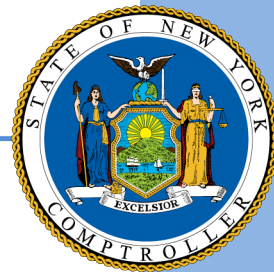


Green and Growing: Employment Opportunities in New York's Sustainable Economy

OFFICE OF THE NEW YORK STATE COMPTROLLER

Thomas P. DiNapoli, State Comptroller

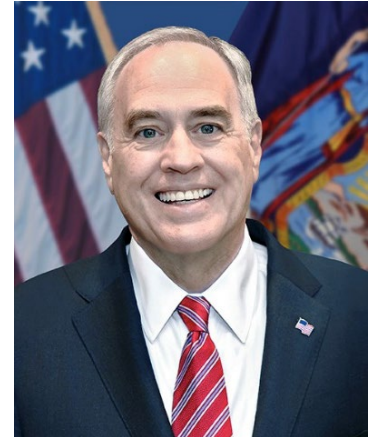


February 2022

Message from the Comptroller

February 2022

The clear and growing threat of extreme weather fueled by climate change calls for concerted action to reduce greenhouse gas emissions and increase the resilience of our homes, businesses and infrastructure. To address this threat, New York State has established stringent greenhouse gas reduction goals in the Climate Leadership and Community Protection Act (CLCPA).



New York has been working to transition to cleaner sources of energy by adopting policies to promote the adoption of lower polluting energy technologies and to reduce energy use. These policies have contributed to making New York one of the most energy efficient states, reducing energy sector pollution and virtually eliminating reliance on the most polluting fuel, coal.

While the goals of the CLCPA are much more ambitious than prior efforts, New York and other states have already seen workforce impacts from the progress to a greener economy. The far-reaching scope of the CLCPA signals that “greening” of occupations is likely to continue and possibly accelerate. In 2019, the green economy influenced up to 17.3 percent of New York State’s workforce. The green workforce is broader than the jobs that often come to mind, such as sustainability officers or solar panel installers and technicians. In fact, most green jobs are found in well-established occupations, such as laborers, electricians and other technicians, for whom measures to address climate change, improve energy efficiency, reduce pollution and enhance sustainability may further increase demand for their services or require new knowledge and skills.

This finding is important for policymakers to consider as New York continues its recovery from the devastation of the COVID-19 pandemic and many workers reconsider their career paths. Workforce development policies that ensure New Yorkers have the education and training assistance that they need to be successful in the green economy will also support the State’s transition to a cleaner energy mix.

Thomas P. DiNapoli
State Comptroller

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I. Executive Summary

In 2019, New York State enacted the Climate Leadership and Community Protection Act (CLCPA), the State's latest and most ambitious endeavor to reduce the negative environmental and public health impacts of energy use. The CLCPA is intended to facilitate significant change to economic activity and industry across the State, and the continued "greening" of the economy has the potential to affect significant numbers of jobs in a wide variety of occupations. Often, "green jobs" are narrowly identified as those related to clean energy or energy efficiency, but the impact of a green economy is broader. As actions are taken to implement the CLCPA, new types of jobs may be created, but more significantly, there may also be increased demand for certain well-established occupations, such as electricians, and others, such as maintenance and repair workers, may be required to enhance their skills and training to adapt to new technologies and approaches.

Using this broader concept of green occupations, this report relies on definitions established by the United States Bureau of Labor Statistics (BLS) and a framework developed by the Occupational Information Network (O*NET) to quantify green jobs in New York. Key findings include:

- There were 1.7 million green jobs in New York in 2019, 17.3 percent of total employment.
- Almost 85 percent of green jobs are in increased demand (37.5 percent) and enhanced skill (46.8 percent) occupations; new and emerging occupations were 15.7 percent of green jobs.
- Green jobs constitute a smaller share of State employment than the national average (18.8 percent), and New York trails neighboring states such as Pennsylvania (20.9 percent) and New Jersey (18.5 percent), midwestern states like Illinois (21.4 percent), as well as large states like California (18.2 percent).
- Between 2015 and 2019, green jobs grew by 13.2 percent, more than twice the rate of total job growth (6 percent). The number of jobs in new and emerging occupations grew by 82.5 percent during this time.
- The number of green jobs declined by 31.9 percent in 2020, more sharply than total employment, largely as a result of the economic disruption of the COVID-19 pandemic.

As the State implements the CLCPA and continues to recover from the pandemic, it is important that the workforce and businesses in the State are prepared for the policy responses and technological innovations needed to respond to problems related to the climate and environment. Educational and workforce development programs should be crafted to ensure that New Yorkers have the skills they need to participate in the growing green economy.

In addition, the State should ensure that robust labor standards and practices, such as project labor agreements, contract terms addressing safety, dispute resolution and labor harmony policies, as well as domestic content and minority and women owned business requirements, are incorporated into the State's environmental and energy policy frameworks and the projects that ensue. This would benefit workers in both new and existing green jobs, and facilitate the State's transition to a green economy.

II. Climate Change Policies in New York

Enacted in 2019, the Climate Leadership and Community Protection Act (CLCPA) is a broad environmental and energy law that sets ambitious goals for long-term reductions in greenhouse gas emissions that are consistent with a scientific consensus on global reductions necessary to avoid the most damaging impacts of climate change.¹ The CLCPA requires a 40 percent reduction in greenhouse gases by 2030 and an 85 percent reduction by 2050, as compared to 1990 emission levels.² Achieving CLCPA goals will require significant changes in sources of energy and more efficient energy use in our homes, businesses, transport and infrastructure.

While job creation or economic development is not the primary purpose of the CLCPA, new green incentive programs and regulations have impacts on the labor market. While some studies have identified dislocation effects, others find increased labor market demand for skills associated with green jobs and employment increases.³

In recognition of potential labor market impacts of the climate goals proposed, an earlier bill, the Climate and Community Protection Act, contained important labor provisions including contractor participation in apprenticeship programs as well as specified contract terms addressing safety, dispute resolution and labor harmony policies.⁴ These provisions would have applied broadly to all permits, regulations and administrative approvals associated with implementing the bill and that: met certain financial thresholds; occurred on public property; or met the criteria for public work. In addition, the bill extended these protections to building service workers employed in association with the project and established a monitoring provision to ensure that the statute's requirements were met.

Ultimately, the CLCPA contained a statement that it was subject to prevailing wage law and required the creation of an advisory group to identify industries that may be significantly impacted and to make recommendations on workforce training and other measures to prepare

¹ The Climate Leadership and Community Protection Act was enacted as Chapter 106 of the Laws of 2019. For more information on greenhouse gas reductions required to maintain at least a reasonable chance of achieving warming of no more than 1.5 degrees Celsius by 2100, see The United Nations Intergovernmental Panel on Climate Change, *Global Warming of 1.5°C.*, 2018, available at: <https://www.ipcc.ch/sr15/>.

² See: 6 NYCRR Part 496, *Statewide Greenhouse Gas Emission Limits*, available at: <https://www.dec.ny.gov/regulations/121052.html>.

³ Studies that have identified dislocation effects include: W. Reed Walker, "Environmental Regulation and Labor Reallocation: Evidence from the Clean Air Act," *The American Economic Review*, May 2011, vol. 101, no. 3; and "The Transitional Costs of Sectoral Reallocation: Evidence from the Clean Air Act and the Workforce," *Quarterly Journal of Economics*, November 2013, vol. 128, no. 4. Studies identifying increased demand for green jobs skills include: Francesco Vona, et. al. "Environmental Regulation and Green Skills: An Empirical Exploration," *Journal of the Association of Environmental and Resource Economists*, October 2018; and Taedong Lee, "The Effect of Clean Energy Regulations and Incentives on Green Jobs: Panel Analysis of the United States, 1998-2007," *Natural Resources Forum: A United Nations Sustainable Development Journal*, August 2017, vol. 41, no. 3, pp. 145-155. Studies finding increased employment levels include: Taedong Lee; and Marilyn A. Brown, et. al. "Estimating Employment from Energy-Efficiency Investments," *MethodsX*, 2020, vol 7.

⁴ See A.8270-B, June 5, 2017.

workers with any required new skills to capitalize on new green job opportunities.⁵ To provide additional support for workers in the State through the transition to a green economy, the State Enacted Budget for SFY 2021-22 established prevailing wage, project labor agreement, domestic content and minority and women owned business requirements for renewable energy projects with a capacity of greater than 5 megawatts and a contract for sale of renewable energy credits to a public entity.⁶

Recently, two programs to provide job training for occupations in the offshore wind industry were established within the State University of New York System. In 2021, the Offshore Wind Training Institute began operations through a partnership between Stony Brook University, Farmingdale State College and the New York State Energy Research and Development Authority (NYSERDA) and will be funded with \$20 million in State funds. In 2019, the National Offshore Wind Training Center was founded through a partnership between the Suffolk County Community College and the Sunrise Wind Project, which will provide \$10 million in funding for the Center.

The CLCPA is the latest in a line of policy initiatives aimed at addressing the environmental impacts of energy use in New York State. Prior to the CLCPA, the State's 2014 Reforming the Energy Vision (REV) was an initiative to integrate energy efficiency and renewable energy efforts, with the stated goal of giving customers more control over their energy use and reducing energy bills.⁷ Under the REV umbrella, the Public Service Commission also initiated new proceedings, like Community Choice Aggregation, the Clean Energy Fund (CEF) and the Clean Energy Standard (CES).

From 2016 through 2020, \$3.7 billion has been disbursed or encumbered in support of REV programs to promote the development of renewable energy or more efficient use of energy.⁸ REV programs include NY-SUN, adopted in 2012 and funded through the CEF, which promotes small-scale distributed renewable generation by subsidizing a portion of the cost of installing equipment and enabling owners to receive a payment from their utility for the sale of the electricity they generate beyond their needs.

The CES, adopted in 2016, provides incentives to large-scale onshore and offshore wind generation, solar generation, certain bioenergy and nuclear generation through a payment for each megawatt hour of renewable or zero emission energy generated.⁹ To implement the CES, NYSERDA conducts regular competitive procurements for qualifying renewable resources,

⁵ See Chapter 106 of the Laws of 2019.

⁶ See Chapter 56 of the Laws of 2021.

⁷ New York State Public Service Commission (NY PSC), "Case 14-M-0101:REV," available at: <https://www3.dps.ny.gov/W/askpsc.nsf/All/71BF9B959E12F08A85257FC5005E0679?OpenDocument>.

⁸ New York State Energy Research and Development Authority (NYSERDA), "Clean Energy Dashboard," available at: <https://www.nyserda.ny.gov/Researchers-and-Policymakers/Clean-Energy-Dashboard/View-the-Dashboard>. Viewed on August 25, 2021.

⁹ NY PSC, "Order Adopting a Clean Energy Standard. Cases 15-E-0302 and 16-E-0270," August 1, 2016.

including two resulting in contract awards for five offshore wind projects capable of generating over 4,300 megawatts of renewable electricity.¹⁰

The State (and federal government) also offers tax credits and other incentives to individuals, businesses and utilities.¹¹ For example, New York State authorizes a personal income tax credit equal to 55 percent of the cost of purchasing and installing solar or wind electric generating equipment, up to a maximum credit of \$2,750 at a taxpayer's principal residence.¹² Federal examples include the production tax credit for wind, which provides 1.5 cents per kilowatt hour for the sale of electricity produced from qualifying equipment and the investment tax credit for solar which provides tax credits equal to 26 percent of the cost of solar electric generating systems installed on homes or businesses.¹³ Utilities are required to provide energy efficiency services or incentives, such as rebates for the purchase of efficient heating or cooling equipment, to their customers and are permitted to recover the costs of these services through their electric rates.

In addition, New York State has adopted a variety of other programs and laws intended to promote sustainability, including incentives for vehicles powered by renewable energy, programs to require the recycling of a variety of waste streams, programs to reduce contaminants in sanitary and other water discharges and programs to protect wildlife.

The following section examines how these policies and their implementation have affected employment in New York State.

¹⁰ Developers are also eligible to receive favorable financing terms through the New York State Green Bank. See, "Purchase of New York Tier 1 Eligible Renewable Energy Certificates (RECs) Request for Proposals No. RESRFP21-1, April 22, 2021," available at: <https://portal.nyserda.ny.gov/servlet/servlet.FileDownload?file=00Pt000000UOhG5EAL>; and NYSERDA, "Offshore Wind: 2,490 Megawatts," available at: <https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind>.

¹¹ New York State Department of Tax and Finance, "Solar Energy System Equipment Credit," available at: https://www.tax.ny.gov/pit/credits/solar_energy_system_equipment_credit.htm; and NY Solar Map, "Residential Solar Incentives," available at <https://nysolarmap.com/financing-solar/incentives/residential/>.

¹² New York State Tax law, Section 606, paragraph g.

¹³ See U.S. Department of the Treasury, Internal Revenue Service "Renewable Electricity, Refined Coal, and Indian Coal Production Credit," available at <https://www.irs.gov/pub/irs-pdf/i8835.pdf>; and U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Homeowner's Guide to the Federal Tax Credit for Solar Photovoltaics," available at: <https://www.energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics>.

III. Green Occupations in New York

Implementing the CLCPA may alter economic activity and encourage the creation of new businesses and occupations; these jobs, such as climate change scientists and solar panel installers, are typically what most people think of as “green jobs.” However, programs such as REV, or those that may be implemented as part of the CLCPA, affect industries across the economy. For example, companies are hiring staff to manage energy use or sustainability initiatives. Construction, manufacturing, sales, and research and development firms are adapting to create new renewable products or adopt more environmentally friendly practices, thereby altering skillsets required or increasing demand within occupations involved in these activities. Employment in these ancillary fields may not be captured by surveys that only consider companies directly involved in installation of efficiency upgrades or renewable energy infrastructure. Environmental and energy policies and investments can affect employment more broadly, requiring new skills in existing occupations, increasing demand for certain occupations and perhaps reducing demand for others.

The U.S. Bureau of Labor Statistics (BLS) defines green jobs broadly as those in industries that produce goods and services that benefit the environment or conserve natural resources.¹⁴ The Occupational Information Network (O*NET), a project of the U.S. Department of Labor Employment and Training Administration, has put a finer point on this definition: “the economic activity related to reducing the use of fossil fuels, decreasing pollution and greenhouse gas emissions, increasing the efficiency of energy usage, recycling materials, and developing and adopting renewable sources of energy.”¹⁵

O*NET identifies industries that will be most affected by the green economy as agriculture and forestry, construction, government, manufacturing, transportation, utilities, securities and commodities trading, professional, scientific, and technical services, and waste management and remediation

Other Definitions of Green Jobs

Some definitions of green jobs used by government institutions, research institutes, and nonprofits are narrow. In a 2011 report, the New York State Department of Labor defined green economic activities as those that produce goods or deliver services that increase energy efficiency or generate renewable energy and defined green employees as those primarily engaged in producing green products or services. Subsequent reports by the New York State Energy Research and Development Authority (NYSERDA) and nonprofit organizations have maintained this focus on clean energy industries. In its *New York Clean Energy Industry Report*, published in 2020, NYSERDA found a total of 163,754 clean energy jobs in New York in 2019.

¹⁴ U.S. Bureau of Labor Statistics, “Green Goods and Services Occupations,” available at: <https://www.bls.gov/ggs/>.

¹⁵ The definition of the green economy is found in: Erich Dierdorff, et. al. *Greening of the World of Work: Revisiting Occupational Consequences*, The National Center for O*NET Development, December 9, 2011. These initiatives translate into more specific activities such as: energy efficiency retrofits of buildings; increasing the use and availability of mass transit; producing and maintaining energy-efficient automobiles; developing technological innovations to use resources and existing fuels with fewer negative environmental impacts and to derive energy from new cleaner and/or renewable fuels.

services.¹⁶ In New York State, these industries constituted approximately one-third of employment in 2019.

O*NET also notes that adoption of new technologies will be a primary driver of the green economy, and understanding how occupations – which are groups of jobs with similar sets of tasks, processes, objectives and worker characteristics – are impacted is important for “locating, describing, and forecasting” workforce consequences and potential workforce developments efforts.¹⁷

In some industries, new occupations will be created, while in others, job requirements and demands will change or grow. O*NET outlines three broad categories of green occupations:

1. *Green New and Emerging Occupations.* Occupations that represent new roles in the workforce for which the green economy requires unique work and worker requirements; these jobs may be “entirely novel or ‘born’ from an existing occupation.”¹⁸ New and emerging occupations are as varied as automotive engineering technicians, environmental restoration planners, water and wastewater engineers, environmental economists, solar photovoltaic installers, wind energy service technicians, recycling and reclamation workers, and biomass plant technicians.
2. *Green Increased Demand Occupations.* Occupations, such as those in certain construction, science, manufacturing and service occupations, for which demand is increased by the activities associated with the green economy, but for which participation does not require the development of new tasks or skills.¹⁹ Examples of increased demand occupations demonstrate the broad array of affected occupations, including: construction workers, materials scientists, engine and other machine assemblers, supervisors of production and operating workers, transit and intercity bus drivers, forest and conservation workers, agricultural inspectors and customer service representatives.

For example, green construction, which primarily refers to the design, construction and retrofitting of buildings to be more resource efficient, involves the work of a number of trades. To the extent that incentives, regulation, or customer preference enhances demand for this activity, the work of construction trades will be increased.²⁰

3. *Green Enhanced Skills Occupations.* Occupations, such as property managers, architects or engineers, for which the activities and/or technologies associated with the green economy require new or updated skills. While the purpose of the occupation does

¹⁶ Twelve categories identified by O*NET placed into U.S. Bureau of Labor Statistics industry and sector groupings by OSC staff. See: Dierdorff, Erich C. et. al. *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations*, The National Center for O*NET Development, February 12, 2009, pp. 13-14.

¹⁷ Ibid.

¹⁸ Ibid.

¹⁹ Ibid.

²⁰ Ibid.

not change, the people who hold these roles may require additional education and/or certifications, new skills and knowledge and may have new tasks to master.²¹ Occupations requiring enhanced skills are also wide ranging, including: general and operations managers, marketing managers, architectural and engineering occupations, urban and regional planners, financial analysts, environmental science and health technicians, arbitrators, mediators and conciliators and public relations specialists.

For example, to increase energy efficiency, green buildings may have updated technology such as heat pumps, or combined heat and power systems, as opposed to more traditional air conditioning and boiler systems for heating and cooling. General and operations managers employed in these buildings will require a new set of skills and knowledge to operate these systems.²²

This report applies O*NET's classifications of green occupations to data produced annually by BLS.²³ The O*NET framework provides a broad understanding of the scope and expansion of green occupations within the larger economy; however, O*NET regularly updates its occupation definitions to reflect the evolution of worker responsibilities. Changes made in 2019 affected the number of jobs attributed to each occupation and within each green job category, limiting the ability to make reliable comparisons in specific jobs, titles and trades over time. Nevertheless, the method is useful for understanding the occupations that are influenced by the green economy and for generating a snapshot of the magnitude of this influence. (See Appendix A for a full description of the methodology.)

Green Jobs in New York

In 2015, there were a total of 1.5 million jobs in green occupations, or 16.2 percent of State employment.²⁴ Of these green jobs, only 9.7 percent or 141,767 were new and emerging jobs, including professions such as solar thermal installers, representatives and assessors; recycling; water and wastewater engineers; and energy brokers.

Most green jobs, 51.3 percent or 748,234, were enhanced skills jobs. Common titles included general and operations managers, maintenance and repair workers, and construction laborers. Increased demand jobs were 567,990, or 39.0 percent, of all green jobs, and included electricians, carpenters, mechanics, and software developers. (See Figure 1.)

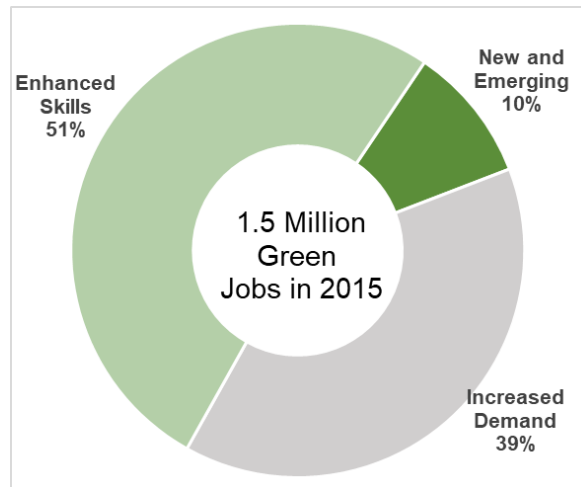
²¹ Ibid.

²² Ibid.

²³ Dierdorff, Erich C. et. al, *Greening of the World of Work: Revisiting Occupational Consequences*, op.cit..

²⁴ Office of the State Comptroller staff analysis of data from U.S. Bureau of Labor Statistics, Occupational Employment and Wage Survey, May 2015, available at: <https://www.bls.gov/oes/tables.htm>.

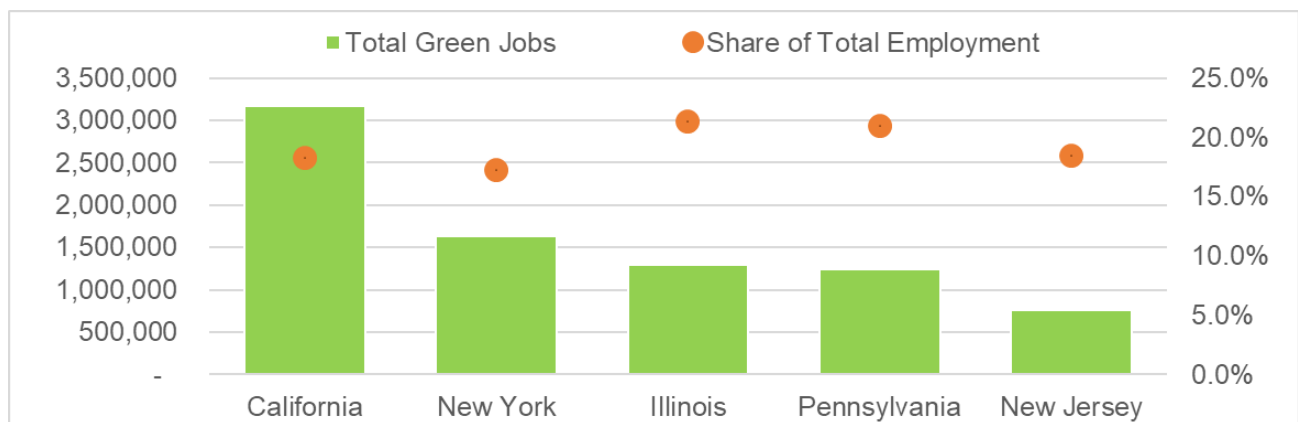
Figure 1
Total Green Jobs by Occupational Type, 2015



Source: Office of the New York State Comptroller staff analysis of US BLS data from the Occupational Employment and Wage Survey (OEWS), 2015.

Between 2015 and 2019, green jobs grew at more than twice the rate of total State jobs growth of roughly 6 percent.²⁵ In 2019, green jobs totaled 1.7 million, an increase of 13.2 percent from 2015, and the share of total State employment rose to 17.3 percent. This share was less than the national share of 18.8 percent, and less than the share in key competitor states, including Illinois (21.4 percent), Pennsylvania (20.9 percent), New Jersey (18.5 percent) and California (18.2 percent).²⁶

Figure 2
Total Green Jobs in New York and Selected States, 2019



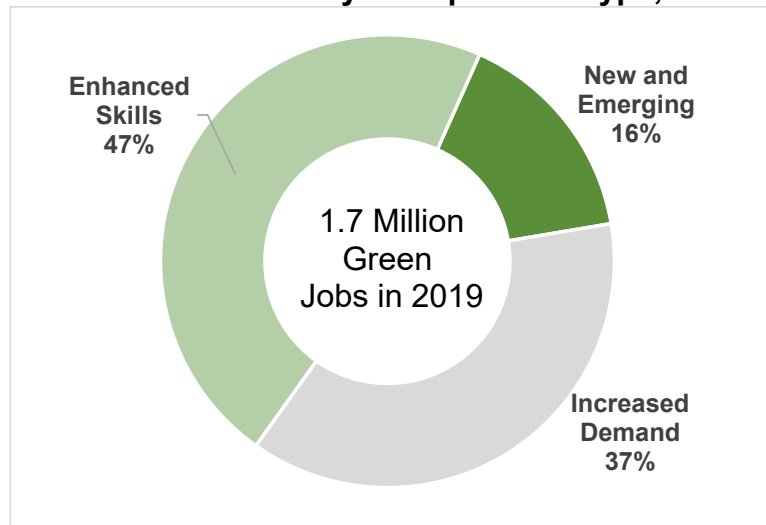
Source: Office of the New York State Comptroller staff analysis of data from OEWS 2019.

²⁵ An analysis that controlled for data excluded in the OEWS 2019 release found an increase in green jobs of 25.2 percent.

²⁶ Office of the New York State Comptroller staff analysis of data from U.S. BLS OEWS 2019 release, available here: <https://www.bls.gov/oes/tables.htm>.

As shown in Figure 3, in 2019, new and emerging green occupations in New York grew to 258,746 jobs, or 15.7 percent of total green jobs. Approximately 62 percent of new and emerging green occupations were in just four titles: securities and commodities traders, recycling and reclamation workers, solar thermal installers and technicians, and solar energy installation managers. (See Appendix B.)

Figure 3
Total Green Jobs By Occupational Type, 2019



Source: Office of the New York State Comptroller staff analysis of data from OEWS 2019.

Increased demand and enhanced skills occupations grew more slowly, at rates of 9.0 percent and 3.3 percent, respectively, to a total of 618,980 and 772,891 jobs, respectively. Among increased demand occupations, skilled trades – including construction carpenters, electricians, supervisors of mechanics, installers, repairers and production and operating workers, and refrigeration mechanics and installers – constitute 36 percent of jobs in this category and 30 percent of all green jobs. Many of these trades offer wages that exceed the statewide average; others, such as laborers pay less, but often serve as stepping stones to more skilled and higher-earning professions. In 2019, average wages for occupations comprising each of O*NET’s categories of green jobs exceeded the New York State average hourly wage of \$30.76.²⁷ New and emerging occupations commanded the highest average wage at \$46.82, followed by enhanced skills occupations with \$40.53 and increased demand occupations with \$32.63.

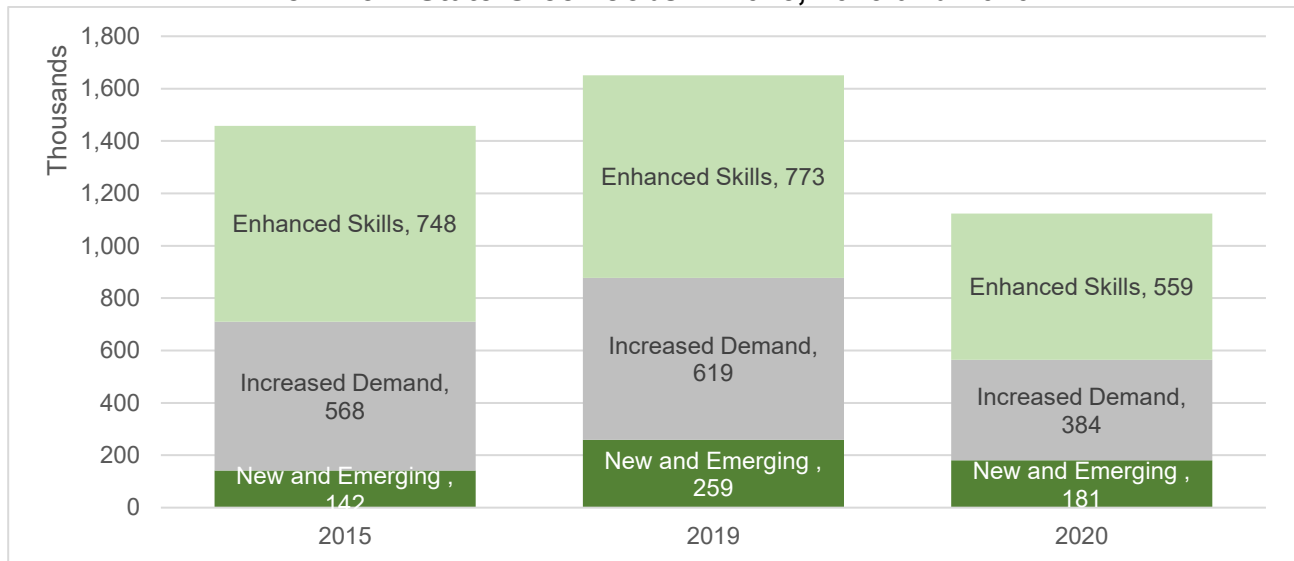
Pandemic’s Impact on Green Jobs

More recent data on green jobs show the sharp impact of the COVID-19 pandemic. According to the BLS Occupational Employment and Wage Statistics (OEWS), a comparison of average annual State jobs in 2019 and 2020 shows a loss of 831,540, or 8.7 percent. During this period,

²⁷ U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics, May 2019, available at <https://www.bls.gov/oes/tables.htm>.

green jobs fell at a much greater rate of 31.9 percent. Between 2019 and 2020, green jobs declined by over 527,000 jobs to 1.1 million and 12.9 percent of total State employment. Employment in new and emerging occupations fell by over 77,500 jobs, or 30.1 percent, to 180,987; increased demand occupations fell by over 235,300, or 38 percent, to 383,619; and enhanced skills occupations fell by close to 214,000 jobs, or 27.7 percent, to 558,985.

Figure 4
New York State Green Jobs in 2015, 2019 and 2020



Source: Office of the New York State Comptroller staff analysis of data from OEWS annual releases.

Reductions in green jobs in 2020 were related to the COVID-19 pandemic and the business closure orders which led to a loss of almost 1.8 million private sector jobs in New York State in April of 2020.²⁸ Statewide job numbers began to recover starting in May of 2020 and the sectors identified by O*NET as influenced by the green economy showed employment losses of almost 200,000, as reported by BLS in 2020 compared to those reported for 2019.

²⁸ New York State Department of Labor, "NYS Economy Loses More Than 1.7 Million Private Sector Jobs In April 2020," May 21, 2020, available at: https://dol.ny.gov/system/files/documents/2021/03/press-release-1-april-2020-final_2.pdf.

IV. Shaping Workforce Development Policies

While most programs to implement the CLCPA are still in the design stage, the State has already taken steps that could impact jobs. While the CLCPA does not place limits on any specific emission source to achieve reduction targets, there will likely be additional rule-making that may alter entire sectors.²⁹ In addition, the PSC recently determined that CLCPA goals apply in the regulatory process that establishes gas and electric rates, which will impact the operations of utilities.³⁰ Finally, the State and utilities are making large infrastructure investments in association with the efforts to increase renewable energy generation.³¹

These are far-reaching measures that are likely to shape economic activity for the foreseeable future, and, as the State emerges from the COVID-19 pandemic, it is important to take necessary steps to ensure that the New York workforce is prepared with skills to take on new jobs and those that evolve to get “greener.”³²

The State Department of Labor should include green jobs in its “Future of Work” occupational outlook and toolkit, and consider future research and investments in workforce programs. The investments necessary will vary by the type of green occupation. Fortunately, many non-green job skill sets can transfer directly to green jobs, allowing for a relative ease of transfer for workers into the green economy.³³ Often the skill difference between green and non-green jobs is relatively small, which means on-the-job training may be all that is required to support a transition.³⁴ For enhanced skill and increased demand occupations, O*NET recommends workforce policies that identify precise green skills and competencies that are required.³⁵ This can aid private industry, educational institutions, and policymakers in considering how best to

²⁹ For example, the 2019 regulations establishing more stringent limits on carbon dioxide emissions from power plants made it infeasible to generate electricity for sale on the New York grid from coal fired power plants. See: *6 NYCRR Part 251, CO2 Performance Standards for Major Electric Generating Facilities*, and *6 NYCRR Part 200, General Provisions*, available at: <https://www.dec.ny.gov/regs/2492.html>.

³⁰ In recognition of CLCPA requirements, on August 12, 2021, the PSC issued an order in a rate case requiring National Grid to adopt practices to reduce the amount of natural gas being sold, which could limit sales and operations, potentially affecting employment. See: NY PSC, *Order Approving Joint Proposal, As Modified and Imposing Additional Requirements in Case 19-G-0309 Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of The Brooklyn Union Gas Company d/b/a National Grid NY for Gas Service. Case 19-G-0310 Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of the KeySpan Gas East Corp. d/b/a National Grid for Gas Service. Case 18-M-0270 Petition for Approval Pursuant to Public Service Law Section 113(2), of a Proposed Allocation of Certain Tax Refunds Between KeySpan Gas East Corporation d/b/a National Grid and Ratepayers*, available at <https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=19-G-0309&submit=Search>.

³¹ For example, New York State utilities are planning to spend an estimated \$6.8 billion on new transmission and distribution infrastructure by 2030 and the State has announced \$400 million in investments in port facilities and created an Offshore Wind Training Institute to support the development of offshore wind.

³² The “2021 Jobs Study” released in December 2021 by the Just Transition Working Group of the New York State Climate Action Committee examines how implementation of the CLCPA may impact the workforce in key affected sectors.

³³ A. Bowen et. al. “Characterizing green employment: The impacts of greening on workforce composition,” op. cit.

³⁴ Ibid.

³⁵ Dierdorff, Erich C. et. al. *Greening of the World of Work: Revisiting Occupational Consequences*, op.cit.

incorporate the skills and competencies into existing training, vocational programs or other jobs programs.

According to O*NET, new and emerging green jobs may require the greatest investment because the intellectual capital, knowledge base and skill sets of these jobs may not be widespread and/or are still in development. Moreover, other research has found that regional economies responding to new regulatory environments demonstrate a demand for science and engineering skills.³⁶

The International Renewable Energy Agency (IRENA) has identified a lack of technical skills as a recruitment barrier for clean energy companies and states that the most significant changes in skills and occupations in the green economy require university education.³⁷ For example, IRENA finds that occupations employing about 30 percent of the solar and offshore wind industry workforce require advanced degrees in science, technology, engineering, or math (STEM) and that a further 5 percent require highly specialized professional degrees in fields such as law or marketing.³⁸ However, significant portions of the solar (60 percent) and offshore wind (47 percent) energy industries do not require advanced degrees or formal certifications.³⁹ Other clean energy industries, such as solar water heating, require a much smaller percentage (10 percent) of the workforce with formal degrees or training.⁴⁰

Despite lagging other states in the share of employment in the green economy, New York has advantages in the form of a highly educated workforce and a relatively diverse economic base with a high level of industry diversity.⁴¹ According to the U.S. Census Bureau, over 37 percent of New Yorkers have at least a bachelor's degree, greater than the national average of 32 percent. Over 43 percent of first degrees are in science and engineering or related fields, indicating that many New Yorkers may be well prepared for the growth of highly specialized and technical green jobs.⁴²

The New York State Department of Labor identifies as "significant industries" those that reflect at least one of the following characteristics: above-average job growth, above-average annual wages, and above-average expected job growth. Substantial numbers of green jobs occur in some of these significant industries including heavy and civil engineering construction,

³⁶ A. Bowen et. al. "Characterizing green employment: The impacts of greening on workforce composition," *Energy Economics*, 2018, vol. 72, pp. 263-275.

³⁷ Renewable Energy and Jobs: Annual Review 2021, International Renewable Energy Agency, International Labour Organization, available at: <https://www.irena.org/publications/2021/Oct/Renewable-Energy-and-Jobs-Annual-Review-2021>.

³⁸ Ibid.

³⁹ Ibid.

⁴⁰ Ibid.

⁴¹ A diversity of related industries is important for the growth of jobs that are new and specific to the green economy, while a diversity of unrelated industries is important for growth in employment in traditional jobs that are related to the green economy only through growth in labor demand. See: Barbieri, Nicolo and Davide Consoli, "Regional Diversification and Green Employment in US Metropolitan Areas," *Research Policy*, 2019, vol. 48, pp. 693-705.

⁴² U.S. Census Bureau, New York: Quick Facts, for 2015-2019, accessed at: [U.S. Census Bureau QuickFacts: New York; United States](https://data.census.gov/); and Table 1502, Field of Bachelor's Degree for First Major, 2019, accessed at: <https://data.census.gov/>.

specialty trade contractors, professional, scientific and technical services, and administrative and support services.⁴³

As the CLCPA is implemented, the economy and occupations in the State may both get greener. Policy makers should consider how to use New York's advantages, notably its large base of individuals with degrees in STEM fields, to build New York's clean energy industry and align workforce development priorities to ensure opportunities are available for New Yorkers seeking to upgrade their skills or take on new career paths. In addition, the State should bolster support to businesses to help with the transition to a green economy, including providing access to the resources needed to provide their employees with the training and skill development needed.

Finally, while the SFY 2021-22 Enacted Budget included measures to improve wage and labor practices on certain renewable energy projects, policy makers should continue to monitor the development of the green economy to identify the additional actions that may be needed to support the labor force. Since the job impacts of the green economy reach beyond those occupations involved directly in clean energy projects, it is likely that additional workforce training and support measures will be warranted. Effective implementation of these measures should translate into a workforce with the knowledge and skills needed to thrive in the green economy and businesses that are better prepared to face the immense challenges caused by climate change.

⁴³ New York State Department of Labor, Bureau of Labor Market Information, *Significant Industries: A Report to the Workforce Development System*, 2019.

Appendix A

Notes on Methodology

The U.S. Department of Labor (USDOL) provides employment numbers within general occupations in the Occupational Employment and Wage Statistics (OEWS) annually. Occupations are identified with a six-digit Standard Occupational Code (SOC). The Occupational Information Network (O*NET), a project of the USDOL Employment and Training Administration, provides a further refinement of jobs within these occupational categories, identifying specific titles using an eight-digit code. For example, within the USDOL's SOC for Chief Executives (11-1011), O*NET provides a subcode for Chief Sustainability Officers (11-1011.03).

O*NET has identified subcodes for green occupations. A commonly established methodology for deriving detailed occupational employment estimates using eight-digit O*NET codes is by assuming that employment numbers are evenly distributed across the O*NET codes within each SOC. Employment totals for each SOC are divided by the number of O*NET codes within each SOC.

Each annual USDOL estimate is based on data collected over a three-year period in six surveys, each carried out over a six-month period, limiting the ability to conduct annual trend analysis with the data. For this reason, our analysis provides only snapshots of 2015, 2019, and in less detail, 2020.

To reflect evolving labor markets and occupational demands, both USDOL and O*NET amended their SOC classifications between 2015 and 2019, which impacted the precise numbers of green jobs and occupations identified in 2019 and 2020. Examples of O*NET classification changes in the categorization of green occupations in 2019 included:

- In 2019, the eight-digit O*NET SOC for recycling and reclamation workers was moved from the six-digit USDOL SOC for "production workers, all other" into the six-digit USDOL SOC for "laborers and freight, stock and material movers." The change produced an increase of more than 60,000 jobs, which is in all likelihood a result of the interaction of the analytical method with the redefinition of O*NET SOCs.
- In other cases, several green job SOCs were collapsed into one, as was done with a 2019 change placing the eight-digit O*NET SOCs for securities and commodity traders and energy brokers into the six-digit USDOL SOC for securities, commodities and financial services sales agents, along with several other financial services occupations, producing a large increase in jobs for securities and commodity traders and energy brokers between 2015 and 2019.

- Similarly, in 2019 solar thermal installers and technicians were reclassified as part of the occupational category for “plumbers, pipefitters and steam fitters” rather than that for “construction and related workers, all other,” producing many more solar thermal installer and technician jobs simply due to the change in classification between 2015 and 2019.

For this reason, this analysis presents data for broad occupational categories and not specific jobs and titles. Nevertheless, it is possible the growth reported is underestimated because USDOL amended SOCs in 2018, resulting in 2019 figures that excluded numbers for 16 new and emerging occupations, five increased demand occupations and seven enhanced skills occupations, reducing the overall numbers of green jobs calculated.

An analysis that controls for the exclusions, by removing excluded occupations from 2015 data, shows an even larger increase in green jobs between 2015 and 2019. In the adjusted analysis new and emerging occupations grew by 136,873 jobs, increased demand occupations grew by 116,120 jobs and enhanced skills occupations grew by 76,633 jobs.

In 2020, the adjusted analysis produced mixed results, increasing the loss of jobs by slightly more than 1,000 in new and emerging occupations, reducing job losses in increased demand occupations by approximately 12,400 and leaving job numbers in enhanced skills occupations substantially unchanged.

Appendix B

2015 and 2019 Green Jobs in New York State

2015 New and Emerging Green Jobs

Occupation	Jobs
Energy Brokers	27,660
Securities and Commodities Traders	14,123
Solar Energy Installation Managers	11,360
Chief Sustainability Officers	8,530
Solar Sales Representatives and Assessors	7,460
Transportation Engineers	7,400
Automotive Engineering Technicians	3,620
Fuel Cell Technicians	3,620
Recycling Coordinators	3,595
Biofuels/Biodiesel Technology and Product Development Managers	3,575
All Others	50,824
Total	141,767

Source: Office of the New York State Comptroller

2015 Increased Demand Green Jobs

Occupation	Jobs
Laborers and Freight, Stock and Material Movers	105,350
Customer Service Representatives	78,795
Electricians	40,100
Team Assemblers	38,400
First-line Supervisors of Production and Operating Workers	25,650
First-line Supervisors of Mechanics, Installers and Repairers	25,410
Production, Planning and Expediting Clerks	22,290
Bus Drivers, Transit and Intercity	20,660
Software Developers, Systems Software	18,390
Construction Carpenters	15,986
All Others	176,959
Total	567,990

Source: Office of the New York State Comptroller

2015 Enhanced Skills Green Jobs

Occupation	Jobs
General and Operations Managers	157,100
Maintenance and Repair Workers, General	97,480
Construction Laborers	58,700
Heavy and Tractor-Trailor Drivers	55,560
Financial Analysts	42,350
Shipping, Receiving and Traffic Clerks	36,400
Personal Financial Advisors	26,680
Public Relations Specialists	26,210
Inspectors, Testers, Sorters, Samplers and Weighers	20,680
Training and Development Specialists	17,020
All Others	210,054
Total	748,234

Source: Office of the New York State Comptroller

2019 New and Emerging Green Jobs

Occupation	Jobs
Securities and Commodities Traders	67,120
Recycling and Reclamation Workers	66,175
Solar Thermal Installers and Technicians	14,815
Solar Energy Installation Managers	13,795
Advertising and Promotions Managers	7,840
Solar Sales Representatives and Assessors	7,520
Electrical Engineering Technologists	5,730
Transportation Engineers	5,467
Water/Wastewater Engineers	5,467
Chief Sustainability Officers	4,495
All Others	60,322
Total	258,746

Source: Office of the New York State Comptroller

2019 Increased Demand Green Jobs

Occupation	Jobs
Customer Service Representatives	158,520
Laborers and Freight, Stock and Material Movers	66,175
Carpenters	52,640
Production, Planning and Expediting Clerks	44,610
Electricians	43,890
First-Line Supervisors of Mechanics, Installers and Repairers	26,960
First-Line Supervisors of Production and Operating Workers	24,760
Refrigeration Mechanics and Installers	18,810
Bus Drivers, Transit and Intercity	18,600
Industrial Truck and Tractor Operators	17,230
All Others	146,785
Total	618,980

Source: Office of the New York State Comptroller

2019 Enhanced Skills Green Jobs

Occupation	Jobs
General and Operations Managers	168,730
Maintenance and Repair Workers	112,560
Construction Laborers	66,740
Heavy and Tractor-Trailer Truck Drivers	63,090
Automotive Specialty Technicians	35,680
Shipping Receiving and Traffic Clerks	27,580
Personal Financial Advisors	26,150
Public Relations Specialists	25,760
Training and Development Specialists	24,190
Inspectors, Testers, Sorters, Samplers and Weighers	22,760
All Others	199,650
Total	772,891

Source: Office of the New York State Comptroller

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