systems rely heavily on technology.

HARNESSING ENERGY

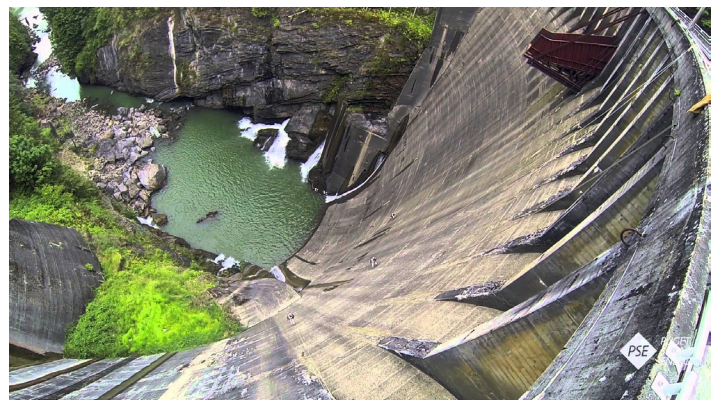
Technology plays a critical role in energy production, especially in areas of solar, wind, and hydro, but also biomass, geothermal, and nuclear. Companies leverage technology platforms to realize the potential of energy resources and reduce waste.

Washington's power generation and distribution industry relies heavily on engineers, computer and software developers, and network and web development experts in tech-oriented roles. In 2016, almost 1,970 people were employed in STEM jobs in the state's power generation and distribution sector, or 15 percent of total jobs in the sector. STEM jobs overall in Washington are projected to grow at a compound annual growth rate of 2.5 percent between 2015 and 2020, compared to 1.9% total occupational growth for Washington state.

Non-renewable Sources

Bellevue-based TerraPower aims to provide the world with a more affordable, secure and cost-efficient form of nuclear energy through its new technology known as the traveling wave reactor. **The traveling wave reactor converts depleted uranium, a byproduct of the nuclear-fission process, into usable fuel.**

Oil refiners and petrochemical plant owners and operators have been looking for cost-effective and environmentally-friendly energy production systems. ClearSign Combustion Corporation headquartered in Seattle has a combustion and emission-control technology that reduces operating costs and offers safety improvements, as well as lowers levels of NOx emissions.



Renewable Sources

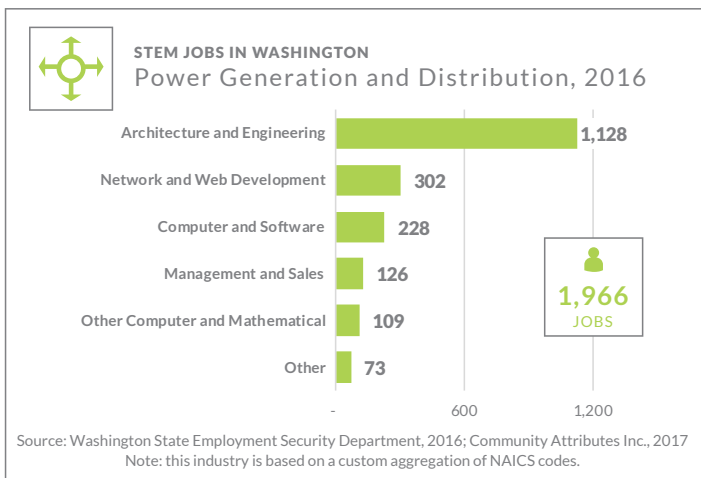
Hydroelectric facilities often have areas inside their generators that are hard to reach for traditional inspection. Puget Sound Energy utilizes drones at their Baker River Hydroelectric Project and the Snoqualmie Falls Hydroelectric Project in Eastern Washington. The drones will increase worker safety while also enhancing the utility's ability to maintain their facilities.

Washington currently ranks ninth in the nation for installed wind capacity. More than 3,000 megawatts of installed capacity make wind energy the second-largest contributor to the state's renewable generation. Offshore wind energy is a growing frontier in the wind sector. Trident Winds—a Seattle-based company—has initiated the development of a **commercial-scale offshore wind farm** off the coast of California.

AltaRock Energy Inc. is a geothermal power technology firm founded in Seattle in 2007. They have a patented enhanced geothermal system technology which, combined with industry expertise, helps reduce investment risk at greenfield geothermal projects and improve conditions and extend the life of existing geothermal wells.

Data analysis is increasingly important in the energy sector, particularly for modeling environmental and ecological conditions for future investments. Seattle-based 3Tier was founded in 1999 and produces wind, solar, and hydro energy assessments and energy forecasting across the globe. Their products include **energy industry data dashboards, an online tool for users to evaluate potential wind farm sites, a wind forecasting tool, and a solar assessment mapping and due diligence information platform.** In 2013 3Tier was acquired by multinational Vaisala, but continues to operate in Seattle with offices around the world.

DISTRIBUTION, TRANSMISSION, AND STORAGE



Utility system construction requires specialized work, including STEM workers at every stage of construction. Expert, certified high-voltage electricians are needed to work on new or existing high-voltage lines. Engineers and architects develop detailed building plans with the latest computer-assisted design software and tools. Washington's specialized utility construction sector employs almost 160 STEM workers, primarily in architecture and engineering occupations.

Schweitzer Engineering Laboratories in Pullman invented the first all-digital relay, which revolutionized the power industry by reducing costs and complexity of power



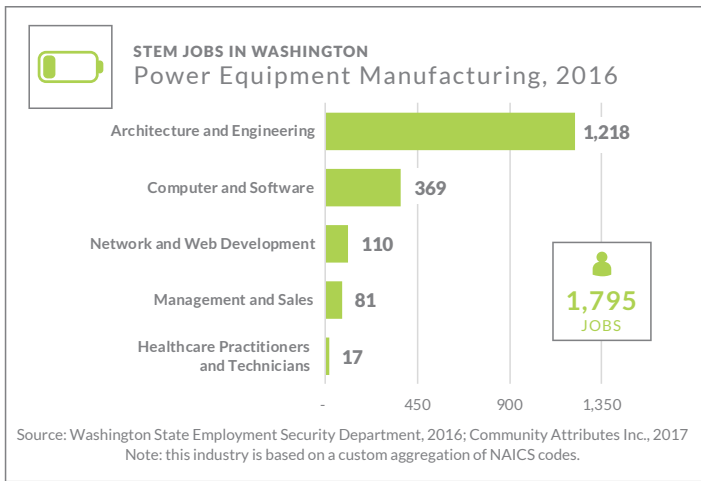
protection. Today, these **computer-based systems that detect electrical faults** are used throughout the US. The Schweitzer digital relays are used in utility and industrial electrical power transmission and distribution systems.

Based in Liberty Lake, Washington, Itron is a leading technology and services company providing solutions that measure and manage electric grids. Itron specializes in the development of smart meters, a critical technology for the smart grid that leverages software and real-time communications to enable optimal real-time responsiveness to electric load demand.

Avista an electric utility company based in Spokane, Washington, selected Itron's smart meters and software for a system-wide upgrade to their electric grid. The company manages the generation, transmission, and distribution of energy to customers in Eastern Washington, Northern Idaho, and Southern and Eastern Oregon. Avista conducted a smart grid study in Pullman, and **provided those customers with a web portal to track energy usage and provide them with alerts to make dynamic adjustments to energy usage.** The systemwide upgrade is expected to increase speed of outage detection as well as real-time usage data.

Several companies in Washington have developed technology solutions to address energy storage. Demand Energy leverages data analytics for distributed energy storage systems. Their solutions include "onsite intelligent energy storage" that allows clients to take advantage of incentive electricity rates, while avoiding high demand charges and time-of-use fees.

Mukilteo-based UniEnergy Technologies (UET) is leading the development of the vanadium flow battery, **a type of battery able to infinitely hold a charge.** UET produces the largest megawatt-scale vanadium flow battery yet, using a molecule developed at the Pacific Northwest National Laboratory



(PNNL). PNNL introduced hydrochloric acid into the battery solution, thereby doubling the storage capacity and making the system work over a far greater range of temperatures.

Doosan GridTech (formed when South Korea-based Doosan acquired Seattle start-up 1Energy Systems as part of its strategy for expanding into the U.S. market) provides megawatt-scale energy storage solutions based on open standards to help utilities integrate renewable energy into their systems. The firm has also developed a distributed energy management software system called DERO that helps electric utilities manage storage, solar and other distributed resources on both sides of the utility meter.

The power sector also enjoys many of the same eco-system features of the tech sector, including the role of university-born start-ups and company spinouts. One such example is Seattle-based EnerG2, founded in 2003 as a start-up out of the University of Washington and in 2016 acquired by BASF. The company specializes in commercial-scale production of carbon materials for energy storage devices. In 2016, EnerG2 announced its own spinout company, Group14 Technologies, specializing in the development of a new low-cost approach to nano-scale silicon production for use in lithium ion batteries. The start-up was recently awarded a \$2.8 million Department of Energy grant to support this work.

ENERGY MANAGEMENT AND CONSUMPTION

Several Washington companies have innovated ways to improve energy efficiencies and optimize distribution, **leveraging big data and systems engineering.**

Smart grid technology, a leading platform for energy efficiency technology, integrates software, metering, and

storage technologies to optimally distribute electricity across a grid. Several Washington firms are at the forefront of smart grid technologies, leveraging Washington's deep pool of expertise in data and software.

South Korean-based Doosan GridTech (which acquired Seattle start-up 1Energy Systems in 2016 as part of its strategy for expanding into the U.S. market) developed and provides energy storage management software solutions based on open standards to help utilities integrate grid-scale storage into their systems. The firm has also developed a distribution energy management system called DERO that integrates utility-scale storage with various behind-the-meter assets.

The role of technology in the power sector includes end-users. Energy management information systems combine software, hardware, and data to help commercial building owners uncover energy-saving opportunities and operate their buildings more efficiently. Spokane's Ecova, in partnership with Verisae Inc has developed a technology and service based solution that allows business owners to continuously monitor facility operations. Their Continuous Monitoring System proactively analyzes data in real-time, even for multisite companies, to detect issues and anomalies in order to predict equipment failure before an issue can arise.

McKinstry represents the intersection of building design and data. Founded in 1960, McKinstry is a full-serve design, build, operation and maintenance firm. They use the latest technologies and design solutions to ensure reduced energy consumption and savings for tenants and building owners.



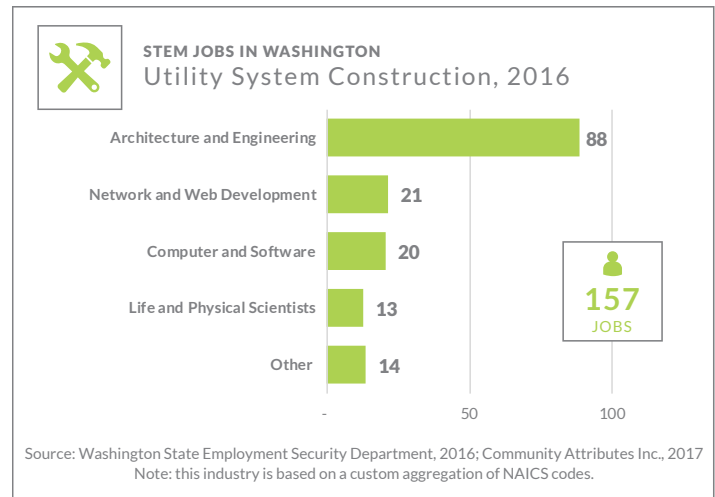
RESEARCH & DEVELOPMENT IN THE ELECTRICITY SECTOR

Some of the most important research in Washington is being focused on the energy sector. Leading research institutions focused on energy and power include the Pacific Northwest National Laboratory and Washington State University, among many others across the state.

Research and development in the power sector is often focused on the specialized machinery and equipment that is used for power generation and distribution. Washington's power equipment manufacturing industry employed almost 1,800 STEM workers in 2016, primarily in engineering roles. Workers in this industry develop new, more efficient tools to generate, distribute and use power.

Development of better technologies for capturing carbon emissions from coal is **addressing the problem of increasing emissions from power generation**. However, much of the challenge is in reducing the costs and time it takes to develop these technologies. Scientists at the Pacific Northwest National Laboratory have found a way to shorten the process of testing the properties of different carbon-capture solvents to a few hours or days through the use of a computational model. The model predicts how easily a solvent will flow and how much carbon it will capture, allowing chemists to focus on the best candidates.

Washington State University led a research initiative that laid the groundwork for the development on an aviation biofuels industry in the Pacific Northwest. In November 2016, **this initiative resulted in a flight, powered by jet fuel made from woody biomass, that flew from Seattle to Washington DC**. Aviation biofuel has a lifecycle carbon footprint that is 50 to 80 percent lower than regular jet fuel. WSU has also been the home of the \$178 million Pacific Northwest Grid Demonstration Project, which has included industry partners such as Avista and Battelle. Research is focused on smart metering and system visibility, electric grid stability, and power quality and reliability.



The Technology Alliance is a statewide, non-profit organization of leaders from Washington's technology-based businesses and research institutions. These stories were created in conjunction with an interactive website: technology-alliance.com/tech-impact-wa



Community Attributes Inc. produced the research, the reports, and the interactive website for *Tech's Impact on Washington*. CAI is based in Seattle, with practice leaders in Denver and San Francisco. CAI provides research and tools to increase awareness, inform decisions, and improve results for our clients and the communities they serve.