2019 New York Clean Energy Industry Report

Letter from NYSERDA President and CEO

I am proud to unveil the results of the third annual New York Clean Energy Industry Report—a critical source of insights that reveals important trends in New York's growing clean energy industry. Under Governor Andrew M. Cuomo's leadership, New York continues to be a national leader in the clean energy transition. This year's report provides further evidence that statewide, residents and businesses are benefitting from the State's growing clean energy economy which is serving as a catalyst for economic development and job growth.

Governor Cuomo's **Green New Deal**, announced in January, is the most aggressive climate change program in the nation, establishing a goal to achieve a **zero-carbon electricity sector by 2040**, faster than any state in the nation, and **70 percent of renewable energy sources such as wind and solar by 2030**. To support the Governor's bold program, New York passed the **Climate Leadership and Community Protection Act** which mandates a **reduction of greenhouse gas emissions by 85% from 1990 levels by 2050**.

New York's push towards Governor Cuomo's goal for a carbon-neutral economy across all sectors is providing the market confidence needed to drive meaningful economic growth and is expected to lead to clean energy job growth all across the State.

Key findings from this year's report include:

- **Nearly 159,000 New Yorkers** are working in the clean energy industry across the State, more workers than the thriving biotech and agriculture industries.
- **New York's clean energy economy saw 8.9% employment growth since 2016**, stronger growth than the State's overall economy which grew 3.4% in that time.
- **Energy Efficiency continues to be the largest clean energy technology category** with 123,292 jobs, or 78% of all clean energy employment in New York.
- **All regions in New York are demonstrating strong clean energy workforce opportunities** that are changing the lives of New Yorkers by providing good paying jobs, cleaner air, and a more sustainable environment.
- **Over 80% of employers who hired clean energy workers in the past year had difficulty hiring**, with incoming talent lacking experience, training, or technical skills as well as industry-specific knowledge.

To address the growing need for a skilled clean energy workforce, the State is continuing to invest in workforce development and training initiatives to establish its pipeline and reduce businesses cost of attracting and hiring new workers. Together, we can change the landscape of New York's green economy by preparing New York's workforce for the industry's growth and employer needs indicated in this year's report.

I am proud that NYSERDA continues to lead the State's unwavering commitment to fighting climate change and engaging the clean energy sector in way a that makes the Governor's bold vision a reality. New York is on a path to a carbon-neutral future that will improve our quality of life, steward our precious natural resources, and create a strong 21st century economy, while serving as a model for other states and the nation.

Alicia Barton — President and CEO, NYSERDA

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The 2019 New York Clean Energy Industry Report was commissioned by NYSERDA to understand the size and composition of the State's clean energy economy. This multi-year, longitudinal research study analyzes data on clean energy jobs, employer needs, and existing assets to inform policies that will help New York meet its climate goals and create jobs and economic opportunity within its borders.

nearly

159,000

clean energy jobs across New York in 2018

since 2016,

clean energy employment has grown by

12,966

that's **8.9%**

7,200

jobs created as a result of clean energy growth in 2018

energy efficiency firms

largest component of New York's clean energy economy and among the fastest growing with **123,000** employed in 2018

Executive Summary

Under Governor Andrew M. Cuomo, New York has established itself as a clean energy leader with our nation-leading clean energy goals and aggressive fight against climate change. The **2019 New York Clean Energy Industry Report** clearly shows that as a result of the State's bold energy policies, New York's clean energy economy continues to drive economic development and employment growth. Today's budding green economy is creating an opportunity to change the landscape of New York's workforce through investments in clean energy workforce development and training. With a majority of clean energy businesses expressing difficulty hiring workers, NYSERDA is committed to establishing a pipeline of workers to meet the significant demands of this growing industry.

In January, Governor Cuomo announced his Green New Deal-the most aggressive climate change program in the nation - putting the State on a path to being entirely carbon-neutral across all sectors of the economy and establishing a goal to achieve a zero-carbon emissions electricity sector by 2040, faster than any state in the nation.

The Green New Deal calls for an unprecedented ramp up in renewable energy—**70 percent renewable energy by 2030**, which includes installing **9,000 megawatts of offshore wind by 2035**, **6,000 megawatts of distributed solar by 2025** and **3,000 megawatts of energy storage by 2030**.

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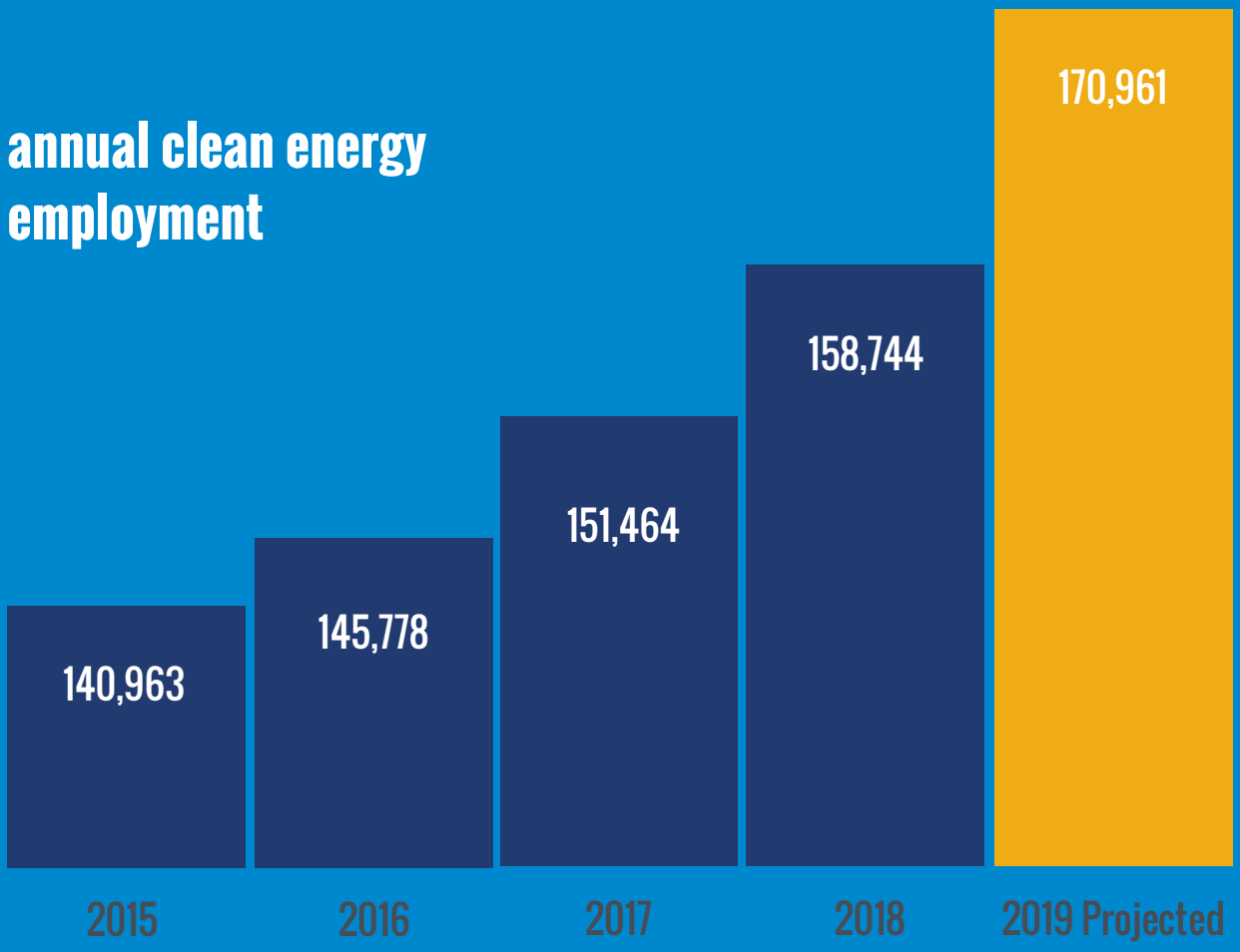
New York's landmark climate bill, the **Climate Leadership and Community Protection Act (CLCPA)**, adopted in July codifies the Governor's ambitious Green New Deal clean energy goals, and mandates **reducing greenhouse gas emissions 85 percent below 1990 levels by 2050**, setting a new standard for states and the nation to expedite the transition to a clean energy economy. To ensure no community is left behind in the clean energy transition, New York State agencies and authorities will work collaboratively with stakeholders toward a goal of investing **40 percent of clean energy and energy efficiency resources to benefit disadvantaged communities**.

New York's ambitious clean energy and climate goals have had a significant impact on New York State's clean energy economy.



Principles of **just transitions** are critical to equitable economic growth in the State. As clean energy increasingly plays a role in the New York economy, some workers may find themselves needing to train for different skills. Just transitions include a broad set of activities such as environmental justice in siting activities, helping displaced workers find jobs in new or adjacent industries, and developing programs and policies to provide access to employment opportunity for traditionally underrepresented populations such as women and people of color.

The **2019 New York Clean Energy Industry Report** compares data on clean energy jobs, geographic distribution, and employee needs.

It reveals important patterns and trends to inform policy recommendations on how to meet New York's climate goals, help create jobs, and drive economic opportunity across the State.

Below is a summary of the key findings:

in 2018
clean energy
employment
in New York
increased 4.8%
to nearly
159,000 workers

Clean energy employment continued to outpace national clean energy employment and statewide overall employment.

- In 2018, clean energy employment **in New York increased 4.8%** to nearly 159,000 workers, while increasing 2.7% nationally.[1]
- Since 2016, employment growth in the clean energy industry outpaced the overall New York economy. While overall employment in New York increased by 3.4%,[2] clean energy employment in the State increased by more than **double that rate at 8.9%**.
- Clean energy-related employment also accounted for a high proportion of overall employment growth across all sectors in New York accounting for approximately 6.7% of the 168,800 jobs created in New York in 2018.

Clean energy employers predicted hiring would continue to accelerate.

Employers and stakeholders were optimistic about continued growth in these sectors and reported that they **expect 7.7% job growth in 2019**, which would add more than 12,000 jobs.

Intensity of clean energy jobs also increased in 2018.

Intensity, or the amount of time a clean energy worker spends on clean energy projects, increased in every clean technology studied, meaning that while the number of clean energy workers in the state increased, the amount of time those workers spent on clean energy projects increased as well.

grid modernization and energy storage saw 35% job growth in 2018

Energy efficiency provided the majority of clean energy jobs.

Energy efficiency employment accounted for nearly 78% of all clean energy employment in New York. In 2018, energy efficiency employment grew 5% adding nearly 6,000 new jobs. Grid modernization and storage also stood out over the last year showing job growth of more than 35%.

Hiring remained difficult for most clean energy employers.

Over 80% of clean energy employers who hired within the past 12 months reported at least some difficulty hiring—up 10% since last year—and nearly three out of every ten (28%) respondents stated it was very difficult. Hiring difficulty was linked primarily to applicants lacking experience, training, or technical skills, and the occupations most frequently cited as difficult were technicians or mechanical support positions, sales, marketing, customer service, and management positions.

Wages, salaries, and benefit rates were high among most clean energy industries.

The average and median hourly **wages for clean energy workers were $28.11 and $21.00, respectively**. The average annual salary was $82,420 and the median annual salary was $65,000. A sampling of occupational profiles indicated that many clean energy occupations had wage premiums at entry-level jobs (+32%), and mid-level jobs (+12%), but that these premiums were not observed for jobs requiring individuals with substantial experience (e.g., manager, director). About three-quarters of respondents employed in clean energy technologies received healthcare, retirement, and vacation benefits; this was true for only about half of respondents in construction and building trades.

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installation sector provided the majority of jobs statewide

Construction was a key pathway to clean energy employment.

The installation sector provided 57% of jobs statewide, largely driven by construction trades positions. These positions were often considered more accessible because they rarely require formal higher education. For several of the larger specialized construction trades, such as electricians and HVAC technicians, work associated with clean energy technologies paid substantial premiums, were more likely to have benefits such as health insurance, retirement plans, and paid vacation. Most critically, employers and employees both noted the importance of apprenticeship, prior work experience, and on-the-job training for candidates seeking to fill open positions. Sales, distribution, and professional services also stood out as opportunities for employment with the greatest employment growth rates around 12% between 2016 and 2018.

New York residents felt clean energy is important.

84% of people said that they believe attempts to reduce carbon emissions were worthwhile because of the importance of improving human health, reducing pollution, and mitigating climate change. A majority, or 51%, of the nearly 2,000 respondents reported they feel that society is not doing enough nationally or locally to combat climate change, while 24% think we're doing just the right amount. Notably, these responses were provided prior to the enactment of New York's landmark climate bill, the Climate Leadership and Community Protection Act.

Clean Energy Case Study


Getty Images/kali9

Company Name:
CUNY Building Performance Lab

Business Type:
Schools

Location:
New York, New York

NYSERDA and the City University of New York Building Performance Lab (CUNY) worked with two Capital Region school districts to train and coach their building operators on the principles of building retuning, a process of highly effective ongoing commissioning for HVAC equipment and systems.

Investing in building technicians, engineers, and maintenance staff is a proactive approach to building operation and maintenance. Buildings with Building Automation Systems (BAS) offer a wealth of data related to system performance and energy use, but corrections and improvements are realized only if the operators are able to see the meaning in the data.

Customized Training and Coaching

CUNY worked with facility staff in the Ballston Spa and Saratoga Springs school districts to instruct them on building retuning and how to interpret data from their BAS. Building staff learned skills to monitor, diagnose, and improve the performance of their systems.

Using actual BAS data from their buildings, several opportunities to improve building system operations were discovered

Lessons Learned

- Improved understanding of building systems and control sequences
- Increased knowledge of using BAS, including the ability to save and share trend data
- An appreciation of BAS for diagnostics, troubleshooting, and experimentation well beyond using it to review system status and change set-points
- Confidence to make adjustments within the BAS for improved equipment performance and energy efficiency

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Clean Energy Industry Overview

clean energy jobs grew 4.8% last year

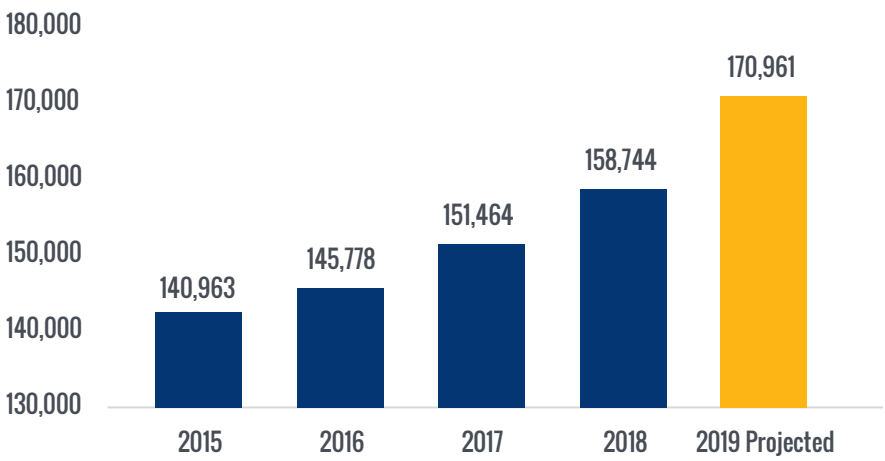
158,744 people employed by clean energy industries in New York State

energy efficiency continued as leading technology of clean energy employment

Overall Employment

As of 2018, the clean energy industry employed 158,744 people in New York State. Clean energy jobs increased 4.8% from 2017 to 2018, outpacing the total job growth of 1.8% in the State and 3.4% nationally.[3] Clean energy employers and stakeholders expect jobs to increase by 12,217—or 7.7%—through 2019.

Figure 1. Annual Clean Energy Employment in New York (2016–2019)[4]



Clean energy employment is spread across five major technology categories which include:

Energy Efficiency - Largest Sector

Energy efficiency technologies are commercially available throughout the State. Includes lighting, ENERGY STAR® appliances (including HVAC), insulation, advanced building materials, renewable heating and cooling, and other efficient technologies.

Renewable Electric Power Generation - Backed by Solar Market

Includes solar, wind, geothermal, low-impact hydropower, and other renewable generation technologies.

Alternative Transportation - Growing Rapidly

Includes electric, hybrid, plug-in hybrid, and fuel cell/hydrogen vehicles, natural gas and other alternative fuel buses, and transportation storage.

Renewable Fuels - 2.5% Growth

Includes biofuels such as wood pellets and ethanol.

Grid Modernization and Storage - Fastest Growing at 35%

Includes smart grid, microgrid, demand response management, and energy storage.

A note about clean energy workers and survey methodology:

Employment data for this report captured all employees from qualifying clean energy firms that spent any portion of their time supporting the research, development, production, manufacturing, distribution, or installation of clean energy products and services. This includes support services such as consulting, finance, tax, and legal services related to clean energy technologies.

As such, employment totals in this report should not be equated to full-time equivalents (FTEs), but instead taken as a total quantification of work in the State's clean energy economy. Survey data captured the number of workers who spent any of their time supporting the clean energy portion of a business.

It is important to note that solar employment in this report will not match numbers reported in The Solar Foundation's (TSF) Solar Census. Where TSF excludes workers who spend less than half their time on solar, the NYCEIR reports total solar employment. As a result, NYCEIR solar employment totals exceed those of TSF.

It is also important to note that employment data excludes any retail employment—i.e., workers at motor vehicle dealerships, appliance and hardware stores, and other retail establishments are not included in the survey.

Employment by Technology

Energy efficiency continued to be the leading technology of clean energy employment in 2018—growing more than 5% and adding nearly 6,000 new jobs—accounting for 77.7% of all clean energy jobs in the State. Alternative transportation, grid modernization, and energy storage also showed robust growth, increasing by 9.4% (743 jobs) and 35.3% (561 jobs), respectively. Renewable electric power generation remained a stable, vital sector of clean energy through 2018, despite seeing nationwide decreases in employment (Table 1).

Figure 2. Employment by Technology in New York (2016–2018)

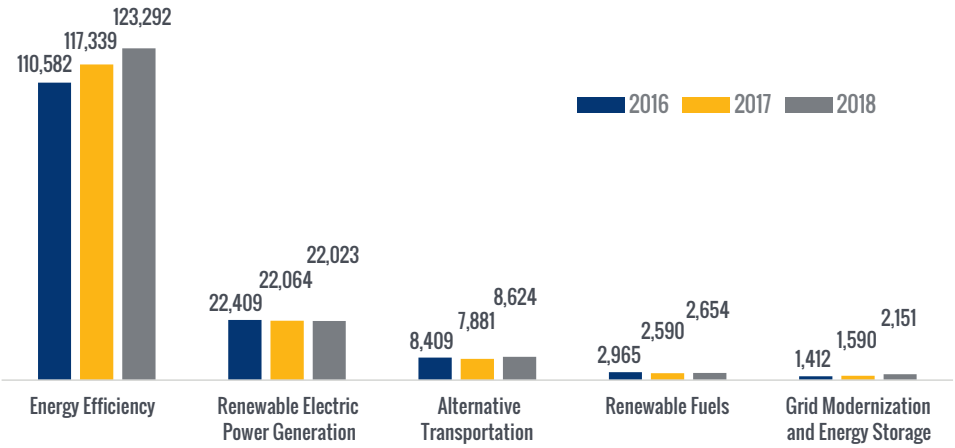


Figure 3. New York Clean Energy Employment by Technology (2018)

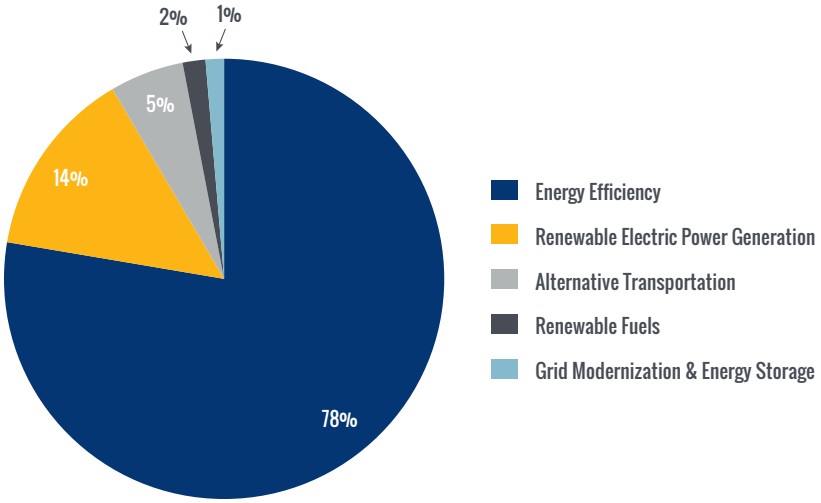
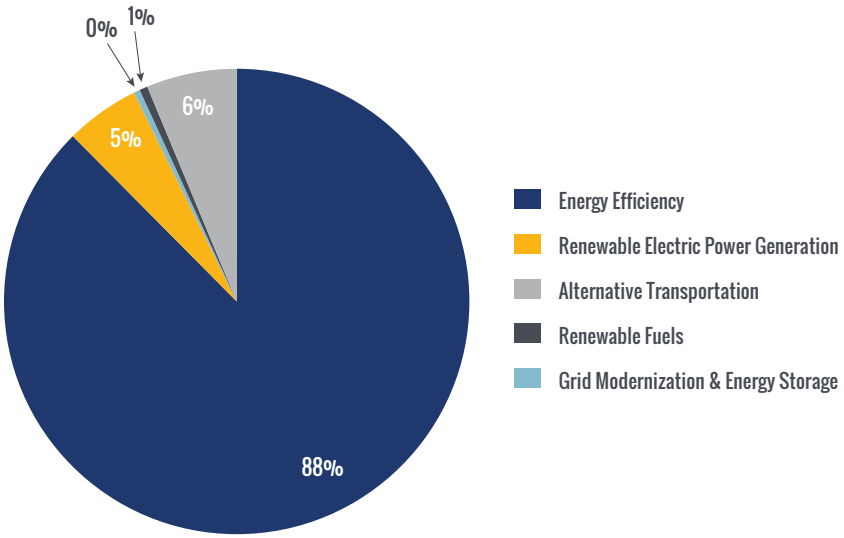


Table 1. Clean Energy Employment Growth by Technology in New York (2016–2018)

	Employment			Change, 2016-18		Change, 2017-18	
Technology	**2016**	**2017**	**2018**		**%**		**%**
Energy Efficiency	110,582	117,339	123,292	12,710	11.49%	5,953	5.1%
Renewable Electric Power Generation	22,409	22,064	22,023	-386	-1.72%	(40)	-0.2%
Alternative Transportation	8,409	7,881	8,624	215	2.56%	743	9.4%
Renewable Fuels	2,965	2,590	2,654	-311	-10.49%	64	2.5%
Grid Modernization and Energy Storage	1,412	1,590	2,151	739	52.34%	561	35.3%

Most clean energy establishments were energy efficiency firms, accounting for more than 10,800 of the 12,371 clean energy establishments across the State. Alternative transportation and renewable electric power generation were the second and third most common types of establishments, accounting for 6% and 5% of all New York clean energy firms.

Figure 4. New York Clean Energy Establishments by Technology (2018)[5]

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Employment by Value Chain

The clean energy value chain represents the underlying industries that support the local economy, such as manufacturing, wholesale trade and logistics, and professional services. Tracking a growing industry's value chain provides insights into innovation activity, highlights regional strengths, and identifies potential opportunities to improve linkages in the region's clean energy activities. For example, a region with particularly strong research, manufacturing, and trade can support local demand for goods and services and presents an opportunity to export this expertise to other areas outside of the region.

Installation had the largest number of clean energy jobs in 2018, exceeding all other sectors of the value chain and capturing 58% of clean energy employment, or 91,651 jobs. However, installation growth between 2017 and 2018 was 4.5%, which was slightly lower than the overall New York clean energy employment growth of 4.8%. Professional services, which include consulting, engineering, finance, legal, and other professional support services, accounted for the second-largest number of jobs (20,396) in the value chain. Other support services (primarily repair and maintenance, administrative support, and facilities management) and sales and distribution had the highest growth rates across the value chain, increasing employment by 11.0% and 7.7%, respectively, between 2017 and 2018. This increase suggests that the industry may be maturing as support roles are growing and streamlining installation and power generation processes to make clean energy activities more efficient. **With the exception of public or private utilities, all components of the value chain increased by 4.9% or more between 2016 and 2018.**

workers shifting between job functions suggest that the clean energy industry may be maturing and streamlining

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Figure 5. Clean Energy Employment by Value Chain (2018)[6]

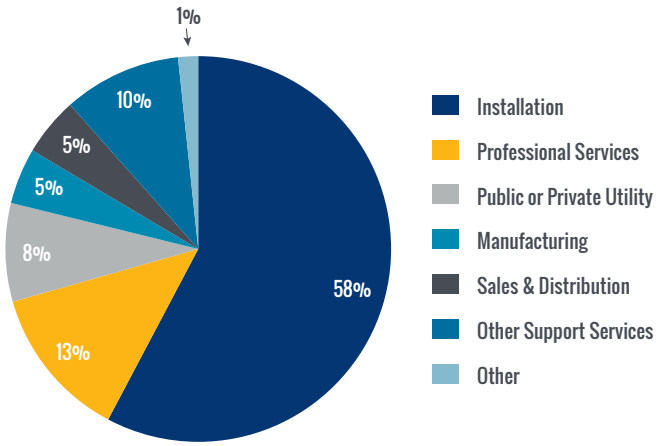
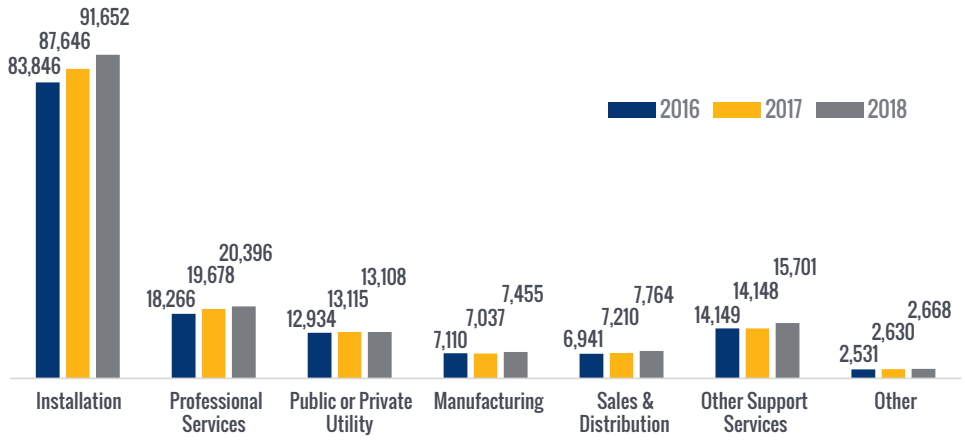


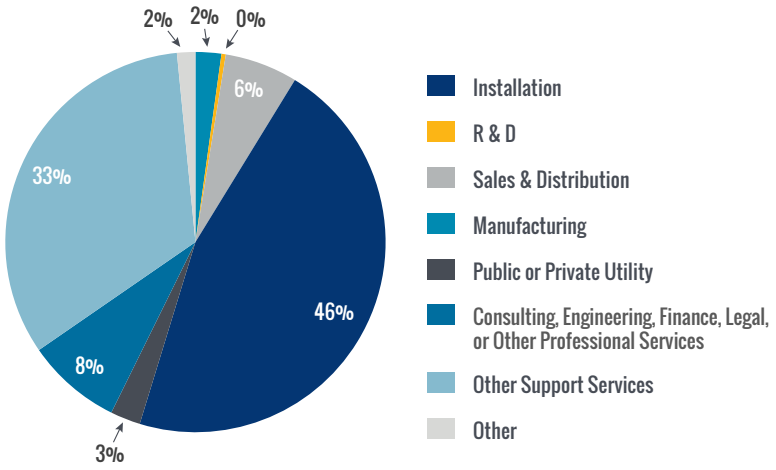
Figure 6. Clean Energy Employment by Value Chain (2016–2018)



There were 12,371 clean energy establishments in New York State. Nearly half (46%) were installation firms, and a third (33%) were other support services firms. This represents a small decrease in manufacturing firms and a modest increase in installation firms since 2017. Consulting, engineering, finance, legal, or other professional services firms were the third-largest aspect of the value chain by number of establishments.

12,371
clean energy establishments in New York State

Figure 7. Clean Energy Establishments by Value Chain[7] 2018 Q4



Demographics and Wages

The demographics of New York's clean energy workforce were shown to differ from a cross-section of the State's population in several respects (Table 2). Most notably, clean energy workers were disproportionately male and white. NYSERDA's workforce training initiatives therefore place a specific emphasis on drawing priority populations, such as minority workers, veterans, or low-income New Yorkers, into the clean energy workforce to help address the current lack of diversity in the industry.

Table 2. New York State Demographics

Category	New York State's population[8]	Clean Energy Workers in New York State[9, 10, 11]		
		All	Renewable Electricity Generation	Energy Efficiency
Female	51.4%	29.0%	27.9%	24.8%
Male	48.6%	71.0%	72.1%	76.0%
White	55.4%	73.2%	73.8%	79.4%
Hispanic/Latinx	19.2%	17.1%	15.9%	14.4%
Black	17.6%	7.9%	7.1%	6.7%
Asian	9.0%	8.4%	7.8%	5.0%
Native American	1.0%	1.2%	1.7%	1.5%
Pacific Islander	0.1%	1.0%	1.0%	0.7%

Wages, salaries, and benefit rates were high among most clean energy industries. A sampling of occupational profiles showed that the highest mid-level wages in both the renewable energy generation and energy efficiency industries were for construction managers and sales representatives (Table 3).

Table 3. Renewable Energy and Energy Efficiency Wages by Occupation

	Renewable Energy Generation Median Hourly Wage			Energy Efficiency Median Hourly Wage		
Career Level	**Entry**	**Mid**	**High**	**Entry**	**Mid**	**High**
Construction Manager	$37.36	$44.89	$63.75	$34.28	$41.55	$62.19
Construction Laborer	$14.15	$23.24	$42.32	$13.59	$22.64	$41.78
Electrician	$20.44	$36.41	$61.87	$19.63	$35.47	$61.08
HVAC Installer	$17.34	$27.16	$41.73	$16.75	$26.21	$41.37
Sales Representative	$22.23	$41.68	$78.22	$19.74	$38.46	$71.64
Team Assembler	$11.99	$16.29	$24.01	$10.95	$14.89	$22.74
Mechanical Insulation Workers	$18.41	$30.66	$55.82	$17.69	$29.86	$55.10

A sampling of occupational profiles indicated that many clean energy occupations have had wage premiums at entry-level jobs (+32%), and mid-level jobs (+12%), but that these premiums were not observed for jobs requiring individuals with substantial experience (Table 4).

Table 4. Renewable Energy and Energy Efficiency Wage Premiums by Occupation

	Renewable Energy Generation Median Hourly Wage			Energy Efficiency Median Hourly Wage		
Career Level	**Entry**	**Mid**	**High**	**Entry**	**Mid**	**High**
Construction Manager	30%	-10%	-29%	19%	-17%	-31%
Construction Laborer	-4%	-16%	-22%	-7%	-19%	-23%
Electrician	39%	31%	14%	34%	28%	13%
HVAC Installer	41%	21%	7%	36%	17%	6%
Sales Representative	74%	38%	21%	54%	27%	11%
Team Assembler	20%	11%	-2%	9%	2%	-8%
Mechanical Insulation Workers	26%	10%	3%	21%	8%	2%

Employment Intensity

Over the past three years, the percentage of clean energy workers who spend all of their time working on clean energy increased. In 2016, 52.9% worked on clean energy full-time, and that number increased to 60.1% by 2018. The percentage of majority-time workers—clean energy workers who spent 50% or more of their time on clean energy—also increased, rising 13% between 2016 and 2018. Increases in worker intensity, both full-time and majority-time was present across all technologies, except for renewable fuels. Between 2016 and 2018, alternative transportation saw the largest increase (25%) in full-time clean energy workers.

Figure 8. Clean Energy – Majority-Time Workers by Technology (2016–2018)

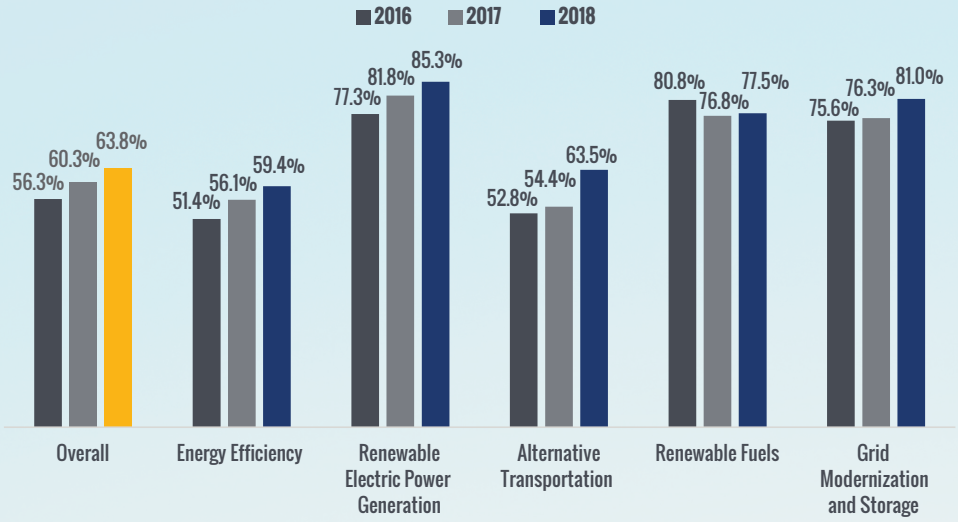
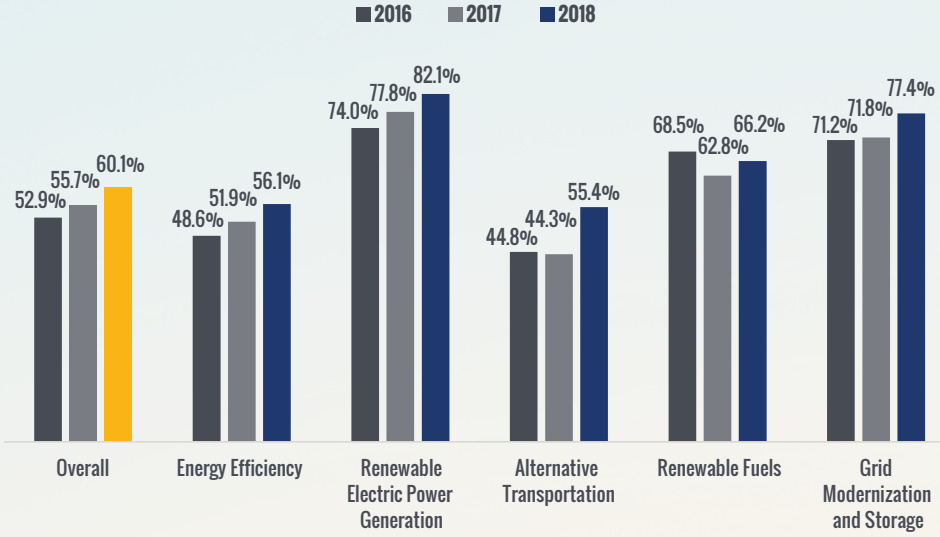
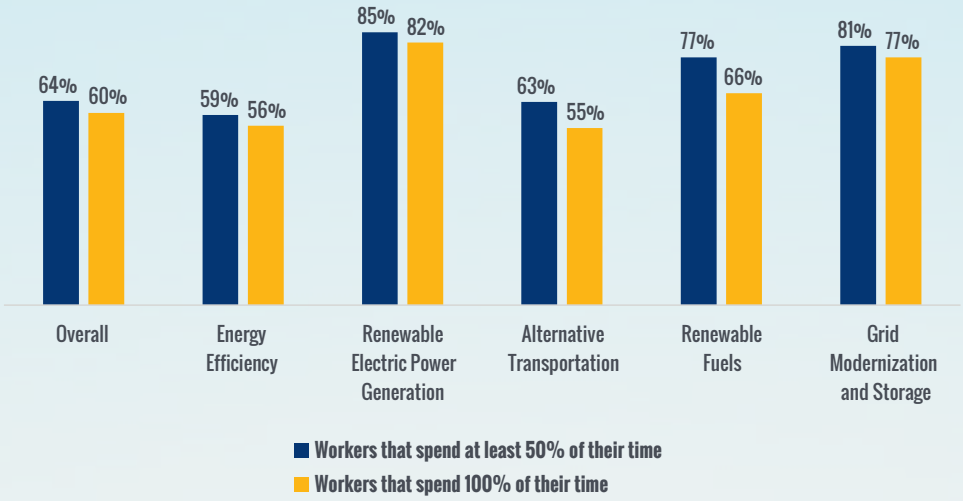


Figure 9. Clean Energy – Full-Time Workers by Technology (2016-2018)



Overall, 64% of all clean energy workers spent at least 50% of their time working on clean energy and 60% spent all their time on clean energy. There was relatively little difference in the percentage of workers who spent at least 50% versus 100% of their time on clean energy-related work. This suggests that most workers who spent at least 50% of their time on clean energy spent all of their time on clean energy. While the difference between these two categories of workers was only four percentage points for overall clean energy employment, renewable fuels and alternative transportation had differences of 11 percentage points and eight percentage points, respectively. It is also noteworthy that in renewable electric power generation and grid modernization and storage, more than three out of every four workers spent all of their time on clean energy-related work.

Figure 10. Clean Energy Employment Intensity Thresholds by Technology (2018)

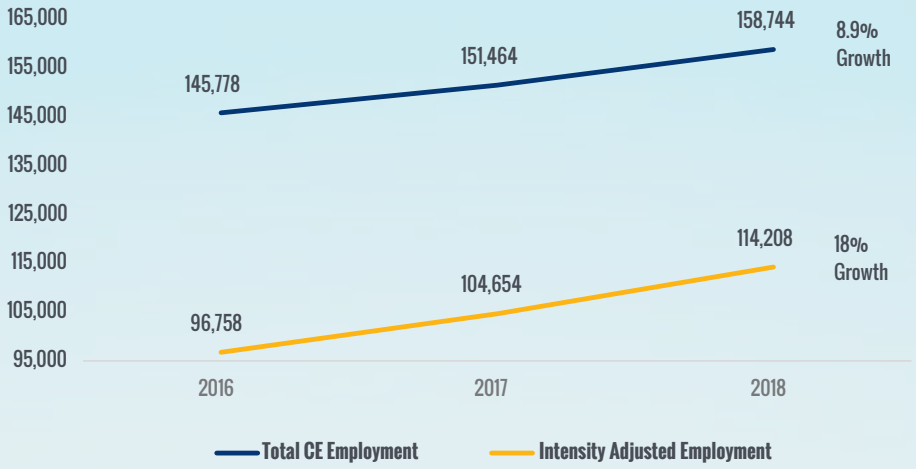


Intensity-Adjusted Employment

Intensity-adjusted employment, a metric that is new to the New York Clean Energy Industry Report, provides another lens through which to analyze clean energy employment and how it changes over time. To create this metric, total clean energy workers are provided a weight based on the amount of time they spend working on clean energy activities: those who spend some but not a majority of their time on clean energy activities (i.e., less than 50% of their time); those who spend a majority on clean energy activities (i.e., more than 50% of their time); those who spend all of their time on clean energy activities (i.e., 100% of their time). For example, a heating, ventilation and air conditioning (HVAC) installer who spends all their time installing heat pumps is weighted more heavily (1.0) than one who only occasionally does (0.25). This weighting allows for more accurate comparisons to other states, and allows for better tracking of activity and trends over time.

This new metric shows that intensity of clean energy jobs is drastically increasing, even more rapidly than overall growth of total number of clean energy workers. In other words, as the number of clean energy workers in the State has been increasing, the amount of time that those workers spend on clean energy activities is also increasing, and at a faster rate. This is shown in Figure 11, which depicts that while unadjusted clean energy jobs increased by 8.9% since 2016, intensity-adjusted clean energy employment increased by twice as much, and increased 18.0%.

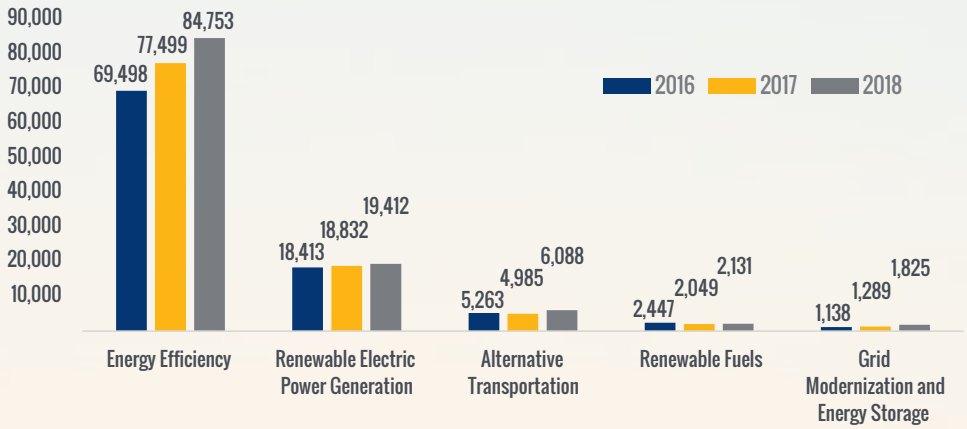
Figure 11. Intensity-Adjusted Employment Growth (2016–2018)



intensity of clean energy jobs is increasing more rapidly than the overall number of clean energy workers

Despite this overall trend in intensity-adjusted employment, there is wide variation between technology sectors. Intensity-adjusted grid modernization and energy storage employment increased by 60.4% between 2016 and 2018, while intensity-adjusted energy efficiency and alternative transportation employment increased by 22.0% and 15.7% respectively. Intensity-adjusted renewable electric power generation employment increased by a modest 5.4% during this time, but as previously mentioned, is already a sector where three out of four workers spend all of their time working on clean energy. Finally, renewable fuels declined by 12.9% in its intensity-adjusted metric over this time period.

Figure 12. Intensity-Adjusted Employment by Technology (2016–2018)



Credit: LM Windpower

Clean Energy Technologies

Decarbonization has already started to have a transformational effect throughout the economy

Decarbonizing the energy system has been shown to produce substantial economic benefits and create thousands of jobs, the creation of which plays out differently in each sector. For instance, New York's recent offshore wind procurement set off a chain reaction that has and will support various types of workers throughout the supply chain.

Credit: MHI Vesta

Hiring activity started with professional services, such as scientific and technical consulting (e.g., seafloor mapping), engineering, and consulting to prepare bids and identify sites. With roughly 1,700 MWs having been awarded through the first procurement, hiring of an estimated 1,600 workers is expected to cascade through manufacturing and assembly (e.g., turbines, platforms, ships, etc.), construction of towers and commissioning of systems, and operations and maintenance positions.[12]

Getty Images/ welcomia

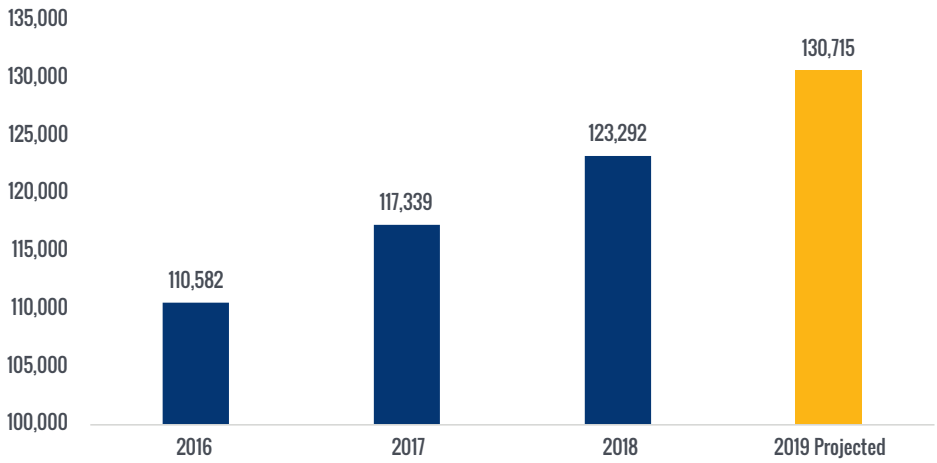
Energy Efficiency

Energy efficiency still accounted for the most jobs in the sector at 78%. In 2018, energy efficiency employment increased by 5.1% in New York compared to 3.7% nationally.[13]

The State's energy efficiency job growth was fueled by parallel growth in traditional HVAC goods/services and advanced building materials and insulation.

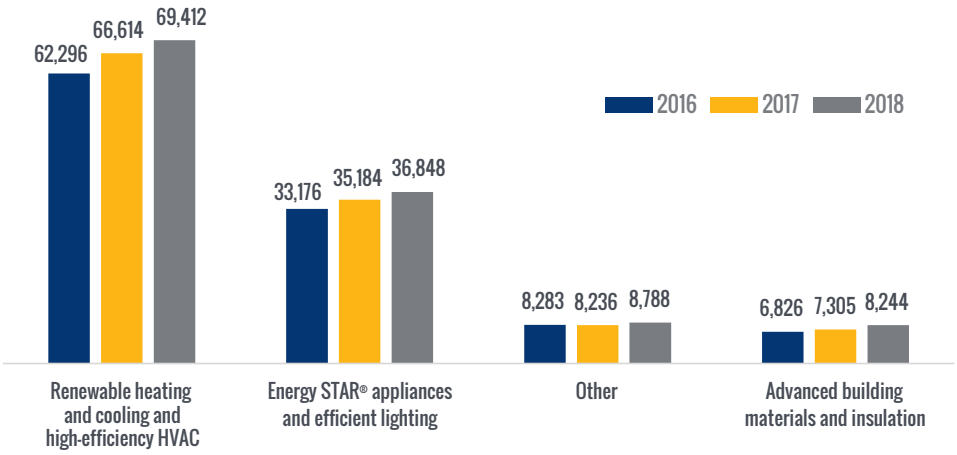
energy efficiency employment grew 5.1% in New York and accounted for 78% of all clean energy jobs

Figure 13. Energy Efficiency Employment Growth, 2016–2018



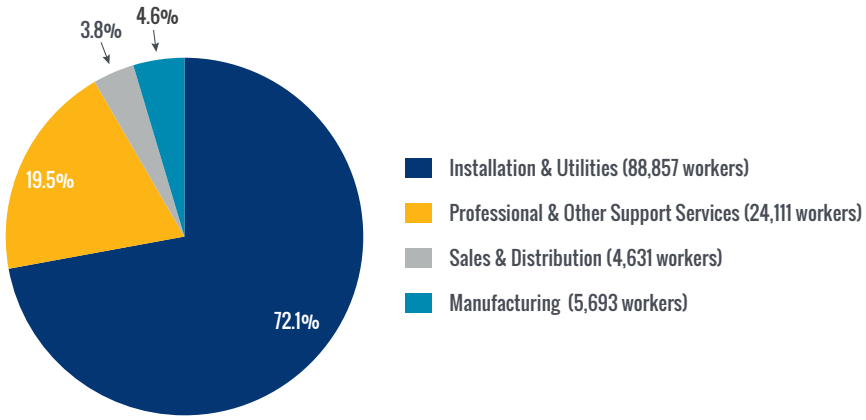
Sub-technologies. All sub-technology categories in energy efficiency showed growth in 2018 but, renewable heating and cooling and high-efficiency HVAC had the highest number of new jobs. Advanced building materials and insulation had the smallest total number of jobs in the sector, but it stood out as the fastest growing sub-technology as a percentage with 13% growth during 2018.

Figure 14. Energy Efficiency Employment by Sub-technology, 2016–2018



Value Chain. Installation and utilities is the largest source of employment in the value chain, accounting for 72.1% of energy efficiency jobs in the State. The share of clean energy employees working in installation and utilities increased a modest 1.3% between 2017 and 2018, while the proportion of professional and other support services employees declined about the same amount. The percentage of sales and distribution and manufacturing employees remained relatively unchanged.

Figure 15. Energy Efficiency Employment by Value Chain (2018)[14]



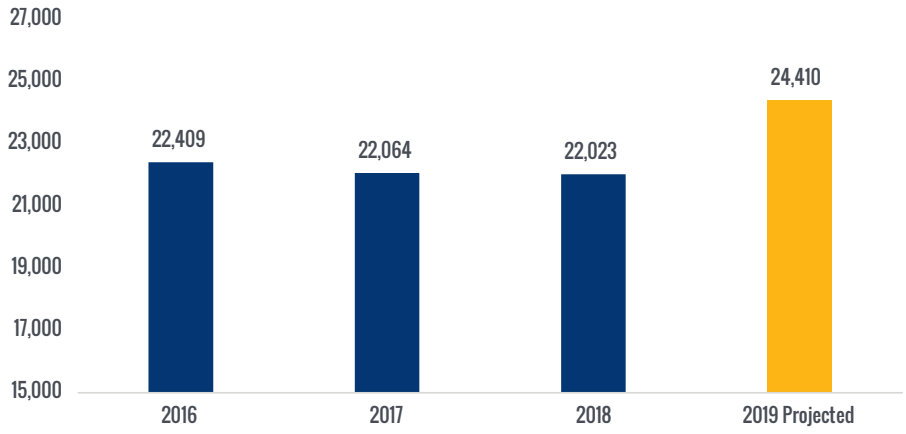
renewable heating and cooling and high-efficiency HVAC had the highest number of new jobs within the energy efficiency category

Getty Images/Monty Rakusen

Renewable Electric Power Generation

While the number of jobs in renewable electric power generation in New York State remained steady with a very slight decline of 0.2% between 2017 and 2018, national employment declines in this sector were higher, at 1.9% overall.

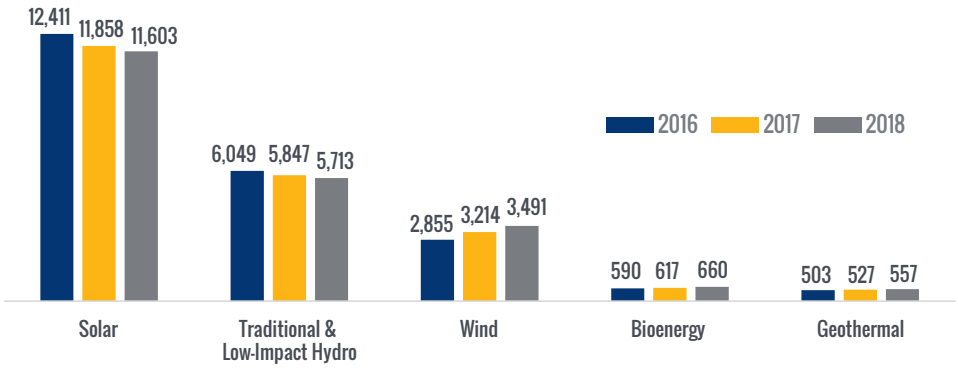
Figure 16. Renewable Electric Power Generation Employment Growth (2016–2018)



Sub-technologies. Renewable electric power generation declined by a modest 23 jobs between 2017 and 2018. While wind, bioenergy, and geothermal increased in employment during this time, solar and traditional and low-impact hydro declined.

The decline in solar employment was a national phenomenon[15] where national solar employment declined by 4.2%. During this time, New York solar jobs decreased by a less severe 2.2%[16] and solar employment increased in intensity. In fact, intensity-adjusted solar employment increased 8% between 2017 and 2018, demonstrating that even while the solar workforce consolidated, the overall time workers spent on solar power generation increased throughout the State.

Figure 17. Renewable Electric Power Generation Employment by Sub-technology (2016–2018)

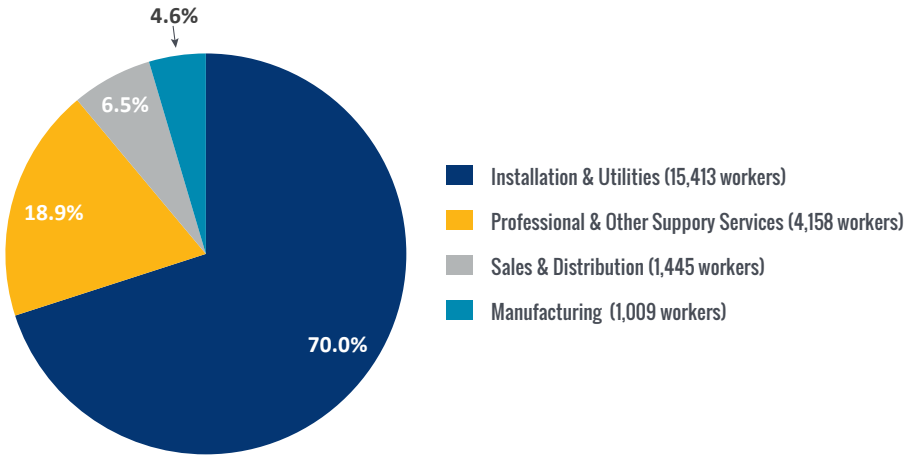


employment for wind, bioenergy, and geothermal increased

employment for solar and traditional and low-impact hydro declined

Value chain. Installation and utilities accounted for most of the employment by value chain. Installation and utilities employment increased as a proportion of total clean energy workers by less than two percentage points, while professional and other support services declined in proportion by the same amount.

Figure 18. Renewable Electric Power Generation Employment by Value Chain (2018)[17]



Grid Modernization and Energy Storage

Grid modernization and energy storage was again the fastest growing technology. Between 2017 and 2018, employment increased by 35.3% (561 jobs), which far exceeded the previous year's projections of about 8% and the national average growth for grid modernization and storage of 7.0%.[18]

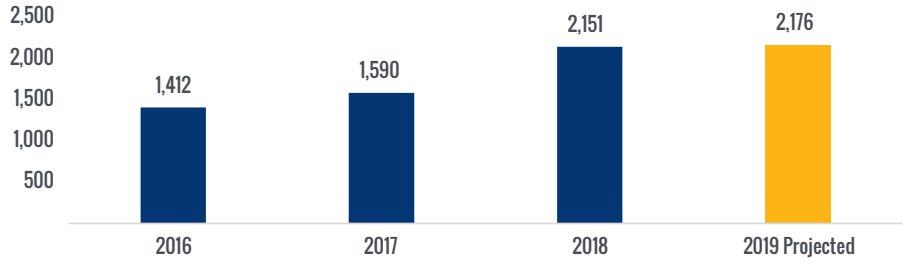
1,500 MW
of energy storage by 2025

3,000 MW
of energy storage by 2030

Governor Andrew M. Cuomo, in his January 2018 State of the State address, set a goal for 1,500 MW of energy storage in New York State by 2025. This put the State on the path to an increased goal of 3,000 MW of energy storage by 2030 that was established by the Public Service Commission in December 2018.

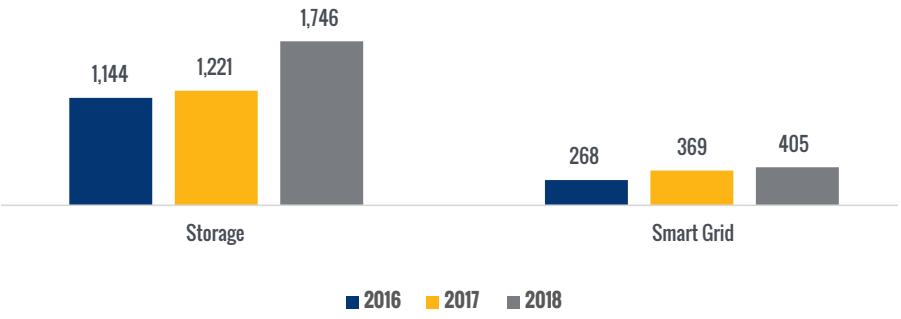
The Climate Leadership and Community Protection Act codified the existing goals into law that was signed in July 2019. These efforts and the development of the State's Energy Storage Roadmap—released by the Governor in June 2018—likely played a role in this boost of employment between 2017 and 2018 as significant national and international industry interest was being paid to this New York market.

Figure 19. Grid Modernization and Energy Storage Employment Growth (2016–2018)



Sub-technologies. Most of the substantial growth in this technology sector occurred within the storage sub-sector, which increased by 43.0%. In 2018, the smart grid sector also grew by nearly 10% in this time.

Figure 20. Grid Modernization and Energy Storage Employment by Sub-technology (2016–2018)

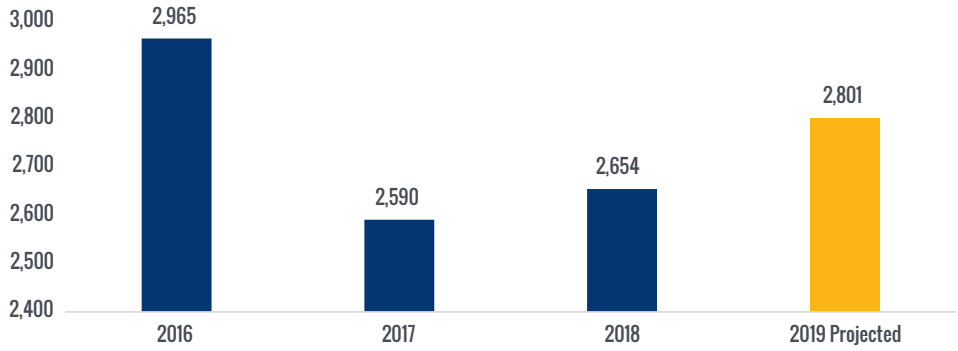


grid modernization and energy storage was again the fastest growing technology at 35.3%

Renewable Fuels

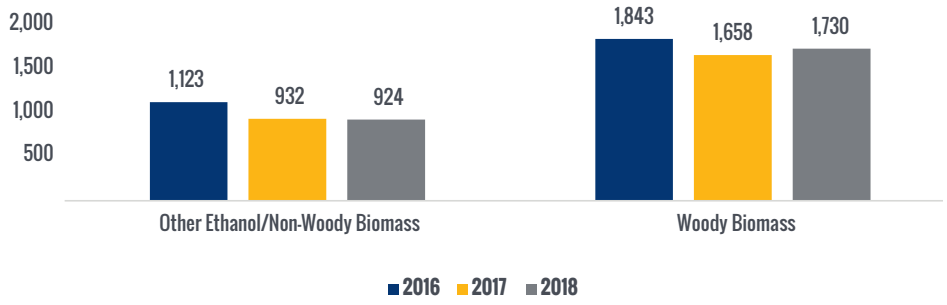
Renewable fuels employment increased slightly during 2018, adding about 65 jobs. Despite a modest downward trend of employment since 2016, renewable fuels employers showed signs of optimism, as signaled by the small increase in hiring between 2017 and 2018. On average, renewable fuels employers expected employment to grow 5.5% between 2018 and 2019. Renewable fuels were the one technology that saw slower employment growth in New York compared to national data, though the growth rates were relatively close. While renewable fuels increased 2.5% in New York between 2017 and 2018, the national growth rate among renewable fuels employment was 3.4%.[19]

Figure 21. Renewable Fuels Employment (2016–2018)



Sub-technologies. The employment growth between 2017 and 2018 occurred exclusively within the woody biomass sub-technology, as other ethanol/non-woody biomass sub-technologies declined slightly during this time.

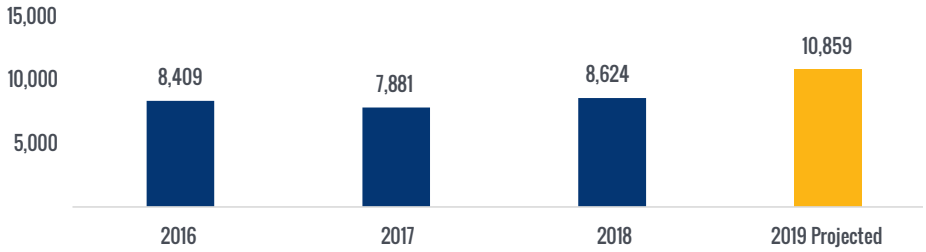
Figure 22. Renewable Fuels Employment by Sub-Technology (2016–2018)



Alternative Transportation

Employment in alternative transportation increased a notable 9.4% between 2017 and 2018. This far exceeded employers' 2018 growth expectations of about 2%.

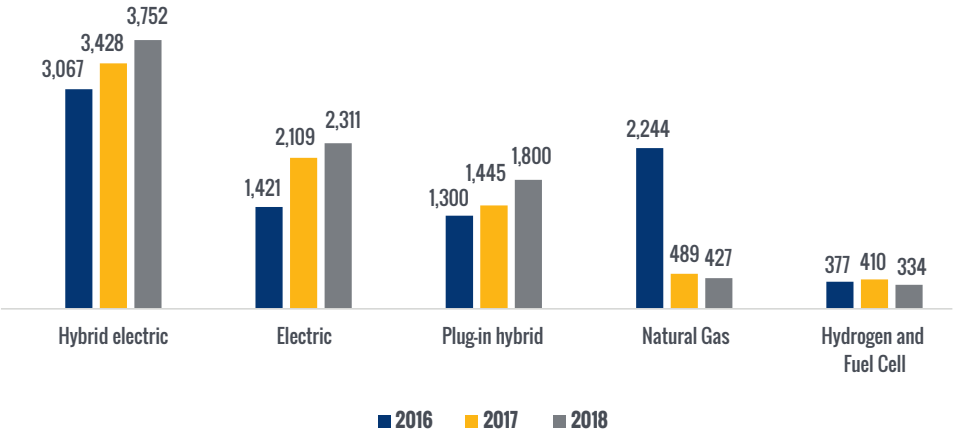
Figure 23. Alternative Transportation Employment (2016–2018)



Getty Images/ kali9

Sub-technologies. Sources of this growth were hybrid electric, electric, and plug-in hybrid sub-technologies. In fact, plug-in hybrid employment increased by nearly 25%. This is a continuation of the trend seen in the 2018 New York Clean Energy Industry Report. As hybrid and electric vehicles have become increasingly popular in New York,[20] the national number of natural gas vehicles remained relatively stagnant since 2016.[21] Automotive service technicians and mechanics that spent time servicing and repairing these electric and hybrid vehicles were the primary drivers of this growth. Alternative transportation employment was not tested nationally.

Figure 24. Alternative Transportation Employment by Sub-technology (2016–2018)



plug-in hybrid employment increased by nearly 25%

Getty Images/SolStock

Clean Energy Industry Analysis and Findings

Clean Energy Workforce Analysis

This section highlights the findings of an occupational survey of 774 people that studied workers in clean energy related industries in New York and surrounding states. The purpose of this research was to get a better understanding of current clean energy workers' education, employment preferences, compensation, benefits, and challenges to career advancement. This information is meant to provide information to employers, stakeholders, policy makers, and potential entrants to the field to better understand workforce dynamics within clean energy industries.

Industry categories in this section were aggregated into broader segments than the other sections of the report to limit respondent error and provide statistically significant results. For more information regarding how categories in this section relate to the technology categories, see Appendix A: Survey & Research Methodology.

career satisfaction was relatively high

about half of renewable energy and energy efficiency workers felt they needed more experience to be competitive for a promotion

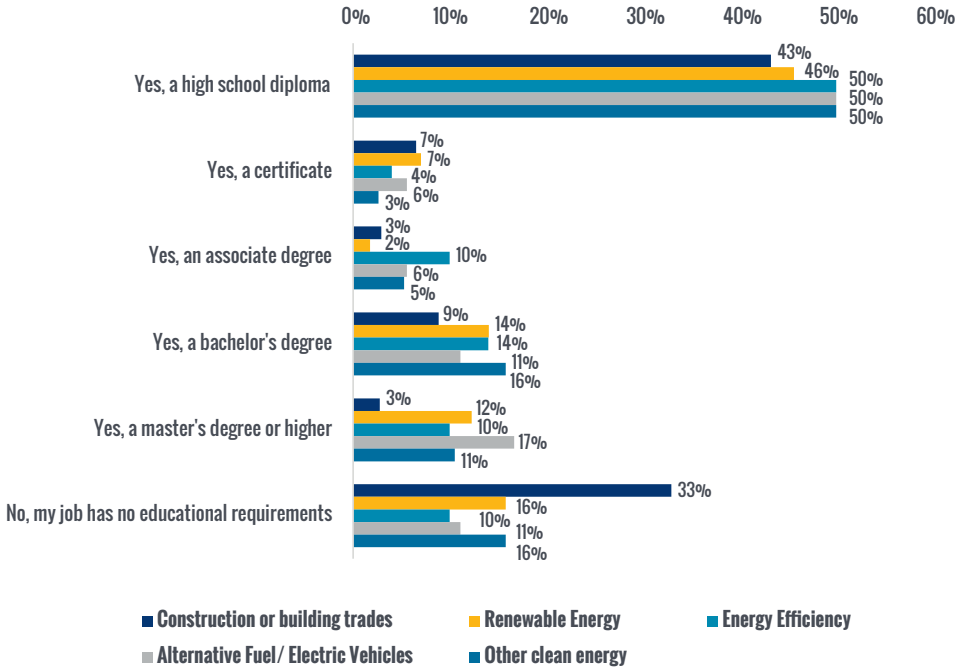
The survey results highlight some areas in which workforces vary or are similar across industries. The following are some of those findings:

- Education requirements were lowest among construction or building trades. Conversely, more than one in seven workers in alternative fuel/electric vehicles had a master's degree or higher.
- About half of renewable energy and energy efficiency respondents had specific license requirements for the jobs they held at the time of the survey. About a quarter of construction or building trades workers had specific credentials or certifications.
- Nearly all tested industries had generally high rates of employers offering healthcare benefits, retirement benefits, and paid vacation. Approximately half of respondents in construction and building trades were offered these benefits, while at least 73% or more of employers in the other industries offered these benefits.
- About half of renewable energy and energy efficiency workers felt they needed more experience to be competitive for a promotion. Interestingly, one in four alternative fuel/electric vehicle workers felt they needed to change geographic location to be competitive for a promotion.
- About half of respondents in all industries felt there were no obstacles to their promotion. Twenty percent (construction or building trades) to 31% (energy efficiency) felt that a lack of opportunities was an obstacle to promotion.
- Satisfaction with careers was relatively high and varied minimally across industries. Approximately half (48%) felt very satisfied with their career and another 37% felt somewhat satisfied. Only 6% felt some degree of unsatisfied.

Education, Certifications, and Benefits

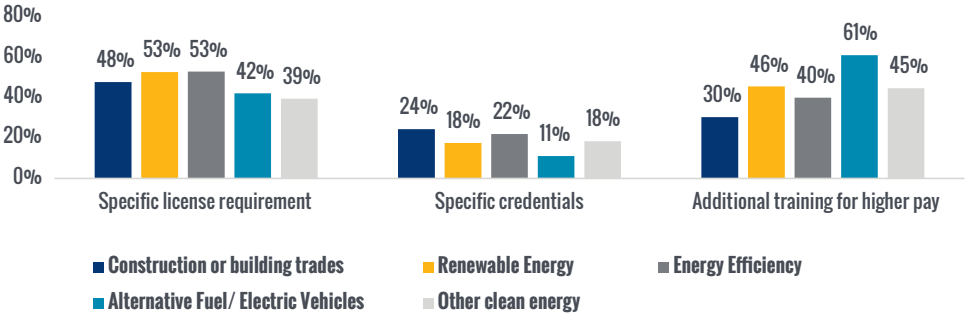
Construction and building trades had the lowest rates of educational requirements; 33% stated their job has no educational requirements and only 22% stated they needed education beyond a high school diploma. High school diplomas were the most frequent educational requirement. Fifty percent of energy efficiency, alternative fuel/electric vehicle, and other clean energy workers stated that only a high school diploma was required. Alternative fuels/electric vehicles had the highest educational demands with 17% of respondents stating their job required a master's degree or higher.

Figure 25. Highest level of education required by industry[22]



Specific licensing or educational requirements were more frequent among renewable energy and energy efficiency occupations, while specific certifications or credentials were more frequent among construction or building trades and energy efficiency. More than six out of 10 alternative fuel/ electric vehicle respondents had undertaken additional training or education to receive higher pay.

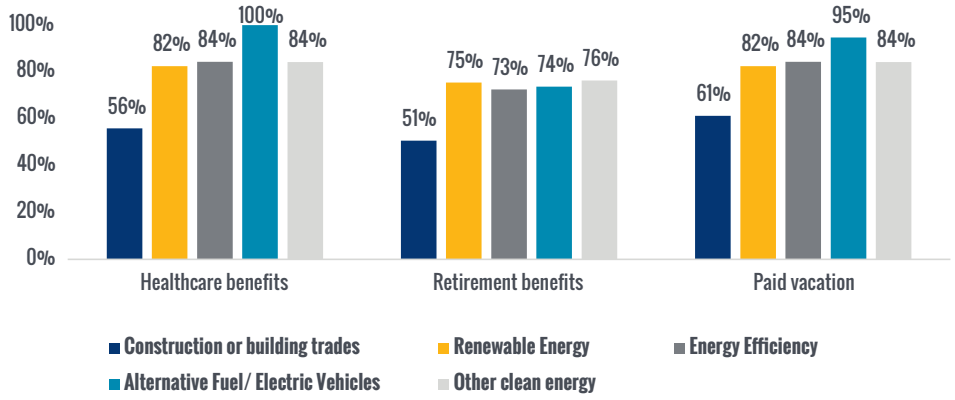
Figure 26. Licensing or educational requirements by industry



specific licenses, certifications or education levels are frequently required for clean energy jobs

Employment benefits such as healthcare, retirement benefits, and paid vacation were less frequent among construction or building trades occupations than those in the other industries examined. Rates of those receiving healthcare benefits and paid vacation among alternative fuel/ electric vehicle employees were higher than those of other industries.

Figure 27. Employment benefits by industry

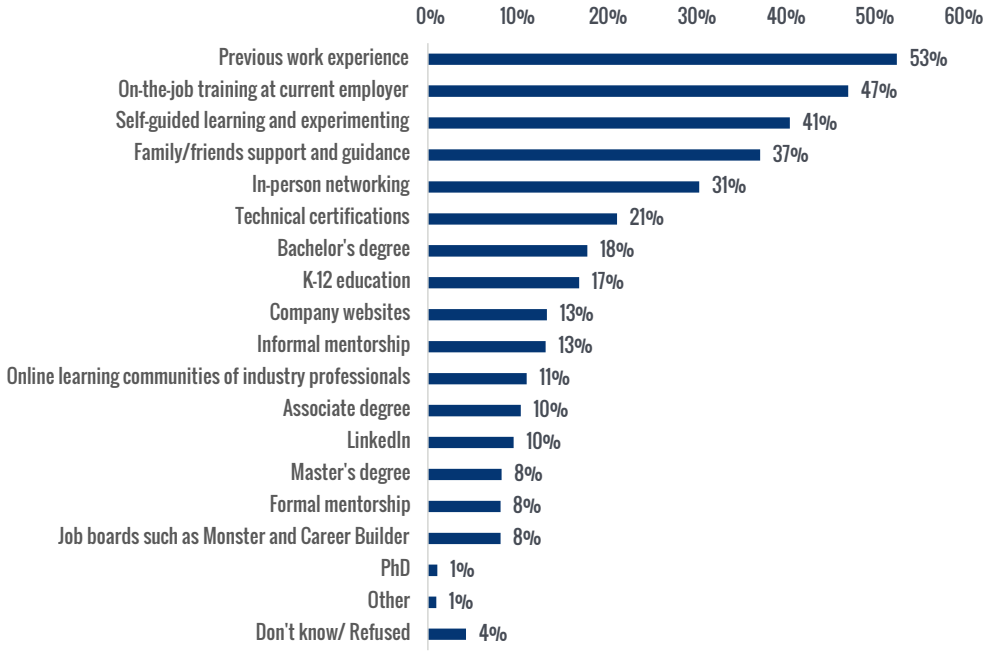


self-guided learning and experimenting are important to successful career navigation

Career Progression and Satisfaction

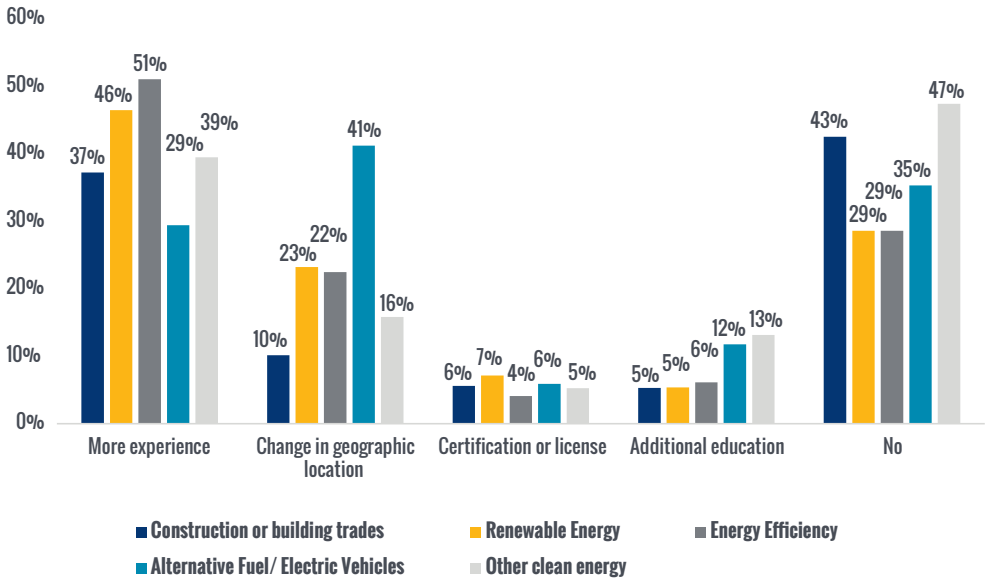
Respondents most often felt that prior work experience, on-the-job training, and self-guided learning and experimenting were important to their successful career navigation. Among the least important were education beyond a bachelor's degree (master's and PhD), formal mentorship, and job boards.

Figure 28. Factors important in respondents' successful career navigation



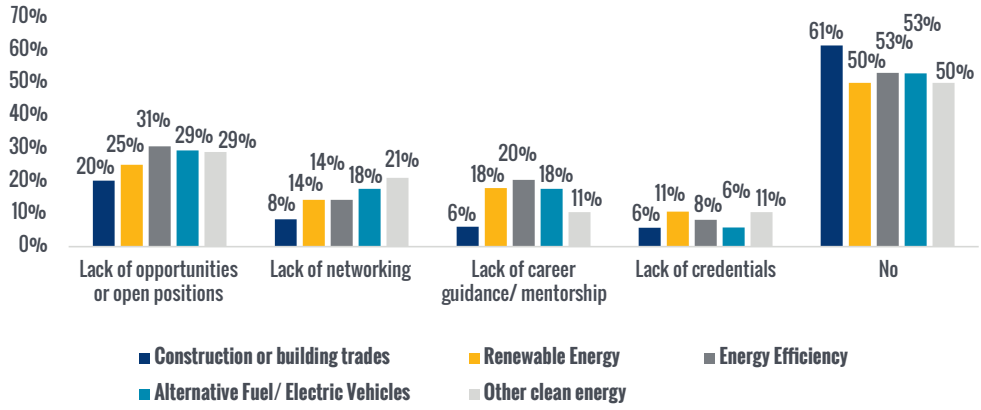
Construction or building trades and other clean energy respondents most frequently felt they did not need any additional factors in order to be competitive for a promotion. More experience was the most commonly cited factor that energy efficiency and renewable energy respondents felt they needed in order to be competitive for a promotion. Approximately four out of 10 alternative fuel/electric vehicle respondents felt they would need to change geographic location.

Figure 29. Do respondents need anything to be competitive for a promotion by industry?



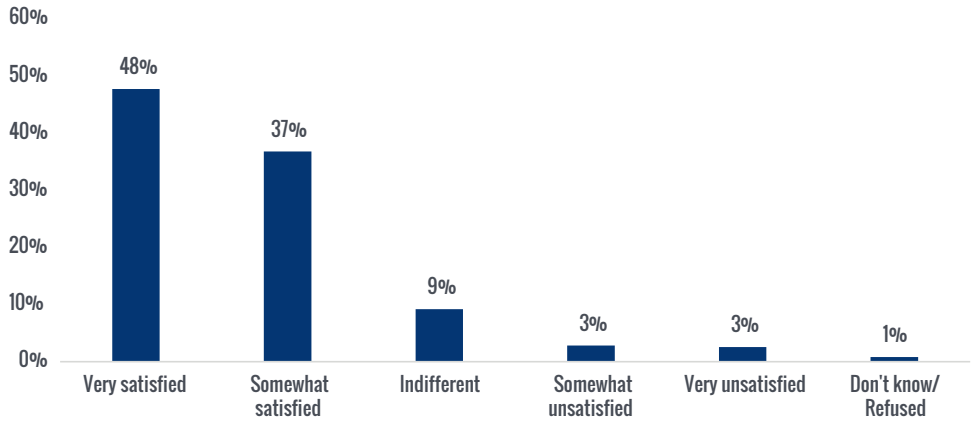
All industries had 50% or more of survey respondents report no obstacles to their promotion. Construction and building trades employees reported obstacles less often than the other industries studied. While lack of opportunities or open positions was the most-commonly cited obstacle, renewable energy, energy efficiency, and alternative fuel/electric vehicle employees also often cited a lack of career guidance and mentorship.

Figure 30. Are there any obstacles to promotion in industry?



Satisfaction among these careers is relatively high; 85% of respondents stated they were at least somewhat satisfied with their current career. Furthermore, only about 6% stated that they were unsatisfied. Interestingly, satisfaction rates varied minimally across industries.

Figure 31. Satisfaction with current career

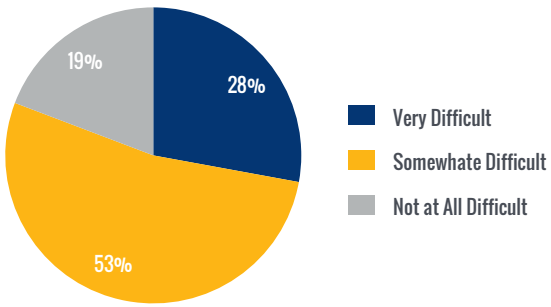


most difficult occupations to hire for were technicians or mechanical support positions, sales, marketing, or customer service positions, and management positions

Hiring Difficulty in the Clean Energy Industry[23]

More than 80% of employers who hired in the past 12 months had some difficulty hiring, with 28% citing hiring as being very difficult. This represents a 12% increase from 2017 in respondents who felt hiring was somewhat difficult. Most of the hiring difficulty was attributed to incoming talent lacking experience, training, or technical skills. Other reasons cited were difficulties finding industry-specific knowledge, skills, and interest, insufficient non-technical skills (work ethic, dependability, critical thinking), and insufficient qualifications (certifications or education). The most difficult occupations to hire for were technicians or mechanical support positions, sales, marketing, or customer service positions, and management positions (directors, supervisors, vice presidents). It was notable that management positions replaced engineers and scientists among the top three most difficult positions for which to hire. This may suggest there was a shortage of qualified management-level candidates. It is also possible that the lack of, or even negative, wage premiums among experienced roles contributed to some management-level hiring difficulty.

Figure 32. Hiring difficulty in clean tech in New York State

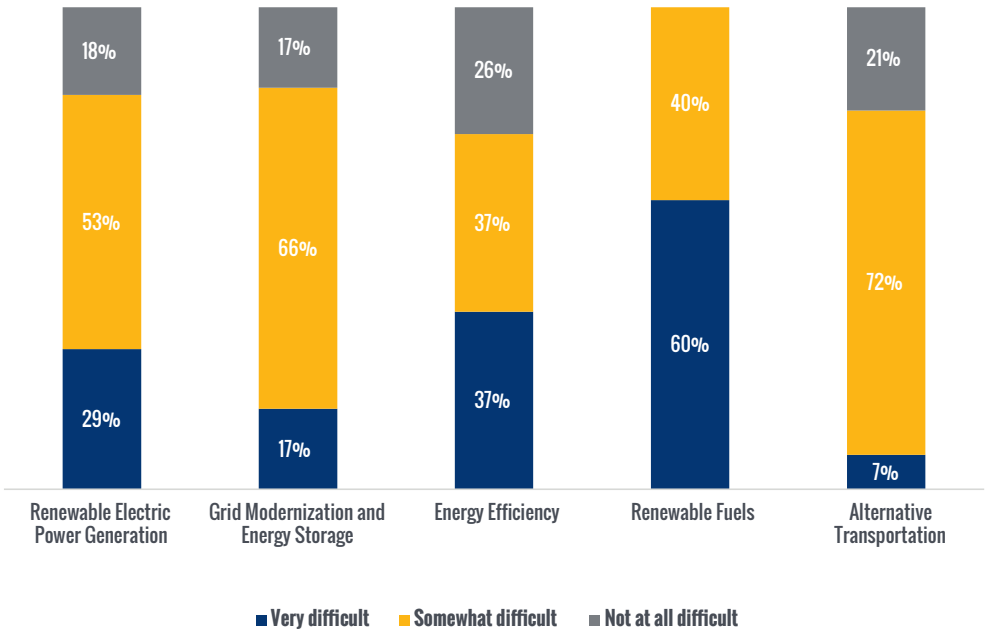


Getty Images/Monty Rakusen

Hiring Difficulties by Technology

Renewable fuels employers reported the highest overall level of difficulty (60% “very difficult” and 40% “somewhat difficult”), followed by grid modernization and energy storage (17% “very difficult” and 67% “somewhat difficult”), and renewable electric power generation (29% “very difficult” and 53% “somewhat difficult”).

Figure 33. Hiring difficulty by technology



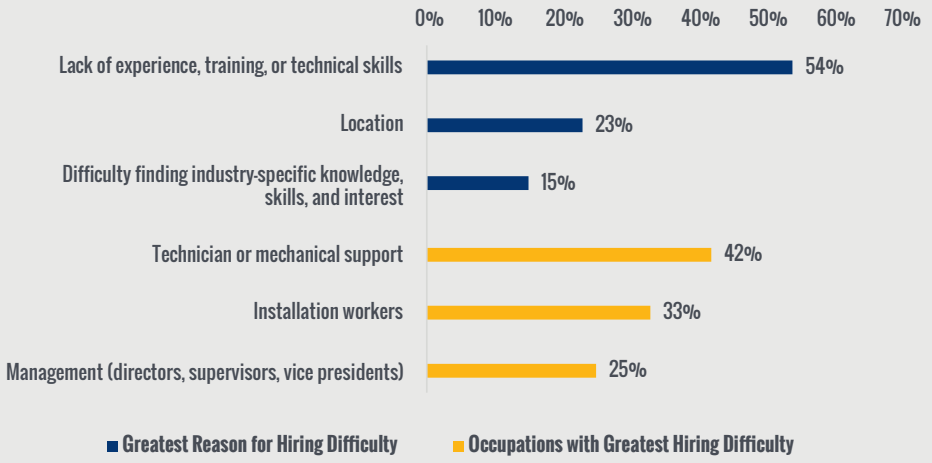
renewable fuels employers reported the highest overall level of hiring difficulty

A lack of experience, training, or technical skills was the primary reason for hiring difficulty. This was in the top three reasons for hiring difficulty across all technology types.

Technicians or mechanical support roles were the most common difficult-to-hire occupationS for four of the five technologies. (Figures 34 to 38)

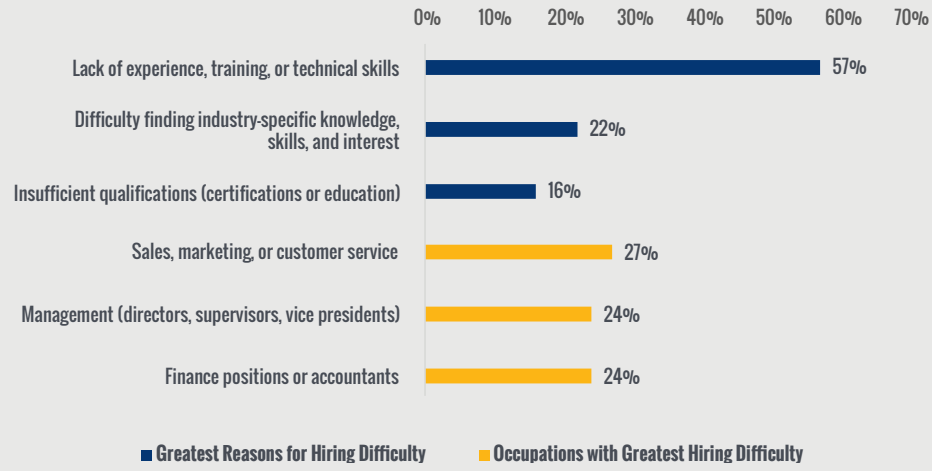
energy efficiency

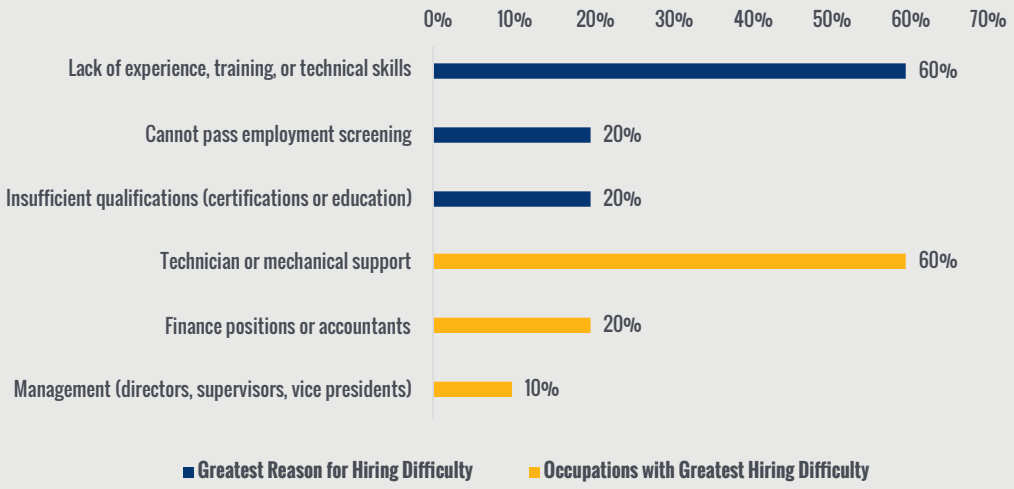
Figure 34. Top three reasons and occupations for energy efficiency hiring difficulty



electric power generation

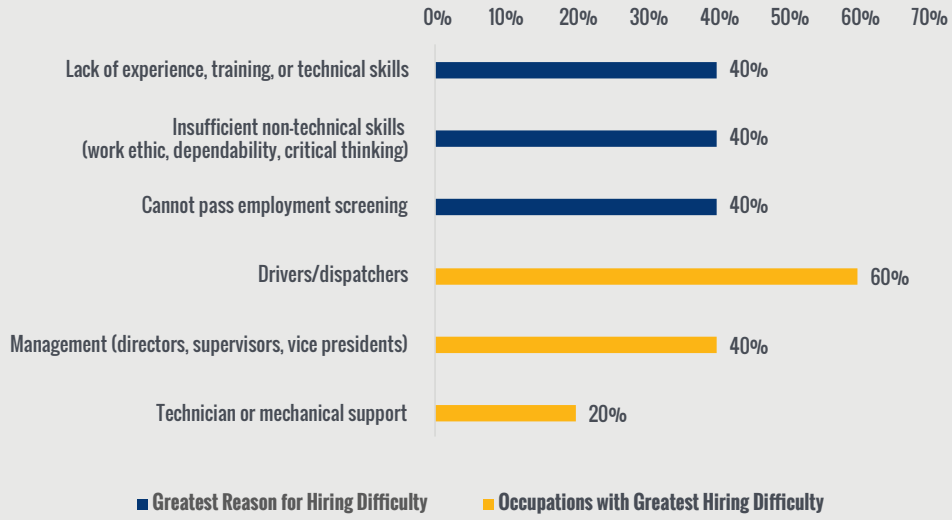
Figure 35. Top three reasons and occupations for renewable electric power generation hiring difficulty





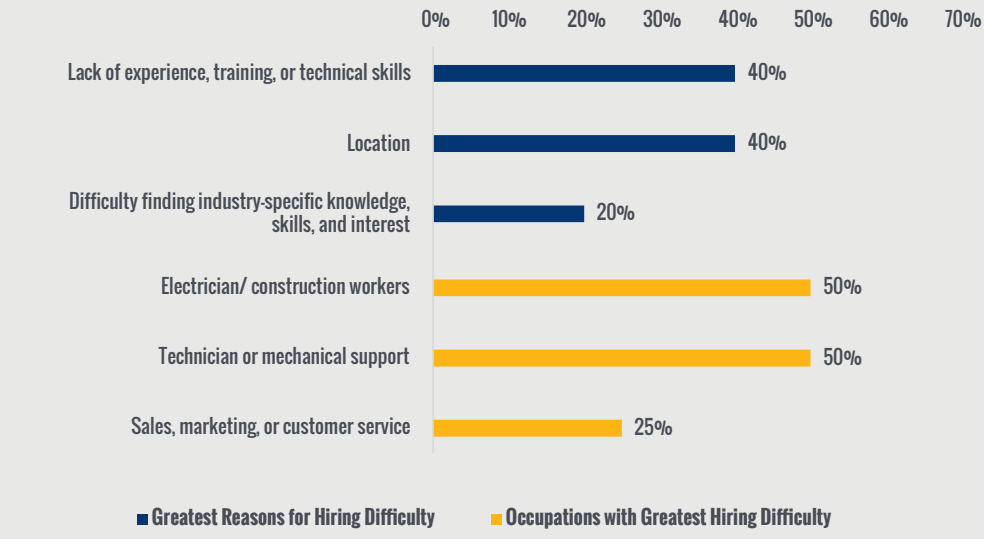
alternative transportation

Figure 36. Top three reasons and occupations for alternative transportation hiring difficulty



renewable fuels

Figure 37. Top three reasons and occupations for renewable fuels hiring difficulty



grid modernization and energy storage

Figure 38. Top three reasons and occupations for grid modernization and energy storage hiring difficulty

Supply-Side Survey Analysis

This section highlights the findings of a supply-side survey of 1,892 people that studied workforce attributes and preferences across workers in all industries in New York State. The purpose of this research was to better understand potential clean energy workers' preferences among employers, industries, sources of information, and beliefs towards clean energy and environmental concerns. The research also served as a way to benchmark favorability and opinion of clean energy industries against other industries in the State. A clearer understanding of these factors and opinions can lead to improved strategies in attracting or retaining workers and can also help policymakers and other stakeholders better grasp statewide opinion and sentiment towards clean energy industries, careers, and initiatives. This research is particularly important in an economy with a tight labor market, where competition for specialized workers can be high. The following are a summary of the findings:

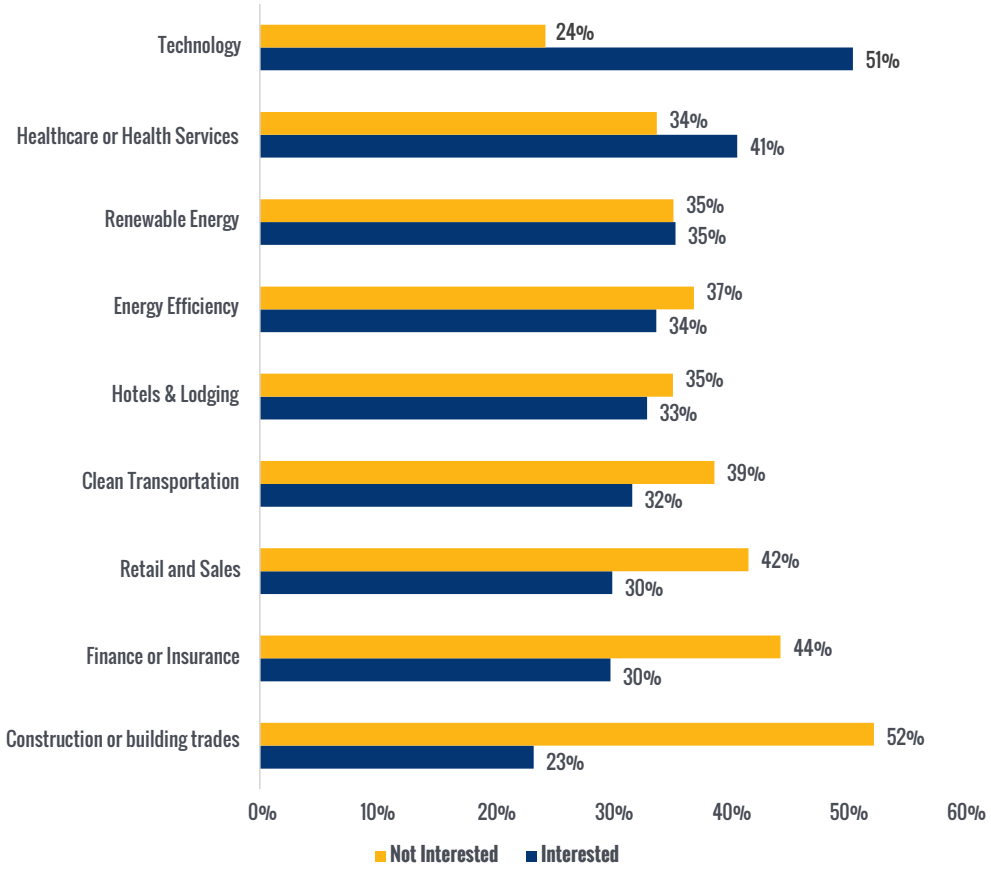
Approximately 51% felt society is currently focusing too little on renewable energy

- Renewable energy, energy efficiency, and alternative transportation had relatively comparable levels of respondents interested in potential careers, but all lagged behind the technology and healthcare fields. These industries did score well within certain aspects that were ranked among the most important, such as "benefits like healthcare and vacation", "opportunity for career growth", and "a company that is socially responsible".
- "What [the respondent is] going to get paid", "benefits like healthcare and vacation", and "opportunity for career growth" were the three aspects most frequently viewed as important when choosing a company to work for.
- Job sites (such as Indeed, Monster, CareerBuilder) were the most popular sources for respondents to find jobs with 73% stating they use these websites. Family and friends was the next most-common source at 46%.
- Approximately 51% of respondents felt that society is currently focusing too little on renewable energy and other climate change mitigation technologies and policies. Another 24% felt that society was focusing the right amount on these efforts. Only 10% felt that society is focusing too much on these efforts.
- The top reasons respondents said pursuing clean technology is worthwhile was "[the policies] are better for human health" (62%), "they reduce pollution and harm to the environment" (59%), and "they help mitigate climate change" (52%).

Career Progression and Preferences

Only 3.5% of respondents had experience in a direct clean energy field (i.e. energy efficiency) and another 11.5% had previously worked in construction or building trades and may have been involved in some clean energy-related work. Of the nine industries tested, renewable energy and energy efficiency received the third and fourth-highest percentage of respondents who are either “very interested” or “interested” in working in that industry. Clean transportation received the sixth-highest percentage of interest, just behind hotels and lodging. Despite these relatively high rankings, clean technology industries appear to lack the popularity and appeal of technology and healthcare.

Figure 39. Respondents’ interest in working in industries[24]



most important aspects when thinking about a job or career

pay

benefits like healthcare and vacation

opportunity for career growth

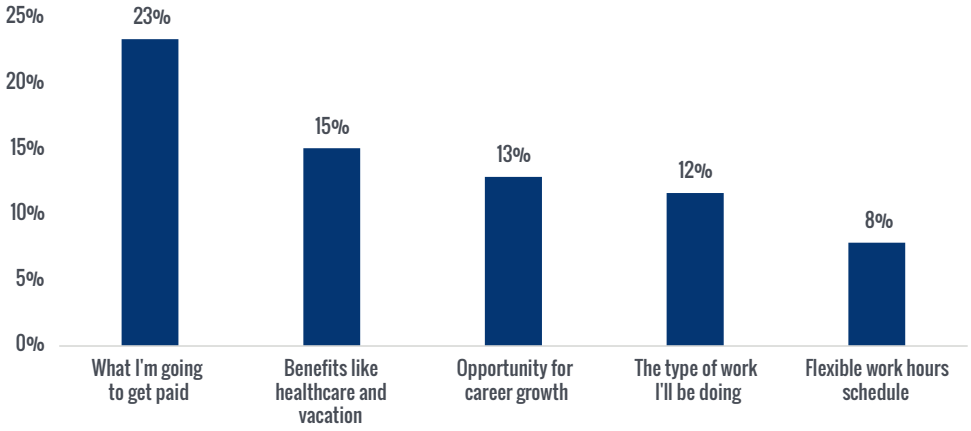
type of work

flexible work hours

The aspects most frequently cited as important when deciding to work for a company are “known for treating employees fairly”, “the type of work I’ll be doing”, and “what I’m going to get paid”. When respondents were asked a follow-up question as to which aspect was the most important, the top five responses were “what I’m going to get paid”, “benefits like healthcare and vacation”, “opportunity for career growth”, “the type of work I’ll be doing”, and “flexible work hours”.

Figure 40. Aspects respondents viewed as important in deciding to work for a company[25]

Figure 41. Five aspects most frequently cited as the most important when thinking about a job or a career




Getty Images/Graham Oliver

Respondents were also asked a follow-up question as to which aspect is the least important. “[Knowing] other people who work/worked there”, “opportunity to travel for work”, “[getting] discounts/free products or services”, “popular brand or company”, and “benefits like paying part of my tuition” were the least important to respondents. While friends and family are often helpful in attaining employment, most did not consider it to be important if a peer, friend, or family member becomes a co-worker.

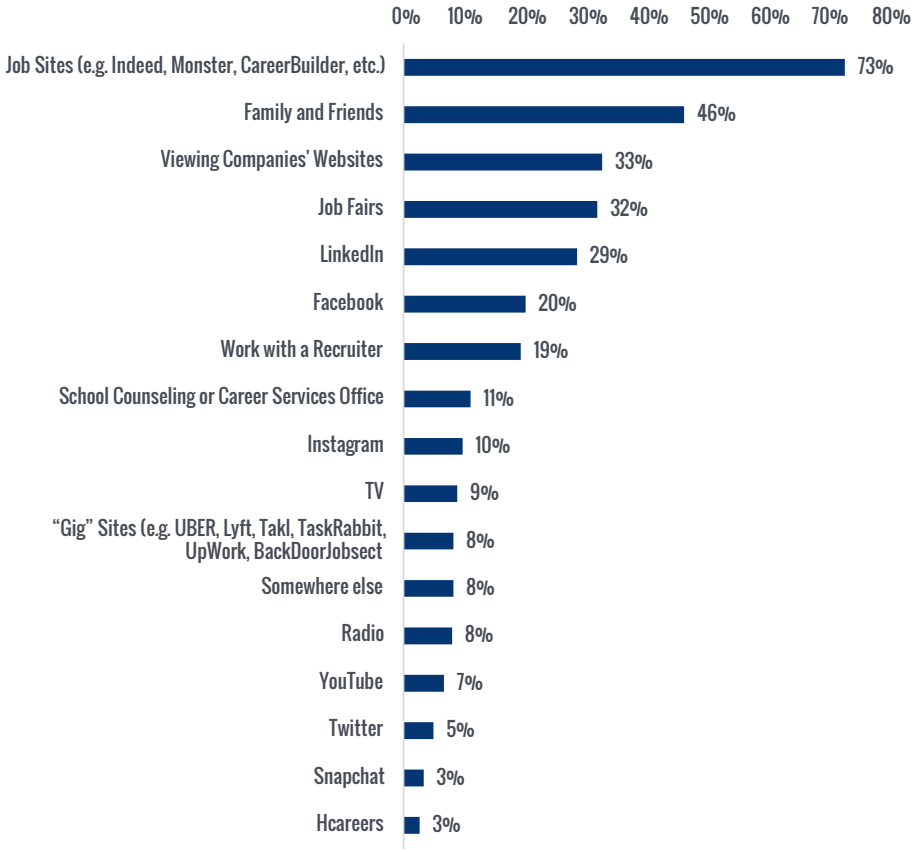
Figure 42. Five considerations most frequently cited as the least important when thinking about a job or career

Outreach and Communication

Job sites such as Indeed, Monster, and Career Builder were the most popular means to find out which employers are hiring. Forty-six percent of respondents also cited family members and friends, and another 33% cited viewing a specific company's websites. When asked how they would like a company they were considering working for to correspond with them, 82% of respondents said email, 62% said phone, and 34% said text. All other means of communication received less than ten percent.

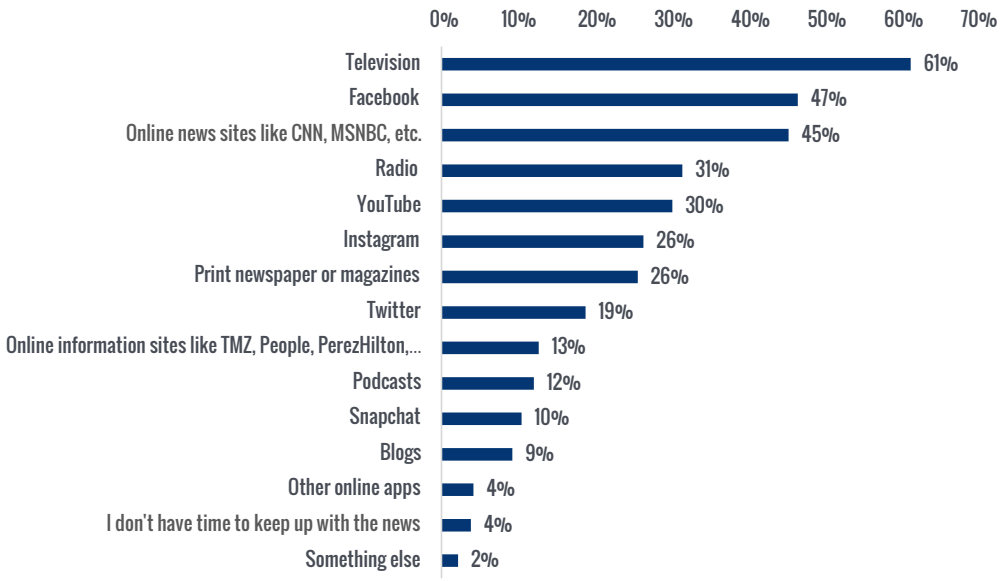
job websites are the most popular means to look for a job

Figure 43. Where respondents look for jobs



Most respondents stated that they received news and information via television, though 47% and 45% of respondents stated that they used Facebook and online new sites, respectively. Radio and YouTube were also among the top five most common responses.

Figure 44. Respondents' preferred source of news and information



Opinions on climate change and efforts to mitigate

Just over half of respondents felt that society was focusing too little on renewable energy and other clean tech development and deployment. Another 24% felt that society was focusing the right amount on such technologies. 84% of respondents felt that clean technology and climate mitigation are worthwhile. Of that 84%, 62% felt clean technology and climate change mitigation are worthwhile because they are better for human health and 59% feel these efforts are worthwhile because they help reduce pollution and harm to the environment.

84% felt that clean technology and climate mitigation are worthwhile

Figure 45. Which statement [does the respondent] most agree with?

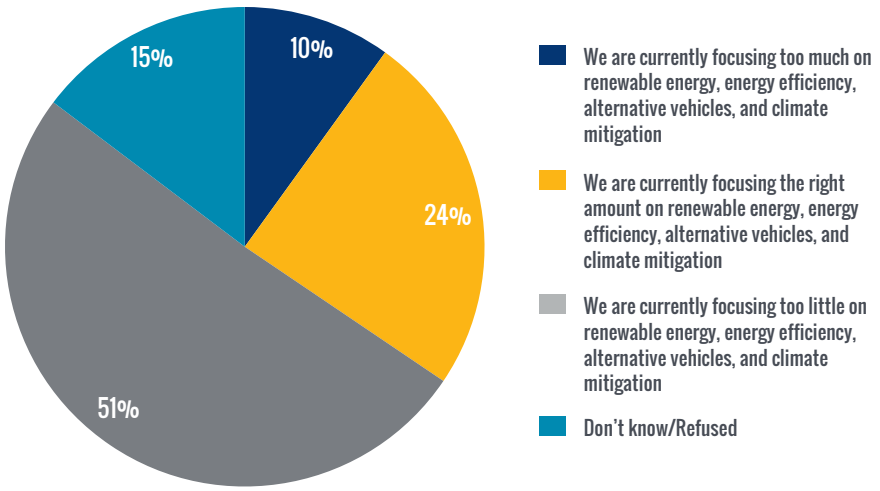
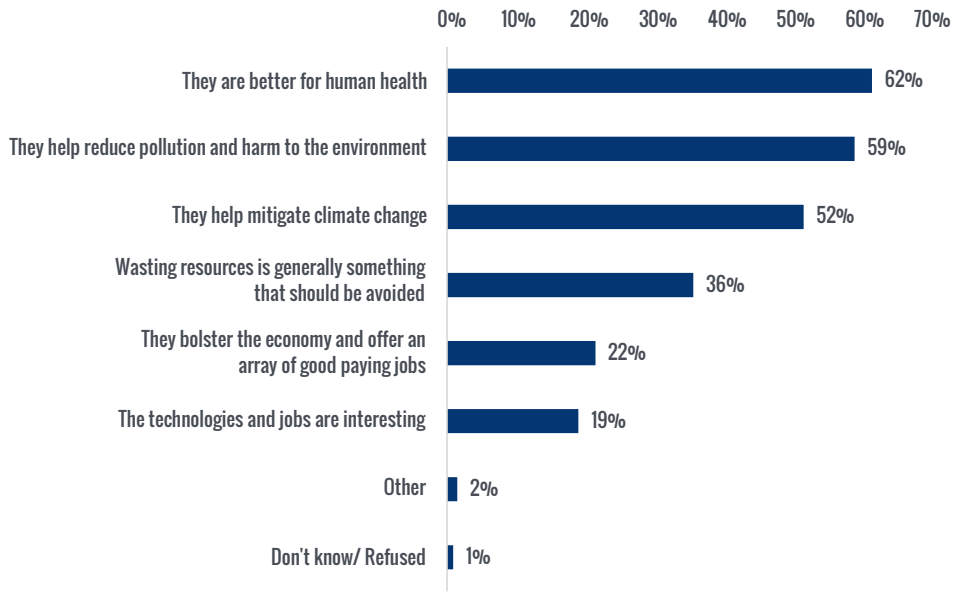


Figure 46. Reasons why energy conservation and clean/renewable energy are worthwhile



job profiles can aid in future recruitment and training efforts

Occupational Analysis

The most in-demand occupations in New York were technicians/mechanical support, sales representatives or customer service, and management.[26] Listed on the following page, are the profiles of occupations that fell within the most in-demand categories in New York clean energy fields. The profiles are meant to aid in future recruitment and training efforts, and include median hourly wages, wage premiums or discounts for clean energy occupations, important knowledge, skills, and detailed work activities, levels of educational attainment, commonly cited certifications, similar occupations, feeder occupations, and occupations that a worker can be promoted to.

It is worth noting that wage premiums for the occupations tend to move in the opposite direction of experience or seniority. Wage premiums for entry-level roles are generally higher than those for mid- and upper-level roles. This phenomenon may be attributable to a variety of forces. One possibility is that a wage premium is needed to incentivize entry-level workers to specialize in clean technology capabilities. However, as seniority and experience increase, these specialized skills play a smaller role in a workers' overall role. More research would be needed to develop a robust understanding of this phenomenon.

Construction Manager

Median Hourly Wage

Renewable Energy Generation		
Entry	**Mid**	**High**
$37.36	$44.89	$63.75

Energy Efficiency		
Entry	**Mid**	**High**
$34.28	$41.55	$62.19

Premium

Renewable Energy Generation		
Entry	**Mid**	**High**
30%	-10%	-29%

Energy Efficiency		
Entry	**Mid**	**High**
19%	-17%	-31%

Reported Educational Attainment Levels

Master's Degree	4%
Post-Baccalaureate Certificate	0%
Bachelor's Degree	76%
Associate Degree (or other 2-year degree)	4%
Some College Courses	12%
Post-Secondary Certificate	4%
High School Diploma or Equivalent (GED)	0%
Less than a High School Diploma	0%

Common Certifications

> North American Board of Certified Energy Practitioners (NABCEP)

> Leadership in Energy and Environmental Design (LEED)

> Association of Energy Engineers (AEE)

Necessary Areas of Knowledge	Necessary Skills	Important Detailed Work Activities
Building and Construction	Coordination	Negotiate project specifications
Design	Monitoring	Manage construction activities
Customer and Personal Service	Reading Comprehension	Develop operating strategies, plans, or procedures

Getty Images/Halfpoint Images

Adjacent Occupations

Architectural and Engineering Managers (11-9041.00)

Wind Energy Project Managers (11-9199.10)

Brownfield Redevelopment Specialists and Site Managers (11-9199.11)

Fire-Prevention and Protection Engineers (17-2111.02)

Energy Engineers (17-2199.03)

Feeder Occupations

Designer, Journeyman, Project Manager, Engineer

Promoted to

Director, Executive

Construction Laborer

Getty Images/Don Mason

Adjacent Occupations

Highway Maintenance Workers (47-4051.00)

Rock Splitters, Quarry (47-5051.00)

Helpers, Carpenters (47-3012.00)

Painters, Construction and Maintenance (47-2141.00)

Loading Machine Operators, Underground Mining (53-7033.00)

Feeder Occupations

Helpers, Students

Promoted to

Crew Lead, Supervisor, Manager

Median Hourly Wage

Renewable Energy Generation		
Entry	**Mid**	**High**
$14.15	$23.24	$42.32

Energy Efficiency		
Entry	**Mid**	**High**
$13.59	$22.64	$41.78

Premium

Renewable Energy Generation		
Entry	**Mid**	**High**
-4%	-16%	-22%

Energy Efficiency		
Entry	**Mid**	**High**
-7%	-19%	-23%

Reported Educational Attainment Levels

Master's Degree	0%
Post-Baccalaureate Certificate	1%
Bachelor's Degree	0%
Associate Degree (or other 2-year degree)	0%
Some College Courses	0%
Post-Secondary Certificate	6%
High School Diploma or Equivalent (GED)	70%
Less than a High School Diploma	23%

Common Certifications

> Occupational Safety and Health Administration (OSHA)

> North American Board of Certified Energy Practitioners (NABCEP)

> International Code Council (ICC)

Necessary Areas of Knowledge	Necessary Skills	Important Detailed Work Activities
Building and Construction	Active Listening	Direct vehicle traffic
Customer and Personal Service	Coordination	Clean work sites
Mechanical	Operation and Control	Signal equipment operators to indicate proper equipment positioning

Electrician

Median Hourly Wage

Renewable Energy Generation		
Entry	**Mid**	**High**
$20.44	$36.41	$61.87

Energy Efficiency		
Entry	**Mid**	**High**
$19.63	$35.47	$61.08

Premium

Renewable Energy Generation		
Entry	**Mid**	**High**
39%	31%	14%

Energy Efficiency		
Entry	**Mid**	**High**
34%	28%	13%

Reported Educational Attainment Levels

Master's Degree	0%
Post-Baccalaureate Certificate	0%
Bachelor's Degree	8%
Associate Degree (or other 2-year degree)	4%
Some College Courses	4%
Post-Secondary Certificate	59%
High School Diploma or Equivalent (GED)	18%
Less than a High School Diploma	8%

Common Certifications

> State licensure

> North American Board of Certified Energy Practitioners (NABCEP)

> Occupational Safety and Health Administration (OSHA)

> Electrical Journeypersons License

Necessary Areas of Knowledge	Necessary Skills	Important Detailed Work Activities
Building and Construction	Troubleshooting	Plan layout of construction, installation, or repairs
Mechanical	Installation	Install electrical components, equipment, or systems
Mathematics	Repairing	Test electrical equipment or systems to ensure proper functioning

Getty Images/aydinmutlu

Adjacent Occupations

Heating and Air Conditioning Mechanics and Installers (49-9021.01)

Plumbers (47-2152.02)

Solar Photovoltaic Installers (47-2231.00)

Wind Turbine Service Technicians (49-9081.00)

Refrigeration Mechanics and Installers (49-9021.02)

Feeder Occupations

Apprentices, Installers

Promoted to

Master Electrician, Journeyman, Foreman, Project Manager

HVAC Installer

Getty Images/sutiporn somnam

Adjacent Occupations

Plumbers (47-2152.02)

Electricians (47-2111.00)

Elevator Installers and Repairers (47-4021.00)

Refrigeration Mechanics and Installers (49-9021.02)

Maintenance and Repair Workers, General (49-9071.00)

Feeder Occupations

Service tech, Helper, Installer, Apprentice

Promoted to

Crew Lead, Senior Service Tech, Project Supervisor

Median Hourly Wage

Renewable Energy Generation		
Entry	**Mid**	**High**
$17.34	$27.16	$41.73

Energy Efficiency		
Entry	**Mid**	**High**
$16.75	$26.21	$41.37

Premium

Renewable Energy Generation		
Entry	**Mid**	**High**
41%	21%	7%

Energy Efficiency		
Entry	**Mid**	**High**
36%	17%	6%

Reported Educational Attainment Levels

Master's Degree	0%
Post-Baccalaureate Certificate	0%
Bachelor's Degree	7%
Associate Degree (or other 2-year degree)	16%
Some College Courses	6%
Post-Secondary Certificate	55%
High School Diploma or Equivalent (GED)	13%
Less than a High School Diploma	4%

Common Certifications

> US EPA certification

> North American Technician Excellence (NATE)

Necessary Areas of Knowledge	Necessary Skills	Important Detailed Work Activities
Mechanical	Troubleshooting	Repair pipes to stop leaking
Building and Construction	Repairing	Test electrical circuits or components for proper functioning
Customer and Personal Service	Equipment Maintenance	Service heating, ventilation or air-conditioning (HVAC) systems or components

Sales Representative

Getty Images/Sam Edwards

Median Hourly Wage

Renewable Energy Generation		
Entry	**Mid**	**High**
$22.23	$41.68	$78.22

Energy Efficiency		
Entry	**Mid**	**High**
$19.74	$38.46	$71.64

Premium

Renewable Energy Generation		
Entry	**Mid**	**High**
74%	38%	21%

Energy Efficiency		
Entry	**Mid**	**High**
54%	27%	11%

Reported Educational Attainment Levels

Master's Degree	1%
Post-Baccalaureate Certificate	7%
Bachelor's Degree	35%
Associate Degree (or other 2-year degree)	9%
Some College Courses	38%
Post-Secondary Certificate	5%
High School Diploma or Equivalent (GED)	6%
Less than a High School Diploma	0%

Common Certifications

> None

Necessary Areas of Knowledge	Necessary Skills	Important Detailed Work Activities
Customer and Personal Service	Speaking	Develop content for sales presentations or other materials
Sales and Marketing	Reading Comprehension	Develop proposals for current or prospective customers
Mathematics	Persuasion	Prepare sales or other contracts

Adjacent Occupations

Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products (41-4011.00)

Real Estate Sales Agents (41-9022.00)

Advertising Sales Agents (41-3011.00)

Energy Brokers (41-3099.01)

Assessors (13-2021.01)

Team Assembler

Getty Images/FG Trade

Adjacent Occupations

Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders (51-4122.00)

Paper Goods Machine Setters, Operators, and Tenders (51-9196.00)

Sawing Machine Setters, Operators, and Tenders, Wood (51-7041.00)

Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders (51-3091.00)

Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders (51-9192.00)

Feeder Occupations

Assembler, Technician, General Labor

Promoted to

Supervisor, Senior Technician, Service Manager

Median Hourly Wage

Renewable Energy Generation		
Entry	**Mid**	**High**
$11.99	$16.29	$24.01

Energy Efficiency		
Entry	**Mid**	**High**
$10.95	$14.89	$22.74

Premium

Renewable Energy Generation		
Entry	**Mid**	**High**
20%	11%	-2%

Energy Efficiency		
Entry	**Mid**	**High**
9%	2%	-8%

Reported Educational Attainment Levels

Master's Degree	0%
Post-Baccalaureate Certificate	0%
Bachelor's Degree	0%
Associate Degree (or other 2-year degree)	4%
Some College Courses	4%
Post-Secondary Certificate	86%
High School Diploma or Equivalent (GED)	6%
Less than a High School Diploma	0%

Common Certifications

> Welding certification

Necessary Areas of Knowledge	Necessary Skills	Important Detailed Work Activities
Production and Processing	Coordination	Evaluate quality of materials or products
Education and Training	Speaking	Package products for storage or shipment
English Language	Critical Thinking	Read work orders or other instructions to determine product specifications or materials requirements

Median Hourly Wage

Renewable Energy Generation		
Entry	**Mid**	**High**
$18.41	$30.66	$55.82

Energy Efficiency		
Entry	**Mid**	**High**
$17.69	$29.86	$55.10

Premium

Renewable Energy Generation		
Entry	**Mid**	**High**
26%	10%	3%

Energy Efficiency		
Entry	**Mid**	**High**
21%	8%	2%

Reported Educational Attainment Levels

Master's Degree	0%
Post-Baccalaureate Certificate	0%
Bachelor's Degree	0%
Associate Degree (or other 2-year degree)	0%
Some College Courses	0%
Post-Secondary Certificate	2%
High School Diploma or Equivalent (GED)	68%
Less than a High School Diploma	29%

Common Certifications

> None

Necessary Areas of Knowledge	Necessary Skills	Important Detailed Work Activities
Building and Construction	Operation and Control	Cut carpet, vinyl or other flexible materials
Mechanical	Operation Monitoring	Measure materials or objects for installation or assembly
Customer and Personal Service	Coordination	Install insulation in equipment or structures

Mechanical Insulation Workers

Getty Images/Klaus Vedfelt

Adjacent Occupations

Fence Erectors (47-4031.00)

Plasterers and Stucco Masons (47-2161.00)

Helpers—Brick masons, Block masons, Stonemasons, and Tile and Marble Setters (47-3011.00)

Laborers and Freight, Stock, and Material Movers, Hand (53-7062.00)

Tile and Marble Setters (47-2044.00)

Fine-Tuning the Heat in Multifamily Buildings

Getty Images/ Assja

Company Name:
Prestige Management

Business Type:
Multifamily

Location:
New York, New York

BY THE NUMBERS

20 buildings

23 employees trained

Diverse audience: 0 to 33 years of building operationsexperience

The New York State Energy Research and Development Authority (NYSERDA) and the Association for Energy Affordability (AEA) completed a building operator training demonstration project with Prestige Management, Inc. that explored the impacts of customized energy efficiency training for proper understanding and use of building controls on different types of heating systems.

Smart Investments in Operations and Maintenance

Building operators are key to keeping buildings running smoothly and performing at their best. Smart building owners know that skilled building operators can find problems early, before they become a major complication and expense. Prestige Management, a real estate management company in New York City, recognizes that a well-designed and well-implemented building operations and maintenance training program will extend equipment life, reduce operating costs, maintain energy efficiency, and improve the overall building conditions and occupant experience.

Targeted Training

AEA worked with Prestige Management to design a training program that focused on their highest building operations priorities—heating systems and building controls—and fit into the busy work schedules of building operators and managers. The training was a three-day condensed version of standard building operator training, with a heavy focus on heating systems and optimizing use of energy management system (EMS) equipment. Managers and building operators participated in the training sessions.

What Was Learned

Part of condensing the training curriculum consisted of holding separate sessions for operators with steam heating and hot water systems, so the topics specific to each heating system type did not need to be covered in full in all sessions. The training covered the following:

- Operations and maintenance processes
- Developing an energy master plan
- Building science basics (e.g., energy and heat, heat transfer in buildings, air sealing priorities, moisture transport in buildings)
- Combustion science and boiler and burner basics
- Hydronic heating system operation and maintenance or steam heating system operation and maintenance
- Energy management systems for hot water boilers or energy

AEA's heating and cooling lab lets students directly see systems in action. The boiler lab includes heating, cooling, and domestic hot water-making equipment, energy management systems, and other controls.

High-definition video allows students in remote classrooms to participate in this experience. The lab also features a functional gas-fired hydronic condensing boiler and furnace equipment, ductwork, and inverters connected to AEA's rooftop Solar PV arrays.

Results

All training participants surveyed indicated that the training met or exceeded their expectations, with nearly 2/3 indicating it "far exceeded expectations." The building operators described an improved understanding of their building systems and an increase in awareness and appreciation for energy efficiency best practices.

Following the training, Prestige Management incorporated a checklist focusing on best practices related to EMS operations at their buildings.

Energy savings varied widely between buildings, as building operations and energy use can be affected by many factors. This demonstration project shows overall positive results for energy use reductions following the training. Training helped to spark improvements in building operations, implementation of best practices, and energy efficiency awareness which continue to resonate across the entire portfolio of buildings.

Next Steps

Based on the success of the initial training sessions, AEA and Prestige Management are expanding their building operator training program with the assistance of NYSERDA. They will be training an additional 51 operators through a comprehensive four-part energy efficiency training series for additional operations improvements.

Getty Images/Monty Rakusen

New York Clean Energy Research & Development

New York State:

a hub for R&D activity

national leader in R&D activity

one of the five largest recipients of all federal R&D funding

Every year public and private companies and institutions put substantial time and resources into research and development (R&D) in order to design, develop, and test novel or improved technologies or products.

Public R&D funding for clean energy is substantial; between the 2009 and 2018 fiscal years, the U.S. Department of Energy offered more than $24.3 billion in funding for renewable energy, energy efficiency, and electrical systems across the nation.[27]

New York is a hub for R&D activity with New York being one of the five largest recipients of all federal R&D funding and being the State with the second highest level of 2017 fiscal year R&D expenditures.[28] Given that New York is a national leader for R&D activity, the following section seeks to highlight clean energy R&D activity within the State.

The research team conducted a survey of 100 known energy efficiency and solar firms in New York. The survey sample consisted of New York firms that have previously been identified as working in clean energy through projects such as the United States Energy Employment Report (USEER) and previous New York Clean Energy Industry Reports.

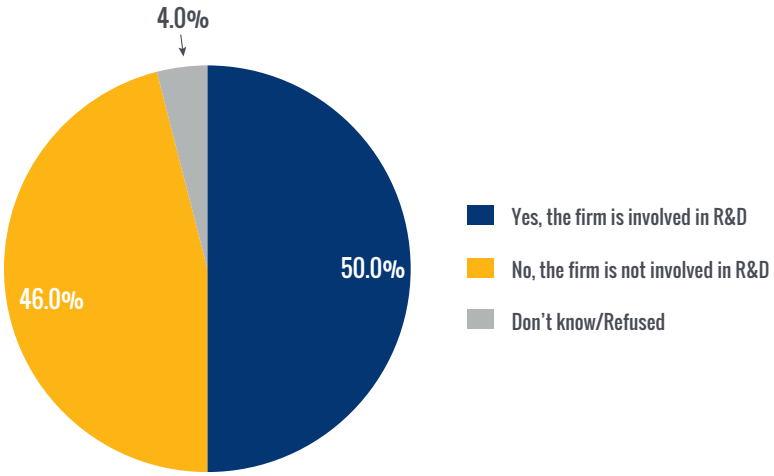
The purpose of this survey was to better understand the channels for R&D funding, the types of funding, and the challenges businesses face when trying to fund R&D projects.

Getty Images/ Westend61

Key R&D Survey Findings

Half of the firms said they conducted some form of R&D in New York.

Figure 47. New York Clean Tech Survey Respondents Involvement in Research and Development



Of those firms that worked within R&D, most worked both with products that were commercially available and those that were still under development.

Founder/owner capital investment were the most commonly cited sources of R&D funding. Equity investment, debt investment, and corporate savings/ revenues were also sources of funding for at least 30% of respondents. Grants and other government funding were the most commonly cited among the "other" category.

The most significant barriers to respondents' ability to grow their businesses were working with utilities and access to skilled labor. Nearly half of respondents provided an "other" response, among which the most frequent themes were costs of doing business (such as navigating regulations, building codes, insurance, etc.) and general difficulty bringing in new sources of capital.

half of clean energy firms surveyed were involved in R&D

Figure 48. Percent of Firms Working Within Stage of Product Development

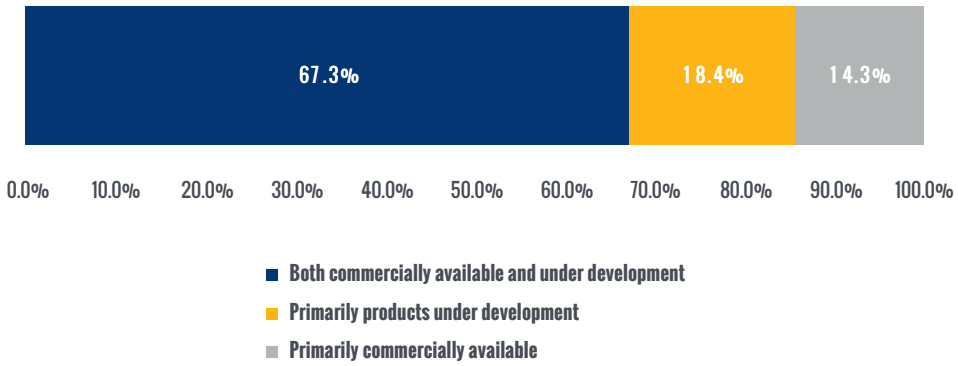
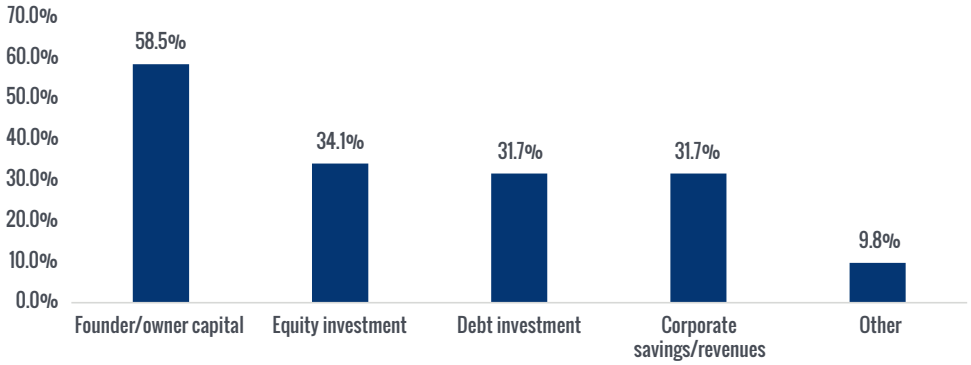
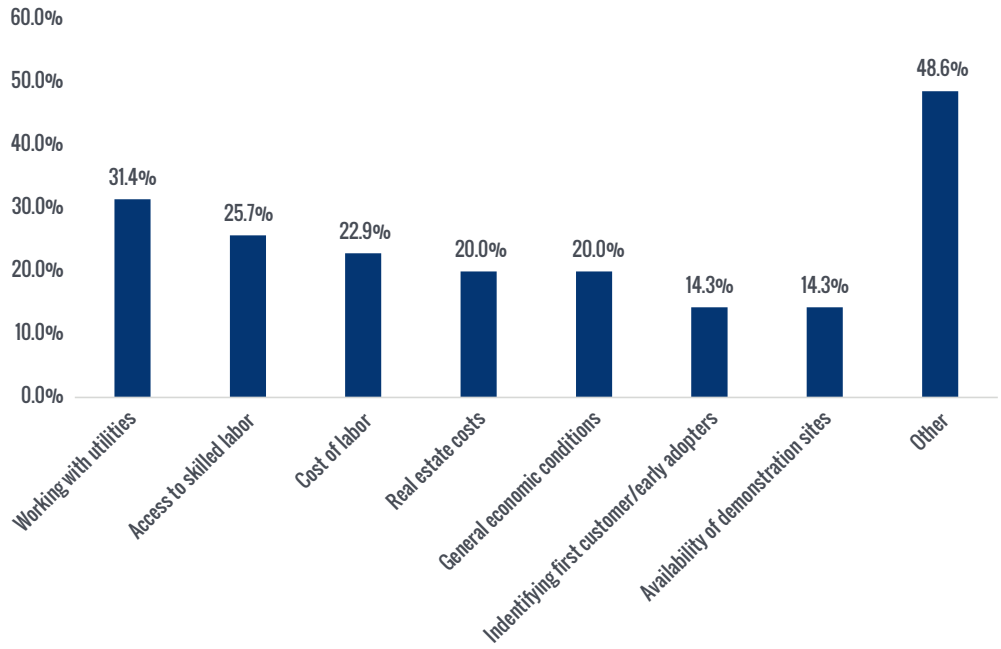


Figure 49. Sources of Firms' R&D Funding



Founder/owner capital investment the most commonly cited source of R&D funding

Figure 50. Barriers to Growing and Developing Businesses



Getty Images/ Mischa Keijser

Appendix A:

Survey & Research Methodology

A Note on Employment by Value Chain

In the interest of presenting reliable estimates for employment by value chain, some value chain categories were combined or in some cases omitted from this report due to a relatively small number of responses.

Future Employment Projections

Employer-projected growth is based on survey responses to a question asking, “how many [energy] employees do you expect to have at your location 12 months from now?” Projected growth rate is calculated by taking the sum of the answers to this question, subtracting the sum of current energy employees, and dividing that total by the sum of current energy employees. This rate is then weighted by technology and value chain to generate overall growth projections.

Research Standards

The research methodology employed for this report, including the survey instrument and sampling plan, has been reviewed rigorously and accepted by the Department of Energy and Bureau of Labor Statistics. The research methodology has been used by the U.S. Government in its annual Energy and Employment Report and has been used increasingly as a tool for measuring clean energy industry jobs and businesses across multiple states, including in California, Massachusetts, Florida, Illinois, Iowa, Missouri, Ohio, Pennsylvania, Rhode Island, Tennessee, and Vermont.

renewable electric power generation

solar

wind

geothermal

bioenergy

low impact hydro

traditional hydro

grid modernization and energy storage

storage

smart grid

energy efficiency

ENERGY STAR® appliances

LED, CFL/efficient lighting

traditional HVAC goods and services

renewable heating & cooling/high AFUE HVAC

advanced building materials/insulation

alternative transportation

hybrid electric

plug-in hybrid electric

natural gas

hydrogen/fuel cell

renewable fuels

other eth/non woody

woody bio

Definition of Clean Energy

The lack of a commonly accepted definition for "clean energy" and the consequent lack of reliable data sources poses a significant challenge in assessing and reporting on the status of this growing industry. Clean Energy, while defined by NYSERDA, does not have a consistent definition across states and nations or a comprehensive set of North American Industry Classification System ("NAICS") codes. As a result, existing data frameworks, which rely on standard industry and occupational codes, do not provide meaningful insight into clean energy trends on their own. Primary data, collected directly from employers, serves as a necessary substitute to ensure the accurate development of clean energy-specific metrics, including employment and establishment totals. The definition of clean energy used in this report includes the technologies listed on this page.

Data Sources

Jobs and business data are collected from federal data sources, state data sources and employer surveys. Survey data references the 12 months between Q4 2017 and Q4 2018.

The federal sources used include the Bureau of Labor Statistics' Quarterly Census of Employment and Wages, Current Employment Statistics, and Occupational Employment Statistics, all available publicly at http://bls.gov.

The 2018 New York clean energy jobs data used within the 2019 New York Clean Energy Industry Report was obtained via the 2019 United States Energy Employment Report (USEER), which was performed under a memorandum of understanding between the Energy Futures Initiative (EFI) and the National Association of State Energy Officials (NASEO). USEER data is publicly available[29] and was refined and customized for New York State based on NYSERDA's definition of the clean energy industry .

The following supplemental surveys for occupational, supply-side, and research and development were conducted on behalf of NYSERDA by BW Research Partnership, Inc.

Occupational Supplemental Survey Methodology

A standard occupational survey instrument was administered to web panels to develop a better understanding of skills and career pathways among current clean energy workers. The survey instrument was programmed internally by BW Research employees and each respondent was assigned a unique ID to prevent duplication. Survey data references the 12 months between Q4 2017 and Q4 2018

In total, 774 respondents participated in the supplemental occupational survey effort. The surveys were administered between April 11th, 2019 and April 23rd, 2019 and the median survey duration was 6.7 minutes.

Workforce Classifications

Since survey respondents in the occupational supplemental were able to self-identify which industry they fell into and no formal definitions were provided, it would be improper to suggest that the following categories are pure equivalents. Rather, they should be thought of as generally similar categories that capture the main thrust of the technology categories used throughout the report.

- Alternative Fuel/Electric Vehicles ≃ Alternative Transportation
- Renewable Energy ≃ Renewable Electric Power Generation
- Energy Efficiency ≃ Energy Efficiency
- Construction or Building Trades ≃ (may contain some energy efficiency otherwise uncaptured).
- Other Clean Energy ≃ a catch-all that captures any other area unmentioned such as renewable fuels.

Supply-Side Supplemental Survey Methodology

Supplemental surveys were administered to online panels of employees. Quotas were set based on age, race, and gender demographics of New York. This survey sought to gain a clearer understanding and develop a profile of potential clean energy workers within the State of New York.

A standard supply-side survey instrument was administered to web panels. The survey instrument was programmed internally by BW Research employees and each respondent was assigned a unique ID to prevent duplication.

In total, 1,892 respondents participated in the supplemental supply-side survey effort. The surveys were administered between April 11th, 2019 and April 23rd, 2019 and the median duration was 15.9 minutes. Survey data references the 12 months between Q4 2017 and Q4 2018

Research and Development Supplemental Survey Methodology

Supplemental surveys were administered to a list of known employers of energy efficiency and solar employees.

A standard occupational survey instrument was administered through email and phone. The survey instrument was programmed internally by BW Research employees and each respondent was assigned a unique ID to prevent duplication.

In total, approximately 100 respondents participated in the supplemental occupational survey effort. The surveys were administered between April 16th, 2019 and May 8th, 2019 and the median duration was 11 minutes.

Getty Images/ Monty Rakusen

Appendix B:

Economic Impact Analysis

Introduction

NYSERDA commissioned BW Research to estimate the economic impact of the net change in clean energy jobs in the State of New York from 2017 to 2018. The first step in this analysis pulled out a New York-specific subset of the United States Energy and Employment Report's (USEER) national dataset. The USEER uses NAICS codes to categorize and aggregate jobs into major technology and sub-technology categories and related value chains. The energy jobs methodology used for USEER is identical to the one used for the 2018 and 2019 New York Clean Energy Industry Reports (NYCEIR).

estimating the economic impact of the net change in clean energy jobs in New York State from 2017 to 2018

To determine the size of the overall clean energy economy in the State of New York, BW Research conducted a further round of modeling for the 2019 NYCEIR. The research team started with the change in energy jobs calculated using the USEER methodology and entered those values into IMPLAN, an economic modeling tool. IMPLAN calculated the impacts of the changes in various categories of New York clean energy jobs on output, earnings, and value added in New York's wider economy. The clean energy jobs estimated by IMPLAN are the result of in-state and out-of-state sales.

Methodology

BW Research used the Economic Impact Analysis for Planning (IMPLAN), an input-output model that traces spending and infrastructural developments through the economy to determine the economic impact of the change in clean energy jobs in 2018 to the State of New York. The cumulative effects of the initial job change are quantified, and the results are categorized into direct, indirect, and induced effects. Direct effects show the change in the economy associated with the initial job creation (or loss), or how the industry experiences the change. Indirect effects include all the backward linkages, or the supply chain responses as a result of the initial job change. Induced effects refer to household spending and are the result of workers who are responsible for the direct and indirect effects spending their wages.

Model Input

To develop the economic model in IMPLAN, BW Research identified the clean energy job net change in the State of New York disaggregated by NAICS code between 2017 and 2018, as calculated for the 2019 NYCEIR (i.e. in-scope jobs). All job changes from 2017 to 2018, whether positive or negative, were added as input to IMPLAN by NAICS code, based on the crosswalk from NAICS to IMPLAN codes. The study area was set as the State of New York, the event year was set to 2018, and the local purchase percentage (LPP) was set to 100%, since it was known that these job changes occurred in the State.

Figure 51. Economic Impact Analysis Model

Model Output

Results from the economic impact analysis included **employment**[30] (full- and part-time jobs), **labor income**, **value added**, and t**otal output**. Output includes total revenues or sales (for retail and wholesale trade, output = gross margin and not gross sales). Value added is the total output minus the cost of inputs from outside the firm, and it measures the contribution to the Gross Regional Product made by the company(ies) or industry(ies). Labor income includes all forms of employment income, such as employee compensation (wages and benefits) and proprietor income (i.e. payments received by self-employed individuals and unincorporated business owners). All these economic impacts are summed to present a final total for the State's overall clean energy economy.

Addressing Supply and Value Chain Double-Counting

One important step in the analysis was to ensure the IMPLAN model, by quantifying direct and indirect jobs, would not double-count the in-scope jobs (jobs from the NYCEIR data). Since NYCEIR data also include value chain jobs and IMPLAN calculates the supply chain employment in the indirect impacts, there could be some double counting. When using jobs as an input (as we do in our analysis) compared to sales or expenditures, determining whether the jobs should be considered direct or indirect jobs, i.e., part of the supply chain economic activity poses an additional challenge. For example, new construction jobs entered in IMPLAN have an impact through the entire value chain (e.g., purchasing Energy Star boilers), as well as in non-energy related industries (e.g., the construction worker buys milk with the new wages, supporting dairy farmers in NY). So, if the supply chain jobs are entered in IMPLAN as direct jobs and the model also accounts for them as an indirect impact of the new construction jobs, then there is double-counting and the impacts will be inflated.

In-scope jobs = Jobs counted in NYCEIR data

Out of scope jobs = Jobs not counted in NYCEIR data

Due to the use of jobs as the economic model input, determining the number of in-scope energy jobs that should be counted in IMPLAN as direct or indirect jobs, without eliminating activity that was not initially included in the NYCEIR data, posed another challenge. While this seems simple in theory, this distinction is more difficult in practice. Thus, to address the double-counting challenge, the research team adopted the following methodology.

The following methodology was developed for the 2018 NYCEIR. The 2019 NYCEIR utilizes the same ratios of adjusted in-scope jobs established from the 2018 methodology and applies those proportions to the employment job growth from 2017 to 2018 in New York State. Thus, using adjustment ratios established in steps 1-3 in the 2018 report, step 4 was the only step taken for the calculation of the 2019 NYCEIR economic impact.

Step 1: Run detailed, individual models for each in-scope industry by IMPLAN code

In-scope jobs are calculated by NAICS industry through sampling methodology utilized in the data collection process. Then, using a NAICS to IMPLAN code crosswalk, the research team ran detailed models for each in-scope industry by IMPLAN code and analyzed the indirect jobs created by each in-scope industry. By creating individual models for each IMPLAN code, the team gained a better understanding of the jobs created in different indirect industries by each in-scope industry.

Step 2: Compare the number of direct + indirect jobs by industry estimated in IMPLAN with the initial in-scope jobs

This step included looking at the number of direct + indirect jobs by industry and comparing it with the initial in-scope jobs by industry. By doing this, the team analyzed the supply chain jobs that are created by each in-scope industry, which determines the adjustment for the in-scope jobs based on the number of direct and indirect jobs created in IMPLAN.

Step 3: Adjust (decrease) the initial in-scope jobs based on the direct + indirect jobs calculated in the IMPLAN model

This step included reducing the in-scope jobs based on the direct + indirect jobs that IMPLAN estimated. For example, if, based on the construction in-scope jobs, IMPLAN calculated that x number of indirect jobs were created in wholesale trade, the research team excluded that x number of jobs from the initial in-scope jobs in wholesale trade since they were already accounted for as indirect jobs of construction.

This important step addresses the fundamental challenge of this study: determining the proportion of in-scope jobs that should be considered direct or indirect (supply-chain) jobs. By following this methodology, the research team avoided double-counting the in-scope jobs that would occur if all of them would be considered direct jobs.

Step 4: Re-run the IMPLAN model with the "adjusted" in-scope jobs by industry

After running several individual and collective models, the last step was to re-run the IMPLAN model one more time with the adjusted number of in-scope jobs by industry. The industries that needed input adjustment due to additional jobs created by other industries included legal services, wholesale trade, architectural, engineering, and related services, other financial investment activities, management consulting services, software publishers, grantmaking and social advocacy organizations, and semiconductor and related device manufacturing.

Final Output

- Direct = "adjusted" in-scope industry jobs by industry to account for the indirect jobs IMPLAN calculates. Direct employment consists of the jobs that are created from the initial impact. For example, increase in demand and use of electric vehicles increases demand for mechanics who are certified to work on electric vehicles.
- Indirect = indirect jobs produced by the model which include in- and out-of-scope industries. Indirect jobs are jobs that are created along the supply chain as a result of the direct activity. For example, the new mechanic for electric vehicles now needs additional tools, which means increased demand for tool manufacturing.
- Induced = all induced jobs calculated in IMPLAN. Induced jobs are jobs that are created as a result of the additional income/wages earned from the direct impact. For example, the new electric vehicle mechanic now has more money and subsequently consumes more on healthcare, food at restaurants, and clothing from retailers. A new nurse, waiter, or retail worker hired as a consequence of this activity falls under induced jobs.

11,316

net jobs were created by clean energy economic activity in 2018

Results

Between 2017 and 2018, there was a positive net change of 7,280 jobs in a variety of clean energy industries. Ultimately, our economic impact analysis finds that **11,316 net jobs were created** due to increased clean energy activity. The industries with the largest job growth were construction of other new nonresidential structures, software publishers, automotive repair and maintenance, construction of new power and communication structures, and construction of new single-family residential structures.[31]

Results from the entry of the 6,847[32] direct jobs estimate in the IMPLAN economic impact model showed that there was a total impact of 11,316 jobs created by clean energy economic activity in 2018, of which 6,847 were direct jobs, 1,491 were indirect jobs, and 2,978 were induced jobs. These jobs were responsible for $849 million in labor income (Table 5). Additionally, they contributed over $1.3 billion in value added and over $2.1 billion in total output. Ultimately, of the approximately 168,800[33] new clean energy and non-clean energy jobs created in New York between 2017-2018, clean energy-related jobs accounted for about 6.7% of that growth.


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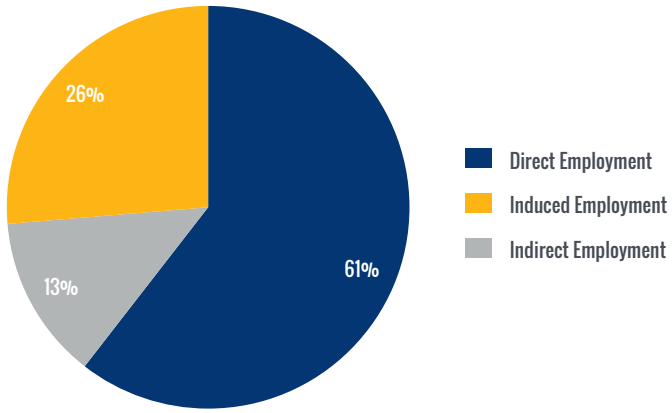
Table 5. Total Economic Impact of the Net Change in Clean Energy Jobs in New York State, 2017-2018

Impact Type	2017-2018 Employment	2017-2018 Labor Income	2016-2017 Employment	2016-2017 Labor Income
Direct Effect	6,847	$551,576,341	5,327	$455,236,964
Indirect Effect	1,491	$117,228,160	1,339	$100,385,716
Induced Effect	2,978	$180,549,492	2,419	$141,515,921
Total Effect	**11,316**	**$849,353,994**	**9,085**	**$697,138,600**

Induced impacts were larger than indirect impacts; 26% of the jobs created were induced and 13% were indirect jobs. This is modest change from the analysis conducted in the 2018 New York Clean Energy Industry Report, where 59% of jobs created were direct, 27% were induced jobs, and 15% were indirect jobs. Even so, these proportions suggest that clean energy employment has a notable multiplier effect—or the creation of additional jobs beyond direct jobs. This is driven by clean energy's strong presence in industries like utilities, construction, and manufacturing, which, according to the Economic Policy Institute, have among the largest multiplier effects.[34]

Figure 52. Portion of Jobs Created by Type of Impact



Direct Industries

The clean energy sectors with the largest direct job growth included construction of other non-residential structures, software publishers, automotive repair and maintenance, construction of new power and communications structures, and construction of new single-family residential structures. Of these top ten industries, six out of ten industries appeared in the top ten direct growth industries in the 2018 NYCEIR. Notable additions and changes to this year's findings are software publishers, which have seen a nationwide increase in clean technology as the Internet of Things (IoT) becomes increasingly popular among both energy production and efficiency technologies. Another substantial change occurred in automotive repair and maintenance, which saw an increase driven largely by the increased demand for technicians who are certified to work on electric and hybrid-electric vehicles.

automotive repair and maintenance saw an increase in job growth driven largely by the increased demand for technicians who are certified to work on electric and hybrid-electric vehicles

Figure 53. Top 10 Clean Energy Direct Sectors in New York State by Employment, 2018

Indirect Industries

Among the industries that make up the supply chain for New York's clean energy sector, those that saw the largest job growth from 2017-2018 were wholesale trade, real estate, architectural, engineering, and related services, software publishers, and full-service restaurants. Of the top ten indirect industries in 2016-2017, five are among the top ten during the 2017-2018 timeframe. Notable additions to this year's list of top industries are software publishers, health and personal care stores, and management of companies and enterprises.

Figure 54. Top 10 Supply Chain (Indirect) Industries in New York State by Employment, 2018[35]

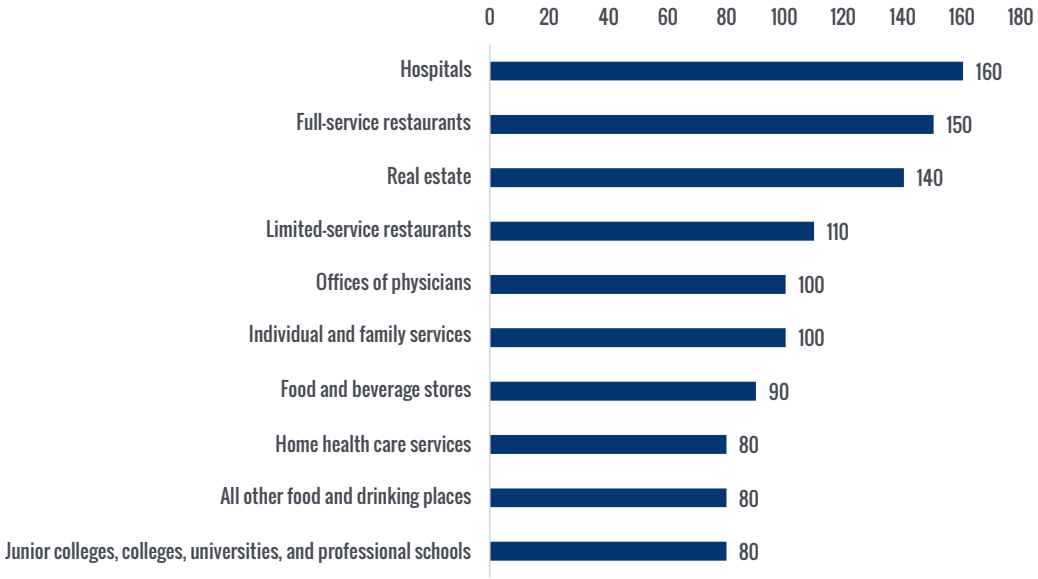
Induced Industries

Induced effects, and the industries they most greatly affect, are helpful in demonstrating the secondary effects of additional employment and economic activity across the State. The industries most impacted by induced effects include hospitals, full-time restaurants, real estate, limited-service restaurants, and physicians' offices. Recognizing the job growth induced by clean energy worker spending, along with direct and indirect job growth, provides a holistic view of the impacts New York clean energy jobs have in the State. Eight of the top ten induced industries in the 2018 NYCEIR also appear on the list of top ten induced industries in the 2019 NYCEIR. The two new additions are all other food and drinking places and junior colleges, colleges, universities, and professional schools.

industries most impacted by induced effects include:

- hospitals
- full-time restaurants
- real estate
- limited-service restaurants
- physicians' offices

Figure 55. Top 10 Induced Industries in New York State by Employment, 2018[36]



Getty Images/Maskot

Fiscal Impacts

New York's clean energy economy contributes a substantial amount to local, State, and federal taxes every year. New York's clean energy jobs are responsible for over $153 million in State and local taxes and more than $196 million in federal taxes (Table 6). Of the additional federal taxes generated, 44% were from household taxes (e.g. income tax) 40% were from employee compensation (taxes paid by employers) and 10% were from private enterprise. Proprietor income tax and tax on production and imports each accounted for 3% of total federal revenues. Of the State and local taxes generated, 69% were from taxes on production and imports, 23% was from taxes on households, 6% was from private enterprise, and 2% was from employee compensation.

New York's clean energy jobs are responsible for over $153 million in State and local taxes and more than $196 million in federal taxes

Table 6. Impact of New York Clean Energy Jobs on Taxes, 2018

Taxes	Impact on Taxes
State and Local Taxes	$153,147,106
Federal Taxes	$196,468,264

Job Distribution

As mentioned previously, this study's economic analysis used multiple individual models to understand the relationship between direct and indirect jobs across multiple industries. This approach makes estimating the distribution of direct, indirect, and induced jobs created in New York by activity in the clean energy industry possible. For example, as Table 7 shows, the fabricated structural metal manufacturing jobs created by clean energy industry activity are predominantly a direct result of that activity—that is, the money flowing to metal fabrication firms results in—with minimal exceptions—the hiring of metal fabricators to produce and repair clean energy related products. By contrast, the money flowing from the clean energy industry to personal and household goods repair and maintenance firms results in the hiring of employees whose work relates indirectly or not at all to clean energy industry activity (Table 7).

Table 7. Type of Job Created by In-Scope Industries[37, 38]

Description	Direct	Indirect	Induced
Wholesale trade	56%	32%	12%
Automotive repair and maintenance	96%	1%	3%
Legal services	91%	3%	5%
Management of companies and enterprises	0%	61%	39%
Management consulting services	30%	45%	24%
Grantmaking, giving, and social advocacy organizations	94%	0%	5%
Architectural, engineering, and related services	78%	20%	2%
Personal and household goods repair and maintenance	0%	41%	59%
Commercial and industrial machinery and equipment repair and maintenance	0%	69%	23%
Software publishers	96%	4%	0%
Sheet metal work manufacturing	98%	2%	0%
Fabricated structural metal manufacturing	94%	6%	0%
Lighting fixture manufacturing	96%	4%	0%
Motor and generator manufacturing	97%	3%	0%
Turbine and turbine generator set units manufacturing	99%	1%	0%
Mineral wool manufacturing	91%	6%	3%
All other miscellaneous electrical equipment and component manufacturing	99%	1%	0%
Wiring device manufacturing	89%	11%	1%
Motor and generator manufacturing	99%	1%	0%
Industrial gas manufacturing	97%	3%	0%
Fabricated structural metal manufacturing	95%	5%	0%
Semiconductor and related device manufacturing	98%	1%	0%

Getty Images/Maskot

IMPLAN identifies job growth in industries affected by the clean energy industry but are not part of that industry

Out-of-Scope Industries

The following list of out-of-scope industries includes employment in industries which the NYCEIR does not collect data on. One benefit of using an economic model like IMPLAN is that it identifies job growth in industries that are affected by the clean energy industry but are not part of that industry. Identifying job growth in these "out-of-scope" industries indicates the overall size of New York's clean energy economy and helps to improve estimates of in-scope industries in future years.

Table 8 provides a list of New York's Clean Energy supply-chain industries that were not included in the original dataset (by IMPLAN industry) and the jobs attributable to clean energy industry growth in those industries.

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Table 8. New York's Clean Energy Out-of-Scope Indirect Industries

Description	Indirect Jobs (2018)
Real estate	103
Full-service restaurants	40
Business support services	37
Health and personal care stores	36
Clothing and clothing accessories stores	31
Truck transportation	31
Services to buildings	29
Advertising, public relations, and related services	29
Miscellaneous store retailers	28
Marketing research and all other miscellaneous professional, scientific, and technical services	28
Accounting, tax preparation, bookkeeping, and payroll services	26
Retail Electronics and appliance stores	26
Other support services	26
Employment services	24
Retail Building material and garden equipment and supplies stores	24
Investigation and security services	22
Commercial and industrial machinery and equipment rental and leasing	20
Other educational services	19
Couriers and messengers	19
Retail Sporting goods, hobby, musical instrument and bookstores	18
Postal service	18
Limited service restaurants	14
Non-store retailers	14
Independent artists, writers, and performers	14
Specialized design services	14
Maintenance and repair construction of nonresidential structures	13
Warehousing and storage	13
Retail Motor vehicle and parts dealers	12
Transit and ground passenger transportation	11
Retail Furniture and home furnishings stores	11
Scenic and sightseeing transportation and support activities for transportation	11
Retail Gasoline stores	10
Landscape and horticultural services	10
Computer systems design services	10

Getty Images/ anatoliy_gleb

End Notes

1 2017-2018 National clean energy job growth of 2.7% - Based on USEER data (NY only) that was adjusted to reflect definitions of clean energy used in this report.

2 2016-2018 New York overall growth of 3.4%: Bureau of Labor Statistics – Quarterly Census of Employment and Wages. Q2, Third Month 2017-2018, Total All Ownership.

3 2017-2018 New York overall growth of 1.8%: Bureau of Labor Statistics – Quarterly Census of Employment and Wages. Q2, Third Month 2017-2018, Total All Ownership.

4 For more information about how future employment is projected, please see Appendix A

5 Grid Modernization & Energy Storage establishments account for 0.4% of clean energy establishments

6 “Other support services” includes primarily NAICS 81 (Repair and Maintenance), as well as some administrative support and waste management firms (NAICS 56). “Other” includes anything not otherwise classified, e.g. non-profits (NAICS 81), management of companies and enterprises (NAICS 55), and other unclassifiable industries by NAICS code.

7 “Other support services” includes primarily NAICS 81 (Repair and Maintenance), as well as some administrative support and waste management firms (NAICS 56). “Other” includes anything not otherwise classified, e.g. non-profits (NAICS 81), management of companies and enterprises (NAICS 55), and other unclassifiable industries by NAICS code.

8 Source: U.S. Census Bureau 2018 estimates

9 Source: 2019 United States Energy and Employment Report

10 The numbers for racial categories in each column sum to more than 100% because, per U.S. Census methods, Hispanics may be of any race and so are also counted in applicable race categories.

11 Insufficient data were available to provide reliable estimates of the demographic breakdown of workers in the other three technology categories considered in this report

12 Press Release: Governor Cuomo Executes the Nation’s Largest Offshore Wind Agreement and Signs Historic Climate Leadership and Community Protection Act, July 18, 2019.

13 Rates used in this analysis are different from those used in the 2019 United States Energy and Employment Report (USEER). Technology definitions used in the 2019 New York Clean Energy Industry Report are not consistent with those used in the USEER, so rates across reports are not comparable.

14 Value chain categories from Section 1.4 have been combined when displayed here due to a relatively low number of responses.

15 National Solar Jobs Census 2018. The Solar Foundation

16 Rates used in this analysis are different from those used in the 2019 United States Energy and Employment Report (USEER). Technology definitions used in the 2019 NY Clean Energy Industry Report are not consistent with those used in the USEER, so rates across reports are not comparable.

17 Value chain categories from Section 1.4 have been combined when displayed here due to a relatively low number of responses.

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19 Rates used in this analysis are different from those used in the 2019 United States Energy and Employment Report (USEER). Technology definitions used in the 2019 New York Clean Energy Industry Report are not consistent with those used in the USEER, so rates across reports are not comparable.

20, NYSERDA Electric Vehicle Registration Map.

21 “Current Natural Gas Vehicle Statistics.” NGV Global.

22 “Don’t know/ Refused” responses were excluded from this analysis

23 Data related to hiring difficulty is from the 2019 USEER and not from the Occupational Survey.

24 Interested include those who selected “agree” or “strongly agree”. Not Interested includes “disagree” and “strongly disagree” responses. “Neutral” and “Don’t know/ Refused” responses are not shown in this figure.

25 Respondents could choose more than one response.

26 US Energy and Employment 2019 State Reports, New York. https://www.usenergyjobs.org/2019-state-reports

27 “Renewable Energy R&D Funding History” Corrie E. Clark. Congressional Research Service. June 18, 2018.

28 “State Government R&D Expenditures Increase 7% in FY 2017”. Christopher Pece. National Center for Science and Engineering Statistics. December 2018.

29 https://www.usenergyjobs.org/

30 Employment refers to the annual average of monthly jobs (same definition used by QCEW, BLS, and BEA, nationally) and it includes both full- and part-time jobs.

31 Based on the NYCEIR jobs’ IMPLAN codes.

32 This number is different than the initial net change since some of the NYCEIR jobs were distributed into direct and indirect jobs as part of the methodology to avoid double counting.

33 Bureau of Labor Statistics Q2 Third Month 2016-2018, public and private ownerships.

34 “Updated Employment Multipliers for the U.S. Economy”. Economic Policy Institute. January 23, 2019.

35 As a result of the 2018 Clean Energy Net Job Change in New York.

36 As a result of the 2017 Clean Energy Net Job Change in New York.

37 This table does not include industries with 100% direct employment. Some examples of these sectors not included are “construction of new power and communications structures” and “construction of other non-residential structures”.

38 Industries which overall lost employment are not included in this table.

State of New York
Andrew M. Cuomo, Governor

New York State Energy Research and Development Authority
Richard L. Kauffman, Chair | Alicia Barton, President and CEO