



Mayor's Office of
Talent and Workforce
Development

NYC / EDC

NYC Green Economy Study

Workforce analysis & findings

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Table of contents

Chapter	Page
Context setting	3
Analysis of priority occupations	13
Demographics analysis	104
Reskilling needs analysis	108
Workforce training landscape	112
Workforce challenges in the Green Economy	118
Appendix	147

CONTEXT SETTING

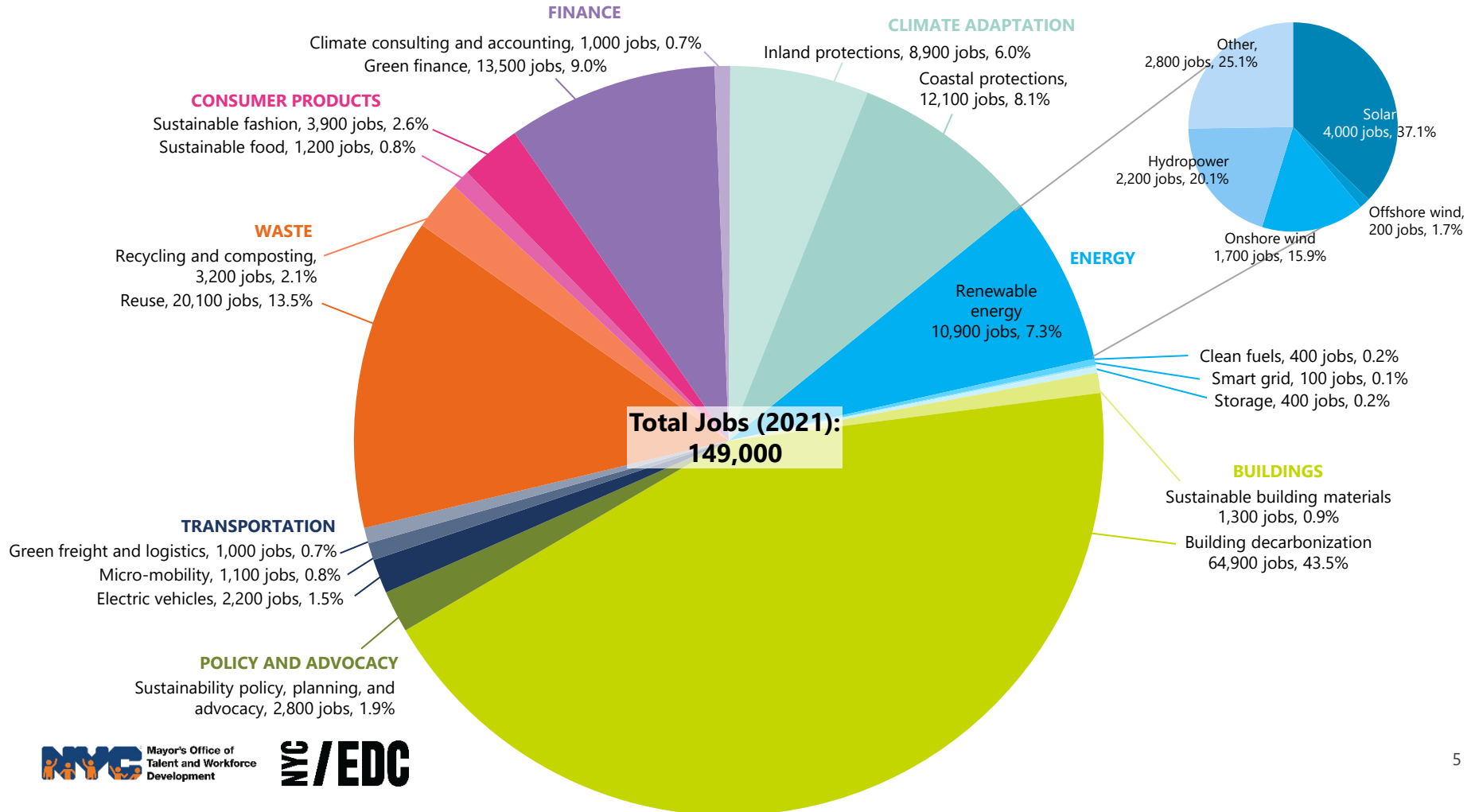
- **DEFINING, SIZING AND FORECASTING
THE GREEN ECONOMY IN NYC**
- **IDENTIFYING PRIORITY OCCUPATIONS**

What is the green economy in NYC?

- The green economy in NYC includes all jobs and activities that **directly contribute to the achievement of decarbonization and climate resilience** goals.
- For NYC, the green economy comprises of a set of **18 sectors** **within** 8 broad industries.
- These green economy sectors reflect the 'green transition' taking place across our economy, which naturally spans **multiple different industries**.
- This sets the green economy apart from other industry ecosystems where their sectors tend to cluster around similar activities.

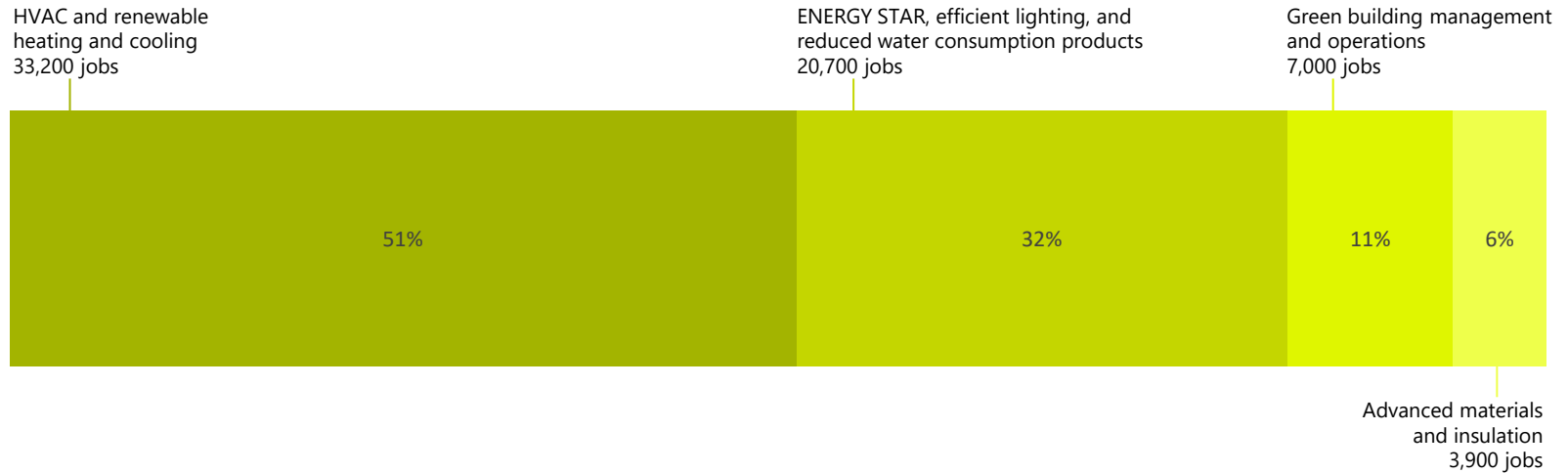
Industry	Sector	Subsector
ENERGY	Renewable energy	Solar
		Offshore wind
		Onshore wind
		Hydropower
		Other
	Clean fuels	
BUILDINGS	Smart grid	
	Storage	
TRANSPORTATION	Building decarbonization	
	Sustainable building materials	
	Electric vehicles	
WASTE	Micro-mobility	
	Green freight and logistics	
CONSUMER PRODUCTS	Reuse	
	Recycling and composting	
FINANCE AND CONSULTING	Sustainable food	
	Sustainable fashion	
CLIMATE ADAPTATION	Green finance	
	Climate consulting and accounting	
POLICY AND ADVOCACY	Coastal protections	
	Inland protections	
	Sustainability policy, planning, and advocacy	

What is the breakdown of green economy jobs by sector?



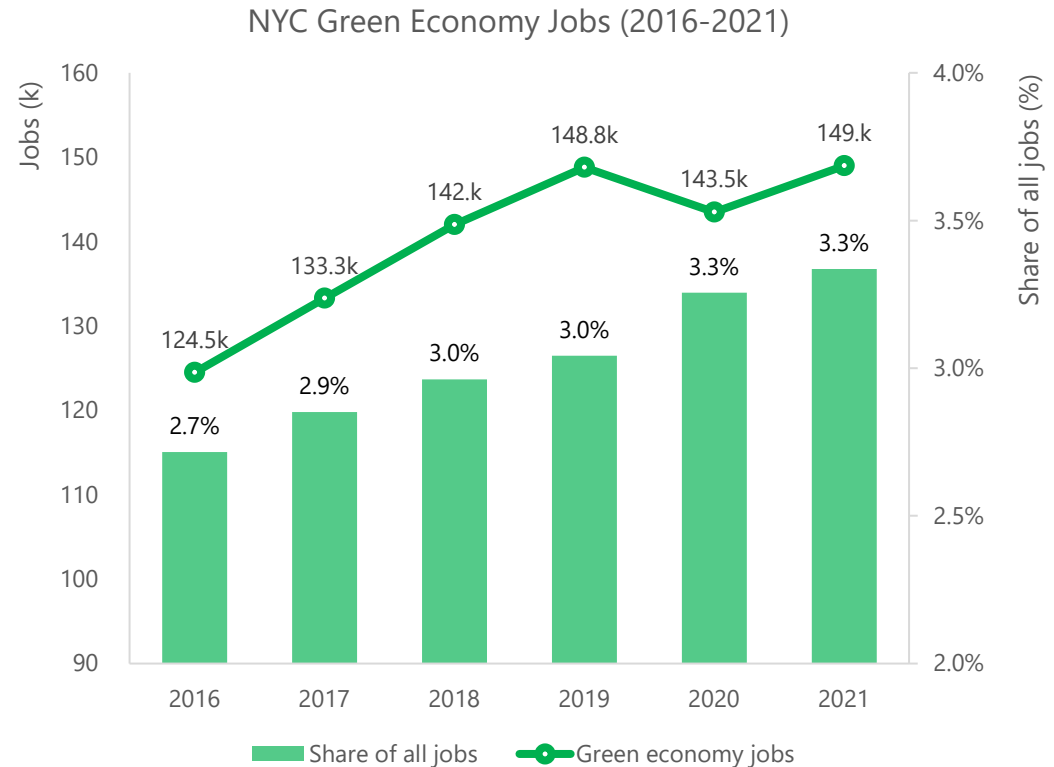
What is the breakdown of building decarbonization jobs?

Building Decarbonization Jobs (2021): 64,900



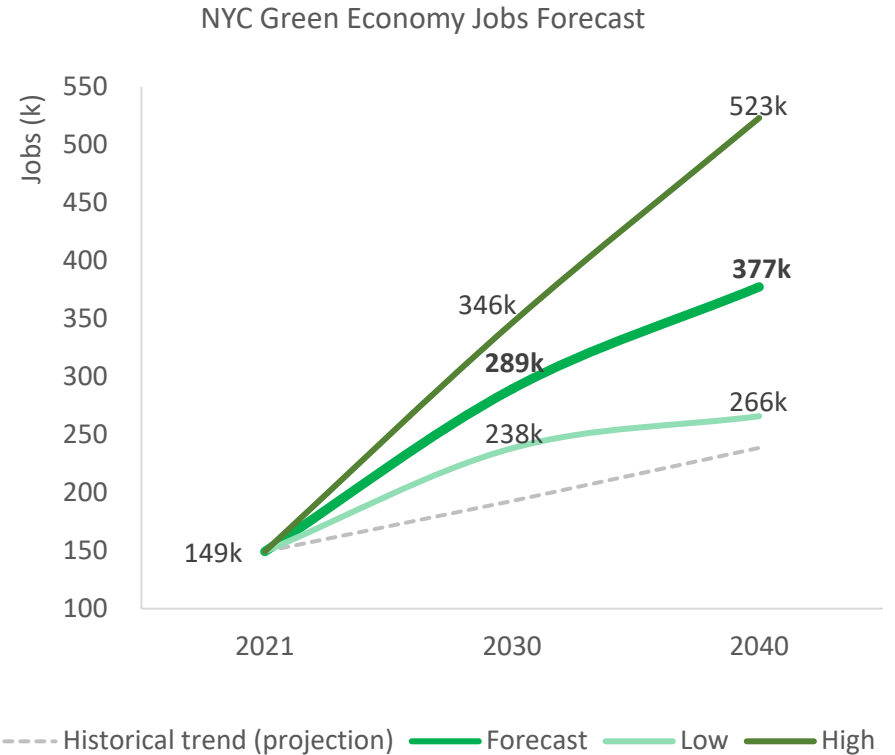
How has the number of jobs in NYC's green economy evolved over time?

- Jobs in NYC's green economy have grown by about **4% annually since 2016** and account for a growing share of the overall NYC economy.
- This job growth represents **both existing jobs that have transitioned** from non-green to green activity and **net new job additions** to the NYC economy.
- Most of this job growth has been driven by activity in:
 - Buildings** (e.g., energy efficiency retrofits and green construction)
 - Finance and consulting** (e.g., ESG, sustainable finance, climate tech investing, and carbon accounting)
 - Climate adaptation** (e.g., large-scale coastal protection projects)



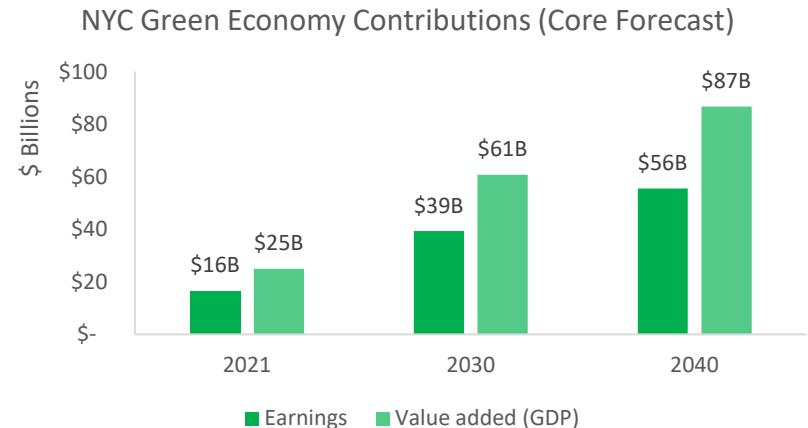
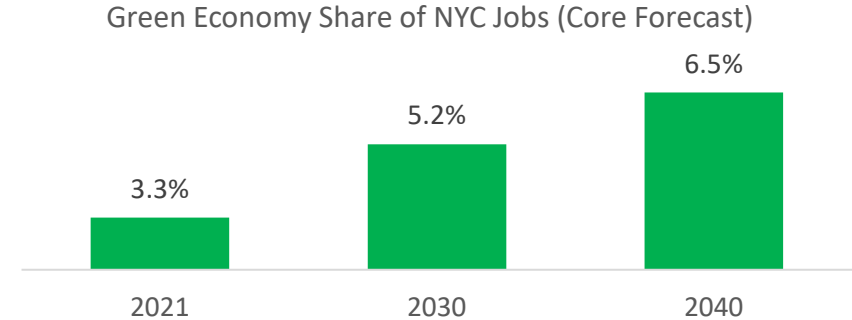
How is the number of jobs in NYC's green economy expected to evolve in the future?

- Jobs in NYC's green economy are forecasted to grow by 8% annually through 2030, reflecting a significant ramp up of decarbonization and resilience efforts.
- This would amount to an accelerated transition towards green economic activity in NYC far above historical levels.
- Beyond 2030, jobs are expected to grow at a relatively slower rate of 3% annually through 2040, as key growth sectors (such as building decarbonization) reach maturity.
- The low and high forecasts represent potential variances from the core forecast to account for alternative growth outcomes.



What are the green economy's expected economic contributions to the NYC economy in the future?

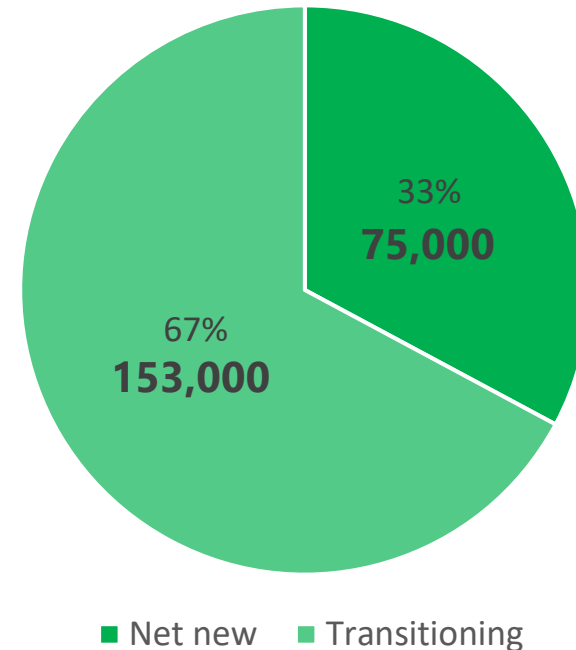
- NYC's green economy is expected to account for 5% of the city's jobs in 2030 and 7% by 2040.
- By 2030, the green economy is expected to contribute \$39 billion in earnings and \$61 billion to the NYC's overall GDP annually; by 2040, \$56 billion in earnings and \$87 billion to GDP annually.



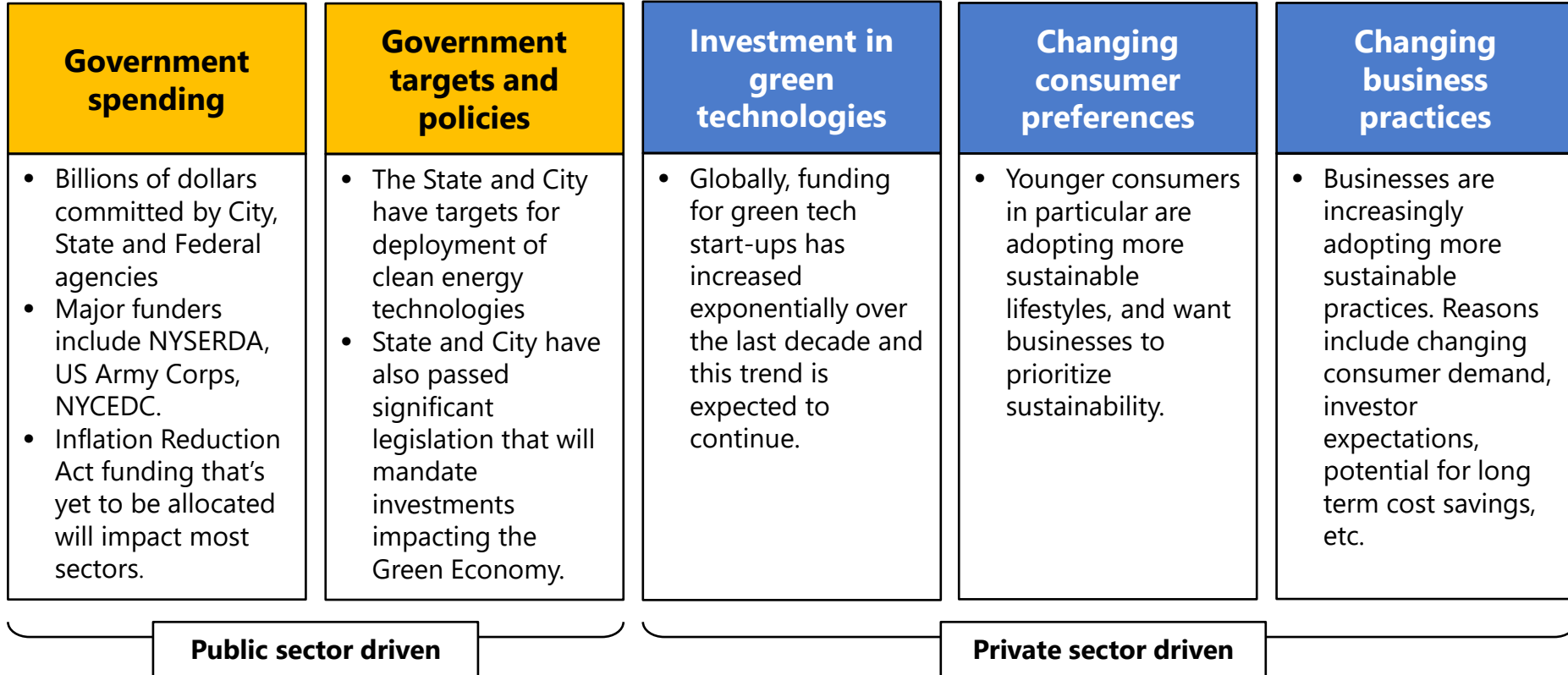
How many green economy job additions will be net new or transitioning?

- Most of the forecasted green economy job additions through 2040 are expected to be result of existing jobs transitioning to green activities or sectors.
- However, the green transition will also be driven by net new demand and investment, which will result in net new job creation.
- Of the 228,000 forecasted Green Economy job additions through 2040:
 - Transitioning jobs will account for 131,000 to 176,000 (57% to 77%)
 - Net new jobs will account for 52,000 to 97,000 (23% to 43%)

2021-2040 Job Additions by Type (Core Forecast)



What are the drivers for this growth?



What are the priority occupations in the green economy?

- Criteria for selection:
 - Requires 'green-specific' skills & knowledge
 - Substantial presence in the green economy currently (or will likely have a substantial presence in the future⁺)
 - Forecasted increase in demand (based on NYSDOL projections)
 - Provides a pathway to a family sustaining wage (of \$31/hr as per MIT's Living Wage calculator for NYC)

Construction, Installation & Operations

Maintenance and Repair Workers, General (\$24/hr)	Glaziers (\$29/hr)	Plumbers, Pipefitters, and Steamers (\$38/hr)
Helpers - Construction Trades (\$24/hr)	Construction Laborers (\$30/hr)	Electricians (\$40/hr)
Insulation Workers, Floor, Ceiling, and Wall (\$25/hr)	Carpenters (\$30/hr)	Energy Auditors (\$40/hr)
Solar PV Installers (\$26/hr)	Facilities Managers (\$34/hr)	Stationary Engineers (\$49/hr)
Roofers (\$28/hr)	HVAC Mechanics & Installers (\$36/hr)	First Line Supervisors of Construction Trades (\$50/hr)

Engineering & Architecture


Architects (\$49/hr)
Civil Engineers (\$49/hr)
Electrical Engineers (\$51/hr)
Mechanical Engineers (\$50/hr)


Management

Solar Energy Installation Managers (\$49/hr)
Construction Managers (\$65/hr)
General and Operations Managers (\$78/hr)

Business / Finance

Sustainability Specialists (\$39/hr)
Project Management Specialists (\$53/hr)
Carbon Accountants

 Feeds into an occupation with a family sustaining wage

 Provides a family sustaining wage

⁺Based on stakeholder feedback

ANALYSIS OF PRIORITY OCCUPATIONS

Priority occupations analysis

- The following slides include a deep dive into specific priority occupations, which include:
 - Occupational characteristics and demographics
 - Skills required
 - Common job titles
 - Feeder and next-step roles (including % skill transferability and % observed transitions)
 - Sample career maps
 - Stakeholder feedback

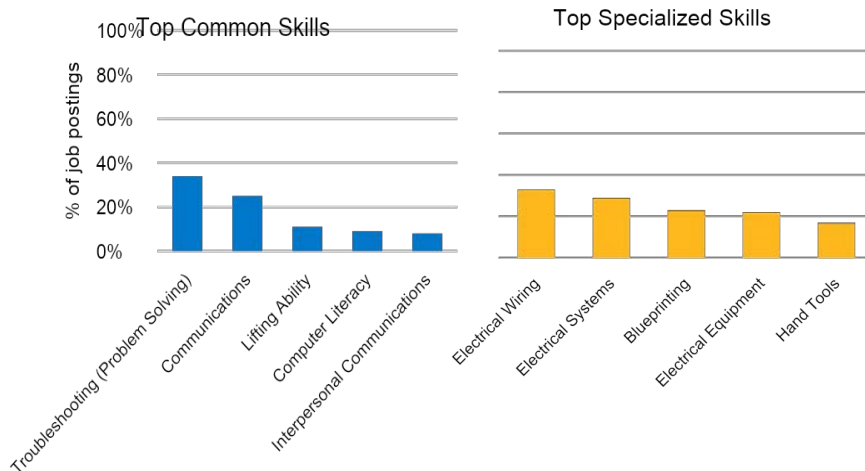
Electricians

Occupation Overview

Electricians - Buildings

Characteristics:

Typical Entry Level Education	High School Diploma or Equivalent
Work Experience Required	None
Typical On-The-Job Training	Apprenticeship
Projected growth by 2028	8.67%
Median annual wage (\$2022)	\$84,650
Black share	21.1%
Hispanic share	31.6%
Female share	2.3%



Sources: American Community Survey 5-year microdata estimates, 2017-2021. Bureau of Labor Statistics Occupational Outlook Handbook, 2023. Lightcast, 2023. NYSDOL 2018-2028 Long-Term Occupational Employment Projections. O*NET OnLine Occupational Data, 2022.

Top Job Titles:

1. Solar Electricians
2. Journeyman Electricians
3. Electrician Mechanics
4. Electrician Technicians
5. Industrial Electricians

Top Qualifications:

6. Valid Driver's License
7. 30-Hour OSHA General Industry Card
8. First Aid Certification
9. Cardiopulmonary Resuscitation (CPR) Certification
10. Approved Medication Assistive Personnel (AMAP) Certification

Common Tasks:

- Prepare sketches or follow blueprints to determine the location of wiring or equipment and to ensure conformance to building and safety codes.
- Place conduit, pipes, or tubing, inside designated partitions, walls, or other concealed areas, and pull insulated wires or cables through the conduit to complete circuits between boxes.
- Use a variety of tools or equipment, such as power construction equipment, measuring devices, power tools, and testing equipment, such as oscilloscopes, ammeters, or test lamps.
- Assemble, install, test, or maintain electrical or electronic wiring, equipment, appliances, apparatus, or fixtures, using hand tools or power tools.
- Connect wires to circuit breakers, transformers, or other components.
- Plan layout and installation of electrical wiring, equipment, or fixtures, based on job specifications and local codes.

Occupation Overview

Electricians - Buildings - Median annual wage (\$2022): \$84,650 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Helpers--Electricians	91.0%	-27.19%
Solar Photovoltaic Installers	74.3%	-13.11%
Terrazzo Workers and Finishers	59.6%	-18.29%
Structural Iron and Steel Workers	55.5%	-17.03%
Sheet Metal Workers	51.0%	-20.58%
Insulation Workers, Mechanical	44.6%	-16.11%
Pipelayers	41.8%	-20.04%
Tile and Stone Setters	39.6%	-7.74%
Carpenters	38.7%	-14.30%
Roofers	38.4%	-8.72%

Next step jobs:

Occupation	Skill relevance	Salary diff
Control and Valve Installers and Repairers, Except Mechanical Door	81%	11.75%
Electro-Mechanical and Mechatronics Technologists and Technicians	78%	1.70%
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	78%	30.53%
Elevator and Escalator Installers and Repairers	75%	16.81%
Signal and Track Switch Repairers	74%	7.98%
Aerospace Engineering and Operations Technologists and Technicians	62%	18.81%
Electrical Engineers***	62%	64.56%
Electrical and Electronics Drafters	59%	34.60%
Wind Turbine Service Technicians	58%	18.98%
First-Line Supervisors of Construction Trades and Extraction Workers***	53%	22.37%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

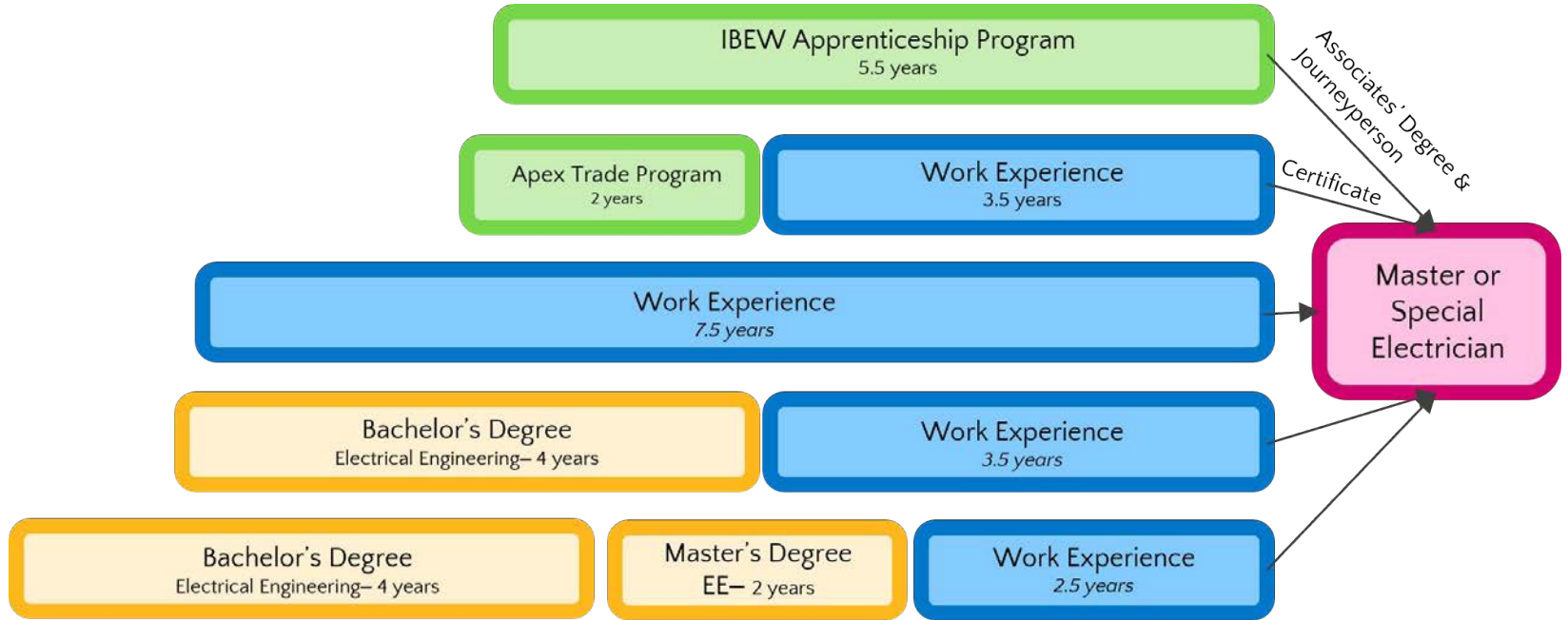
Electricians - Solar - Median annual wage (\$2022): \$84,650 (Lightcast)

Previous occupations										Skill relevance
Helpers—Electricians (91.0%)	Solar Photovoltaic Installers (74.3%)	Terrazzo Workers and Finishers (59.6%)	Structural Iron and Steel Workers (55.5%)	Sheet Metal Workers (51.0%)	Insulation Workers, Mechanical (44.6%)	Pipelayers (41.8%)	Tile and Stone Setters (39.6%)	Carpenters (38.7%)	Roofers (38.4%)	
First-Line Supervisors of Mechanics, Installers, and Repairers (10.7%)	Maintenance and Repair Workers, General (9.4%)	First-Line Supervisors of Construction Trades and Extraction Workers (5.0%)	Electrical and Electronic Engineering Technologists and Technicians (5.0%)	Managers, All Other (3.7%)	Chief Executives (3.6%)	Computer User Support Specialists (3.5%)	General and Operations Managers (3.5%)	Electrical Engineers (2.9%)	Retail Salespersons (2.8%)	Share of observed transitions

↓

Electricians										
Following occupations										Skill relevance
Control and Valve Installers and Repairers, Except Mechanical Door (80.6%)	Electro-Mechanical and Mechatronics Technologists and Technicians (78.0%)	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay (77.6%)	Elevator and Escalator Installers and Repairers (74.9%)	Signal and Track Switch Repairers (73.7%)	Aerospace Engineering and Operations Technologists and Technicians (62.5%)	Electrical Engineers (62.4%)	Electrical and Electronics Drafters (58.7%)	Wind Turbine Service Technicians (58.2%)	First-Line Supervisors of Construction Trades and Extraction Workers (52.7%)	
First-Line Supervisors of Mechanics, Installers, and Repairers (12.9%)	Maintenance and Repair Workers, General (8.2%)	Electrical and Electronic Engineering Technologists and Technicians (5.5%)	First-Line Supervisors of Construction Trades and Extraction Workers (5.1%)	Computer User Support Specialists (4.4%)	Electrical Engineers (4.4%)	Chief Executives (4.1%)	General and Operations Managers (3.2%)	Project Management Specialists (2.8%)	Automotive Service Technicians and Mechanics (2.4%)	Share of observed transitions

How does one become an electrician?



Source: NYC Buildings

- NYS Registered Apprenticeship or Trade School
- On-the-Job Training
- Postsecondary Degree

Electricians

KSAA Deep Dive

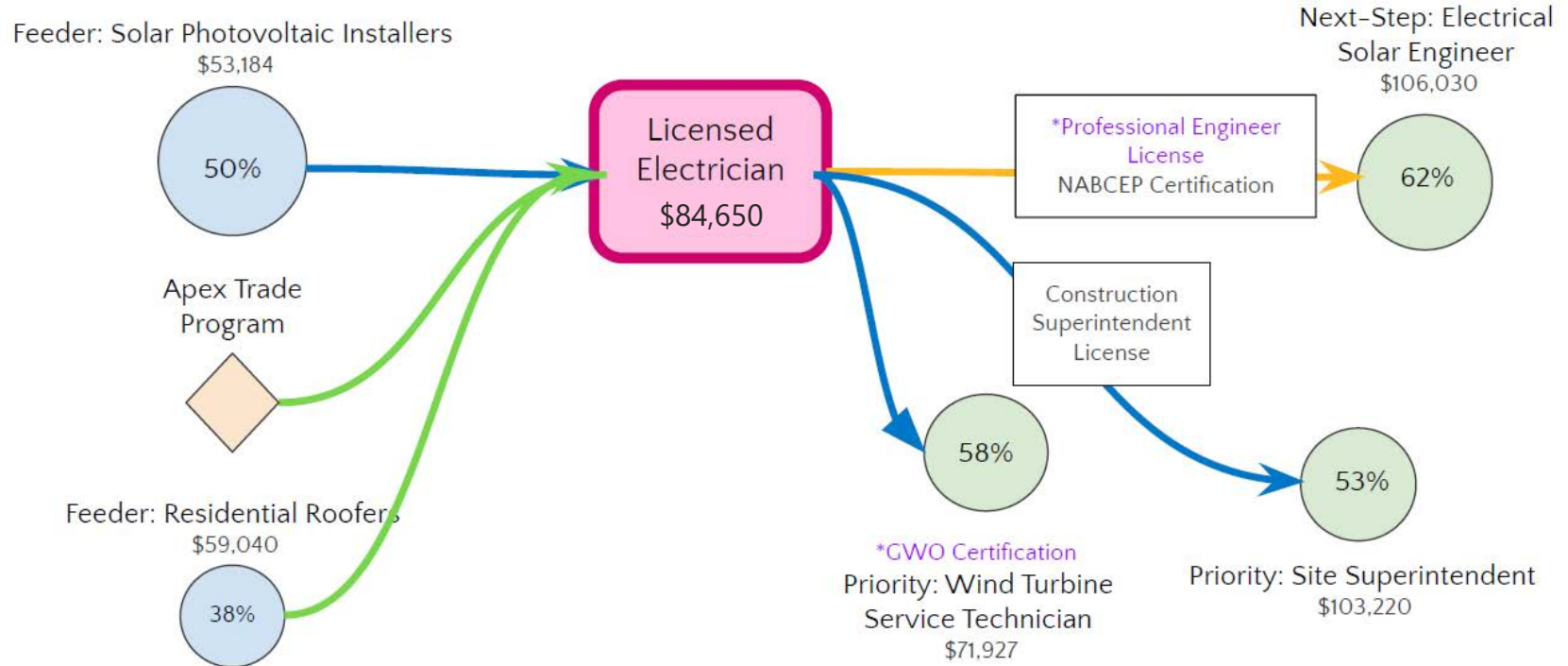
Energy Efficiency	Alternating and direct current motors
	Balance of system components*
	Building base loads
	Circuit types and applications*
	Common electrical fittings (e.g., connectors, couplings, grounding bushings, strain reliefs, LBs)*
	Conductor properties (e.g., temperature ratings, ampacity ratings, UV resistance, moisture rating)*
	Electrical test instruments and devices (e.g., multimeters, megommeters, etc.)*
	Electrical transmission and distribution systems*
	Grounding and bonding elements*
	Lighting system components and controls
	Types and features of high-efficiency appliances
	Types of common raceways
	Types of electrical components (e.g., inverters, hybrid inverters, microinverters, optimizers, charge controllers, disconnects, switchgear)
	Uninterruptible power supplies
	Variable frequency drives
	Wiring best practices (e.g., drip loops, service loops, minimum bend radius)

Codes, Metrics, Performance	Building automation and control systems
	Building, energy, and health and safety codes
	Electrical measurements (impedance, resistance, etc.)*
	Electrical symbols*

Sample career map

■ NYS Registered Apprenticeship or Trade School
■ On-the-Job Training
■ Postsecondary Degree

% = Skills Relevance to Electricians (Source: Lightcast)
 Median annual wage (\$2022) (Source: NYSDOL)
 * Required credential/certification
 Helpful credential



Electrician

Illustrative Pathway – New Worker to Electrician

Education

- High school diploma or GED

Experience

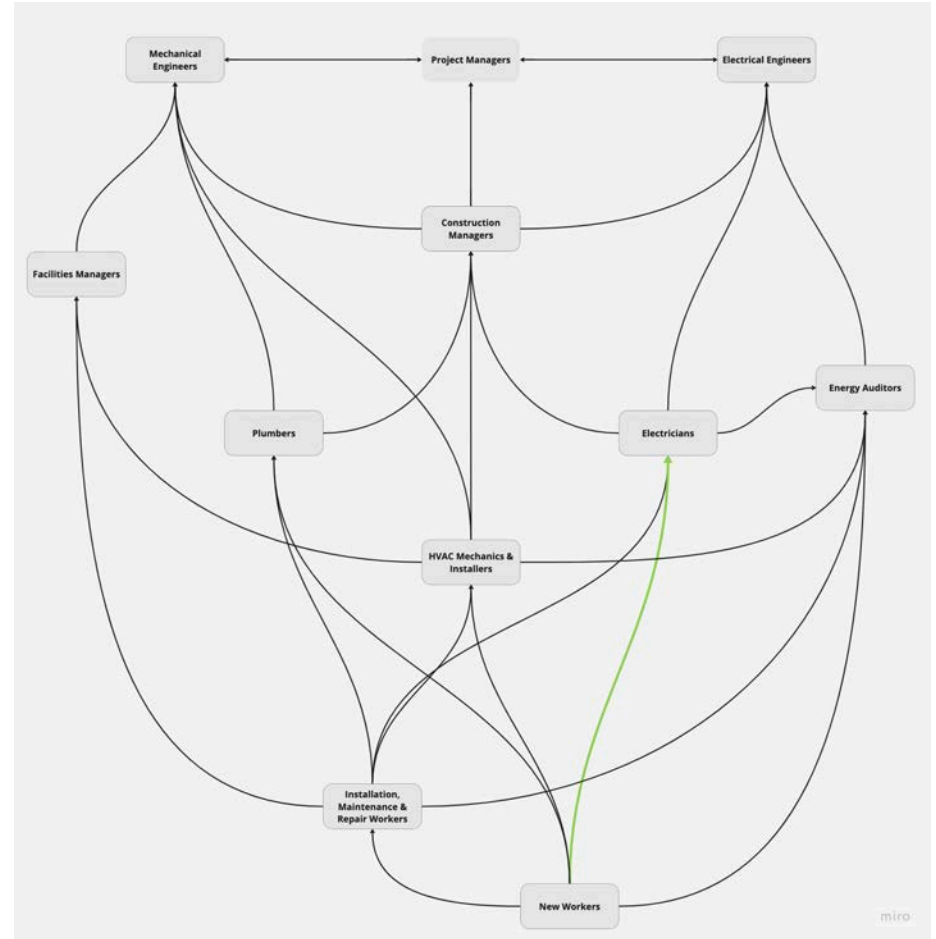
- 4-5 years as an apprentice

“Green” Credentials

- Urban Green Council – GPRO (Electrical Systems)
- Passive House Institute – Certified Consultant
- North American Board of Certified Energy Practitioners – Associate Credential (Multiple)

Local Programs Offering Credential-Related Training

- SWA Academy
- IBEW Local 3



Stakeholder feedback notes

Electricians

From Employers, Advocacy Organizations, Policy Advisors

- Employers struggle to find electricians with solar experience, exacerbated by a larger **electrician shortage nationwide**. Relatedly, **electricians with solar experience tend to live in other areas of the state** or region because most of these projects tend to be outside of the metro area (Brooklyn Solarworks, Ecogy Energy).
- **Minimal reskilling is required** for work in the solar sector. Smaller developers may electricians with general experience and then training them on the job (Brooklyn Solarworks).
- It is **challenging to incentivize electricians to pursue work in solar, battery storage, or alternative transportation** given the demand and high pay for their services in other sectors that will not require any additional training or reskilling and perceptions there is not steady and consistent work in solar (Brooklyn Solar Works, Ecosave, Itselectric, Soltage).
- Employers would like to see greater public **investment in trade school and continuing education programs** for electrical workers (Brooklyn Solarworks).
- Typical **small-scale residential electrical work** will **likely not** be completed through **union labor** (Cornell ILR Climate Jobs Institute).

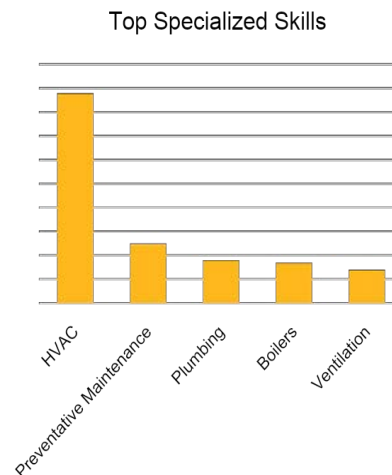
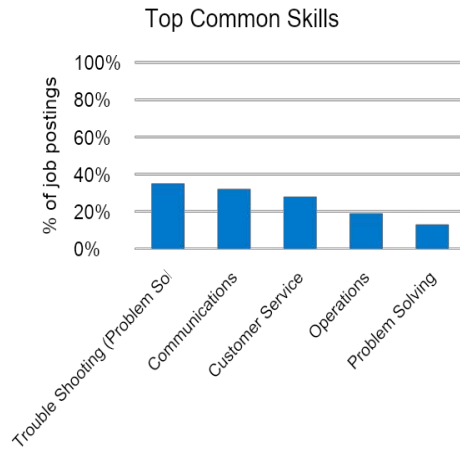
HVAC Mechanics and Installers

Occupation Overview

Heating, Air Conditioning, and Refrigeration Mechanics and Installers

Characteristics:

Typical Entry Level Education	Postsecondary non-degree award
Work Experience Required	None
Typical On-The-Job Training	Long-term on-the-job training
Projected growth by 2028	10.5%
Median annual wage (\$2022)	\$75,080
Black share	18.9%
Hispanic share	26.5%
Female share	4.4%



Top Job Titles:

1. HVAC Technicians
2. HVAC Service Technicians
3. Service Technicians
4. HVAC Mechanics
5. HVAC Project Managers

Top Qualifications:

1. Valid Driver's License
2. EPA 608 Technician Certification
3. EPA Universal Certification
4. 30-Hour OSHA General Industry Card
5. HVAC Certification

Common Tasks:

- Test electrical circuits or components for continuity.
- Comply with all applicable standards, policies, or procedures, such as safety procedures or the maintenance of a clean work area.
- Study blueprints, design specifications, or manufacturers' recommendations to ascertain the configuration of heating or cooling equipment components.
- Discuss heating or cooling system malfunctions with users to isolate problems or to verify that repairs corrected malfunctions.
- Adjust system controls to settings recommended by manufacturer to balance system.
- Recommend, develop, or perform preventive or general maintenance procedures, such as cleaning, power-washing, or vacuuming equipment, oiling parts, or changing filters.

Occupation Overview

Heat, AC, and Refrigeration Mechanics and Installers - Median annual wage (\$2022): \$68,467 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Maintenance and Repair Workers, General	87%	-20.6%
Helpers--Installation, Maintenance, and Repair Workers	80%	-32.0%
Installation, Maintenance, and Repair Workers, All Other	72%	-17.7%
Medical Equipment Repairers	68%	-8.5%
Explosives Workers, Ordnance Handling Experts, and Blasters	63%	-9.7%
Earth Drillers, Except Oil and Gas	63%	-9.7%
Electric Motor, Power Tool, and Related Repairers	62%	-12.7%
Automotive Service Technicians and Mechanics	61%	-13.9%
Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	61%	-28.0%
Manufactured Building and Mobile Home Installers	56%	-17.9%

Next step jobs:

Occupation	Skill relevance	Salary diff
First-Line Supervisors of Mechanics, Installers, and Repairers ***	82%	7.7%
Home Appliance Repairers	65%	26.9%
Elevator and Escalator Installers and Repairers	61%	14.5%
Boilermakers	58%	9.5%
Construction and Building Inspectors	56%	9.7%
Administrative Services Managers	56%	35.5%
Facilities Managers	56%	35.5%
Nuclear Technicians	54%	12.3%
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	44%	30.0%
Wind Turbine Service Technicians	43%	17.0%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

Heat, AC, and Refrigeration Mechanics and Installers Median annual wage (\$2022): \$68,467 (Lightcast)

Previous occupations										Skill relevance
Maintenance and Repair Workers, General (87%)	Helpers—Installation, Maintenance, and Repair Workers (80%)	Installation, Maintenance, and Repair Workers, All Other (72%)	Medical Equipment Repairers (68%)	Explosives Workers, Ordnance Handling Experts, and Blasters (63%)	Earth Drillers, Except Oil and Gas (63%)	Electric Motor, Power Tool, and Related Repairers (62%)	Automotive Service Technicians and Mechanics (61%)	Helpers—Pipefitters, Plumbers, Pipefitters, and Steamfitters (61%)	Manufactured Building and Mobile Home Installers (56%)	
Maintenance and Repair Workers, General (15.1%)	First-Line Supervisors of Mechanics, Installers, and Repairers (10.4%)	Automotive Service Technicians and Mechanics (7.4%)	Computer User Support Specialists (4.3%)	General and Operations Managers (3.7%)	Managers, All Other (3.5%)	Mechanical Engineers (3.4%)	Chief Executives (3.1%)	First-Line Supervisors of Office and Administrative Support Workers (2.6%)	First-Line Supervisors of Production and Operating Workers (2.3%)	



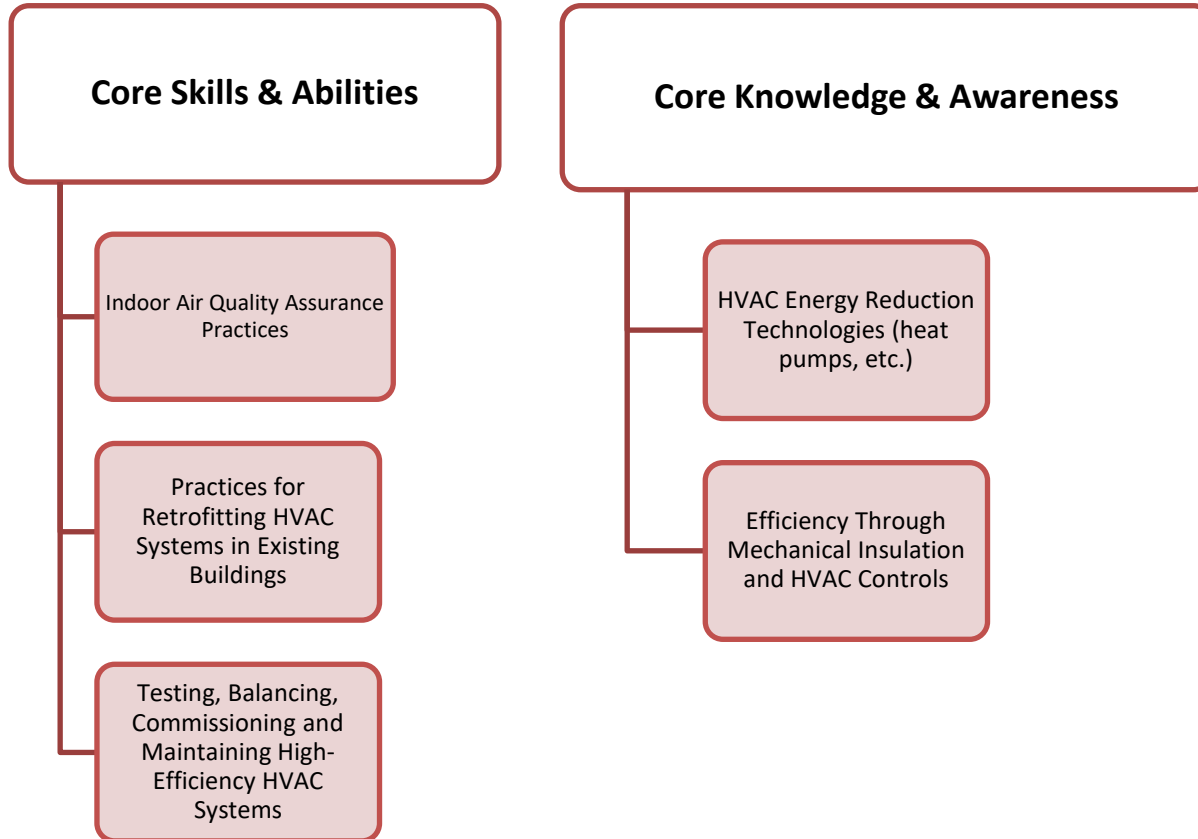
Heat, AC, and Refrigeration Mechanics and Installers



Following occupations										Skill relevance
First-Line Supervisors of Mechanics, Installers, and Repairers (82%)	Home Appliance Repairers (65%)	Elevator and Escalator Installers and Repairers (61%)	Boilermakers (58%)	Construction and Building Inspectors (56%)	Administrative Services Managers (56%)	Facilities Managers (56%)	Nuclear Technicians (54%)	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay (44%)	Wind Turbine Service Technicians (43%)	
Maintenance and Repair Workers, General (12.3%)	First-Line Supervisors of Mechanics, Installers, and Repairers (11.2%)	Automotive Service Technicians and Mechanics (7.5%)	Computer User Support Specialists (5.8%)	Mechanical Engineers (4.5%)	Chief Executives (3.8%)	General and Operations Managers (3.7%)	Managers, All Other (3.2%)	First-Line Supervisors of Office and Administrative Support Workers (3.0%)	Customer Service Representatives (2.2%)	

HVAC Mechanics & Installers

Knowledge, Skills, Awareness, Abilities (KSAA) Deep Dive



Stakeholder feedback notes

HVAC Mechanics and Installers

From Employers

- Very few HVAC companies are skilled in installing heat pumps and this process gets more complicated in multi-family units compared to single-family homes (Sealed).
- Workers/contractors are not incentivized to learn heat pump installation because of a lack of incentives and perceptions that **demand is still lacking** (Sealed).
- Need more contractors and installers familiar with high-performance systems. Clients on the retrofit side are having trouble finding these skilled contractors. (Bright Power)

From Workforce Providers

- Contractors tend to not have relationships with city government and are averse to what they see as the red tape that comes with working with city government. The City will need to proactively attract employers through these sorts of programs. Strategies where the **City takes on the cost of training** and employers are not obligated to hire trainees following an apprenticeship can be useful incentives. BlocPower's partnership with National Grid for HVAC installers offers a precedent for this model (BlocPower).
- Work on **HVAC systems does not required licensed specialists** which adds to concerns around reliability and skills for these installations (UA Local 1- Plumbers).
- Attainment of driver's license makes workers, those looking at entry-level roles and beyond, more marketable for HVAC positions (HOPE Program).

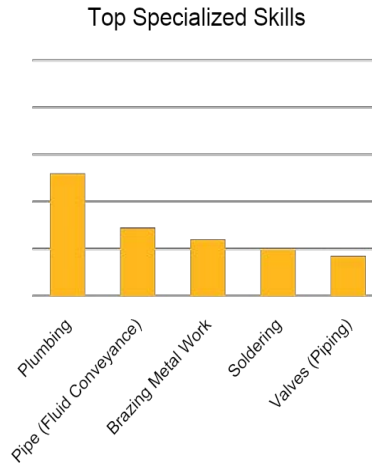
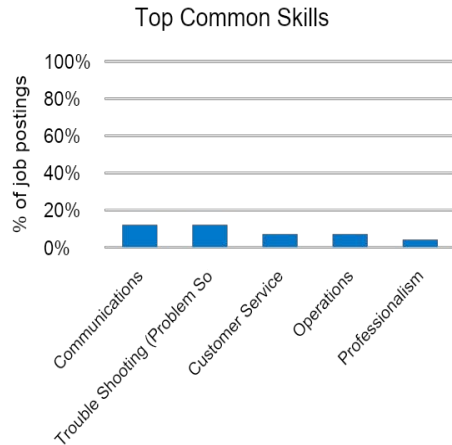
Plumbers, Pipefitters, & Steamfitters

Occupation Overview

Plumbers, Pipefitters, & Steamfitters

Characteristics:

Typical Entry Level Education	High school diploma or equivalent
Work Experience Required	None
Typical On-The-Job Training	Apprenticeship
Projected growth by 2028	12.6%
Median annual wage (\$2022)	\$79,560
Black share	23.4%
Hispanic share	31.7%
Female share	1.5%



Top Job Titles:

1. Plumbers
2. Pipefitters
3. Plumber Helpers
4. Plumber Mechanics
5. Fire Sprinkler Installers

Top Qualifications:

6. Valid Drivers License
7. 30-Hour OSHA Industry Card
8. 10-Hour OSHA Industry Card
9. National Institute For Certification In Engineering Technologies Certification
10. Security Clearance

Common Tasks:

- Shut off steam, water, or other gases or liquids from pipe sections.
- Install underground storm, sanitary, or water piping systems, extending piping as needed to connect fixtures and plumbing.
- Assemble pipe sections, tubing, or fittings.
- Locate and mark the position of pipe installations, connections, passage holes, or fixtures in structures.
- Cut, thread, or hammer pipes to specifications, using tools such as saws, cutting torches, pipe threaders, or pipe benders.
- Lay out full scale drawings of pipe systems, supports, or related equipment, according to blueprints.
- Plan pipe system layout, installation, or repair, according to specifications.

Occupation Overview

Plumbers, Pipefitters, & Steamfitters - Median annual wage (\$2022): \$79,504 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Construction Laborers	70%	-23.6%
Pipelayers	59%	-21.8%
Structural Iron and Steel Workers	55%	-18.6%
Tile and Stone Setters	53%	-8.7%
Sheet Metal Workers	53%	-22.4%
Cement Masons and Concrete Finishers	50%	-19.2%
Solar Photovoltaic Installers	50%	-14.4%
Brickmasons and Blockmasons	50%	-11.3%
Insulation Workers, Mechanical	49%	-17.6%
Carpenters	47%	-15.7%

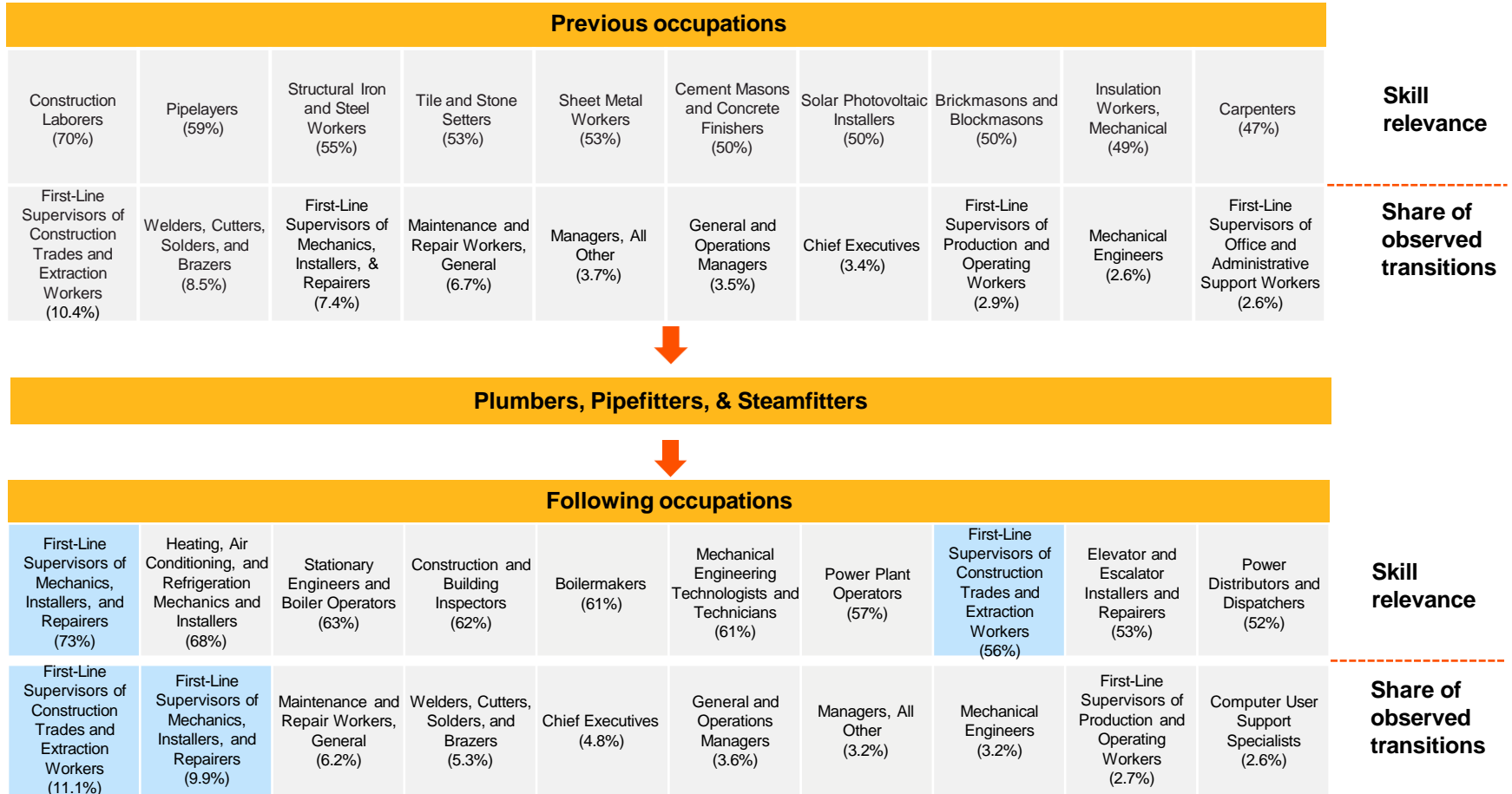
Next step jobs:

Occupation	Skill relevance	Salary diff
First-Line Supervisors of Mechanics, Installers, and Repairers ***	73%	0.7%
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	68%	-5.9%
Stationary Engineers and Boiler Operators	63%	-3.1%
Construction and Building Inspectors	62%	2.4%
Boilermakers	61%	2.2%
Mechanical Engineering Technologists and Technicians	61%	-7.8%
Power Plant Operators	57%	-4.6%
First-Line Supervisors of Construction Trades and Extraction Workers ***	56%	12.0%
Elevator and Escalator Installers and Repairers	53%	6.6%
Power Distributors and Dispatchers	52%	-0.3%

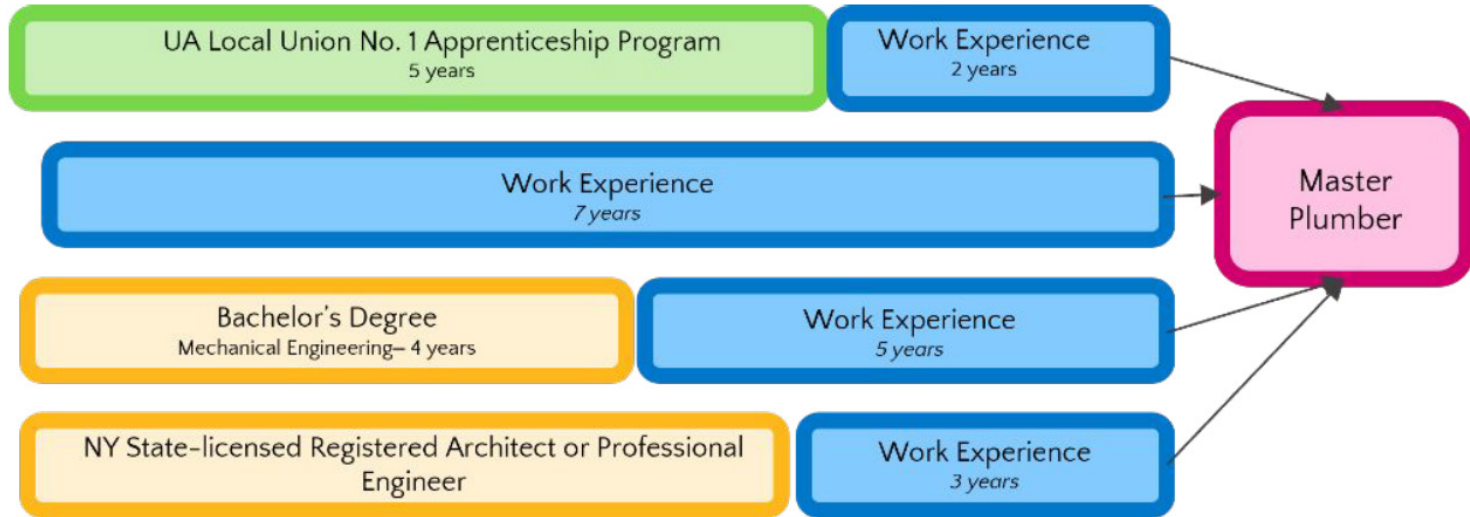
*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

Plumbers, Pipefitters, & Steamfitters - Median annual wage (\$2022): \$79,504 (Lightcast)



How does one become a Master Plumber?

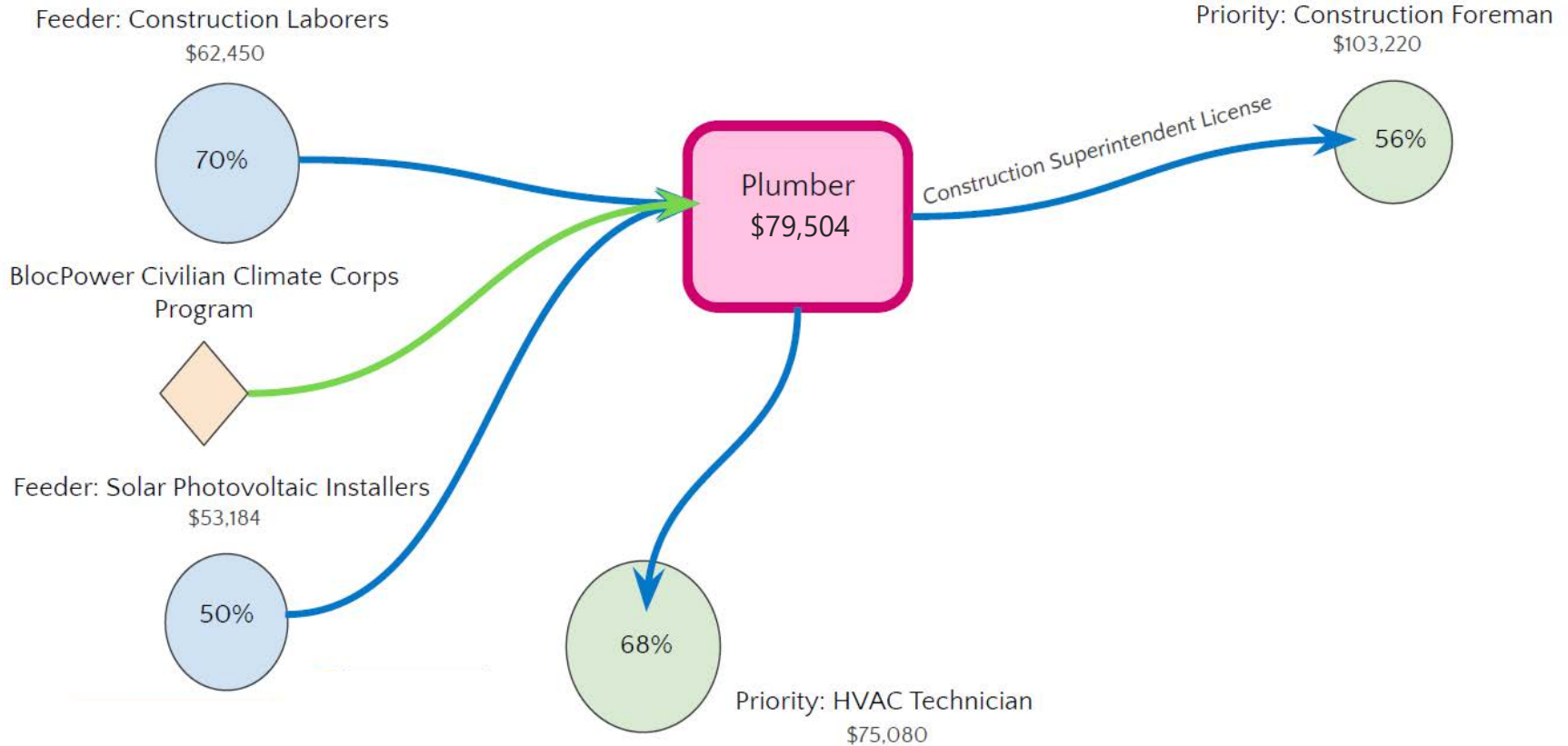


- NYS Registered Apprenticeship or Trade School
- On-the-Job Training
- Postsecondary Degree

Sample career map

■ NYS Registered Apprenticeship or Trade School
■ On-the-Job Training
■ Postsecondary Degree

% = Skills Relevance to Electricians (Source: Lightcast)
 Median annual wage (\$2022) (Source: NYSDOL)
 * Required credential/certification
 Helpful credential



Stakeholder feedback notes

Plumbers, Pipefitters, and Steamfitters

From Employers, Advocacy Organizations

- Demand for heat pumps is not here yet and as a result, contractors are not enrolling in heat pump training (BE-EX, Sealed).
- Contractors may be **less likely to market heat pumps to customers because they are less familiar with the system** leaving more room for error, potentially increasing project costs and timelines. However, as plumbers install more of these systems, they will become more proficient. In turn, consumer demand will be central to the implementation of these systems (BE-EX, UA Local 1- Plumbers).

From Workforce Providers

- As the city moves towards decarbonization, **plumbers will be essential in the installation of heat pumps and HVAC systems** (UA Local 1- Plumbers).
- NYC plumbers are highly skilled. The **modified skills needed** for building decarbonization and renewables are **simple to learn**, but a knowledge gap remains. The modified skills will not require a new workforce but rather increased awareness among workers of how to use their skills differently (Urban Green Council, UA Local 1- Plumbers, 32BJ).
- The discussion around the transition to heat pumps has been ongoing among plumbers unions for many years and they suspect that at some point there will be a paradigm shift resulting in considerable more work and jobs in this area (UA Local 1- Plumbers, 32BJ).
- There are **not yet standard industry credentials for heat pumps**; this would go a long way to standardize training curricula and grow their use because it would ensure quality for customers. These credentials would also help provide the city with the opportunity to dictate training requirements for plumbers' licenses (UA Local 1- Plumbers, 32BJ).

First Line Supervisors of Construction Trades and Extraction Workers

Occupation Overview

First Line Supervisors of Construction Trades and Extraction Workers

Characteristics:

Sector Representation	High (1.5% - 5%)
Typical Entry Level Education	High School Diploma or Equivalent
Work Experience Required	5 years or more
Typical On-The-Job Training	None
Projected growth by 2028	8.03%
Median annual wage (\$2022)	\$103,220
Black share	16.1%
Hispanic share	34.6%
Female share	4.5%

Top Job Titles:

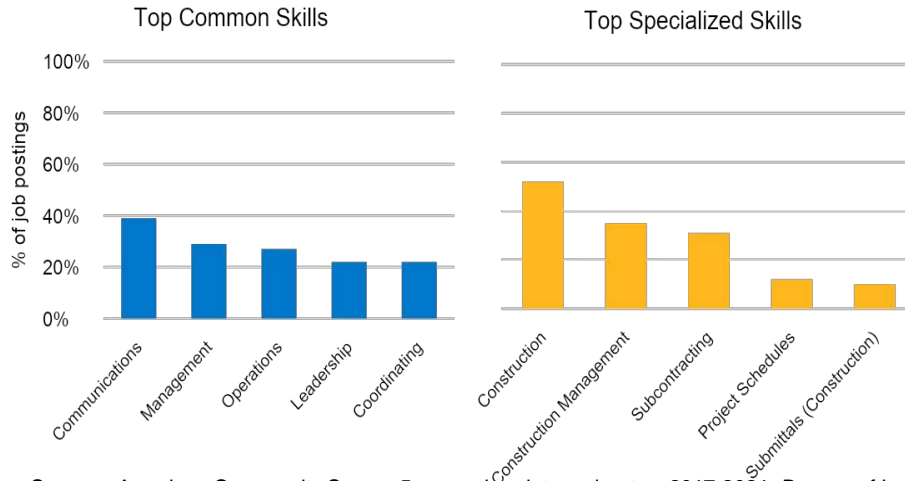
1. Construction Superintendents
2. Electrical Foremen
3. Assistant Superintendents
4. Field Specialists
5. Solar Project Managers

Top Qualifications:

1. Valid Driver's License
2. 30-Hour OSHA General Industry Card
3. 10-Hour OSHA General Industry Card
4. NABCEP Certified Energy Practitioner
5. OSHA Certification

Common Tasks:

- Inspect work progress, equipment, or construction sites to verify safety or to ensure that specifications are met.
- Read specifications, such as blueprints, to determine construction requirements or to plan procedures.
- Supervise, coordinate, or schedule the activities of construction or extractive workers.
- Assign work to employees, based on material or worker requirements of specific jobs.
- Coordinate work activities with other construction project activities.
- Estimate material or worker requirements to complete jobs.
- Analyze worker or production problems and recommend solutions, such as improving production methods or implementing motivational plans.



Occupation Overview

First Line Supervisors of Construction Trades and Extraction Workers - Median annual wage (\$2022): \$96,395 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Construction and Building Inspectors	86%	-7.9%
Construction Laborers	85%	-29.3%
Miscellaneous Construction and Related Workers	73%	-27.3%
Civil Engineering Technologists and Technicians	70%	-19.3%
First-Line Supervisors of Mechanics, Installers, and Repairers	69%	-9.3%
Manufactured Building and Mobile Home Installers	68%	-27.5%
Hazardous Materials Removal Workers	67%	-23.9%
Cement Masons and Concrete Finishers	67%	-25.7%
Plasterers and Stucco Masons	67%	-19.2%
Signal and Track Switch Repairers	66%	-11.5%

Next step jobs:

Occupation	Skill relevance	Salary diff
Construction Managers ***	97%	22.2%
Civil Engineers	74%	18.9%
Project Management Specialists ***	71%	15.0%
Business Operations Specialists, All Other	71%	15.0%
Administrative Services Managers	64%	10.4%
Facilities Managers	64%	10.4%
Managers, All Other ***	58%	14.4%
Personal Service Managers, All Other	58%	14.4%
Entertainment and Recreation Managers, Except Gambling	58%	14.4%
Environmental Engineers	55%	14.8%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

First Line Supervisors of Construction Trades and Extraction Workers - Median annual wage (\$2022): \$96,395 (Lightcast)

Previous occupations										Skill relevance
Construction and Building Inspectors (86%)	Construction Laborers (85%)	Miscellaneous Construction and Related Workers (73%)	Civil Engineering Technologists and Technicians (70%)	First-Line Supervisors of Mechanics, Installers, and Repairers (69%)	Manufactured Building and Mobile Home Installers (68%)	Hazardous Materials Removal Workers (67%)	Cement Masons and Concrete Finishers (67%)	Plasterers and Stucco Masons (67%)	Signal and Track Switch Repairers (66%)	
Construction Managers (6.5%)	Managers, All Other (6.1%)	First-Line Supervisors of Mechanics, Installers, and Repairers (5.9%)	General and Operations Managers (5.3%)	Project Management Specialists (5.1%)	First-Line Supervisors of Office and Administrative Support Workers (4.7%)	First-Line Supervisors of Production and Operating Workers (4.4%)	Chief Executives (3.8%)	Education Administrators, Kindergarten through Secondary (2.7%)	Computer user Support Specialists (2.4%)	



First Line Supervisors of Construction Trades and Extraction Workers



Following occupations										Skill relevance
Construction Managers (97%)	Civil Engineers (74%)	Project Management Specialists (71%)	Business Operations Specialists, All Other (71%)	Administrative Services Managers (64%)	Facilities Managers (64%)	Managers, All Other (58%)	Personal Service Managers, All Other (58%)	Entertainment and Recreation Managers, Except Gambling (58%)	Environmental Engineers (55%)	
Construction Managers (10.0%)	Project Management Specialists (8.7%)	General and Operations Managers (5.9%)	Managers, All Other (5.5%)	First-Line Supervisors of Mechanics, Installers, and Repairers (4.5%)	Educational Administrators, Kindergarten through Secondary (4.1%)	Chief Executives (3.8%)	First-Line Supervisors of Office and Administrative Support Workers (3.7%)	First-Line Supervisors of Production and Operating Workers (3.6%)	Computer User Support Specialists (2.2%)	

Stakeholder feedback notes

First Line Supervisors of Construction Trades

From Employers and Workforce Providers

- Real estate developers, solar and battery storage developers, and building retrofit companies **struggle to find contractors or other supervisors of construction workers** proficient in green building techniques (Hines, Soltage).
- New green construction developers are increasingly aiming for passive house certification on their projects. This poses a labor challenge because it requires contractors and other vendors to be familiar with these requirements (Bright Power).
- A **supervisor/foreman proficient in green building** technologies can be **instrumental to more seamless implementation** during the construction phase of a project. This person may be the one conveying the nuances of a particular system to the workers they lead and leaves less room for error and associated increased project costs (UA Local 3 - Plumbers, Hines, Endurant, NSU Water).
- Solar energy installation manager requires work experience, but no secondary degree. **Pipeline is likely heavily reliant on advancement within the solar sector** from feeder roles (e.g. solar energy installer). This can also mean a limited pipeline of workers into supervisory occupations while sector continues to grow in NYC (Brooklyn Solarworks).

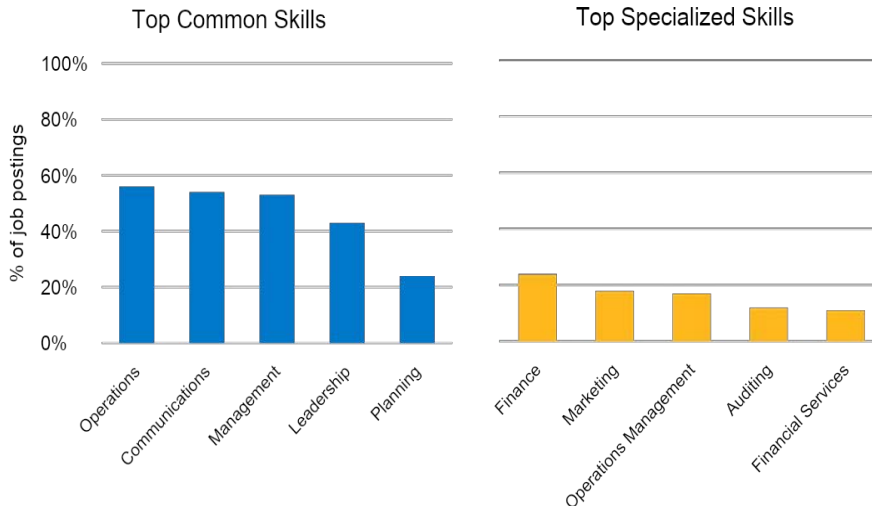
General and Operations Managers

Occupation Overview

General and Operations Managers

Characteristics:

Typical Entry Level Education	Bachelor's degree
Work Experience Required	5 years or more
Typical On-The-Job Training	None
Projected growth by 2028	9.7%
Median annual wage (\$2022)	\$161,960
Black share	15.7%
Hispanic share	22.4%
Female share	45.4%



Top Job Titles:

1. Operations Managers
2. Director of Operations
3. General Managers
4. Chiefs of Staff
5. Vice Presidents

Top Qualifications:

6. Masters of Business Administration
7. Valid Driver's License
8. Chartered Financial Analyst
9. Certified Public Accountant
10. FINRA Series 7 (General Securities Representative)

Common Tasks:

- Review financial statements, sales or activity reports, or other performance data to measure productivity or goal achievement.
- Direct and coordinate activities of businesses or departments concerned with the production, pricing, sales, or distribution.
- Direct administrative activities directly related to making products or providing services.
- Prepare staff work schedules and assign specific duties.
- Monitor suppliers to ensure that they efficiently and effectively provide needed goods or services within budgetary limits.
- Direct or coordinate financial or budget activities to fund operations, maximize investments, or increase efficiency.
- Establish or implement departmental policies, goals, objectives, or procedures in conjunction with board members, officials, or staff.

Occupation Overview

General and Operations Manager - Median annual wage (\$2022): \$139,040 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
First-Line Supervisors of Office and Administrative Support Workers	86%	-16.8%
First-Line Supervisors of Non-Retail Sales Workers	81%	-11.1%
Lodging Managers	79%	-17.9%
First-Line Supervisors of Production and Operating Workers	78%	-17.1%
First-Line Supervisors of Retail Sales Workers	77%	-26.2%
Production, Planning, and Expediting Clerks	77%	-24.7%
Airfield Operations Specialists	75%	-18.2%
Compliance Officers	75%	-9.6%
Training and Development Specialists	75%	-13.4%
First-Line Supervisors of Gambling Services Workers	74%	-26.0%

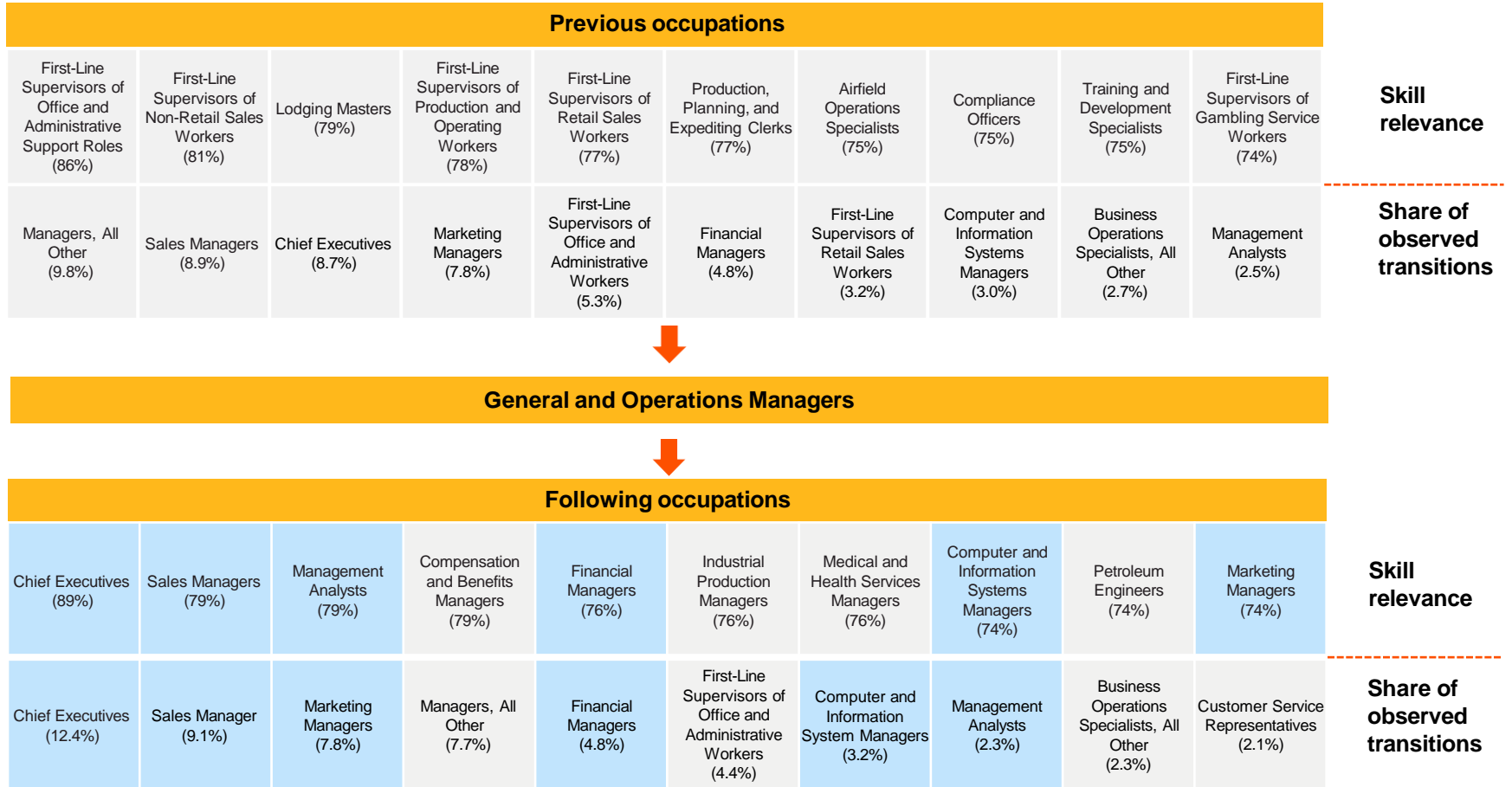
Next step jobs:

Occupation	Skill Relevance	Salary diff
Chief Executives ***	89%	27.7%
Sales Managers** *	79%	14.6%
Management Analysts ***	79%	9.8%
Compensation and Benefits Managers	79%	22.7%
Financial Managers***	76%	23.9%
Industrial Production Managers	76%	10.9%
Medical and Health Services Managers	76%	13.3%
Computer and Information Systems Managers ***	74%	47.4%
Petroleum Engineers	74%	24.4%
Marketing Managers***	74%	25.3%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

General and Operations Manager - Median annual wage (\$2022): \$139,040 (Lightcast)



Stationary Engineers/Boiler Operators

Stakeholder feedback notes

Stationary Engineer/Boiler Operator

From Employers

- Moving forward there will be particular emphasis on stationary engineers and other roles to operate a building efficiently. There needs to be concerted effort in enticing people to enter trade roles and to keep the level of skill high. As building systems move digitally, as opposed to mechanically, this will **require expanded digital operations skills** (Hines).

From Workforce Providers

- The **reskilling of stationary engineers is a primary barrier** to the expansion of building retrofits (32BJ, Stacks+Joules, Urban Green Council).
- Have a healthy pipeline of workers and will be developing trainings to be responsive to LL97 (Local 94).
- **Energy conservations courses** have kept their popularity and are **largely attended due to employer mandates** (Local 94).
- A member of Local 94 can start off as engineer helpers than become building engineers than become assistant chiefs and then chief engineer. This fast track only happens within this union and can take 3-10 years depending on the size of the portfolio of the employer (Local 94).
- Sophisticated facilities require specialized skills to operate machinery and it is difficult to get members trained with these skills with lack of access to these machines and the **automation gap among the aging workforce** (Local 94).

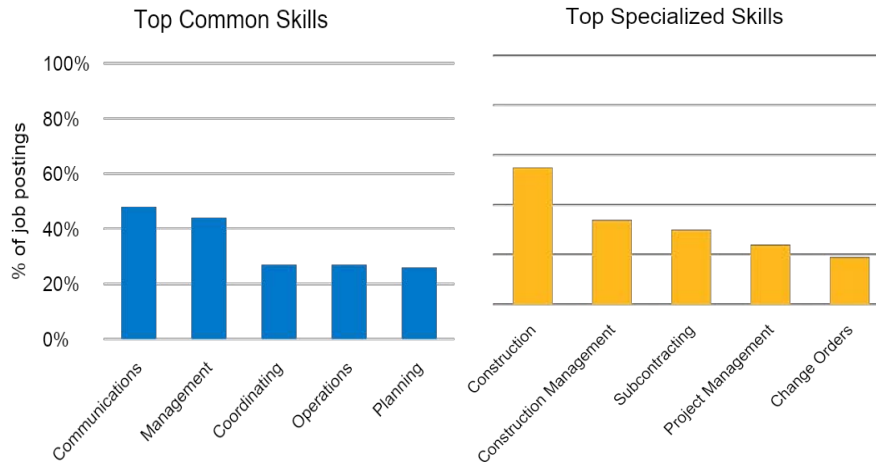
Construction Managers

Occupation Overview

Construction Managers

Characteristics:

Typical Entry Level Education	Bachelor's Degree
Work Experience Required	None
Typical On-The-Job Training	Moderate-term on-the-job training
Projected growth by 2028	8.5%
Median annual wage (\$2022)	\$135,170
Black share	9.8%
Hispanic share	24.6%
Female share	17.2%



Top Job Titles:

1. Construction Project Managers
2. Superintendents
3. Project Managers
4. Construction Managers
5. Construction Superintendents

Top Qualifications:

6. Valid Drivers License
7. Project Management Professional Certification
8. 30-Hour OSHA General Industry Card
9. 10-Hour OSHA General Industry Card
10. Architecture License

Common Tasks:

- Plan, schedule, or coordinate construction project activities to meet deadlines
- Prepare and submit budget estimates, progress reports, or cost tracking reports
- Interpret and explain plans and contract terms to representatives of the owner or developer, including administrative staff, workers, or clients
- Direct and supervise construction or related workers
- Prepare contracts or negotiate revisions to contractual agreements with architects, consultants, clients, suppliers, or subcontractors.
- Confer with supervisory personnel, owners, contractors, or design professionals to discuss and resolve matters, such as work procedures, complaints, or construction problems.

Occupation Overview

Construction Managers - Median annual wage (\$2022): \$137,075 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
First-Line Supervisors of Construction Trades and Extraction Workers ***	97%	-15.6%
Cost Estimators ***	93%	-13.8%
Construction and Building Inspectors	83%	-21.1%
Construction Laborers	75%	-36.2%
Civil Engineering Technologists and Technicians	68%	-29.2%
Administrative Services Managers	66%	-8.3%
Facilities Managers	66%	-8.3%
Miscellaneous Construction and Related Workers	62%	-34.8%
Plasterers and Stucco Masons	59%	-29.1%
Property, Real Estate, and Community Association Managers	49%	-29.9%

Next step jobs:

Occupation	Skill relevance	Salary diff
Project Management Specialists ***	81%	-5.1%
Business Operations Specialists, All Other	81%	-5.1%
Civil Engineers	78%	-2.3%
Personal Service Managers, All Other	64%	-5.5%
Entertainment and Recreation Managers, Except Gambling	64%	-5.5%
Environmental Engineers	56%	-5.2%
Industrial Production Managers	53%	2.4%
Petroleum Engineers	53%	16.1%
Chief Executives ***	52%	19.5%
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	51%	-2.7%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

Construction Managers - Median annual wage (\$2022): \$137,075 (Lightcast)

Previous occupations										
First-Line Supervisors of Construction Trades and Extraction Workers (97%)	Cost Estimators (93%)	Construction and Building Inspectors (83%)	Construction Laborers (75%)	Civil Engineering Technologists and Technicians (68%)	Administrative Services Managers (66%)	Facilities Managers (66%)	Miscellaneous Construction and Related Workers (62%)	Plasterers and Stucco Masons (59%)	Property, Real Estate, and Community Association Managers (49%)	Skill relevance
Project Management Specialists (15.8%)	First-Line Supervisors of Construction Trades and Extraction Workers (7.1%)	General and Operations Managers (6.8%)	Managers, All Other (5.4%)	Education Administrators, Kindergarten through Secondary (5.4%)	Chief Executives (4.1%)	Cost Estimators (3.8%)	Architectural and Engineering Managers (3.5%)	Civil Engineers (3.2%)	Engineers, All Other (3.1%)	Share of observed transitions
↓										
Construction Managers										
Following occupations										
Project Management Specialists (81%)	Business Operations Specialists, All Other (81%)	Civil Engineers (78%)	Personal Service Managers, All Other (64%)	Entertainment and Recreation Managers, Except Gambling (64%)	Environmental Engineers (56%)	Industrial Production Managers (53%)	Petroleum Engineers (53%)	Chief Executives (52%)	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors (51%)	Skill relevance
Project Management Specialists (20.9%)	General and Operations Managers (8.8%)	Managers, All Other (5.9%)	Chief Executives (5.9%)	Architectural and Engineering Managers (4.3%)	Education Administrators, Kindergarten through Secondary (4.2%)	First-Line Supervisors of Construction Trades and Extraction Workers (3.9%)	Cost Estimators (2.8%)	Computer Occupations, All Other (2.8%)	Sales Managers (2.4%)	Share of observed transitions

Construction Managers

Knowledge, Skills, Awareness, Abilities (KSAA) Deep Dive

Energy Efficiency	Energy rebates and available incentive programs
	Operational energy efficiency*
	Passive house design*
	Types and features of high-efficiency appliances
HVAC + Air Circulation	HVAC distribution systems types

Envelope, Weatherization, Construction Means & Methods	Biodimatic design*
	Building & building material reuse*
	Building envelopes
	Building loads
	Building material types
	Building techniques (retrofit & new construction)*
	Construction management software*
	Material-efficient framing*
	Topography
	Waterway sedimentation/contamination
Codes, Metrics, Performance	Building and energy rating systems*
	Building commissioning types
	Building, energy, and health and safety codes
	Green building product ratings*
	IAQ and IEQ
	Life cycle analysis

Construction Manager

Illustrative Pathway – Plumber to Construction Manager

Education

- Bachelor's degree in a related field

Experience

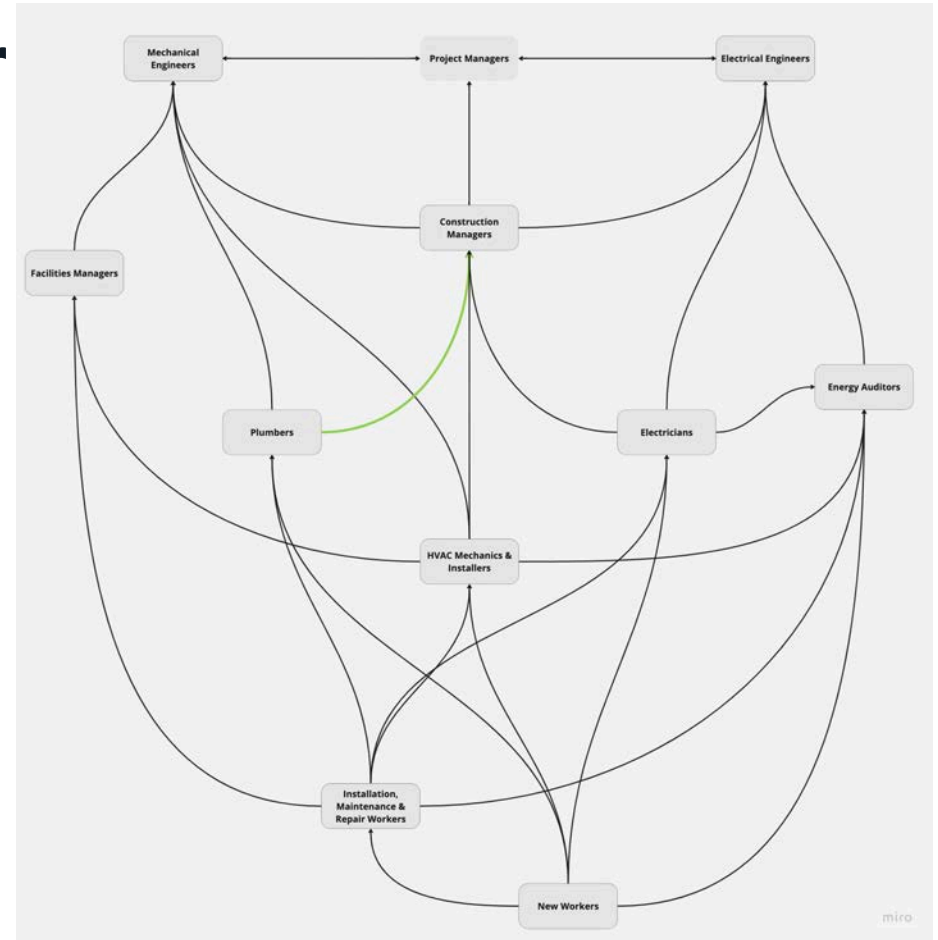
- 3-5 years in a construction trade (plumbing, electrical, etc.)

“Green” Credentials

- Green Advantage – Certified Practitioner
- Urban Green Council – GPRO (Construction Management)
- LEED Accredited Professional – Homes; Building Design & Construction
- Passive House Institute – Certified Builder

Local Programs Offering Credential-Related Training

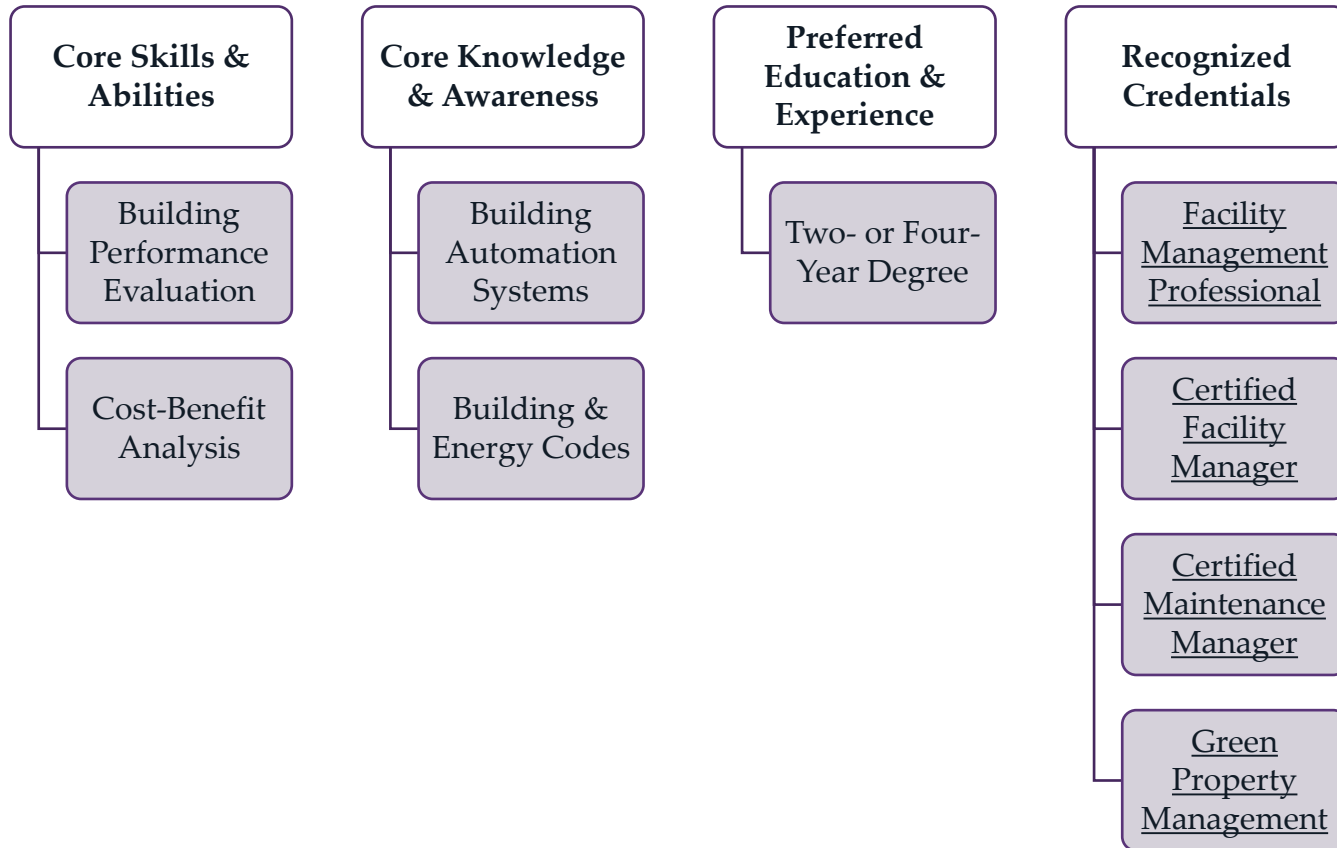
- SWA Academy



Facilities Managers

Facilities Managers

KSAA Deep Dive



Facilities Manager

Illustrative Pathway – Maintenance & Repair Worker to Facilities Manager

Education

- High school diploma or GED

Experience

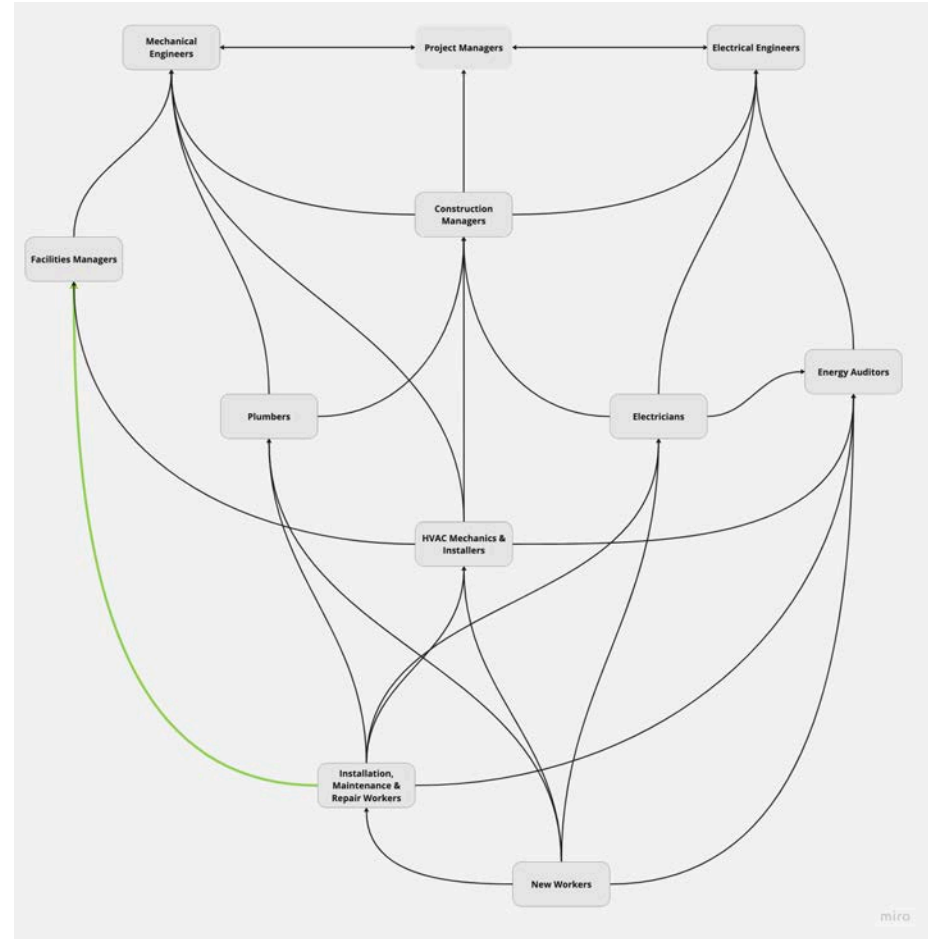
- 3-5 years in building operations, maintenance, and repair

“Green” Credentials

- Urban Green Council – GRPO (Operations & Maintenance)
- Building Performance Institute – Multifamily Building Operator
- Northwest Energy Efficiency Council – Building Operator Certification (Levels I & II)

Local Programs Offering Credential-Related Training

- CUNY Building Performance Lab
- Association for Energy Affordability NYC
- 32 BJ SEIU Training Fund



Stakeholder feedback notes

Facilities Manager

From Workforce Providers

- Supers and property managers who are proficient in how to efficiently operate a building will be critical to the overall building decarbonization effort. Relatedly, they play a **critical role in encouraging the installation of more efficient heating and cooling systems** in small- and mid-size residential and commercial buildings and encouraging building residents/tenants to utilize their heating and cooling systems in an efficient manner (Urban Green Council, BE-EX).
- 32BJ has over 250 training courses specific to building decarbonization, but enrollment is voluntary. Legislation like LL97 has led to an uptick in participation in our green buildings courses. From policy perspective, if something is mandated, it legally requires employer to pay workers to do the training. For workers that are low wage, free time is very valuable and courses can be inaccessible without employer payments (32BJ).
- **Building decarbonization training will be necessary for members to continue operating buildings.** Learning these skills will not lead to hire earnings; rather, if they do not learn these skills they will increasingly be barred from job opportunities as buildings transition (32BJ).

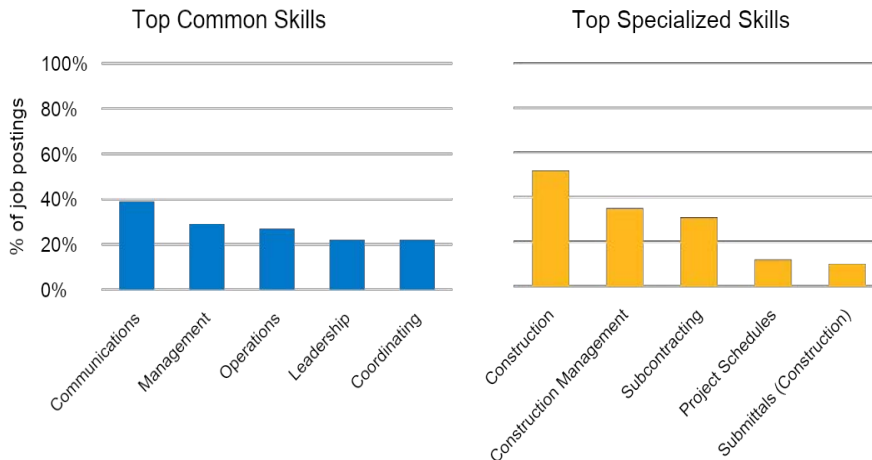
Solar energy installation managers

Occupation Overview

Solar Energy Installation Managers

Characteristics:

Typical Entry Level Education	High School Diploma or Equivalent
Work Experience Required	5 years or more
Typical On-The-Job Training	None
Projected growth by 2028	8.8%
Median annual wage (\$2022)	\$103,220
Black share	16.1%
Hispanic share	34.6%
Female share	4.5%



Sources: American Community Survey 5-year microdata estimates, 2017-2021. Bureau of Labor Statistics Occupational Outlook Handbook, 2023. Lightcast, 2023. NYSDOL 2018-2028 Long-Term Occupational Employment Projections. O*NET OnLine Occupational Data, 2022.

Top Job Titles:

1. Construction Superintendents
2. Electrical Foremen
3. Assistant Superintendents
4. Field Specialists
5. Solar Project Managers

Top Qualifications:

6. NABCEP Certified Energy Practitioner
7. Valid Driver's License
8. Project Management Professional Certification
9. 30-Hour OSHA General Industry Card
10. PV Installation Professional

Common Tasks:

- Supervise solar installers, technicians, and subcontractors for solar installation projects to ensure compliance with safety standards
- Estimate materials, equipment, and personnel needed for residential or commercial solar installation projects
- Prepare solar installation project proposals, quotes, budgets, or schedules
- Plan and coordinate installations of photovoltaic (PV) solar and solar thermal systems to ensure conformance to codes
- Monitor work of contractors and subcontractors to ensure projects conform to plans, specifications, schedules, or budgets
- Assess potential solar installation sites to determine feasibility and design requirements.

Occupation Overview

Solar Energy Installation Managers - Median annual wage (2022): \$96,395(Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Construction Managers***	92%	-11.9%
First-Line Supervisors of Construction Trades and Extraction Workers	87%	-35.8%
Cost Estimators	86%	-31.5%
Project Management Specialists***	79%	-12.4%
Solar Energy Systems Engineers	76%	-14.8%
Civil Engineers	73%	-14.9%
Government Property Inspectors and Investigators	70%	-53.6%
Construction and Building Inspectors	68%	-45.7%
Purchasing Agents, Except Wholesale, Retail, and Farm Products	64%	-39.5%
Facilities Managers	62%	-31.1%

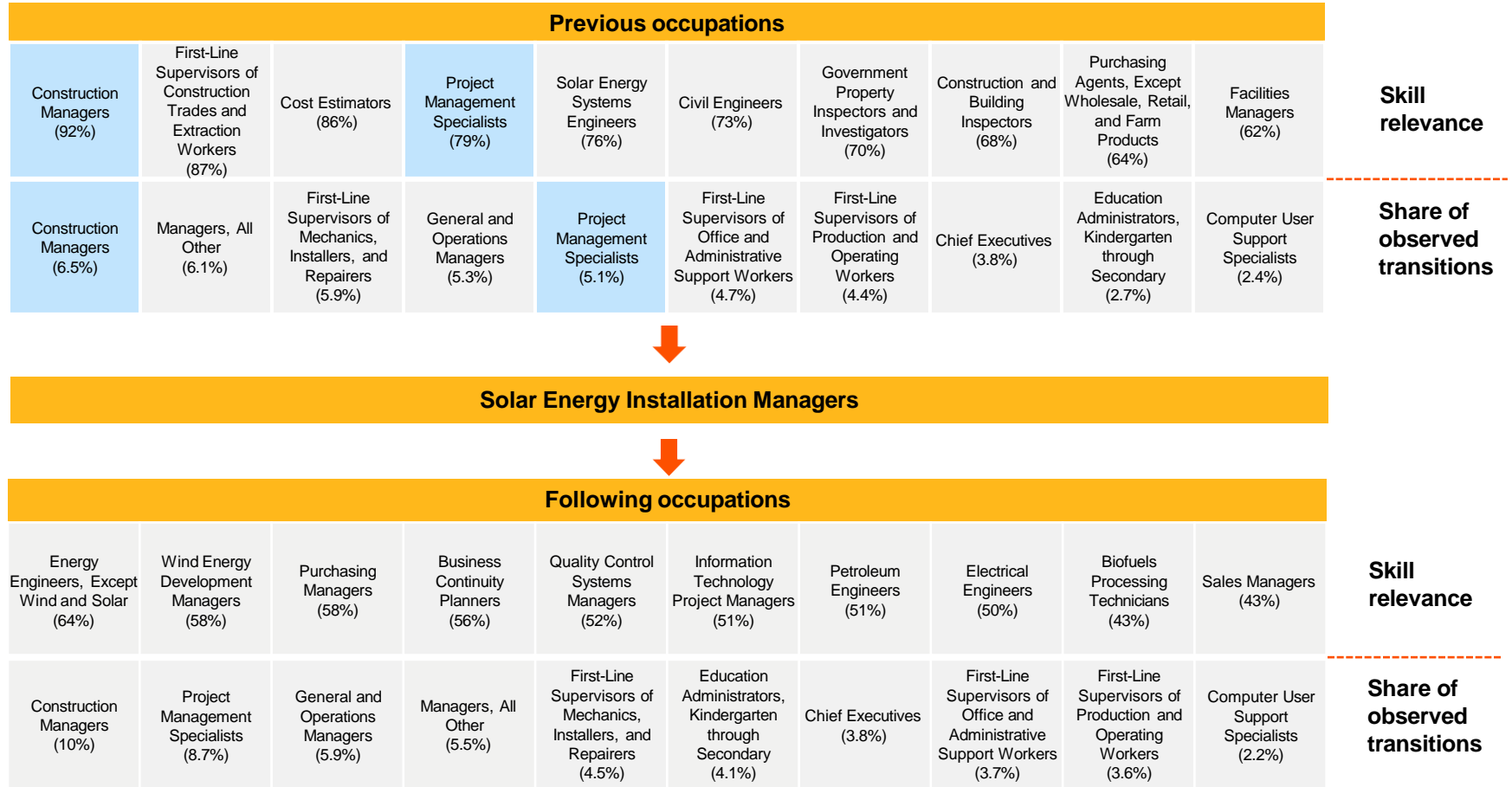
*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Next step jobs:

Occupation	Skill relevance	Salary diff
Energy Engineers, Except Wind and Solar	64%	-5.6%
Wind Energy Development Managers	58%	-3.7%
Purchasing Managers	58%	-5.3%
Business Continuity Planners	56%	-8.5%
Quality Control Systems Managers	52%	-0.7%
Information Technology Project Managers	51%	7.2%
Petroleum Engineers	51%	10.9%
Electrical Engineers	50%	-0.3%
Biofuels Processing Technicians	43%	-0.9%
Sales Managers	43%	-3.1%

Occupation Overview

Solar Energy Installation Managers - Median annual wage (2022): \$96,395(Lightcast)



Other construction and installation trades

Stakeholder feedback notes (1 of 3)

Construction Trades and Helpers Occupations

Construction Trades: Carpenters; Construction Laborers; Glazier; Insulation Workers, Floor, Ceiling, and Wall, Maintenance and Repair Workers, General

Helpers: Carpenters; Installation, Maintenance, and Repair Workers; Construction Trades; Pipelayers, Plumbers, Pipefitters, and Steamfitters

From Employers

- Once OSW projects are out of the planning phase, the city will need to be prepared for a huge uptick in construction, manufacturing, and installation jobs (NOWRDC).
- **Trades workers generally do not need to have battery storage specific knowledge** because the developer's project managers and construction managers can relatively easily articulate the particularities of a given project need (Endurant Energy).
- Workers planning to work on OSW projects will **need GWO safety certifications** (Massachusetts CEC, Indigo River).
- Due to regulations set forth in the IRA, much of the **trades work for battery storage** moving forward **will be union roles with apprenticeship requirements** (Soltage).

Stakeholder feedback notes (1 of 3)

Construction Trades and Helpers Occupations

Construction Trades: Carpenters; Construction Laborers; Glazier; Insulation Workers, Floor, Ceiling, and Wall, Maintenance and Repair Workers, General

Helpers: Carpenters; Installation, Maintenance, and Repair Workers; Construction Trades; Pipelayers, Plumbers, Pipefitters, and Steamfitters

From Workforce Providers

- Workers planning to work on OSW projects will **need GWO safety certifications** (UA Local 3-Electricians).
- Nonprofit providers tend to **train workers in foundational skills** that will be **transferable** across **“helper” occupations** (Brooklyn Workforce Innovations, HOPE Program, SolarOne)
- In NYC, generally **union labor** makes up **less than the majority of all work in a given trade**. While public works projects will be all union labor, it varies across residential/commercial buildings and depends on PLA and Site agreements. Many **developers try to meet the minimum** union labor to limit project costs. (Cornell ILR Climate Jobs Institute)
- Green Economy is on the radar of the NYCPS CTE team and they are aware it will mean uplifting the construction trades (NYCPS CTE)
- There needs to be an **increase in apprenticeship slots** in the construction trades to be able to **funnel all interested NYCPS students** (NYCPS CTE, CWE).
- Workforce Development providers struggle to connect participants, particularly given their backgrounds, to employers and jobs for entry level construction/renewable energy jobs. Their success in this role is then a further challenge. It takes **significant effort to build strong employer relationships** (BlocPower, HOPE Program, Solar One, Stacks + Joules).

Stakeholder feedback notes (1 of 3)

Construction Trades and Helpers Occupations

Construction Trades: Carpenters; Construction Laborers; Glazier; Insulation Workers, Floor, Ceiling, and Wall, Maintenance and Repair Workers, General

Helpers: Carpenters; Installation, Maintenance, and Repair Workers; Construction Trades; Pipelayers, Plumbers, Pipefitters, and Steamfitters

From Workforce Providers

- 32BJ has over 250 training courses specific to building decarbonization, but enrollment is voluntary. Legislation like LL97 has led to an uptick in participation in our green buildings courses. From policy perspective, **if something is mandated, it legally requires employer to pay workers to do the training.** For workers that are low wage, free time is very valuable and courses can be inaccessible without employer payments (32BJ).
- **Building decarbonization training will be necessary for members to continue operating buildings.** Learning these skills will not lead to hire earnings; rather, if they do not learn these skills they will increasingly be barred from job opportunities as buildings transition (32BJ).

Stakeholder feedback notes

Solar Photovoltaic Installers and Roofers

From Employers

- People starting off as installers/roofers have gone on to **take up managerial and operational positions** (Brooklyn Solarworks).
- Individuals with basic electrical skills, general construction, carpentry, or roofing experience can be relatively **easily reskilled** to be PV Installers (Brooklyn Solarworks, Brooklyn Workforce Innovations).
- At the same time, however, **reskilling workers from other trades** (ie. carpenters, mechanics) **in solar electrical work** to compensate for the electrician shortage is a **burden for smaller firms** with limited capacity (Brooklyn Solarworks).

From Workforce Providers

- Having an **industry partner develop a curriculum focused on credential attainment** (e.g. NABCEP) with intensive teacher training like the SolarOne program can be **easily replicated across Green Economy sectors** (NYCPS CTE).
- Participants have expressed interest in Solar PV roles but have found that **developers tend to only want people with experience**. Most of these with experience come from outside of NYC (HOPE Program).
- When the HOPE program has referred participants to PV installer roles, they have found that most of their workers tend to stay in entry-level roles (HOPE Program).



Sustainability Specialists

Occupation Overview

Sustainability Specialists

Characteristics:

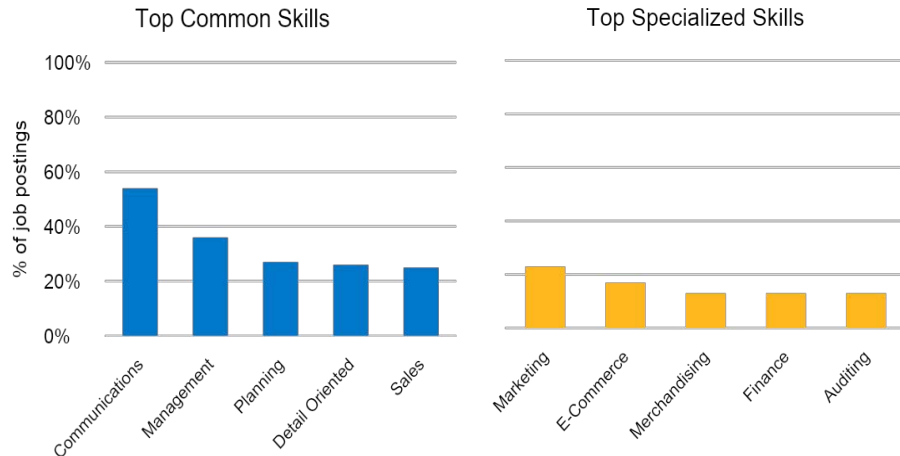
Typical Entry Level Education	Bachelor's degree
Work Experience Required	None
Typical On-The-Job Training	None
Projected growth by 2028	11.4%
Median annual wage (\$2022)	\$81,460
Black share	14.2%
Hispanic share	13.9%
Female share	51.9%

Top Qualifications:

1. LEED Accredited Professional
2. Master Of Business Administration
3. Project Management Professional Certification
4. LEED Green Associate

Common Tasks:

- Develop sustainability project goals, objectives, initiatives, or strategies in collaboration with other sustainability professionals.
- Monitor or track sustainability indicators, such as energy usage, natural resource usage, waste generation, and recycling.
- Assess or propose sustainability initiatives, considering factors such as cost effectiveness, technical feasibility, and acceptance.
- Provide technical or administrative support for sustainability programs.
- Review and revise sustainability proposals or policies.
- Develop reports or presentations to communicate the effectiveness of sustainability initiatives.
- Create or maintain plans or other documents related to sustainability projects.



Occupation Overview

Sustainability Specialists - Median annual wage (\$2022): \$84,925 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Environmental Compliance Inspectors	66%	-36.6%
Buyers and Purchasing Agents, Farm Products	66%	-43.3%
Compensation, Benefits, and Job Analysis Specialists	66%	-31.2%
Regulatory Affairs Specialists	65%	-25.0%
Wholesale and Retail Buyers, Except Farm Products	62%	-21.6%
Logistics Analysts	61%	-28.7%
Government Property Inspectors and Investigators	61%	-45.2%
Cost Estimators	60%	-20.2%
Purchasing Agents, Except Wholesale, Retail, and Farm Products	60%	-29.2%
Logistics Engineers	60%	-11.9%

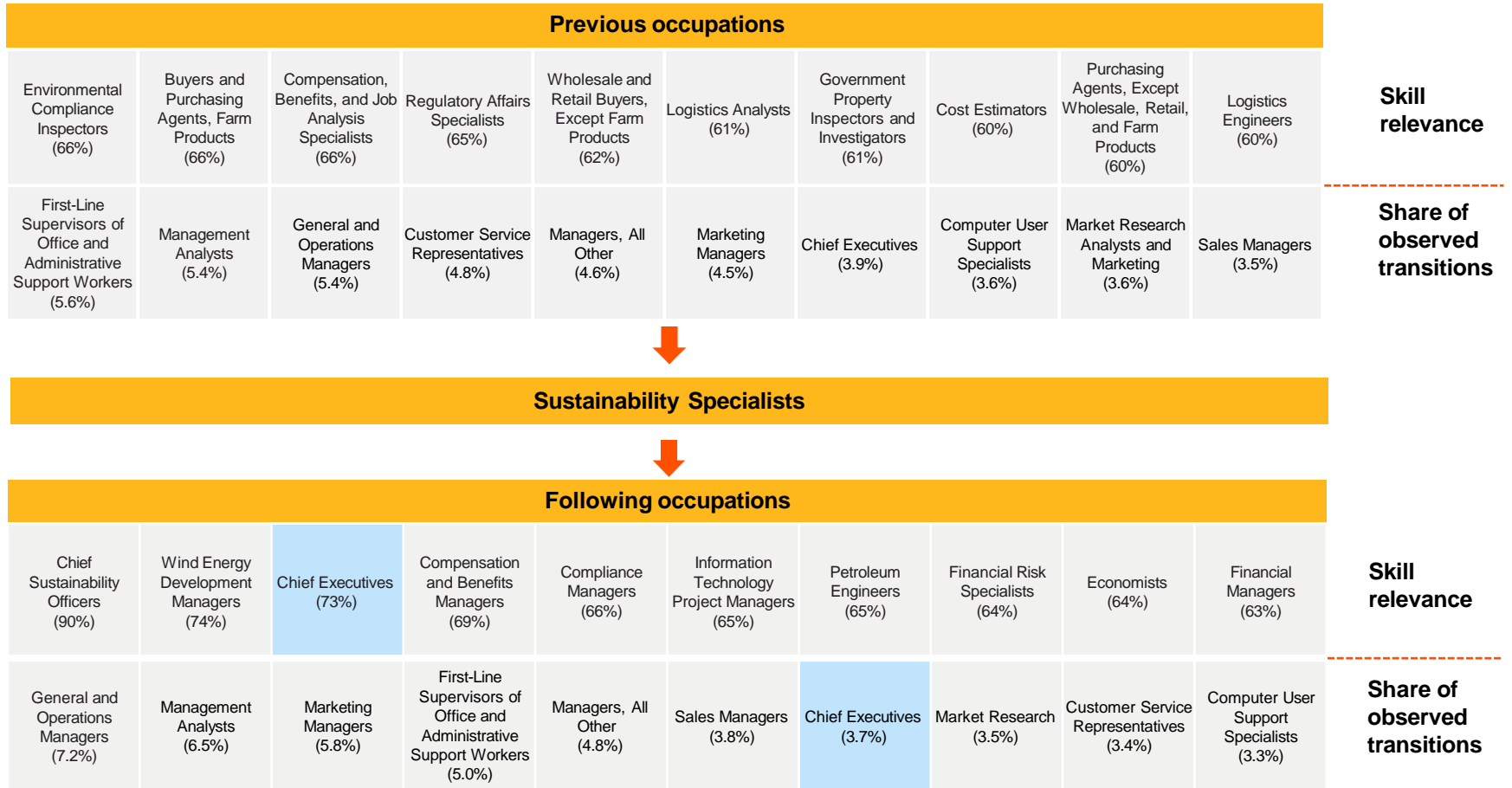
Next step jobs:

Occupation	Skill Relevance	Salary diff
Chief Sustainability Officers	90%	42.5%
Wind Energy Development Managers	74%	11.4%
Chief Executives***	73%	32.8%
Compensation and Benefits Managers	69%	25.3%
Compliance Managers	66%	14.2%
Information Technology Project Managers	65%	23.8%
Petroleum Engineers	65%	28.0%
Financial Risk Specialists	64%	24.8%
Economists	64%	13.6%
Financial Managers	63%	26.4%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

Sustainability Specialists- Median annual wage (\$2022): \$84,925 (Lightcast)



Carbon accountant

Stakeholder feedback notes

Carbon Accountants

From Employers and Advocacy Organizations

- ESG reporting needs are growing in private companies, and there is a tremendous need for individuals with carbon accounting skills (Wall St Green Summit)
- Very few universities current offer courses in carbon accounting (Wall St Green Summit).
- There is a huge knowledge capital shortage in the ESG space at large financial companies like Moody's, Fitch, S&P Global. They're acquiring ESG accounting/consulting firms in order to meet today's needs (Wall St Green Summit).
- Last March, the SEC revealed plans to enhance standardized climate-related disclosures for investors, as part of a growing awareness of the importance of ESG issues among public companies. If the proposed plan is adopted, it would require listed companies to disclose information about its direct greenhouse gas emissions (scope 1 emissions), as well as indirect emissions (scope 2 and 3 emissions). This will significantly increase the need for individuals with carbon accounting and reporting skills (Wall St Green Summit).

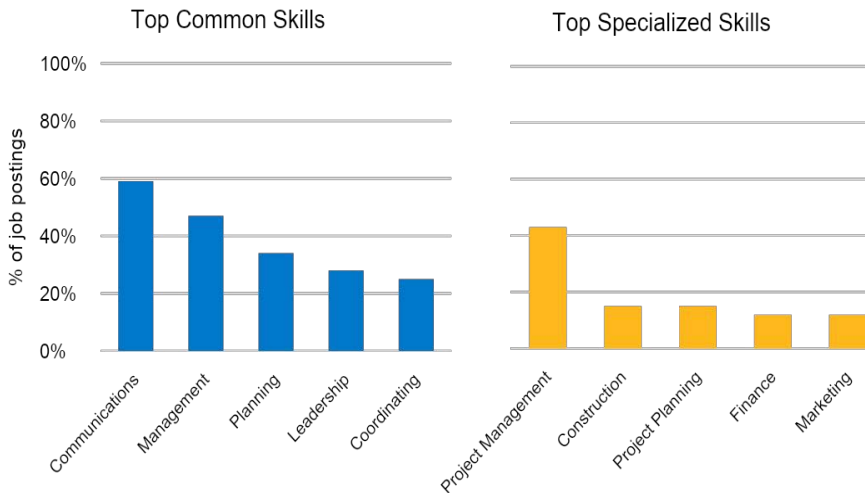
Project Management Specialist

Occupation Overview

Project Management Specialist

Characteristics:

Typical Entry Level Education	Bachelor's Degree
Work Experience Required	N/A
Typical On-The-Job Training	N/A
Projected growth by 2028	5.5%
Median annual wage (\$2022)	\$109,722
Black share	8.6%
Hispanic share	14.7%
Female share	52.3%



Top Job Titles:

1. Project Managers
2. Associate Project Managers
3. Creative Project Managers
4. Directors of Project Management
5. Healthcare Project Managers

Top Qualifications:

6. Project Management Professional Certification
7. Valid Driver's License
8. Masters of Business Administration
9. LEED Accredited Professional
10. Architecture License

Common Tasks:

- Assign duties or responsibilities to project personnel
- Communicate with key stakeholders to determine project requirements and objectives
- Create project status presentations for delivery to customers or project personnel
- Develop or update project plans including information such as objectives, technologies, schedules, funding, and staffing
- Identify project needs such as resources, staff, or finances by reviewing project objectives and schedules.
- Identify, review, or select vendors or consultants to meet project needs.
- Monitor costs incurred by project staff to identify budget issues.
- Monitor project milestones and deliverables.

Occupation Overview

Project Management Specialist - Median annual wage (\$2022): \$109,722 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Cost Estimators	74%	-10.9%
Compliance Officers	70%	-16.5%
Buyers and Purchasing Agents	67%	-17.6%
Compensation, Benefits, and Job Analysis Specialists	66%	-19.4%
Training and Development Specialists	64%	-21.4%
Logisticians	62%	-17.9%
Meeting, Convention, and Event Planners	59%	-34.7%
Market Research Analysts and Marketing Specialists	56%	-26.3%
Fundraisers	52%	-32.7%
Human Resources Specialists	52%	-23.5%

Next step jobs:

Occupation	Skill relevance	Salary diff
Architectural and Engineering Managers ***	79%	52.3%
Chief Executives ***	78%	30.7%
Computer Occupations, All Other	76%	22.2%
Computer and Information Systems Managers ***	73%	55.7%
Compensation and Benefits Managers	71%	24.3%
Computer Systems Analysts	71%	10.4%
Petroleum Engineers	69%	26.4%
Purchasing Managers	68%	12.2%
Industrial Production Managers	67%	9.4%
Sales Managers	65%	14.1%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

Project Management Specialist - Median annual wage (\$2022): \$109,722 (Lightcast)

Previous occupations										
Cost Estimators (74%)	Compliance Officers (70%)	Buyers and Purchasing Agents (67%)	Compensation, Benefits, and Job Analysis Specialists (66%)	Training and Development Specialists (64%)	Logisticians (62%)	Meeting, Convention, and Event Planners (59%)	Market Research Analysts and Marketing Specialists (56%)	Fundraisers (52%)	Human Resources Specialists (52%)	Skill relevance
Computer Occupations, All Other (9.3%)	Managers, All Other (8.5%)	General and Operations Managers (5.6%)	Construction Managers (5.6%)	Engineers, All Other (5.6%)	Marketing Managers (4.2%)	Management Analysts (4.1%)	First-Line Supervisors of Office and Administrative Support Workers (3.4%)	Chief Executives (3.0%)	Architectural and Engineering Managers (2.8%)	Share of observed transitions
↓										
Project Management Specialist										
↓										
Following occupations										
Architectural and Engineering Managers (79%)	Chief Executives (78%)	Computer Occupations, All Other (76%)	Computer and Information Systems Managers (73%)	Compensation and Benefits Managers (71%)	Computer Systems Analysts (71%)	Petroleum Engineers (69%)	Purchasing Managers (68%)	Industrial Production Managers (67%)	Sales Managers (65%)	Skill relevance
Managers, All Other (9.8%)	Computer Occupations, All Other (8.6%)	General and Operations Managers (8.4%)	Marketing Managers (6.3%)	Construction Managers (5.2%)	Chief Executives (4.3%)	Computer and Information Systems Managers (4.0%)	Management Analysts (3.6%)	Architectural and Engineering Managers (3.6%)	First-Line Supervisors of Office and Administrative Support Workers (3.0%)	Share of observed transitions

Stakeholder feedback notes (1 of 2)

Project Managers

From Employers, Advocacy Organizations, Policy Advisors

- A **project manager** proficient in **green building/renewable energy** technologies can be **instrumental to more seamless implementation** during the construction phase of a project. This person may be the one conveying the nuances of a particular system to contractors and leaves less room for error and associated increased project costs (Hines, Endurant).
- There should be **attention to the “decision makers” at all phases of a project’s development** to build and operate buildings efficiently; in addition to the developer and design team, this includes **construction managers and operations and maintenance managers** who are at once involved in a building’s mechanical details and also oversee the entire building system (BE-EX).
- A **shortage** of DOB **permitters**, and in particular those with battery storage specific knowledge, is a primary **barrier to the growth** of the subsector. Developers often receive inconsistent feedback on unpredictable timelines that hinder project completion. This uncertainty limits investment in projects. Similarly, inconsistent feedback from ConED makes projects take longer and at a higher cost (Endurant, Newleaf, Ninedot, Soltage).
- NYC DOB is currently working to be able to hire more **permitters** at a medium salary level. As of now, the salaries jump from \$36k for more entry level permitting roles to the \$90-\$100k mark. This **low starting salary** and **limited room for mobility contributes to hiring challenges** and the shortage of permitters referenced by battery storage developers (NYCEDC).

Stakeholder feedback notes (2 of 2)

Project Managers

From Employers, Advocacy Organizations, Policy Advisors (*Continued*)

- “Energy as a service” and building retrofit companies **value but struggle to find qualified project managers** with field and engineering experience. They tend to hear from engineers that they do not want to be in a PM role (Bright Power, Ecosave).

From Workforce Providers

- A primary barrier to the **building retrofits** effort in NYC is **confusion** around the **process to get from design to implementation** and the expectations set forth by LL 97. With this in mind, there is a major need for **project managers**, likely employed by the City, to **provide technical assistance** to co-ops, contractors, and others (Urban Green Council, Cornell ILR Climate Jobs Institute).

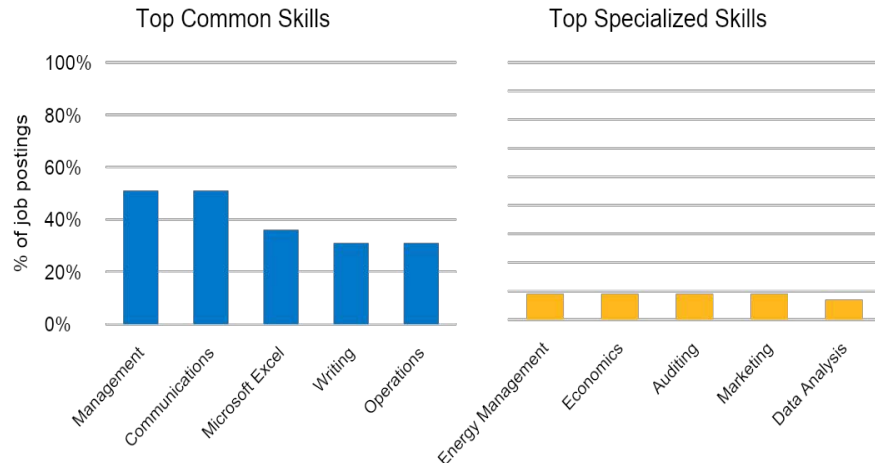
Energy auditors

Occupation Overview

Energy Auditors

Characteristics:

Typical Entry Level Education	High School Diploma or Equivalent
Work Experience Required	5 years or more
Typical On-The-Job Training	Moderate on-the-job training
Projected growth by 2028	8.03%
Median annual wage (\$2022)	\$80,920
Black share	22.2%
Hispanic share	22.7%
Female share	20.7%



Top Job Titles:

1. Energy Analysts
2. Energy Efficiency Specialists
3. Energy Efficiency Program Managers
4. Energy Efficiency Analysts
5. Energy Advisors

Top Qualifications:

6. Valid Drivers License
7. Masters of Business Administration
8. Certified Energy Manager
9. LEED Accredited Professional
10. Chartered Financial Analyst

Common Tasks:

- Identify and prioritize energy-saving measures.
- Prepare audit reports containing energy analysis results or recommendations for energy cost savings.
- Identify health or safety issues related to planned weatherization.
- Identify opportunities to improve the operation, maintenance, or energy efficiency of building or process systems.
- Calculate potential for energy savings.
- Inspect or evaluate building envelopes, mechanical systems, electrical systems, or process systems to determine energy.
- Analyze technical feasibility of energy-saving measures, using knowledge of engineering, energy production, energy use, construction, maintenance, system operation, or process systems.

Occupation Overview

Energy Auditors - Median annual wage (\$2022): \$85,429 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Compensation, Benefits, and Job Analysis Specialists	70%	-14.7%
Sales Representatives, Wholesale and Manufacturing, Except Technical Products	68%	-9.6%
Buyers and Purchasing Agents, Farm Products	68%	-26.7%
Sales Representatives of Services (Non-Advertising, Insurance, Finance, and Travel)	68%	-22.4%
First-Line Supervisors of Office and Administrative Support Workers	67%	-22.8%
Production, Planning, and Expediting Clerks	65%	-35.7%
Purchasing Agents, Except Wholesale, Retail, and Farm Products	64%	-12.7%
Document Management Specialists	64%	-19.4%
Weatherization Installers and Technicians	59%	-44.9%
Next step jobs Building Inspectors	53%	-19.7%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation	Skill relevance	Salary diff
Energy Engineers, Except Wind and Solar	86%	25.5%
Sustainability Specialists	78%	16.3%
Administrative Services Managers	75%	9.8%
Chief Sustainability Officers	73%	58.6%
Chief Executives ***	72%	48.9%
Management Analysts	71%	20.4%
Sales Managers ***	71%	28.3%
Compensation and Benefits Managers	71%	41.4%
Wind Energy Development Managers	70%	27.7%
Petroleum Engineers	69%	44.2%

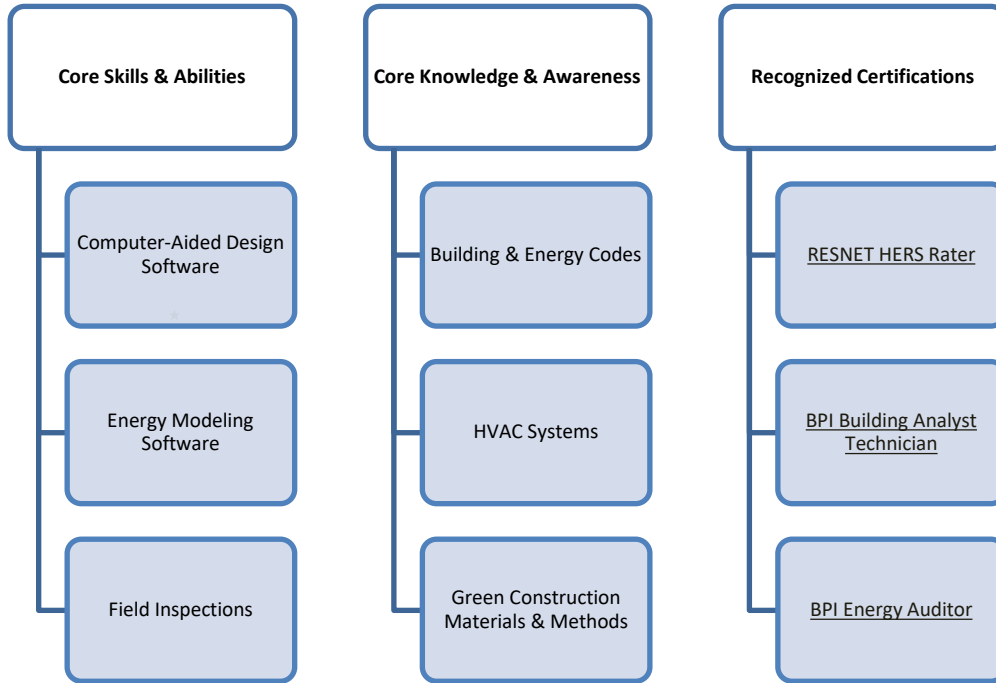
Occupation Overview

Energy Auditors - Median annual wage (\$2022): \$85,429 (Lightcast)

Previous occupations										
Compensation, Benefits, and Job Analysis Specialists (70%)	Sales Representatives, Wholesale and Manufacturing, Except Technical & Scientific Products (68%)	Buyers and Purchasing Agents, Farm Products (68%)	Sales Representatives of Services, Except Advertising, Insurance, Financial Services and Travel (68%)	First-Line Supervisors of Office and Administrative Support Workers (67%)	Productions, Planning, and Expediting Clerks (65%)	Purchasing Agents, Except Wholesale, Retail, and Farm Products (64%)	Document Management Specialists (64%)	Weatherization Installers and Technicians (59%)	Construction and Building Inspectors (53%)	Skill relevance
Inspectors, Testers, Sorters, Samplers, and Weighers (7.7%)	Chief Executives (5.6%)	Managers, All Other (4.2%)	General and Operations Managers (4.1%)	Sales Managers (3.6%)	Civil Engineers (3.5)	Construction Managers (3.3%)	First-Line Supervisors of Office and Administrative Support Workers (3.3%)	Compliance Officers (3.2%)	Engineers, All Other (3.1%)	Share of observed transitions
Energy Auditors										
Following occupations										
Energy Engineers, Except Wind and Solar (86%)	Sustainability Specialists (78%)	Administrative Services Managers (75%)	Chief Sustainability Officers (73%)	Chief Executives (72%)	Management Analysts (71%)	Sales Managers (71%)	Compensation and Benefits Managers (71%)	Wind Energy Development Managers (70%)	Petroleum Engineers (69%)	Skill relevance
Inspectors, Testers, Sorters, Samplers, and Weighers (8.0%)	Chief Executives (4.8%)	Civil Engineers (4.8%)	Engineers, All Other (4.6%)	Construction Managers (3.9%)	Managers, All Other (3.9%)	Sales Managers (3.6%)	Project Management Specialists (3.6%)	General and Operations Managers (3.4%)	First-Line Supervisors of Office and Administrative Support Workers (3.0%)	Share of observed transitions

Energy Auditors

Knowledge, Skills, Awareness, Abilities (KSAA) Deep Dive



*

Energy Auditors

Illustrative Pathway 1 – New Worker to Energy Auditor

Education

- Bachelor's degree in a related field

Experience

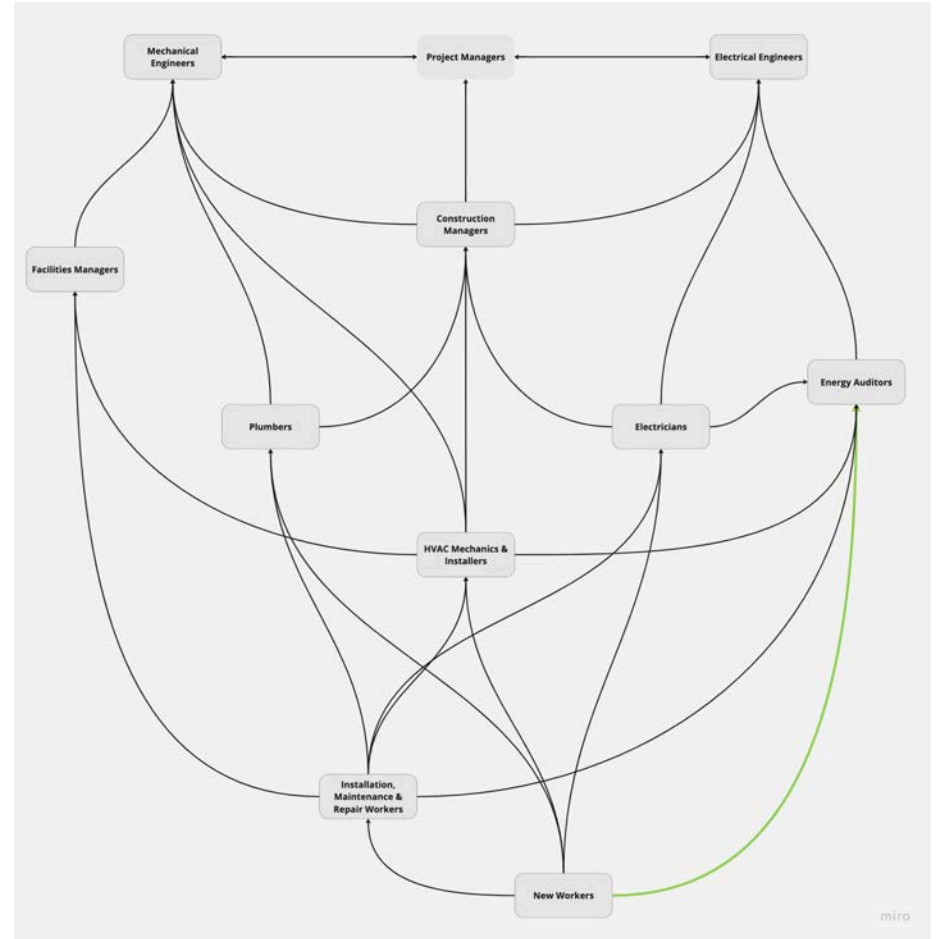
- N/A

“Green” Credentials

- Association of Energy Engineers - Certified Energy Auditor; Certified Measurement & Verification Professional
- American Society of Heating, Refrigerating and Air-Conditioning Engineers - Building Energy Assessment Professional

Local Programs Offering Credential-Related Training

- Wildan Clean Energy Academy



Energy Auditors

Illustrative Pathway 2 – HVAC Mechanic & Installer to Energy Auditor

Education

- Some post-secondary coursework in a related field

Experience

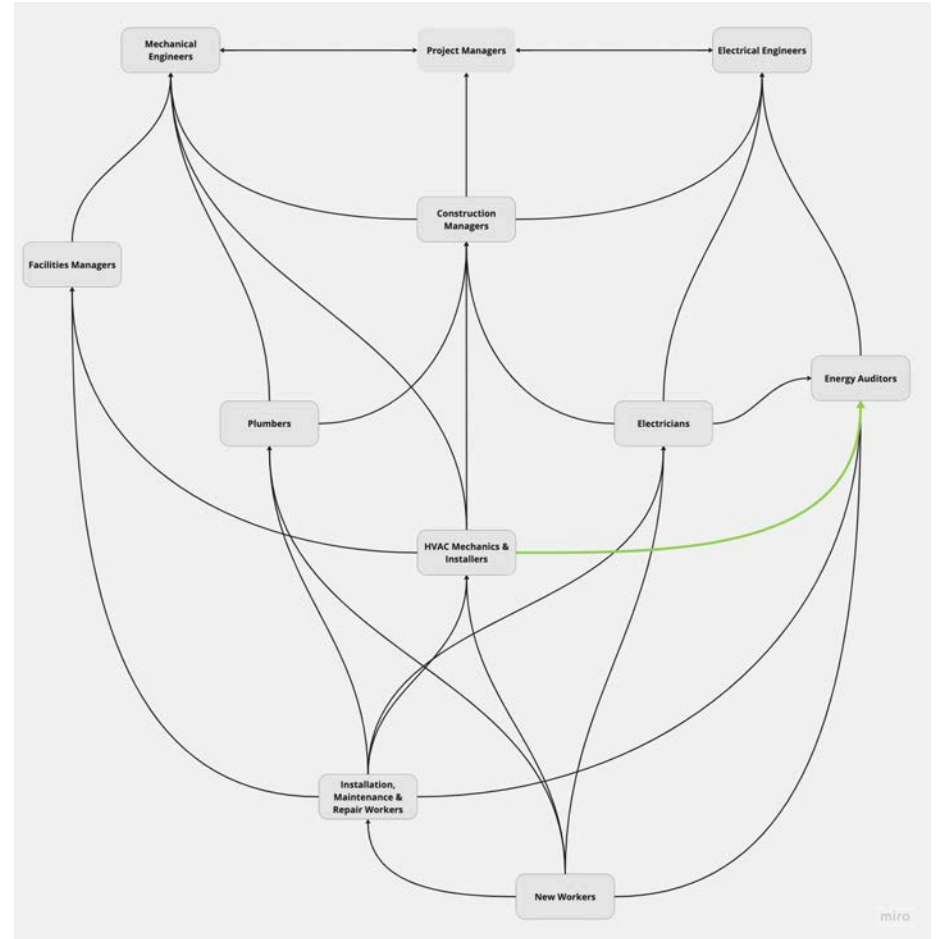
- 3-5 years in HVAC/R

“Green” Credentials

- Building Performance Institute - Multifamily Building Analyst

Local Programs Offering Credential-Related Training

- Wildan Clean Energy Academy
- Association for Energy Affordability NYC



Stakeholder feedback notes

Energy Auditors

From Employers, Advocacy Organizations, Policy Advisors

- Builders and developers are **increasingly relying on third party inspection companies** to evaluate and certify the energy efficiency levels of buildings. The need for these inspectors will continue to grow (BE-EX).
- Quality, third-party energy auditors are in short supply in New York City and that building owners and representatives consequently struggle to identify whose work is meeting required standards

From Workforce Providers

- **High demand for this role and anticipated to grow in importance** with more need for tracking building efficiency and updating energy systems. A shortage of these workers and reskilling of these workers represents a barrier to the overall building decarbonization effort (BE-EX, BlocPower, Stacks+Joules, Urban Green Council).
- The skills for these technician roles can be taught through trainings and **do not require a four year degree in software engineering or data analytics** (BlocPower, Stacks+Joules). However, just over 60 percent of incumbent NYC energy auditors have a bachelor's degree
- Building efficiency systems tend to be common in large scale buildings, but less so in mid-size buildings. These systems would need to be developed in medium-sized buildings for NYC to meet its climate goals and thus would further increased demand for energy auditors (Stacks+Joules).

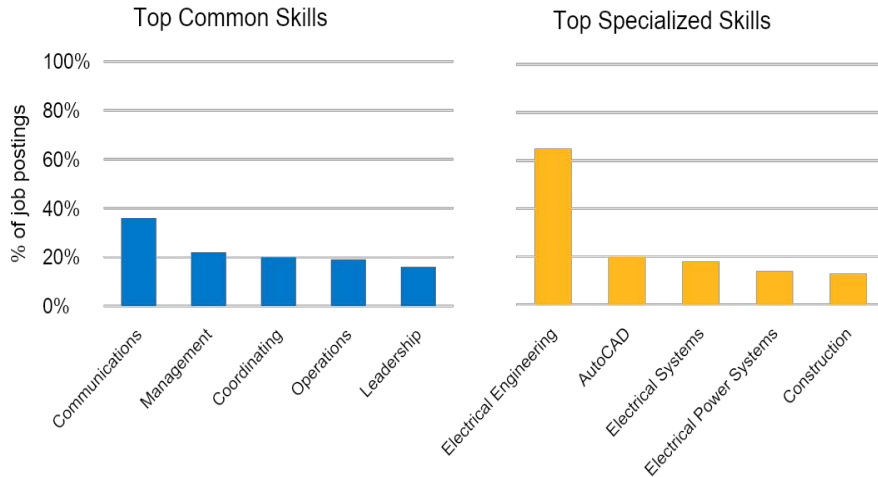
Electrical engineers

Occupation Overview

Electrical Engineers

Characteristics:

Typical Entry Level Education	Bachelor's Degree
Work Experience Required	None
Typical On-The-Job Training	None
Projected growth by 2028	8.5%
Median annual wage (\$2022)	\$106,030
Black share	21.2%
Hispanic share	20.2%
Female share	14.4%



Top Job Titles:

1. Electrical Engineers
2. Controls Engineers
3. Electrical Project Engineers
4. Electrical Project Managers
5. Plant Electrical Engineers

Top Qualifications:

6. Professional Engineer License
7. Valid Drivers License
8. Security Clearance
9. LEED Accredited Professional
10. Engineer in Training

Common Tasks:

- Operate computer-assisted engineering or design software or equipment to perform engineering tasks.
- Prepare technical drawings, specifications of electrical systems, or topographical maps to ensure that installation and operations conform to standards and customer requirements.
- Design, implement, maintain, or improve electrical instruments, equipment, facilities, components, products, or systems for commercial, industrial, or domestic purposes.
- Direct or coordinate manufacturing, construction, installation, maintenance, support, documentation, or testing activities to ensure compliance with specifications, codes, or customer requirements.
- Inspect completed installations and observe operations to ensure conformance to design and equipment specifications and compliance with operational, safety, or environmental standards.

Occupation Overview

Electrical Engineers- Median annual wage (\$2022): \$107,056 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Electrical and Electronics Drafters	89%	-21.6%
Electrical and Electronic Engineering Technologists and Technicians	74%	-46.3%
Calibration Technologists and Technicians	73%	-34.2%
Civil Engineers	61%	-13.4%
Bioengineers and Biomedical Engineers	61%	-11.2%
Materials Engineers	53%	-10.9%
Marine Engineers and Naval Architects	52%	-19.9%
Mining and Geological Engineers, Including Mining Safety Engineers	51%	-20.6%
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	49%	-13.9%
Environmental Engineers	46%	-17.1%

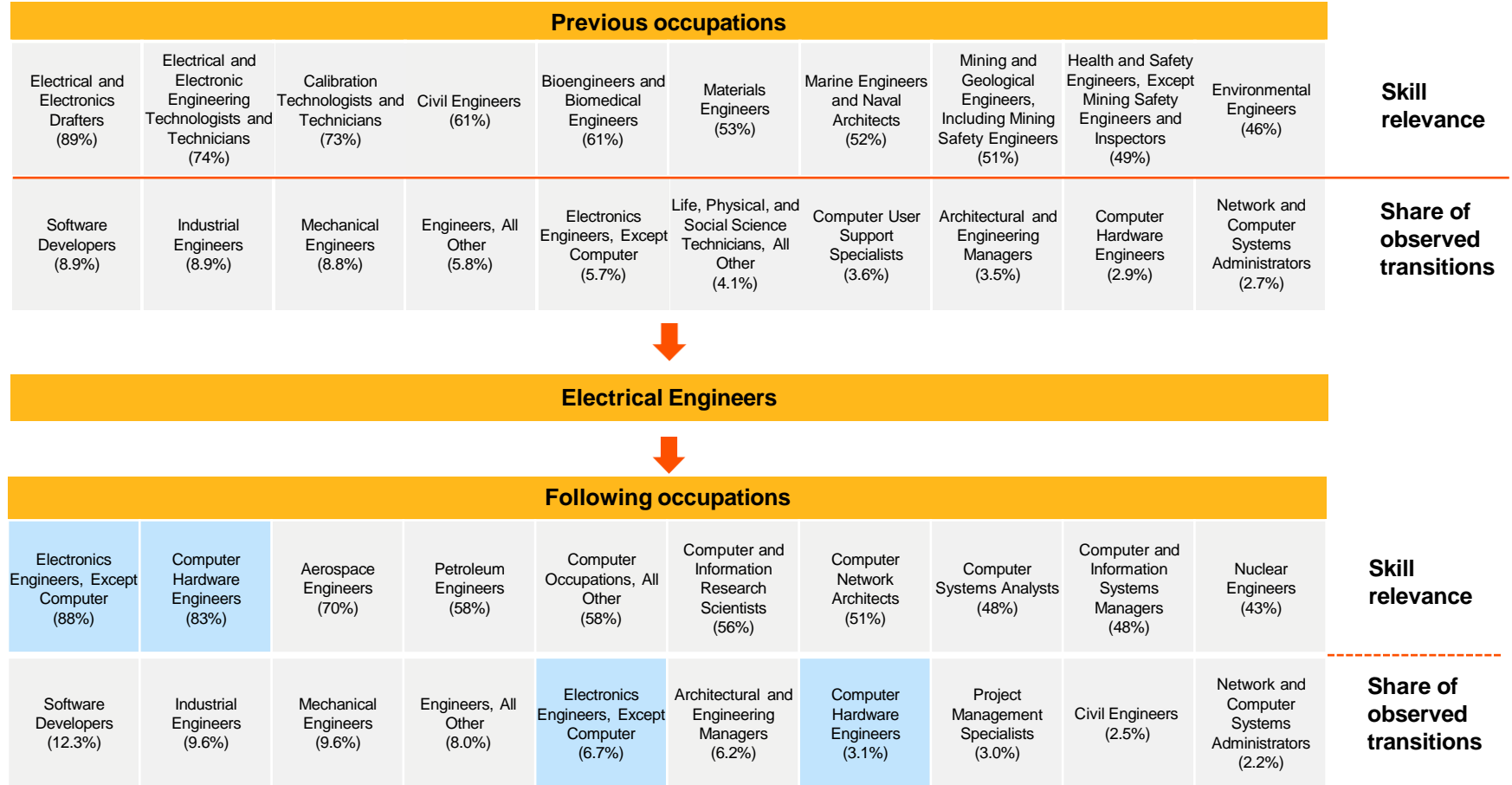
Next step jobs:

Occupation	Skill relevance	Salary diff
Electronics Engineers, Except Computer ***	88%	11.0%
Computer Hardware Engineers ***	83%	19.7%
Aerospace Engineers	70%	12.8%
Petroleum Engineers	58%	10.1%
Computer Occupations, All Other	58%	5.8%
Computer and Information Research Scientists	56%	0.7%
Computer Network Architects	51%	5.7%
Computer Systems Analysts	48%	-6.3%
Computer and Information Systems Managers	48%	40.1%
Nuclear Engineers	43%	13.2%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

Electrical Engineers - Median annual wage (\$2022): \$107,056 (Lightcast)



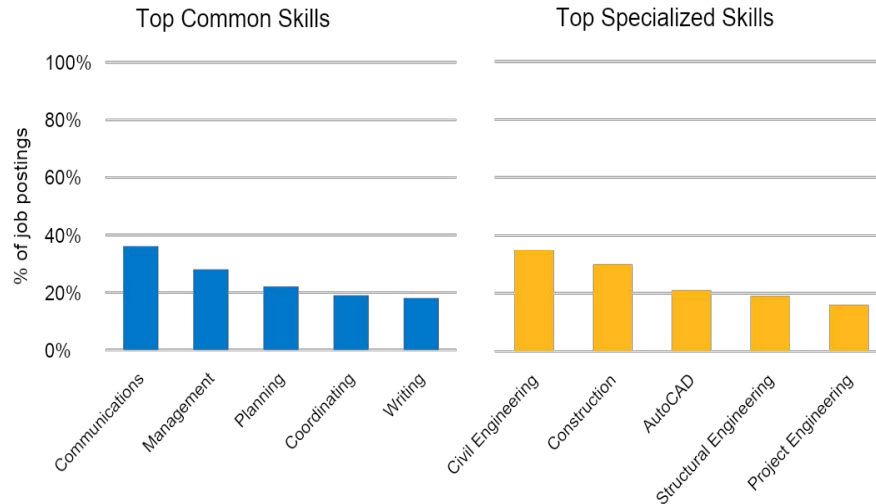
Civil Engineers

Occupation Overview

Civil Engineers

Characteristics:

Typical Entry Level Education	Bachelor's Degree
Work Experience Required	None
Typical On-The-Job Training	None
Projected growth by 2028	11.8%
Median annual wage (\$2022)	\$102,340
Black share	13.4%
Hispanic share	16.6%
Female share	22.8%



Sources: American Community Survey 5-year microdata estimates, 2017-2021. Bureau of Labor Statistics Occupational Outlook Handbook, 2023. Lightcast, 2023. NYSDOL 2018-2028 Long-Term Occupational Employment Projections. O*NET OnLine Occupational Data, 2022.

Top Job Titles:

1. Structural Engineers
2. Civil Engineers
3. Project Engineers
4. Geotechnical Engineers
5. Civil Project Engineers

Top Qualifications:

6. Professional Engineering License
7. Valid Driver's License
8. Engineer in Training
9. 30-Hour OSHA Industry Card
10. Project Management Professional Certification

Common Tasks:

- Direct engineering activities, ensuring compliance with environmental, safety, or other governmental regulations.
- Manage and direct the construction, operations, or maintenance activities at project site.
- Inspect project sites to monitor progress and ensure conformance to design specifications and safety or sanitation standards.
- Compute load and grade requirements, water flow rates, or material stress factors to determine design specifications.
- Plan and design transportation or hydraulic systems or structures, using computer-assisted design or drawing tools.
- Provide technical advice to industrial or managerial personnel regarding design, construction, program modifications, or structural repairs.

Occupation Overview

Civil Engineers - Median annual wage (\$2022): \$107,079 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Civil Engineering Technologists and Technicians	89%	-34.4%
Architectural and Civil Drafters	83%	-28.5%
Construction and Building Inspectors	76%	-24.1%
Cost Estimators	74%	-14.7%
First-Line Supervisors of Construction Trades and Extraction Workers	74%	-17.0%
Mechanical Drafters	68%	-29.0%
Electrical and Electronics Drafters	66%	-8.2%
Surveyors	61%	-22.5%
Environmental Engineering Technologists and Technicians	60%	-23.0%
Landscape Architects	58%	-15.5%

Next step jobs:

Occupation	Skill relevance	Salary diff
Construction Managers	78%	2.9%
Project Management Specialists	69%	-3.6%
Business Operations Specialists, All Other	69%	-3.6%
Electrical and Electronics Drafters	66%	-8.2%
Electrical Engineers	61%	13.4%
Entertainment and Recreation Managers, Except Gambling	56%	-4.0%
Petroleum Engineers	56%	23.5%
Engineers, All Other	50%	23.1%
Chemical Engineers	49%	10.7%
Chief Executives	47%	27.9%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

Civil Engineers - Median annual wage (\$2022): \$107,079 (Lightcast)

Previous occupations										Skill relevance
Civil Engineering Technologists and Technicians (89%)	Architectural and Civil Drafters (83%)	Construction and Building Inspectors (76%)	Cost Estimators (74%)	First-Line Supervisors of Construction Trades and Extraction Workers (74%)	Mechanical Drafters (68%)	Electrical and Electronics Drafters (66%)	Surveyors (61%)	Environmental Engineering Technologists and Technicians (60%)	Landscape Architects (58%)	
Engineers, All Other (10.3%)	Mechanical Engineers (7.4%)	Industrial Engineers (6.1%)	Life, Physical, and Social Science Technicians, All Other (5.0%)	Software Developers (4.7%)	Project Management Specialists (4.2%)	Architectural and Engineering Managers (4.1%)	Teaching Assistants, Postsecondary (3.3%)	Electrical Engineers (3.3%)	Construction Managers (3.0%)	Share of observed transitions
↓										
Civil Engineers										
↓										
Following occupations										Skill relevance
Construction Managers (78%)	Project Management Specialists (69%)	Business Operations Specialists, All Other (69%)	Electrical and Electronics Drafters (66%)	Electrical Engineers (61%)	Entertainment and Recreation Managers, Except Gambling (56%)	Petroleum Engineers (56%)	Engineers, All Other (50%)	Chemical Engineers (49%)	Chief Executives (47%)	
Engineers, All Other (12.1%)	Project Management Specialists (8.4%)	Mechanical Engineers (7.4%)	Architectural and Engineering Managers (6.9%)	Industrial Engineers (6.6%)	Software Developers (5.8%)	Construction Managers (4.6%)	Chief Executives (3.3%)	Electrical Engineers (2.8%)	Managers, All Other (2.5%)	Share of observed transitions

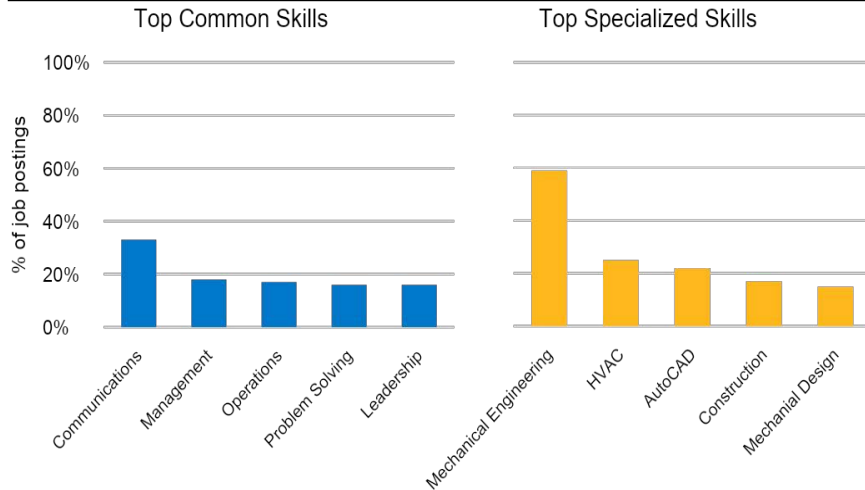
Mechanical Engineers

Occupation Overview

Mechanical Engineers

Characteristics:

Typical Entry Level Education	Bachelor's Degree
Work Experience Required	None
Typical On-The-Job Training	None
Projected growth by 2028	10.2%
Median annual wage (\$2022)	\$102,890
Black share	10.1%
Hispanic share	24.6%
Female share	7.7%



Top job titles:

1. Mechanical Engineers
2. Mechanical HVAC Engineers
3. Refrigeration Engineers
4. Mechanical Design Engineers
5. HVAC Engineers

Common tasks:

- Read and interpret blueprints, technical drawings, schematics, or computer-generated reports.
- Research, design, evaluate, install, operate, or maintain mechanical products, equipment, systems or processes to meet requirements.
- Confer with engineers or other personnel to implement operating procedures, resolve system malfunctions, or provide technical information.
- Develop, coordinate, or monitor all aspects of production, including selection of manufacturing methods, fabrication, or operation of product designs.
- Investigate equipment failures or difficulties to diagnose faulty operation and recommend remedial actions.
- Develop or test models of alternate designs or processing methods to assess feasibility, sustainability, operating condition effects, potential new applications, or necessity of modification.

Occupation Overview

Mechanical Engineers- Median annual wage (\$2022): \$106,470 (Lightcast)

Feeder jobs:

Occupation	Skill relevance	Salary diff
Mechanical Engineering Technologists and Technicians	79%	-38.0%
Mechanical Drafters	78%	-35.2%
Electrical and Electronics Drafters	73%	-14.3%
Engineering Technologists and Technicians, Except Drafters, All Other	72%	-27.0%
Calibration Technologists and Technicians	72%	-27.0%
Engine and Other Machine Assemblers	67%	-44.3%
Marine Engineers and Naval Architects	57%	-12.6%
Agricultural Engineers	52%	-18.1%
Mining and Geological Engineers, Including Mining Safety Engineers	51%	-13.3%
Environmental Engineers	49%	-9.8%

Next step jobs:

Occupation	Skill relevance	Salary diff
Aerospace Engineers	79%	20.3%
Engineers, All Other***	69%	17.1%
Electronics Engineers, Except Computer	68%	18.5%
Commercial and Industrial Designers	63%	15.7%
Petroleum Engineers	62%	17.6%
Computer Hardware Engineers	62%	27.2%
Materials Scientists	58%	-3.4%
Computer Occupations, All Other***	54%	13.2%
Industrial Production Managers	53%	0.0%
Nuclear Engineers	46%	20.7%

*** indicates a commonly observed transition (top 10 in previous/following occupations, respectively)

Occupation Overview

Mechanical Engineers - Median annual wage (\$2022): \$106,470 (Lightcast)

Previous occupations										Skill relevance
Mechanical Engineering Technologists and Technicians (79%)	Mechanical Drafters (78%)	Electrical and Electronics Drafters (73%)	Engineering Technologists and Technicians, Except Drafters, All Other (72%)	Calibration Technologists and Technicians (72%)	Engine and Other Machine Assemblers (67%)	Marine Engineers and Naval Architects (57%)	Agricultural Engineers (52%)	Mining and Geological Engineers, Including Mining Safety Engineers (51%)	Environmental Engineers (49%)	
Industrial Engineers (16.5%)	Software Developers (10.8%)	Engineers, All Other (5.1%)	Electrical Engineers (4.1%)	Life, Physical, and Social Science Technicians, All Other (3.9%)	Architectural and Engineering Managers (3.5%)	Civil Engineers (2.6%)	Computer User Support Specialists (2.5%)	Teaching Assistants, Postsecondary (2.4%)	Commercial and Industrial Designers (2.4%)	Share of observed transitions
Mechanical Engineers										
Following occupations										Skill relevance
Aerospace Engineers (79%)	Engineers, All Other (69%)	Electronics Engineers, Except Computer (68%)	Commercial and Industrial Designers (63%)	Petroleum Engineers (62%)	Computer Hardware Engineers (62%)	Materials Scientists (58%)	Computer Occupations, All Other (54%)	Industrial Production Managers (53%)	Nuclear Engineers (46%)	
Industrial Engineers (16.6%)	Software Developers (12.5%)	Architectural and Engineering Managers (7.8%)	Engineers, All Other (6.5%)	Electrical Engineers (3.7%)	Project Management Specialists (2.6%)	Civil Engineers (2.5%)	Marketing Managers (2.4%)	Computer Occupations, All Other (2.2%)	Chief Executives (2.0%)	Share of observed transitions



Engineering and Architecture occupations (overarching stakeholder feedback)

Stakeholder feedback notes (1 of 3)

Engineers and Architects

From Employers

Findings Specific to Civil, Mechanical, Electrical, or Energy Engineering Disciplines; Architects

- The Buildings sector is in need of visionary **energy modelers and mechanical engineers** who are **skilled in understanding how heat transfer systems operate in buildings** and whole building energy systems. There is already a shortage and the demand will continue to grow. The strategies become easier to replicate with each project (Hines).
- It is incredibly different for Battery Storage developers to find people with the proper combination of skill sets and knowledge bases across engineering and design. On top of this, it is **difficult to attract talent given the high cost of living/salary needs**. These factors are barriers to the growth of Battery Storage in NYC. Developers tend to **hire highly skilled electrical/chemical engineers and designers and train them for battery storage in-house** (Endurant, Ninedot, Soltage, Urban Electric Power).
- For battery storage projects, **civil engineers** tend to be **based in the NYC metro area** because they must understand all the permitting requirements unique to NYC (Ninedot).
- Solar developers struggle to hire **electrical engineers** with specialized solar energy systems knowledge, and therefore **train in-house** (Ecogy).
- **NYCDEP struggles to hire water or energy engineers** due to **low salaries and limited work-life flexibility** when compared to the private sector and other municipalities (NYCDEP).
- Stakeholders expressed differing opinions on whether they believe there is a sufficient pool of local **architects** proficient in green building practices, but affirmed that **increased client demand for green building will be the primary driver of an increase in these services** (NY Energy Efficiency Corporation, BE-EX).

Stakeholder feedback notes (2 of 3)

Engineers and Architects

From Employers

High-Level Engineering Occupations Takeaways

- Highly specialized technical consultants and engineers will be **needed** to do all the planning in the early design phases of **OSW** projects (NOWRDC).
- Pipeline of OSW engineers is hard to come by and relies on **scant alumni networks** (FKA OSW Consulting, Bright Power).
- Sector-specific offshore wind **training tends to occur on the job** for engineering recruits (FKA OSW Consulting).
- NYSERDA's clean energy internship programs have helped companies host engineering students. A similar **City funded program** could go a long way to **building a pipeline of engineers** particularly for smaller developers who are hesitant to take on the training in-house. Paid internship programs expose more students to career pathways in renewable energy and allow companies to host students from a variety of backgrounds (Ecogy).
- Solar and battery storage developers affirmed that **sector specific concentrations within university electrical engineering program** would be valuable to growing a workforce pipeline (Brooklyn Solar, Ecogy Energy, Newleaf, Soltage).
- Hard to operate and maintain an engineering practice in New York City due to the cost of doing business (ie. rent, salaries) (FKA OSW Consulting).

Stakeholder feedback notes (3 of 3)

Engineers and Architects

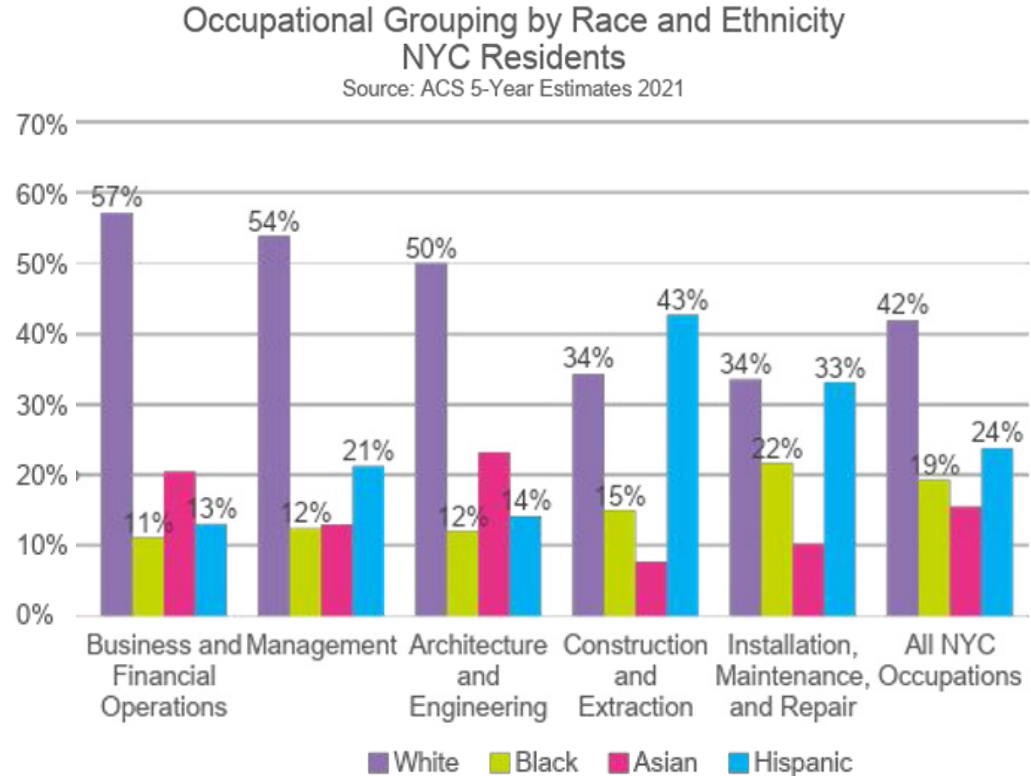
From Workforce and Education Providers

- Providers have seen how **participation in renewable energy programs at the high school level** has prompted youth to **pursue pathways in software, mechanical, or electrical engineering** at the postsecondary level while also providing students with the career readiness skills to succeed in their goals (Stacks+Joules).
- Engineering students at CUNY struggle to find lab space and internship opportunities and may transition away from the field due to challenges securing full time roles following graduation. Those who find internships often need additional support when surrounded by students from very different educational backgrounds (CUNY).
- **Engineering internship wages subsidized by the city or state** could help to secure more positions because employees would not take on any financial risk (CUNY).
- Sees **opportunity for a Y14 or Y16 engineering model in partnership with NYC Public Schools**. Given that CTE has a strong partnership with many employers, could pursue a model where students would begin working with employers in high school through CTE or other funding and later on be positioned for a preferential hire. DOE would assume all the risk up front and the student would be well positioned for the role by the time they complete their degree (CUNY).

DEMOGRAPHICS ANALYSIS

Race and ethnicity of priority occupations analysis (by occupational grouping)

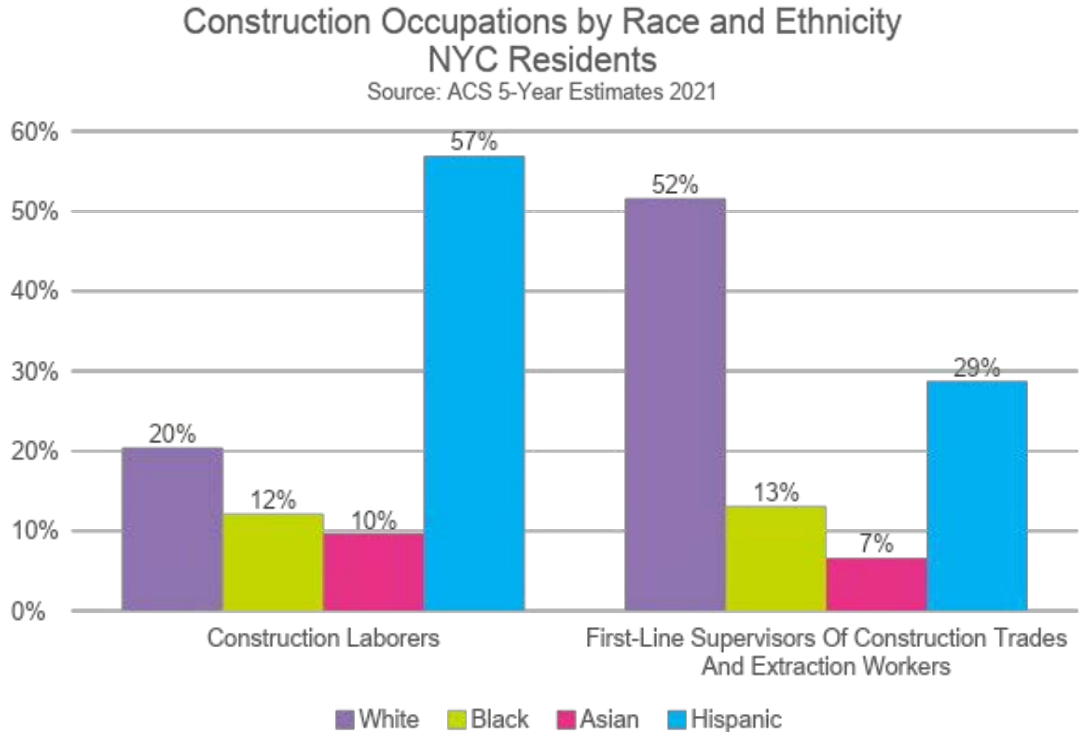
- Occupational groupings see the greatest diversity in Installation, Maintenance, and Repair, and Construction and Extraction. All other occupational groupings have larger shares of White workers relative to the City overall.
- Strong diversity in the trades suggests opportunities to promote accessible pathways and job opportunities to historically marginalized populations.



Note: see Appendix for race and ethnicity analysis for individual occupations

Race and ethnicity analysis for specific construction occupations

- The concentration of Hispanic workers in feeder occupations is also observed within the Construction occupational grouping, which boasts high Hispanic representation overall.
- The relative lack of diversity in priority and next-step occupations underscores a need to ensure that meaningful pathways are developed into the Green Economy from historically marginalized populations.

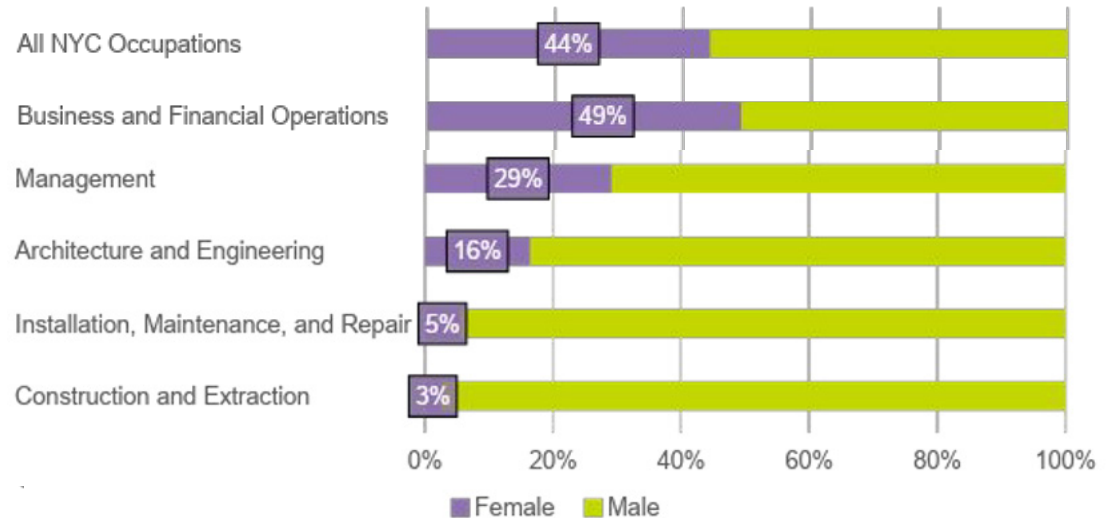


Gender analysis of priority occupations (by occupational groupings)

- Female workers are most well represented in Business and Financial Operations and Sales and Related occupations.
- Conversely, they are highly underrepresented in Installation, Maintenance, and Repair and Construction and Extraction occupations.
- This points to a need to intervene to ensure access to low-barrier occupations and pathways into the Green Economy.

Occupational Grouping by Sex
NYC Residents

Source: ACS 5-Year Estimates 2021



Note: see Appendix for gender analysis for individual occupations

RESKILLING NEEDS ANALYSIS

Reskilling Needs by Occupation (based on stakeholder feedback)

Minimal Reskilling Needs	Reskilling Needs Across Sectors
Electricians	Battery Storage, Building Decarbonization and Solar Energy: Basic exposure to relevant electrical systems
Electrical Technologists and Technicians	Offshore Wind: industry-recognized safety standards training through Global Wind Organization (GWO), which are required to work on-site.
Enhanced Skills	Reskilling Needs Across Sectors
HVAC Mechanics and Installers	Building Decarbonization: Installation, repair, and maintenance experience with air source and geothermal heat pumps
Plumbers, Pipefitters and Steamfitters	Solar Energy: Installation, repair, and maintenance experience with solar thermal heat pumps Offshore Wind: industry-recognized safety standards training through GWO
First-Line Supervisors of Construction Trades	Building Decarbonization: Familiarity and comfort with mechanical, electrical, and plumbing (MEP) systems to oversee and direct teams of construction, installation, repair, and maintenance workers Offshore Wind: industry-recognized safety standards training through GWO
New and Emerging Occupations	Reskilling Needs Across Sectors
Solar Energy Installation Manager	Battery Storage and Solar Energy: First-Line Supervisors with specific expertise supervising rooftop solar installation workers (e.g., roofers, PV installers, electricians and electrical technicians)
Energy Auditors	Building Decarbonization: Energy Auditors are an emerging occupation from building inspectors, resulting from need to properly audit and identify compliance strategies for building energy consumption mandates

Reskilling Needs by Occupation

Enhanced Skills	Reskilling Needs Across Sectors
<p>Electrical Engineers</p>	<p>Battery Storage & Solar Energy: Specific expertise designing solar and storage systems according to local permitting requirements. Design of interconnection with utility infrastructure for battery storage.</p> <p>Building Decarbonization: Electrical needs for heat pumps and other electrified building energy systems and appliances.</p> <p>Offshore Wind: Design of electrical systems conducive to conditions offshore.</p>
<p>Civil Engineers</p>	<p>Battery Storage: Design of battery storage site, foundation, and structure and knowledge of local permitting requirements.</p> <p>Building Decarbonization: Understanding of green building principles and the material and structural qualities of sustainable building materials. Design of buildings in a way that is compatible with sustainable building systems.</p> <p>Offshore Wind: Design of wind farm structures, test soil and water conditions for adequacy and strength of foundations, Industry-recognized safety standards training through GWO</p>
<p>Mechanical Engineers</p>	<p>Building Decarbonization: Specific expertise designing heat pump and heat transfer systems and their interaction with other building systems.</p>
<p>Construction Manager</p>	<p>Building Decarbonization: Understanding of green building principles and the integration among MEP systems. Comfortable communicating across trades disciplines and with those working in project design and development roles.</p> <p>Offshore Wind: Understanding of project needs and processes for the development, construction, and daily O&M needs for offshore wind. Industry-recognized safety standards training through GWO</p>
<p>General & Operations Managers / Facilities Managers</p>	<p>Building Decarbonization: Best practices for building operations both for traditional and green building systems</p>

Reskilling Needs by Occupation

New and Emerging Occupations	Reskilling Needs Across Sectors
Energy Engineers (Energy Engineers, Solar Systems Energy Engineers, Wind Energy Engineers)	Energy Engineers are an emerging crossdiscipline of electric and mechanical engineering on energy and power systems such as battery storage, solar power, wind energy, or geothermal energy.
Sustainability Specialists	An emerging occupation from Business Operations Specialists that develops building decarbonization project goals, objectives, or strategies for clients in collaboration with other sustainability professionals across building occupations
Carbon Accountants	An emerging occupation that specializes in accounting and reporting the greenhouse gas emissions of large companies.

“We’re going to need a lot more people skilled in energy modelling and who understand how heat transfer systems operate in buildings and how to pull a whole building system together. Some people are really good at it and others are only used to more traditional concepts.”

Benjamin Rodney, Hines

“They have the skills, but there’s a small knowledge gap that they’re missing...I think we’re teaching them awareness. How to apply your skills in the slightly different way.”

Ellen Honigstock, Urban Green Council

A plumber who’s done thousands of gas water heaters is very skilled but needs to understand the very distinct differences in how the system is piped out... There are hundreds of journeymen plumbers who are very confident and capable in their work but will need some heads up, explanations, and training.

Artie Klock, UA Local No. 1 Plumbers

WORKFORCE TRAINING LANDSCAPE

The Workforce Development Training Landscape

- The current workforce and education landscape is a complex landscape of educational institutions (K-12 and post-secondary), trade schools, nonprofit training providers, union apprenticeship programs, and some for-profit training providers. Employers also take on some re-skilling in house
- Most green training and education programs focus on **building decarbonization efforts**, such as green construction and building operations/maintenance, with some small and **emerging programs** for solar and battery installation, EV charging, and offshore wind
- Some nonprofit training providers offer preparation and **direct entry to union-sponsored apprenticeship programs**, but there are limited seats available for these pre-apprenticeship programs. For example, Nontraditional Employment for Women serves **350+** participants annually across its pre-apprenticeship programs

The Workforce Development Training Landscape

- Other organizations (SolarOne) partner with social services organizations serving high barrier populations to prioritize basic, transferable green construction skills over highly-compensated specialized skilled trades
- It is difficult to gauge the exact number of people trained by nonprofits per year, but based on advertised impact numbers, nonprofit training providers are training perhaps **a thousand per year**, both new and incumbent workers, with relevant skills
- Unions offer continuing education for members and are the primary sponsors of apprenticeship programs for many of our relevant occupations, but seats are limited. For example, the Carpenters' Joint Apprenticeship Training Committee is currently only hiring for 25* apprenticeships in New York City
- Some occupations, such as electricians, have private employers as sponsors, but there are outstanding questions about quality assurance: nine of these registered apprenticeship sponsors for electricians are “on probation”
- The following slides show more information more about the relationship between construction unions and apprenticeship programs

▪ [*https://dol.ny.gov/carpenters-jatc-nyc-february-16-2023-effective-april-1-2023](https://dol.ny.gov/carpenters-jatc-nyc-february-16-2023-effective-april-1-2023)

Adapting the Workforce Provider Landscape: Union Apprenticeships

Example Union	Local Affiliates	Union-Affiliated Sponsored Apprenticeship Programs
United Brotherhood of Carpenters	<p>Carpenters Local Union #20 Carpenters Local Union #45 Carpenters Local Union #157 High Rise Concrete Carpentry Local #212 Carpenters Local Union #926</p> <p>Millwright and Machinery Erectors Local Union #740* Timbermen and Dockbuilders Local Union #1556* Resilient Floor Coverers Local Union #2287*</p>	<p>Carpenter's Joint Apprenticeship and Training Committee (JATC) of NYC & Vicinity</p> <p>High Rise Concrete Carpenters JATC</p>
International Brotherhood of Electrical Workers	Electrical Workers Local Union #3	Joint Apprenticeship Committee (JAC) IBEW Electrical Local Union #3
International Association of Heat and Frost Insulators and Allied Workers	<p>Heat and Frost Insulators and Allied Workers Local Union #12 Heat and Frost Insulators Local Union #12a</p>	Local 12A.J.E.F.
International Union of Operating Engineers	<p>Operating Engineers Local Union #14 Operating Engineers Local Union 15, 15a, 15b, 15c and 15d Operating Engineers Local Union #30 Operating Engineers Local Union #94</p>	<p>International Union of Operating Engineers LU #30 JAC Operating Engineers LU #15 JAC Operating Engineers LU #14-14B JAC</p>
International Union of Painters and Allied Trades	<p>Painters District Council #9 Metal Polishers Local Union Local #8a Painters Structural Steel Local Union #806 Glaziers Local Union #1281 Drywall Tapers Local Union #1974</p>	Finishing Trades Institute of New York
United Association of Journeymen & Apprentices of the Plumbing & Pipefitting Industry of the United States & Canada	<p>UA Plumbers Local #1 Steamfitters Local Union #638</p>	<p>Plumbers Local Union #1 JATC, Joint Steamfitting Apprenticeship LU #638</p>

WORKFORCE CHALLENGES IN THE GREEN ECONOMY

Key Workforce Challenges

Awareness: Many occupations in the Green Economy can offer pathways towards economic mobility for New Yorkers, but limited awareness and understanding hampers workers' transition.

Preparedness: Current trends indicate that the demand for skilled Green Economy workers may surpass supply, jeopardizing NYC's ability to achieve its climate goals and impede industry growth.

Diversity: Workforces in priority occupations are less diverse than the City's workforce at large, indicating unequal access to opportunity for minoritized persons within the existing workforce infrastructure.

Methodology & approach to arrive at these challenges

Stakeholder Engagement

Reviewed notes and summaries from 80+ stakeholder interviews

Conducted additional conversations with stakeholders including the Workforce Development Institute and Urban Green Council, among others

Data Analysis

Reviewed the existing data aggregated and analyzed by Buro Happold, Urbane, and Public Works Partners

Conducted targeted additional analyses to get at specific dynamics related to the focus occupations, primarily via Lightcast

Desktop Research

Reviewed existing research on precedents compiled by Buro Happold, Urbane, and Public Works Partners

Conducted an extensive assessment of the curricula of relevant training programs

Ongoing Vetting + Refinement

Met weekly with EDC project team and presented interstitial findings, challenges, and recommendations

Green Economy Workforce Challenges

Preparedness, Awareness, Diversity

AWARENESS

Many occupations in the Green Economy can offer pathways towards economic mobility for New Yorkers, but limited awareness and understanding hampers workers' ability to transition.

AWARENESS

A lack of awareness regarding the job opportunities presented by the Green Economy exists and persists across various populations and workforce segments.

RELATED FINDINGS

- The Department of Education noted that while school-aged youth are often interested in climate change, there is a need for greater messaging that communicates both the existence of viable career paths within the Green Economy and the heterogeneity of these opportunities
 - There remains a perception that the primary career paths for those interested in climate are white-collar positions in law and business or activism
-

AWARENESS

The emphasis on a job's "greenness" is misplaced, as most workers prioritize other job quality characteristics.

RELATED FINDINGS

- Sealed noted that contractors and workers shy away from describing themselves as "green" due to its sociopolitical connotations
- Urban Green Council added that most workers would tell you that they are primarily concerned with delivering "efficiency", "durability", and "resiliency"
- Multiple stakeholders reported that while workers care about climate issues, a job's economic return prospects take precedence
- Many "green" jobs are highly conducive to lateral and upward mobility, holding substantial knowledge, skill, ability, and awareness overlap with other positions both within and outside of the Green Economy

AWARENESS

For most of the target occupations, the credentials that are needed to prepare workers for opportunities in the Green Economy are unclear.

RELATED FINDINGS

- Certification-based credentials appear to be the primary means of determining which workers possess the “green” knowledge, skills, abilities, and awareness associated with an occupation
- For example, energy auditors have well-established “green” credentials that are recognized by relevant city agencies such as DOB and employers alike
- By contrast, multiple stakeholders report that there is not yet a standardized “green” credential that signifies an HVAC mechanic as capable of working with heat pumps and other high-efficiency equipment

AWARENESS

List of "Green" Credentials by Occupation

Occupation	Associated "Green" Training & Credentialing							
Project Management Specialists	BPI Building Analyst	BPI Multifamily Building Analyst	LEED AP BD+C	AEE Certified Energy Manager	BPI Energy Auditor			
Mechanical Engineers	LEED AP BD+C	ASHRAE Operations & Performance Management	Columbia Mechanical Engineering Sustainable Energy Certification					
Construction Managers	Green Advantage Certified Practitioner	RESNET Energy Smart Builders	LEED AP BD+C	GPRO Construction Management	Passive House Institute Certified			
Energy Auditors	BPI Building Analyst	BPI Multifamily Building Analyst	AEE Certified Energy Manager	LEED AP BD+C	ASHRAE Building Energy Assessment			
HVAC Mechanics & Installers	BPI AC & Heat Pump Professional	GPRO Mechanical	Manufacturer-Led Programs					
Facilities Managers	BPI Multifamily Building Operator	AEE Certified Energy Manager	Building Operator Certification (BOC)	LEED AP Operations & Maintenance	NAA Green Property Management			
Electricians	Green Advantage Associate	LEED AP BD+C	NABCEP PV Installer	AEE Building Commissioning	GPRO Electrical	ASHRAE Building Energy Assessment	Passive House Institute Certified	
Electrical Engineers	ASHRAE Building Energy Assessment	AEE Building Commissioning	AEE Certified Energy Manager	AEE Certified Measurement & Verification Professional	LEED AP BD+C			
Plumbers	Green Advantage Associate	LEED AP BD+C	NABCEP Solar Water Heating	GPRO Plumbing	ASHRAE Operations & Performance Management			
Installation, Maintenance, and Repair Workers	City Tech - Green Building Maintenance							

Source(s): National Renewable Energy Laboratory

AWARENESS

Existing government programs that seek to bolster relevant training and workforce development activity are underutilized, largely due to a lack of awareness.

RELATED FINDINGS

- City and state government offer a variety of programs that can support employers as they seek to upskill or reskill their workforces
 - One recent count found nearly 50 different programs administered by more than half a dozen agencies
- However, as multiple stakeholders noted, most companies do not have a relationship with government and are not aware of these opportunities as a result
- They also asserted that even businesses who have a relationship with government can be wary of participating, as they are unsure whether the potential benefits justify the effort involved

CITY WORKFORCE PROGRAMS

Green Economy-Related Workforce Programs

ApprenticeNYC: Advanced Manufacturing	OSW and Maritime Career Awareness Fair
BNY Summer Internship Program	OSW CUNY Central Partnership
Brooklyn Steam Center	Out-Of-School Youth Programs: Advance & Earn/Train & Earn
Chares B Rangel Infrastructure Workforce Initiative at CUNY City College	Painter Apprentice Program
Climate Corps	Parks Opportunity Program
Construction Business Pathways Program	Pathways to Industrial and Construction Careers
Construction Site Safety Training Program	Precision Employment Initiative
CTE Industry Scholars	Real Estate Fellow Program
CUNY Inclusive Economy Initiative	Resident Economic Empowerment and Sustainability (REES)
DEP Tech Internship Program	SBS Building Operators Program
Green Applied Projects at Parks	SBS Construction Pre-Apprenticeship
Kingsborough Community College Introduction to Careers	SCA College Internship Program
New York City Building Operator Training Program	SCA Opportunity Academy
NYC Career & Technical Education Industry Scholars Program	SCA Summer Internship Program
NYC Cool Roofs	STEAM College Summer Internship Program
NYC VISTA	Tech51
NYCEDC HE ³ AT Program	VCRED
NYCHA Clean Energy Academy	WE NYC
NYCHA Resident Training Academy	Work Plus
NYSERDA Fellows	Workforce1 Career Centers

PREPAREDNESS

Current trends indicate that the demand for skilled Green Economy workers may surpass supply, jeopardizing NYC's ability to achieve its climate goals and impede industry growth.

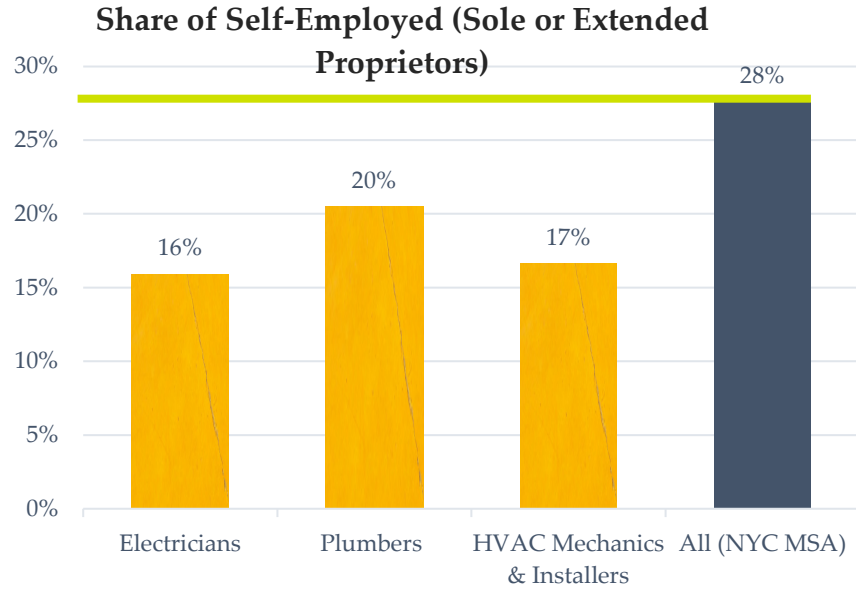
PREPAREDNESS

Incumbent building and construction trades workers are well positioned for opportunities in the Green Economy but lack incentives to transition away from conventional work in pursuit of greener opportunities.

RELATED FINDINGS

- Multiple stakeholders noted that:
 - Most licensed electricians and plumbers can learn how to apply their skills to renewable energy and building decarbonization with a modest amount of exposure to relevant technologies and on-the-job training
- The robustness of demand and compensation for non-green projects remains a deterrent
- Most building and construction trades workers in New York are not sole proprietors, indicating a need for employer buy-in
- IUOE Local 94 reported that most of their members only attend green building and energy efficiency-related trainings due to employer mandates

PREPAREDNESS



Source(s): Lightcast

PREPAREDNESS

Occupations that require a combination of higher education and field experience are among the most difficult to recruit and hire for.

RELATED FINDINGS

- Multiple employers reported significant issues when recruiting and hiring for installation, retrofit, and repair management positions (e.g., construction managers)
- Per a recent NYSERDA report, employers typically either require or prefer these workers to possess some combination of both higher education and field experience,
- These stakeholders also noted that:
 - Many engineers do not want to go the project management route
 - Often, workers with adequate field experience lack the ability to perform tasks such as reading drawings and directing personnel effectively

PREPAREDNESS

Project-driven workforce development is the most effective means of rightsizing labor supply with labor demand, but unions are the only ones currently utilizing this approach.

RELATED FINDINGS

- Unions often conduct their hiring and training in response to “project-labor agreements”
 - This enables them to size and time their apprentice cohorts in a way that is commensurate with the labor needs of a given construction or infrastructure project
- The Workforce Development Institute asserted that such “project-driven” approaches to workforce development should extend beyond unions
- In this stakeholder’s view, employers are often hesitant to hire when there is not a discrete project opportunity that justifies the decision to add capacity

PREPAREDNESS

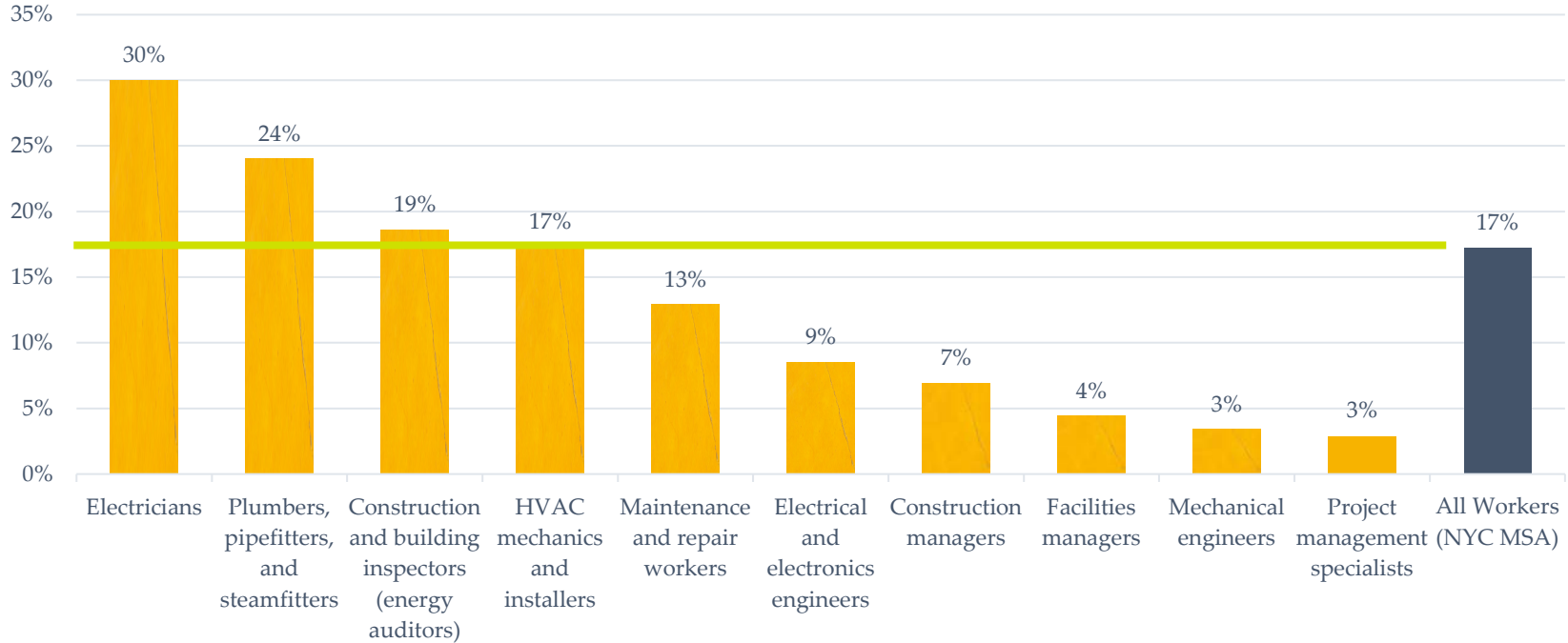
Non-unionized employers lack the resources and capacity to provide on-the-job training and paid learning opportunities, even though these are the most effective ways to prepare workers for green economy applications.

RELATED FINDINGS

- Multiple employers reported that they prefer for workers of all skill and experience levels to receive some degree of on-the-job training
 - However, many also note lacking the time, money, and manpower necessary to do deliver it – even those who are well-resourced expressed some wariness around making the investment
- Building trades unions are one of the few entities who have the capacity to deliver on-the-job training in a structured fashion via apprenticeship and pre-apprenticeship programs
- Most of the selected occupations lack substantial union affiliation and are therefore mostly without the associated, formalized on-the-job training opportunities

PREPAREDNESS

Percent of Workers Who Are Union Members



Source(s): Current Population Survey

PREPAREDNESS

Non-governmental organizations and educational institutions that fill the emerging green training gap are hampered by a current lack of industry involvement and subsequently struggle with post-program job placement, eroding participants' belief in the validity of such programs.

RELATED FINDINGS

- Many third-party training providers, including CUNY, have expressed a desire for industry to play a more significant role in curriculum development processes
 - Particularly for programs aimed at incumbent workers
- In their view, programs of study that are more informed by and aligned with the needs of employers will increase graduate and trainee placement rates
- Many third-party programs, including those administered by the unions, also reported lacking access to the equipment that workers will encounter in the field

PREPAREDNESS

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PREPAREDNESS

Third-party training providers are struggling to build and sustain industry partnerships more broadly, limiting their ability to get graduates and trainees hired.

RELATED FINDINGS

- SolarOne, a nonprofit that is widely considered a best-in-class training provider, reported issues around connecting program participants to employers and job opportunities
- BlocPower, a climate tech startup focused on building decarbonization, estimated that their rate of hiring/job placement hovered around 35 to 40 percent
- The Department of Youth and Community Development expressed a need to provide community-based organizations with technical assistance on how to navigate job placements within the green economy

DIVERSITY

Workforces in priority occupations are less diverse than the City's workforce at large, indicating unequal access to opportunity for minoritized persons within the existing workforce infrastructure.

DIVERSITY

Union-driven pathways are the most robust routes into the building trades and many of the “green” training opportunities associated with them – however, they are also difficult to access for most New Yorkers.

RELATED FINDINGS

- New York’s unions appear to be responsive to changing policy frameworks and the shifts in demand that they seek to bring about, offering training programs
 - IBEW Local 3 – PV solar installer exam preparation
 - UA Local 1 – Domestic hot water heat pump systems
 - IUOE Local 94 – Green buildings and energy conservation
- Despite efforts to expand and diversify their recruitment pipelines, multiple stakeholders report that organized labor is still widely viewed as inaccessible for minority groups.

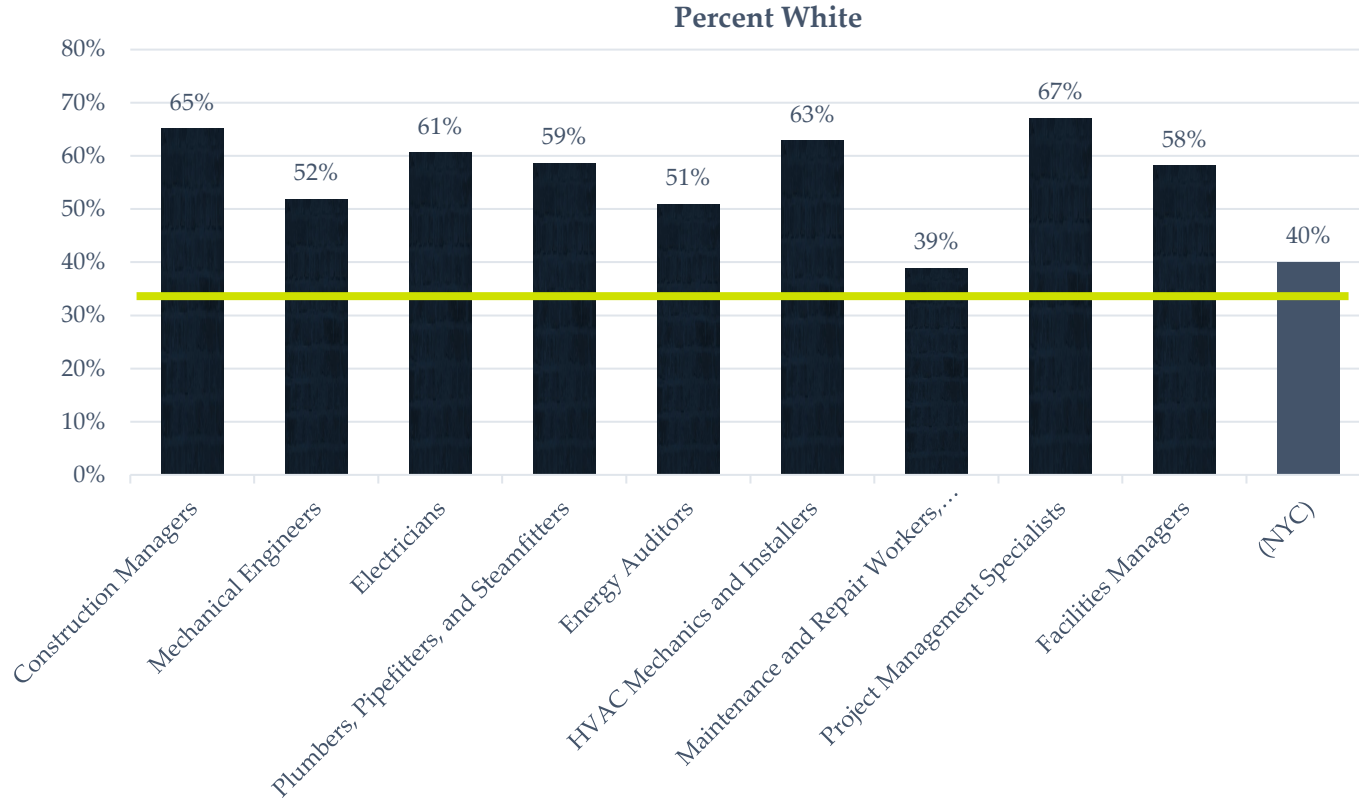
DIVERSITY

Many of the target occupation workforces are not representative of New York City's population at large.

RELATED FINDINGS

- Nearly two-thirds of New York City's construction managers and project management specialists are white
- According to data from Lightcast, maintenance and repair workers are one of the primary "feeder" occupations to various building and construction trades occupations
- However, roughly 60 percent of maintenance and repair workers are nonwhite, whereas just 39 percent of building trades workers are, on average
- This substantial drop-off in BIPOC workers speaks to issues around accessibility that merit further investigation

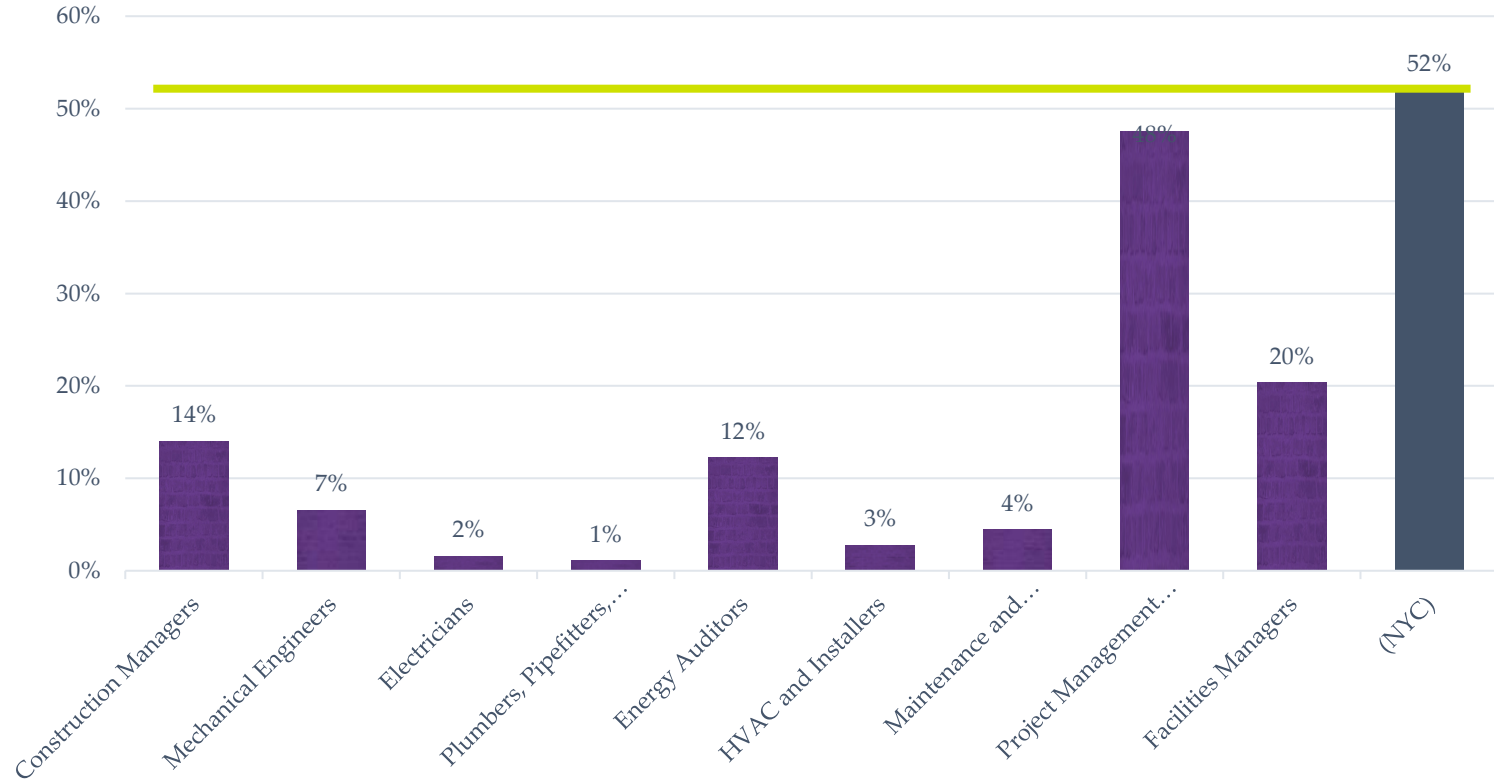
DIVERSITY



Source(s): American Community Survey

DIVERSITY

Percent Female



Source(s): American Community Survey

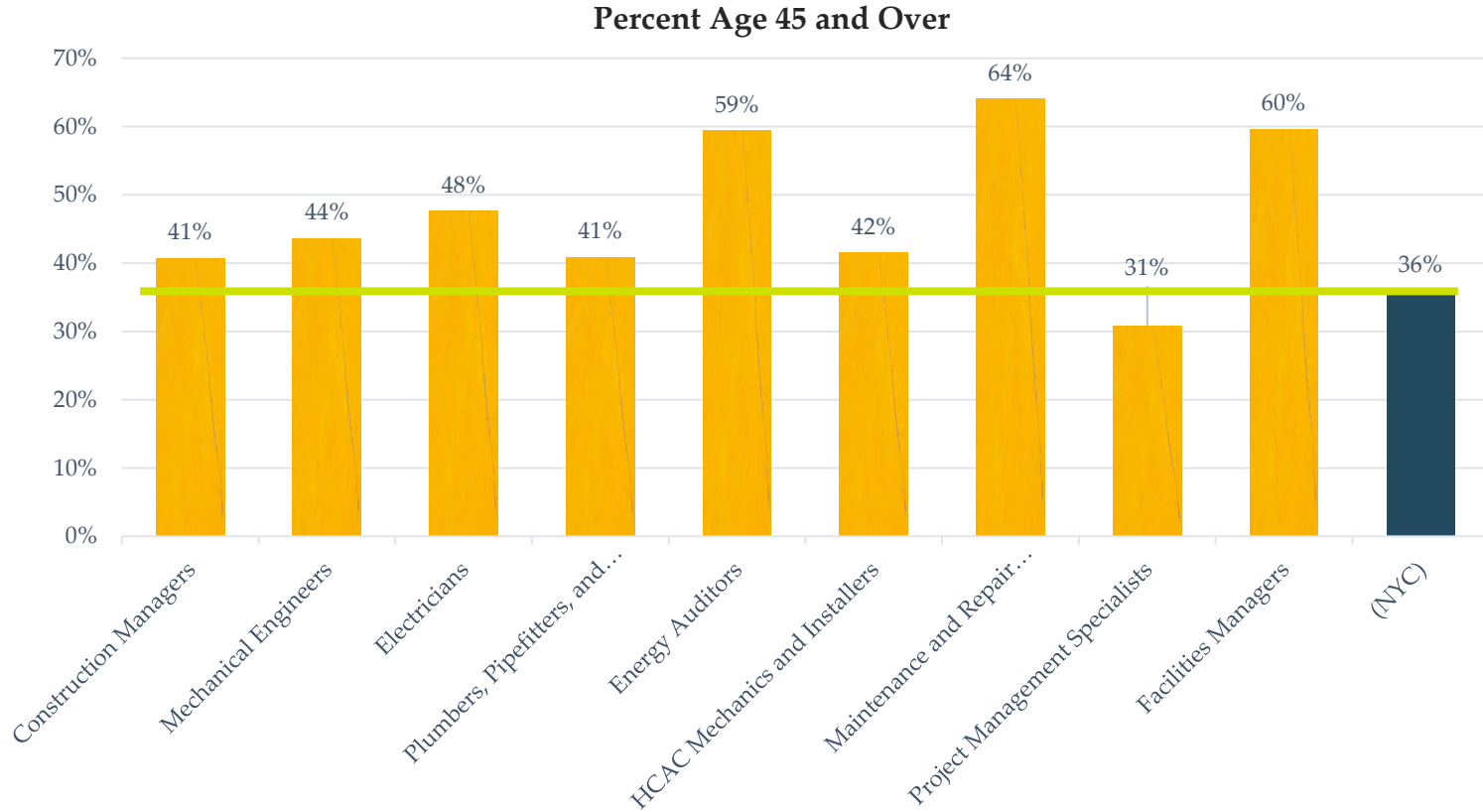
DIVERSITY

Many of the target occupations are also aging, but some are more rapidly approaching a “retirement cliff” than others.

RELATED FINDINGS

- Stakeholders have repeatedly raised concerns regarding a looming “retirement cliff” in several of the occupations that are essential to the continued growth of New York City’s Green Economy
- While the building and construction trades were the occupational group most mentioned in this vein, American Community Survey data indicates that the following target occupations were the oldest:
 - Maintenance and repair workers – 64 percent age 45+
 - Facilities managers – 60 percent age 45+
 - Energy auditors – 59 percent age 45+

DIVERSITY



Source(s): American Community Survey

DIVERSITY

For longer, more intensive training programs, participants' social and economic needs often go unaddressed, hampering their ability to complete them.

RELATED FINDINGS

- While “earn and learn” training program models are increasingly becoming the norm, they are not universal
- Key non-degree credentials (certifications, licenses, and the like) have sizable fees that are beyond the means of many LMI workers
 - For example, the least expensive course offered by the Building Performance Institute is \$500
- The Massachusetts Clean Energy Center noted that addressing wraparound service-related needs is key to overcoming barriers to workforce entry

APPENDIX

Previous iterations of this work

- In previous iterations of this work, the team had used two primary frameworks to assess the green economy workforce, and categorize priority occupations. Those include:
 - Framework through the lens of wages and accessibility: Feeder, Priority, Next-Step
 - Framework through the lens of workforce needs: Grow, Skill, Diversify
- While our team is no longer using these frameworks to assess the green economy workforce, the following slides include the analysis done for these frameworks, as reference for the NYCEDC and Talent teams.

Framework: Feeder, Priority, Next-Step Occupations

Prioritization Methodology for Occupations

What are the guiding principles and assumptions undergirding occupational prioritization?

- New York City is responding to a **dual mandate** to reach climate goals and support high-quality employment for New Yorkers.
- To meet these mandates, New York City must be intentional about investing limited resources, which means prioritizing occupations based on the **highest likelihood of successful public sector intervention**.
- To that end, the prioritization methodology assumes deemphasized investment in jobs with **limited career advancement opportunities** or signs of **obsolescence**.
- The methodology focuses on jobs that **need public sector intervention**, as the labor market will respond to meet demand or re-skill accordingly for many occupations.
- In summary: the team developed a methodology to surface relevant occupations that have meaningful prospects but need robust public sector intervention to resolve labor market failures that are impeding equitable access, skills training, or job growth to meet future demand in the Green Economy.

The next slides show the specific process by which we categorized our relevant occupations.

Prioritization Methodology

Significant Job Count

- Based on 6-digit SOC job count, represents at least 3% of the total job count for the entire sector

Positive Growth Projections

- Demonstrates net increase in jobs (>0%)
- Source: NYSDOL; 2018-2028 projections

Family Sustaining Wage

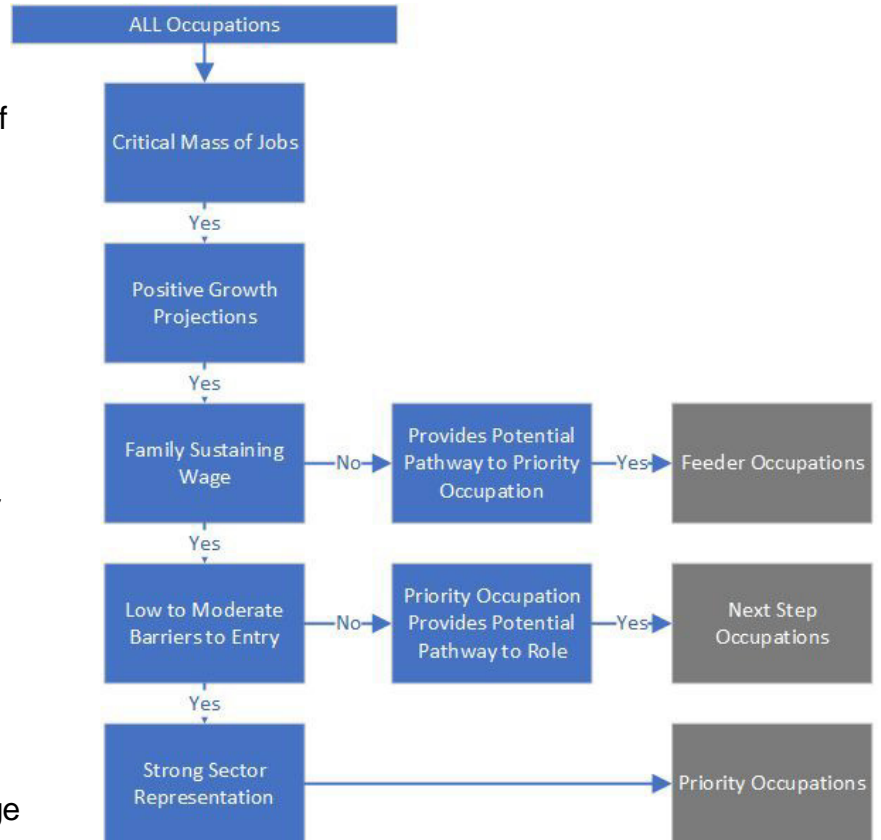
- Meets the living wage threshold for a family of four with two working adults (\$30.79)
- Sources: NYSDOL; Lightcast; MIT Living Wage Calculator

Accessibility

- Shows low to moderate barriers to entry based on O*NET's job zone framework (Job Zones 1-3)
- *See appendix for more information*

Sector Representation

- Occupation estimated to contribute significant percentage of all jobs within a priority sector
- Sources: Lightcast Job Postings; ACS-5 Year Estimates Public Use Microdata Sample - Vintage 2021



O*NET Job Zone Framework

Job Zones are composite rankings based on level of education, experience, and job training, including specific vocational training required to do the work in an occupation. Below is a paraphrased summary of each Zone:

Job Zone 1: Little to no preparation needed

Education: Some may require HS Diploma and/or GED

Related Experience: Little to none

Job Training: A few days to a few months

Specific Vocational Training: Up to 3 months

Job Zone 2: Some preparation needed

Education: HS Diploma or GED

Related Experience: Some work-related skill or experience needed

Job Training: A few months to 1 year

Specific Vocational Training: 3 months to 1 year

Job Zone 3: Medium preparation needed

Education: Vocational school, On-the-job training, or associate's degree

Related Experience: Previous work-related skill, knowledge, or experience is required for these occupations

Job Training: 1-2 years

Specific Vocational Training: 1-2 years

Job Zone 4: Considerable preparation needed

Education: 4-year degree generally

Related Experience: A considerable amount of work-related skill, knowledge, or experience is needed for these occupation

Job Training: "several" years

Specific Vocational Training: 2-4 years

Job Zone 5: Extensive preparation needed

Education: Most of these occupations require graduate school

Related Experience: Extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience

Job Training: Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training.

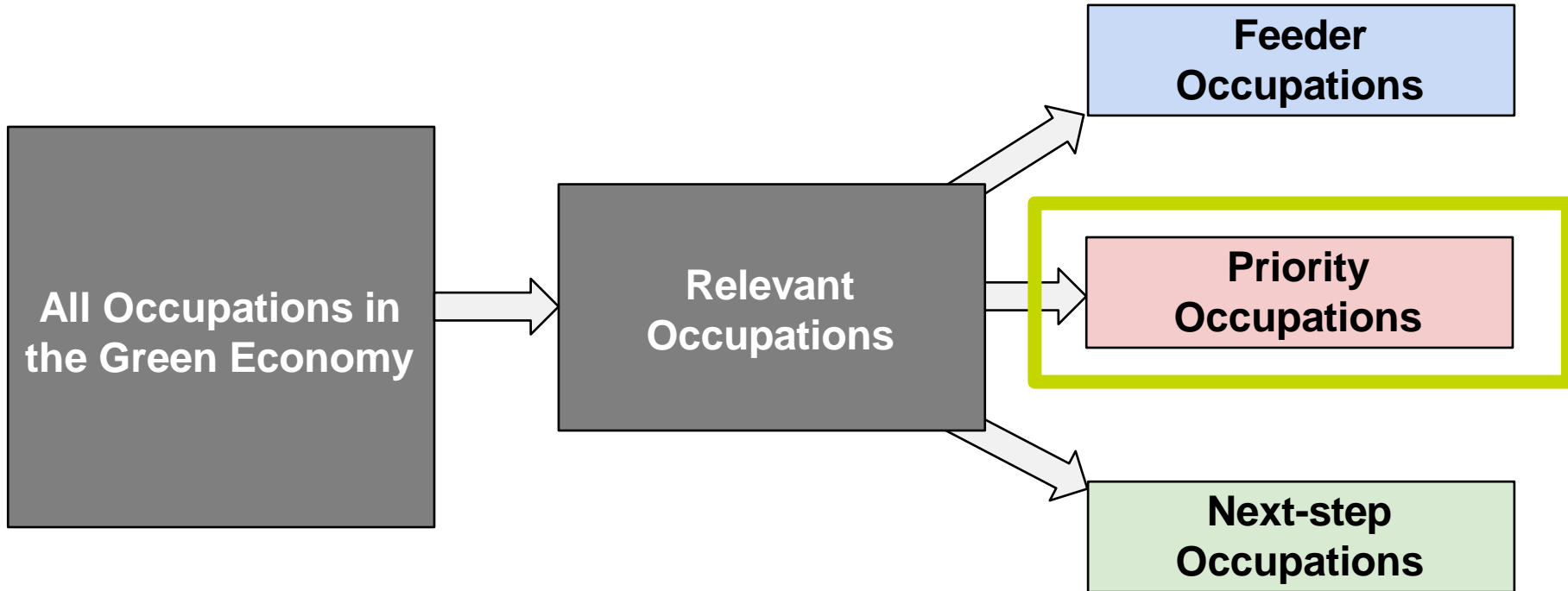
Specific Vocational Training: 4+ years

Assessment Criteria - Additional Context

- The prioritization criteria looks closely at the occupations' wages— does it pay a family sustaining wage of \$31/hr, and accessibility— can workers enter this occupation without having a college degree?
- This criteria led to the breakout of feeder, priority, and next-step occupations.
- Using family sustaining wages as a threshold ensures we are not prioritizing occupations that keep people in cycles of poverty and instead offer pathways for economic mobility.
- Accessibility is subjective, but in this case we are looking closely at the level of education/training required to enter the occupation. Priority occupations would be inclusive of New Yorkers' varied access to educational and training opportunities and that offer advancement opportunities.
- We also looked at growth prospects of the occupations to see if the occupation would benefit from intervention and tapping into existing infrastructure.

Process for Categorizing Occupations

The methodology enabled the list of occupations to be filtered into a relevant list and then into levels based on quality and accessibility



Categorizing Occupations Via Quality and Accessibility

Applying the criteria allows us to identify and categorize desirable occupations into 3 levels based on their accessibility, and rule out those with less potential for upward mobility:

Priority Occupations:

- Occupations that meet all prioritization criteria, including sufficient job count, positive growth, a family sustaining wage, and low to moderate accessibility.

Next-Step Occupations:

- Occupations meeting all criteria except accessibility, but are next-step jobs from other priority occupations.

Feeder Occupations:

- Occupations that do not meet the baseline criteria for job counts, growth, and/or a family sustaining wage but exist on the same pathway as priority occupations.

Categorizing Occupations

Feeder Occupations

Carpenters (\$30/hr)

Buildings

Construction Laborers (\$30/hr)

Buildings / Renewable Energy / Climate Adaptation

Helpers – Carpenters (\$20/hr)

Buildings

Glaziers (\$29/hr)

Buildings

Helpers - Installation, Maintenance, and Repair Workers (\$23/hr)

Buildings / Renewable Energy / Climate Adaptation

Insulation Workers, Floor, Ceiling, and Wall (\$25/hr)

Buildings

Roofers (\$28/hr)

Buildings / Renewable Energy

Solar PV Installers (\$26/hr)

Buildings / Renewable Energy

Maintenance and Repair Workers, General (\$24/hr)

Buildings / Renewable Energy / Climate Adaptation

Helpers - Construction Trades (\$24/hr)

Buildings / Renewable Energy/ Climate Adaptation

Helpers - Pipelayers, Plumbers, Pipefitters, and Steamfitters (\$23/hr)

Buildings / Renewable Energy / Waste / Climate Adaptation

Priority Occupations

Electricians (\$40/hr)

Renewable Energy / Buildings / Climate Adaptation / Electric Vehicles

Sales Representatives (\$50/hr)

Buildings / Renewable Energy / Electric Vehicles

Energy Auditors (\$40/hr)

Buildings / Renewable Energy

HVAC Mechanics & Installers (\$36/hr)

Buildings / Renewable Energy

Plumbers, Pipefitters, and Steamers (\$38/hr)

Buildings / Climate Adaptation / Renewable Energy .

First Line Supervisors of Construction (\$50/hr)

Buildings / Climate Adaptation / Renewable Energy

Solar Energy Installation Manager (\$50/hr)

Buildings / Climate Adaptation / Renewable Energy

First Line Supervisors of Mechanics, Installers, and Repairers (\$40/hr)

Buildings / Climate Adaptation / Renewable Energy / Electric Vehicles

Electrical and Electronic Engineering Technologists And Technicians (\$39/hr)

Buildings / Renewable Energy / Electric Vehicles

Facilities Managers (\$34/hr)

Buildings / Renewable Energy / Waste

Stationary Engineers (\$49/hr)

Buildings / Renewable Energy

Next-Step Occupations

Electrical Engineer (\$51/hr)

Renewable Energy / Buildings / Climate Adaptation / Transportation

Solar Energy Systems Engineer (\$49/hr)

Renewable Energy / Buildings / Climate Adaptation

Wind Energy Engineers (\$49/hr)

Renewable Energy / Climate Adaptation

Energy Engineers (\$49/hr)

Renewable Energy / Climate Adaptation

Civil Engineers (\$49/hr)

Buildings / Renewable Energy / Climate Adaptation

Construction Managers (\$65/hr)

Buildings / Renewable Energy / Climate Adaptation

Mechanical Engineers (\$50/hr)

Renewable Energy / Transportation

General and Operations Managers (\$78/hr)

Buildings / Renewable Energy

Project Management Specialists (\$53/hr)

Buildings / Renewable Energy / Climate Adaptation / Sustainable Food

Sustainability Specialists (\$39/hr)

Renewable Energy / Climate Adaptation

Architects (\$49/hr)

Buildings / Renewable Energy / Climate Adaptation

Other Lenses for Occupational Classification

Other frameworks for classifying occupations exist, so why did we elect to use our prioritization framework instead of others, such as the JFF/ Burning Glass methodology of static, springboard, and lifetime jobs?

- The project team considered multiple frameworks for categorizing and prioritizing occupations in the Green Economy. While the JFF/Burning Glass method is effective at communicating the quality and relative mobility of certain occupations, it is based on proprietary worker profile and resume data that is not publicly accessible and could not be replicated for this study.
- Our prioritization framework conveys the same essential information regarding occupations; whether they are quality jobs with a living wage and whether they provide opportunities for advancement.
- We also determined that O*NET's Green Occupation categories have utility as an additional lens that layers over our prioritization framework.

Supporting Materials:

- Definitions for JFF/Burning Glass and O*NET Green Occupation categories
- Comparison tables of Green Economy Study and JFF/Burning Glass methodologies

Other Lenses for Categorization: JFF/Burning Glass Middle Skill Job Definitions

1. **Static Jobs:** Static jobs consist of two categories—jobs with low wages and little advancement, as well as unstable jobs. Low-wage, low-advancement jobs are occupations with a median wage of less than \$18 per hour and advancement of less than 10 percent. Unstable jobs are those with high turnover, where at least 50 percent of job holders change within five years, or jobs where at least 40 percent of job holders change career areas within five years. Many static jobs fit into both categories.
2. **Springboard Jobs:** Springboard jobs have a high rate of advancement. At least 10 percent of job holders move to higher-paying roles in the same career area within five years.
3. **Lifetime Jobs:** Lifetime jobs have a median wage of over \$18 per hour with at least 50 percent of job holders staying in the same occupation for five years, or 60 percent of job holders staying within the same career area for five years—or they have a median wage of over \$23 per hour.

Relevant Occupations Analyzed by Alternative Categorizations

Occupation	NYC Methodology	O*NET Methodology	JFF Methodology
Cross-Cutting Occupation			
Electricians	Priority Occupations	Increased Demand	Lifetime
Solar Occupations			
Solar Energy Installation Managers	Priority Occupations	New and Emerging	N/A
Solar Sales Representatives and Assessors	Priority Occupations	New and Emerging	Springboard
Building Occupations			
Energy Auditors	Priority Occupations	New and Emerging	Springboard
HVAC Mechanics and Installers	Priority Occupations	Enhanced Skills	Lifetime
Plumbers, Pipefitters and Steamfitters	Priority Occupations	Enhanced Skills	Lifetime
First-Line Supervisors of Construction Trades and Extraction Workers*	Priority Occupations	Increased Demand	Lifetime

* Occupations not identified as increased demand occupation by O*Net but falls within the criteria and is supported by stakeholder conversations

Other Lenses for Categorization: O*NET Green Occupations Definitions

1. **Enhanced Skills Jobs:** The impact of green economy activities and technologies results in a significant change to the work and worker requirements of an existing O*NET-SOC occupation. This impact may or may not result in an increase in employment demand for the occupation. The essential purposes of the occupation remain the same, but tasks, skills, knowledge, and external elements, such as credentials, have been altered.
2. **Increased Demand Occupations:** The impact of green economy activities and technologies is an increase in the employment demand for an existing occupation. However, this impact does not entail significant changes in the work and worker requirements of the occupation. The work context may change, but the tasks themselves do not.
3. **Green New and Emerging Occupations:** The impact of green economy activities and technologies is sufficient to create the need for unique work and worker requirements, which results in the generation of a new occupation relative to the O*NET taxonomy. This new occupation could be entirely novel or "born" from an existing occupation.

Relevant Occupations Analyzed by Alternative Categorizations

Occupation	NYC Methodology	O*NET Methodology	JFF Methodology
Cross-Cutting Occupation			
Electrical Engineer	Next-Step Occupations	Enhanced Skills	Lifetime
Solar Occupations			
Solar Energy Systems Engineer	Next-Step Occupations	New and Emerging	Lifetime
Building Occupations			
Civil Engineers	Next-Step Occupations	Enhanced Skills	Lifetime
Construction Managers	Next-Step Occupations	Enhanced Skills	Lifetime
Mechanical Engineers	Next-Step Occupations	Enhanced Skills	Lifetime
General and Operations Managers	Next-Step Occupations	Enhanced Skills	Lifetime
Project Management Specialists	Next-Step Occupations	N/A	Springboard
Sustainability Specialist	Next-Step Occupations	New and Emerging	Springboard

Feeder Occupations

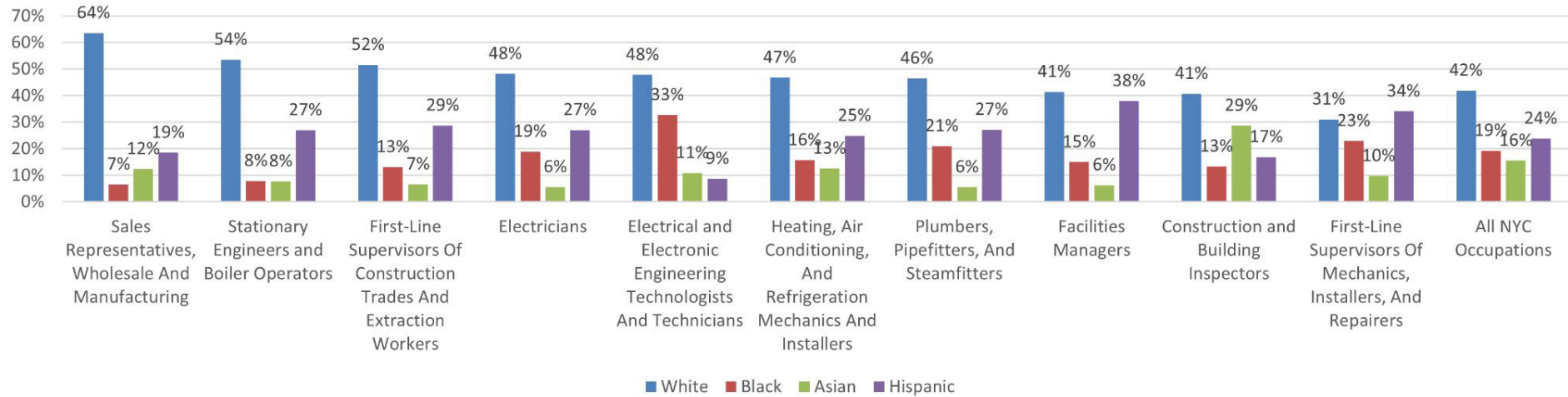
Occupation	NYC Methodology	O*NET Methodology	JFF Methodology
Architectural and Civil Drafters	Feeder Occupations	-	<p>***Occupations likely classified as static or springboard but could not be determined due to unavailability of proprietary data***</p>
Carpenters	Feeder Occupations	Increased Demand	
Construction Laborers	Feeder Occupations	Enhanced Skills	
Glaziers	Feeder Occupations	Increased Demand	
Helpers– Carpenters	Feeder Occupations	Increased Demand	
Helpers– Construction Trades*	Feeder Occupations	Increased Demand	
Helpers– Installation, Maintenance, and Repair Workers	Feeder Occupations	Increased Demand	
Helpers– Pipelayers, Plumbers, Pipefitters, and Steamfitters*	Feeder Occupations	Increased Demand	
Insulation Workers, Floor, Ceiling, and Wall	Feeder Occupations	Increased Demand	
Maintenance and Repair Workers, General	Feeder Occupations	Enhanced Skills	
Weatherization Installers and Technicians	Feeder Occupations	-	
Solar Voltaic Installers	Feeder Occupations	-	
Roofers	Feeder Occupations	Enhanced Skills	

* Occupations not identified as increased demand occupation by O*Net but falls within the criteria and is supported by stakeholder conversations

Race and Ethnicity analysis for priority occupations

Priority Occupations by Race and Ethnicity
 NYC Residents

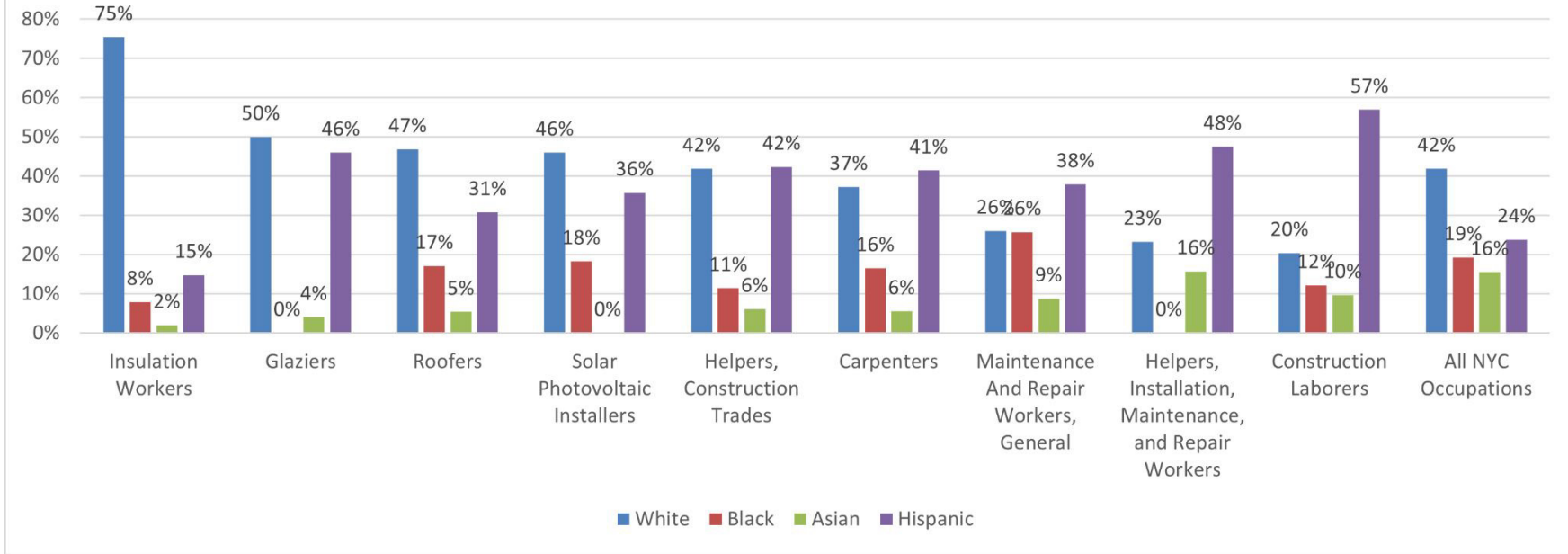
Source: ACS 5-Year Estimates 2021



Race and Ethnicity analysis for feeder occupations

Feeder Occupations by Race and Ethnicity
 NYC Residents

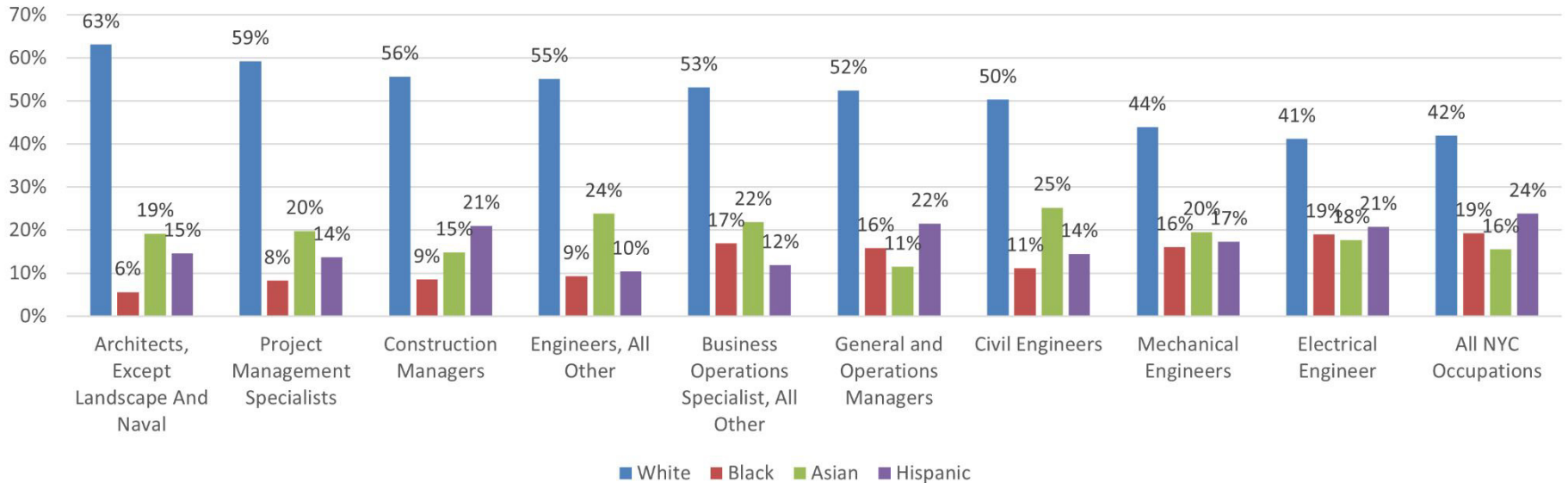
Source: ACS 5-Year Estimates 2021



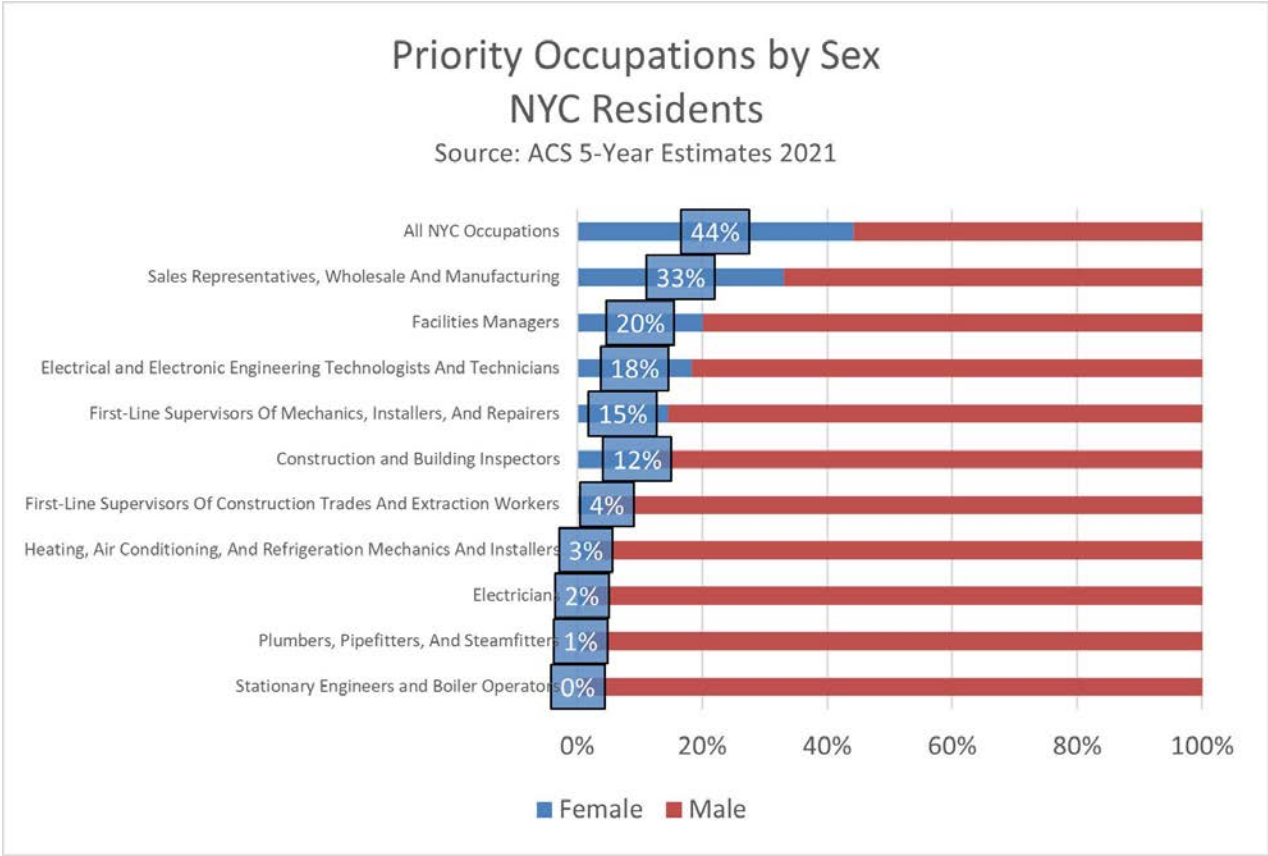
Race and Ethnicity analysis for next-step occupations

Next Step Occupations by Race and Ethnicity
 NYC Residents

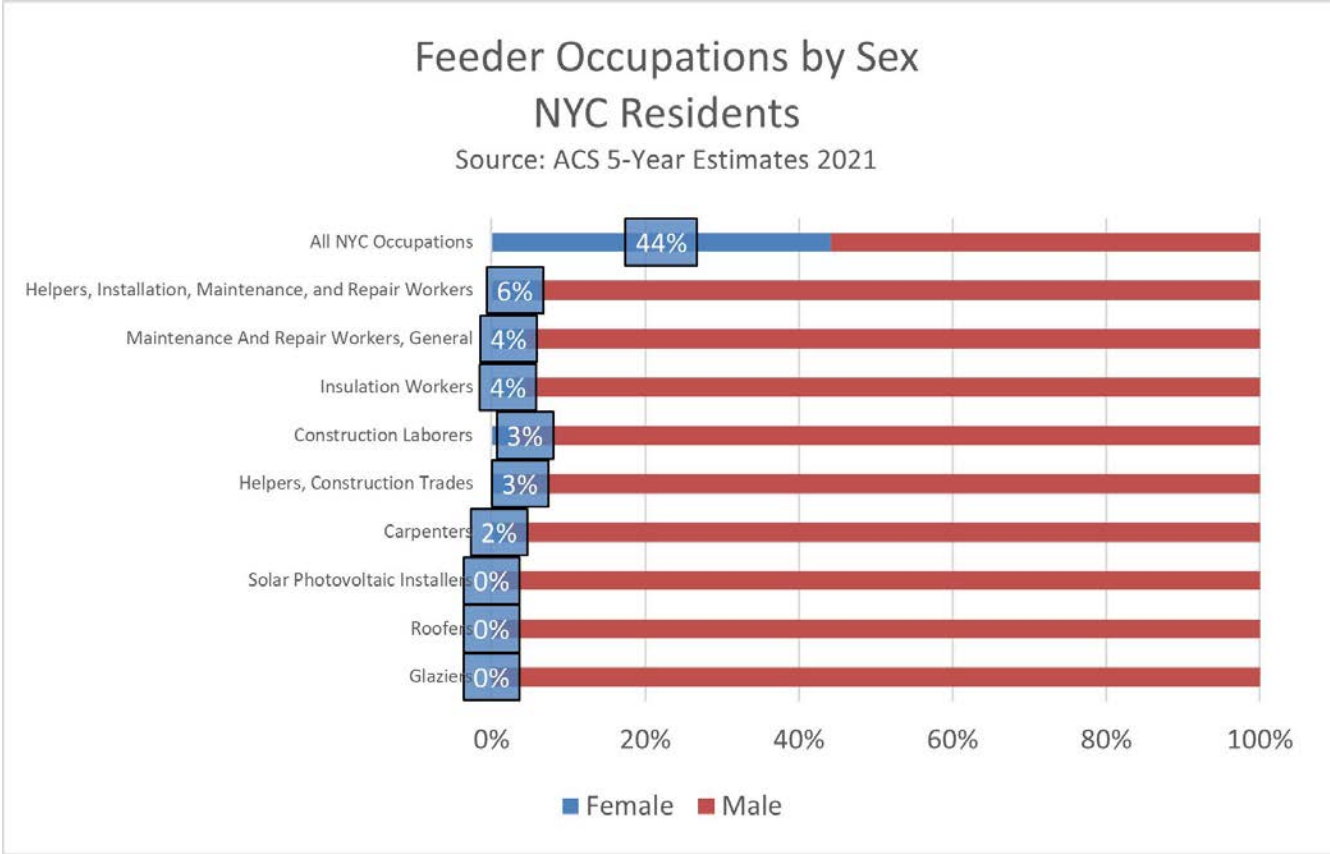
Source: ACS 5-Year Estimates 2021



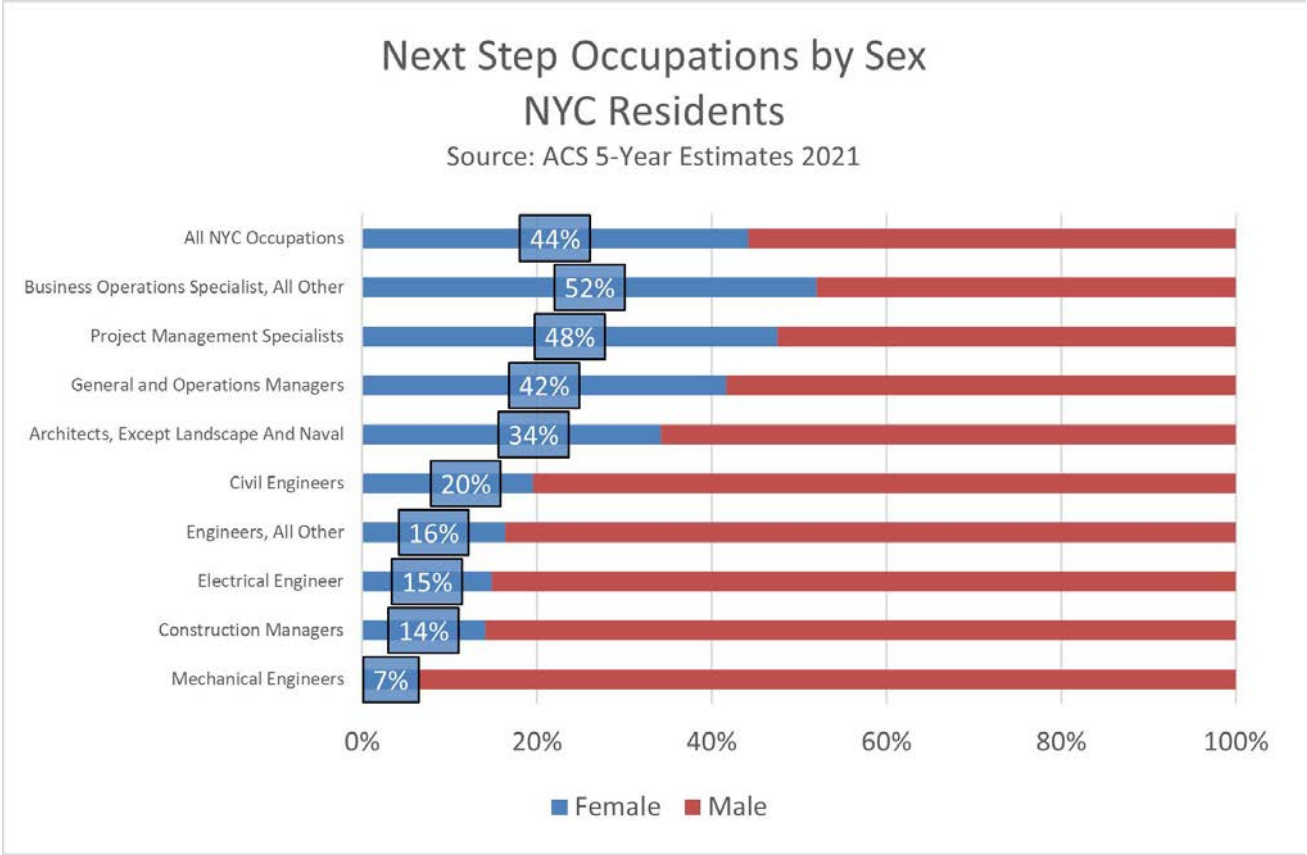
Gender breakdown for priority occupations



Gender breakdown for feeder occupations



Gender breakdown for next-step occupations



Framework: Grow, Skill, Diversify

Demystifying the Green Economy – Workforce Needs

Skill

- The growth of the Green Economy will increase demand for workers with specific skill, knowledge, abilities, or awareness (KSAA) related to decarbonization & resilience.
- This will require either:
 - **upskilling** (allowing for career advancement) or
 - **reskilling** (lateral transition) in existing occupations

Grow

- The growth of the Green Economy will require more of these occupations.
- Additional 'programming' to existing pipelines maybe required to provide pathways into these occupations in the Green Economy (e.g., new renewable energy courses in existing engineering programs at CUNY, new green training in existing CTE curriculums)

Diversify

- Most Green Economy occupations see an under-representation of non-white workers (compared to the rest of the City), and functionally exclude women from participating (particularly in the construction trades)
- As the city considers skilling and growing its green workforce, it needs to ensure it happens in an equitable manner

Required to meet our climate goals

Required to ensure inclusive growth and pipeline health

Demystifying the Green Economy – Workforce Needs

Skill

Grow

Diversify

Reskill and Grow

- HVAC mechanics & installers*
- Plumbers, pipefitters & steamers*
- Electricians*
- Stationary engineers*
- Electrical & mechanical engineers*
- Roofers
- Carpenters
- Glaziers / insulation workers
- Maintenance & repair workers*
- Architects

Upskill and Grow

- First line supervisors of construction*
- Project management specialists*
- Solar installation managers*
- Construction managers

Reskill

- Facilities managers*
- Mechanics*

Grow

- Energy auditors*
- Carbon/ESG accountants*
- Sustainability specialists
- Solar PV installers
- Construction laborers & helpers

Increasing racial/ethnic diversity

- Sales
- Managerial positions (in operations and construction)
- Engineers

Increasing gender diversity

- All construction and maintenance trades
- Engineers