

# Just Transition Working Group

## Meeting #12

December 3, 2021  
2:00pm - 4:00 pm



Department  
of Labor



NYCERDA



Climate Action  
Council

# Just Transition Working Group (JTWG)

## Meeting #12 Agenda

1. Introduction / Roll Call
2. Member Updates
3. Guest Presentation: Economic Impacts of Investing in Climate Mitigation in New York Forests & Agriculture
4. JTWG Jobs Study Secondary Employment Outputs
5. Implications for New York's Workforce – Finalizing JTWG Workforce Recommendations
6. Workforce Discussion
7. Next Steps

# Member Updates

**Recent highlights from Working Group Members**

# Economic Impacts of Investing in Climate Mitigation in New York Forests & Agriculture

Jared Woollacott, Kirsten Franzen, Chris Wade,  
Naomi Taylor, Kemen Austin

December 3, 2021



# Introduction

- **Origin:** US Climate Alliance facilitated study
- **Objective:** Assess economic impacts of climate mitigation on natural and working lands
- **Scenarios:** Afforestation, reforestation, and manure methane capture

	AFFORESTATION	REFORESTATION	DAIRY MANURE MANAGEMENT	TOTAL
<b>Abatement</b> (MMT CO <sub>2</sub> e / yr)	7.8	0.8	4.8	13.4
<b>Total Wages</b> (MM 2020\$)	\$133	\$43	\$13	\$188
<b>Total Jobs</b>	4,621	1,175	342	6,138

## Economic Impacts of Investing in Climate Mitigation in New York Forests & Agriculture

Afforestation, Reforestation, and Manure Methane Capture throughout New York State

NOVEMBER 2021



UNITED STATES  
CLIMATE ALLIANCE



# Approach: Mitigation Opportunity – Forests

## Forests

- Acres from Reforestation Hub & USFS Forest Inventory Analysis
- 4.0mm acres, 2.9 in afforestation and 1.1 in reforestation
- Acres by land type, location, and forest stocking (reforestation)

		CAPITAL	CENTRAL	FINGER LAKES	MID-HUDSON	MOHAWK VALLEY	NORTH COUNTRY	SOUTHERN TIER	WESTERN	TOTAL
Afforestation	Pasture	137.5	191.1	285.5	61.6	185.7	160.3	248.1	180.6	1,450.4
	Bio-Corridors	23.5	29.0	77.0	11.4	36.9	54.7	80.8	37.5	350.9
	Floodplains	28.5	37.0	74.2	20.5	35.4	31.4	49.4	51.0	331.4
	Cropland	10.5	16.4	28.2	13.1	17.2	10.8	17.2	11.4	125.8
	All Other	51.3	56.6	103.6	64.8	54.1	39.6	70.3	80.2	566.0
Reforestation		106.0	87.5	49.2	146.4	182.3	346.6	126.4	89.8	1,146.3
TOTAL		357	418	618	318	512	643	592	451	3,971

# Approach: Cost Assessment – Forests

- \$2.7 bn in afforestation and \$0.6 bn in reforestation costs
- Afforestation \$/acre vary widely – we use a moderate value
- Cost assumptions from Fargione et al (2021)

## Afforestation

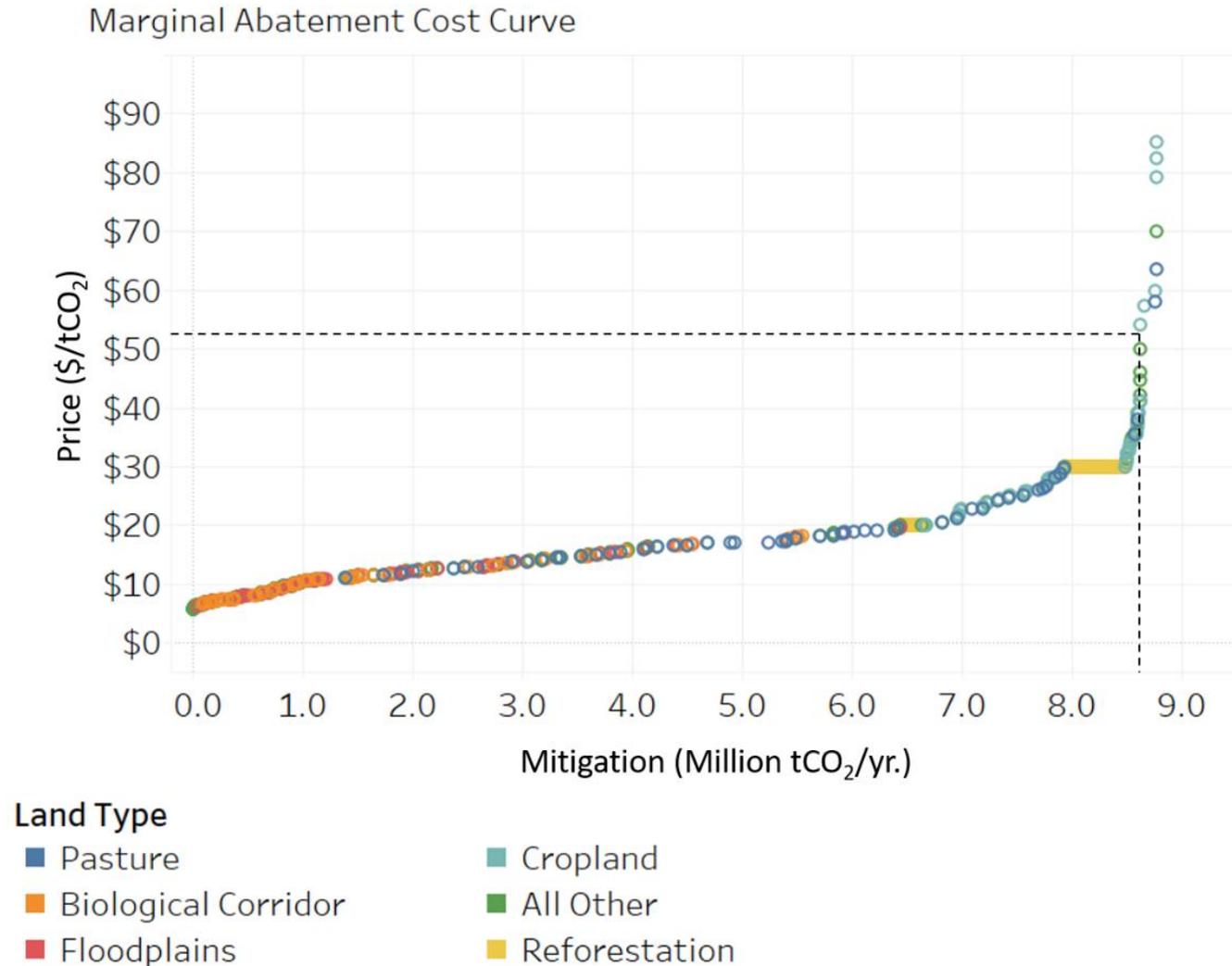
COST TYPE	COST
Seedlings	664.1
Site Prep	318.8
Planting	664.1
Post Planting	265.6
Opportunity	775.3
<b>Total</b>	<b>2,687.9</b>

## Reforestation

COST TYPE	COST
Seedlings	\$377.08
Other Planting Expenses	\$217.15
Harvesting Current Timber	\$1.00
Sawtimber Value	\$-0.01
Biomass Value	\$-1.11
<b>Net Cost</b>	<b>\$594.1</b>

# Approach: Marginal Abatement Costs – Forests

- Most forest mitigation can be achieved under \$51/ton
- Urban acres are cost prohibitive
- Total mitigation of 8.6 MMT/yr



# Approach: Mitigation Opportunity – Dairy Manure Methane

## Dairy Manure Methane

- County-level farm and cow counts from USDA NASS
- Manure & CH<sub>4</sub> production per Wightman & Woodbury (2016)
- 4.9 MMT of CH<sub>4</sub> emissions by county and farm size

REGION	TOTAL	SMALL	MEDIUM	LARGE	XL	XXL
<b>Total</b>	<b>4,941,116</b>	<b>141,202</b>	<b>838,608</b>	<b>742,051</b>	<b>2,175,271</b>	<b>1,043,984</b>
Capital Region	439,012	4,872	121,663	51,197	177,548	83,731
Central NY	894,090	15,691	112,762	140,969	421,217	203,452
Finger Lakes	1,406,437	37,598	179,307	191,501	669,092	328,940
Mid-Hudson	24,206	2,108	22,098			
Mohawk Valley	287,288	21,303	76,991	43,117	99,300	46,577
North Country	1,047,523	25,582	86,720	195,976	503,119	236,126
Southern Tier	406,859	18,171	137,906	60,757	129,691	60,335
Western NY	435,700	15,876	101,161	58,535	175,304	84,824

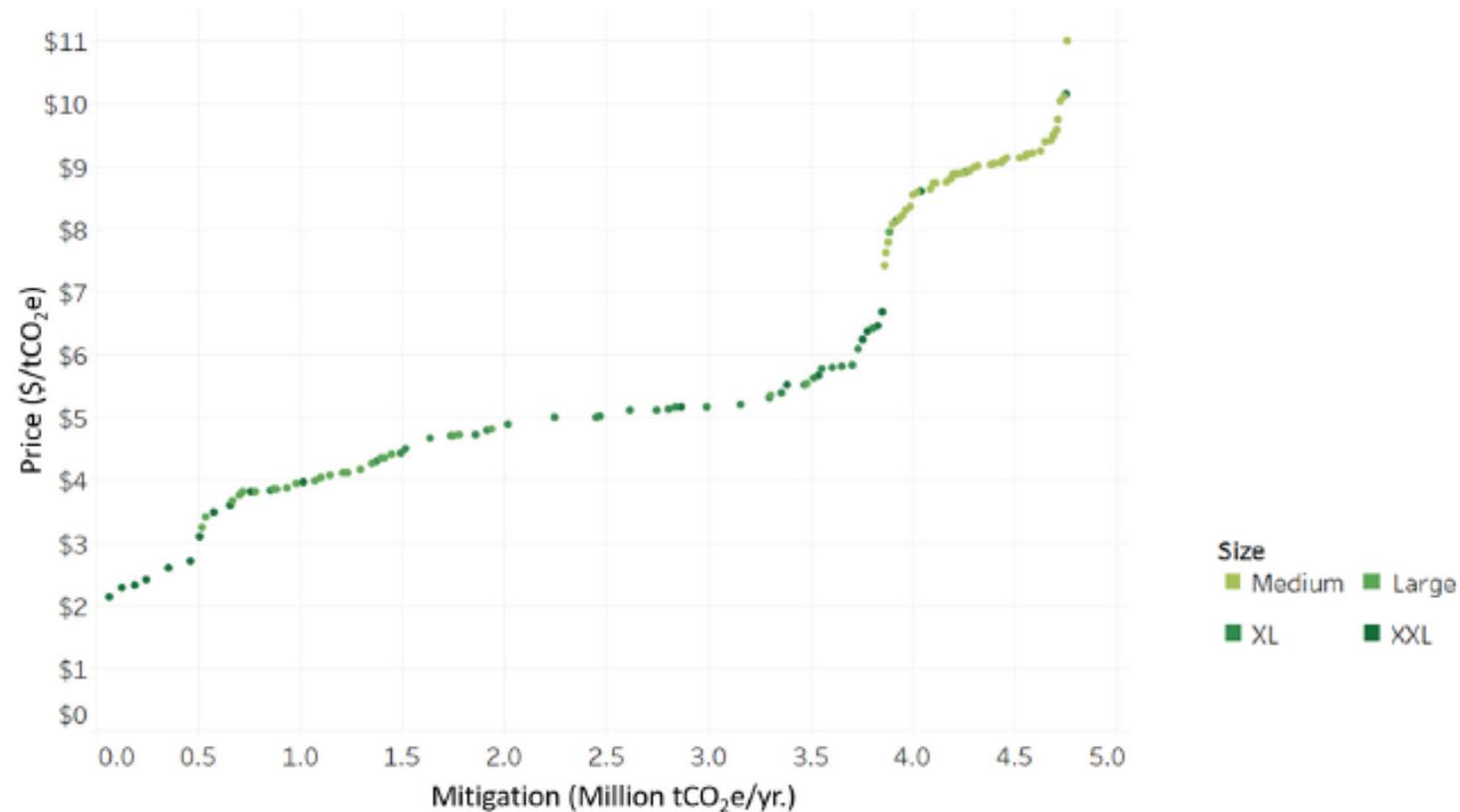
# Approach: Cost Assessment – Dairy Manure Methane

- Costs vary by farm size (small farms excluded)
- \$244mm in covering costs, \$24.4 million over 10 years
- Cost assumptions from Wightman & Woodbury (2016)

REGION	COVERING COSTS
Capital	\$2.5
Central NY	4.2
Finger Lakes	6.8
Mid-Hudson	0.2
Mohawk Valley	1.4
North Country	4.7
Southern Tier	2.3
Western	2.2
<b>New York Total</b>	<b>\$24.4</b>

# Approach: Marginal Abatement Costs – Dairy Manure Methane

- All farms medium and larger can cover and flare CH<sub>4</sub> for well under \$51/ton
- 4.8 MMT/yr of abatement can be achieved
- Costs are highest for smallest farms

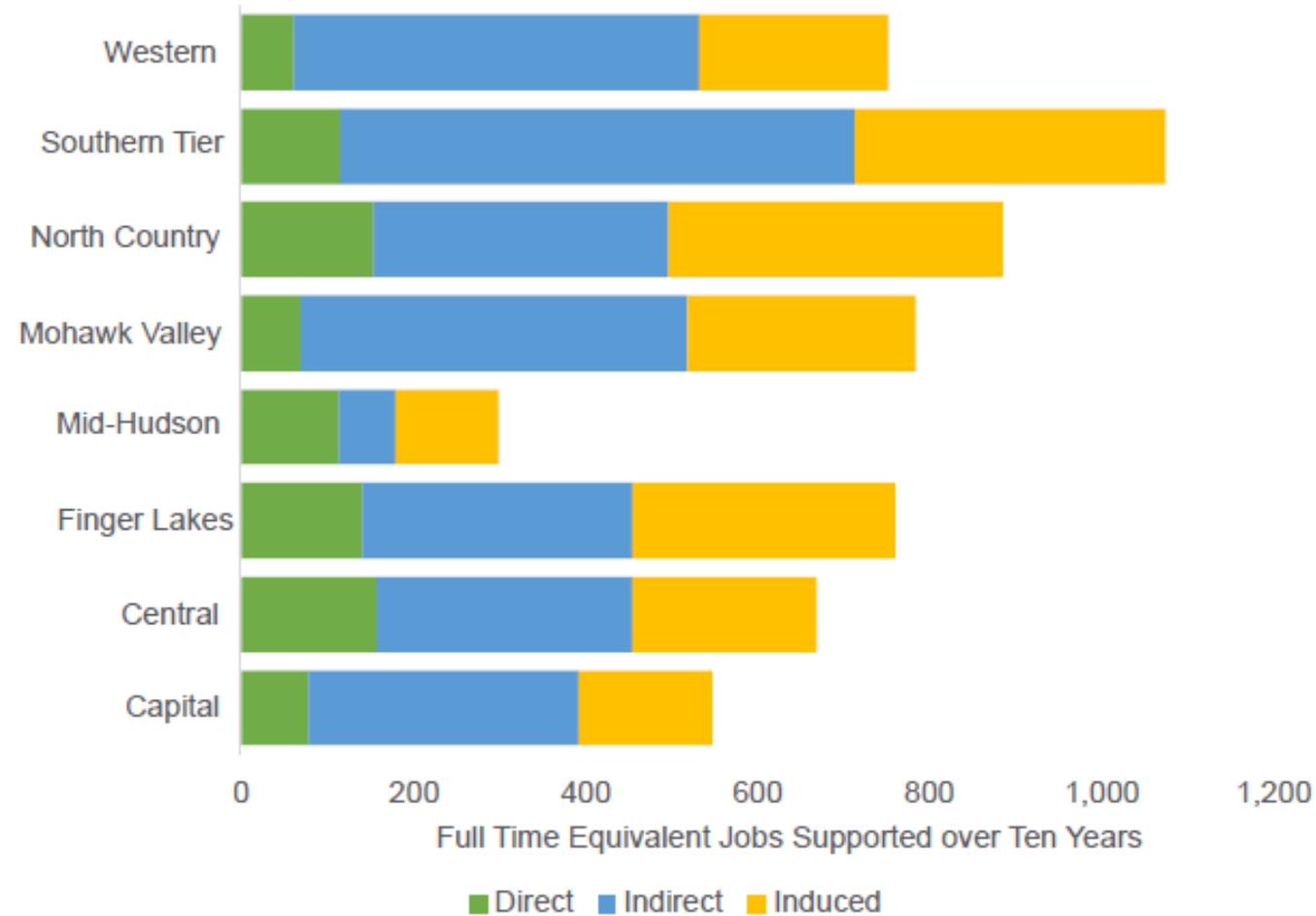
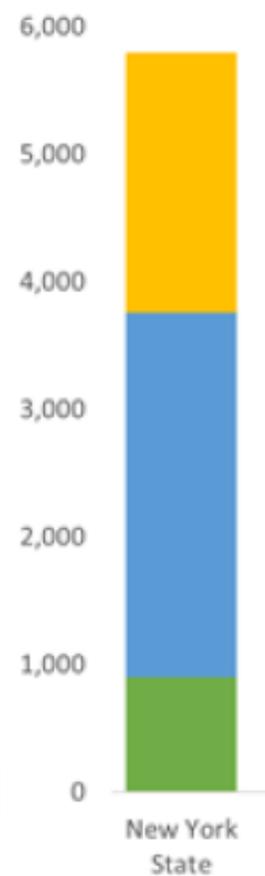


# Approach: IO Modeling

- County IMPLAN 2018 data aggregated to 10 NY development regions
- Economic impacts (jobs, wages) are those accruing to NY residents
- Implementation costs mapped to subset of 35 sectors, including forestry, materials, and construction
- Afforestation opportunity costs modeled as pure income effects
- Pulp milling from reforestation impacts modeled as indirect and induced

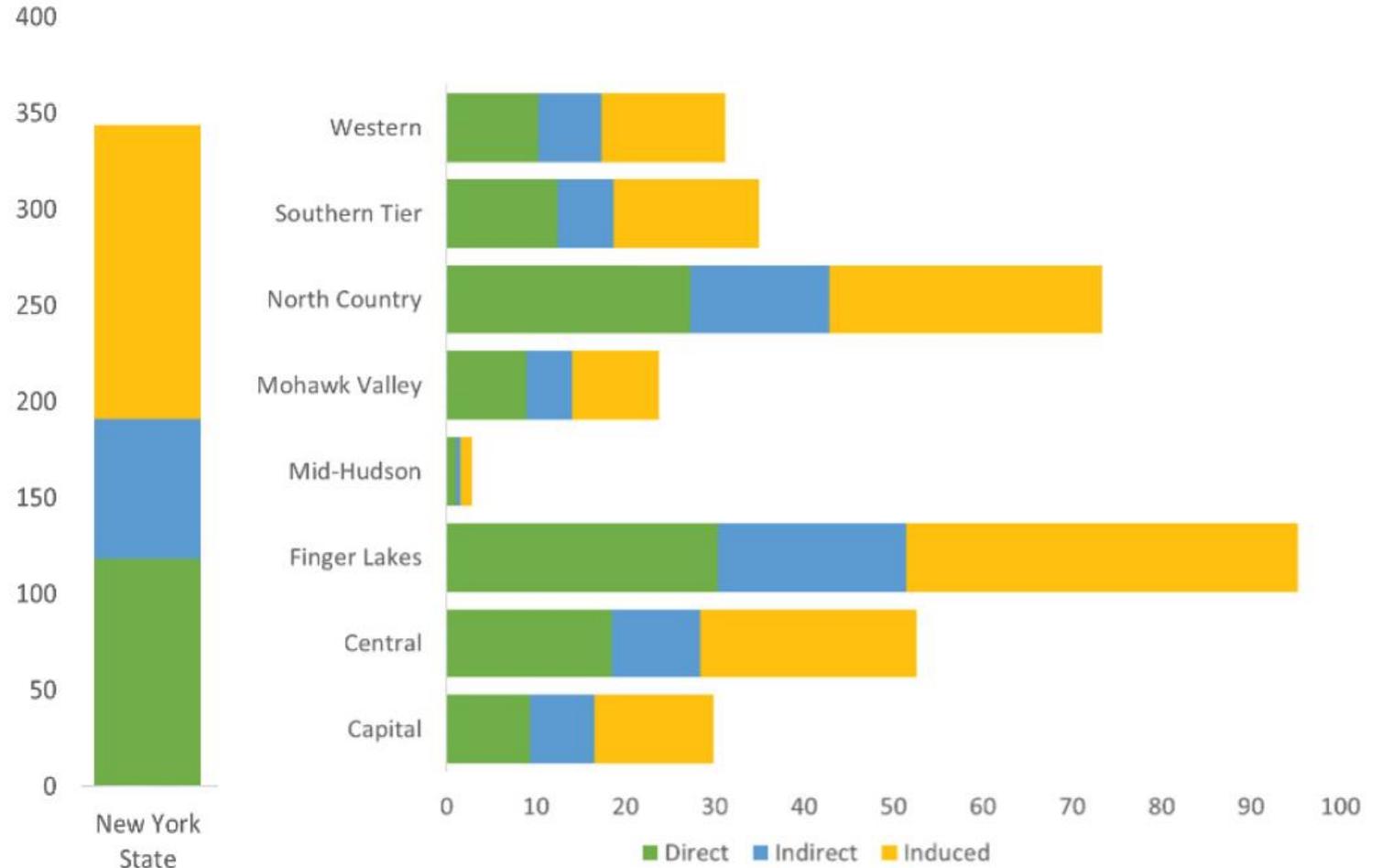
# Results – Forests

- 5,796 jobs for 10yrs planting >1bn seedlings
- Greatest job support in Southern Tier
- 20% of direct jobs in professional occupations
- \$176mm in total annual wages



# Results – Dairy Manure Methane

- 342 jobs for 10yrs
- Greatest job support in Finger Lakes
- 36% of manufacturing jobs in professional occupations
- \$12.6mm in total annual wage



# Future Research

- Economic impacts of additional mitigation initiatives under the CAC
- Distribution of impacts across different sub-populations
- Policy options for implementation and their relative costs
- Comparative cost-per-ton analysis of different mitigation strategies



# Thank you

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# Jobs Study Secondary Employment Outlook (SEO)



# Presentation Overview



**I. Jobs Study Background**

**II. Overview of Initial Employment Outputs**

**III. Model Sensitivities**

**IV. Secondary Employment Outlook**

**V. Workforce Analyses**

The image is a vertical collage of four horizontal panels. The top panel shows a cloudy sky with a blue gradient on the right. The second panel shows several wind turbines against a cloudy sky. The third panel shows a city skyline with several wind turbines in the foreground, with a yellow gradient on the right. The bottom panel shows a body of water with a dark blue gradient on the right.

# **Jobs Study** **Project** **Background**

## Jobs Study

# Sectors and Sub-sectors

## Primary Sectors

### I. Energy Supply

1. Electricity (13 sub-sectors)
2. Fuels (5 sub-sectors)

### II. Energy Demand

1. Buildings (6 sub-sectors)
2. Transportation (5 sub-sectors)

## Methodology Overview

# Initial Employment Outputs (IEO)

**For 2019, 2025, 2030, 2035, 2040, 2045, & 2050**

1. Investment Stream by sub-sector
2. Overall annual employment by sub-sector
3. For electricity, the energy that will be generated within each sub-sector

## Methodology Overview

# Secondary Employment Outlook (SEO)

### For 2019 & 2030

1. Employment by Industry
2. Employment by occupational category
3. Employment by geographic region within NYS (5 Regions within NYS)
4. Employment by sustaining wage tier

# IEO to SEO & Wage Analysis





**Jobs Study**  
**Overview of**  
**IEO's**

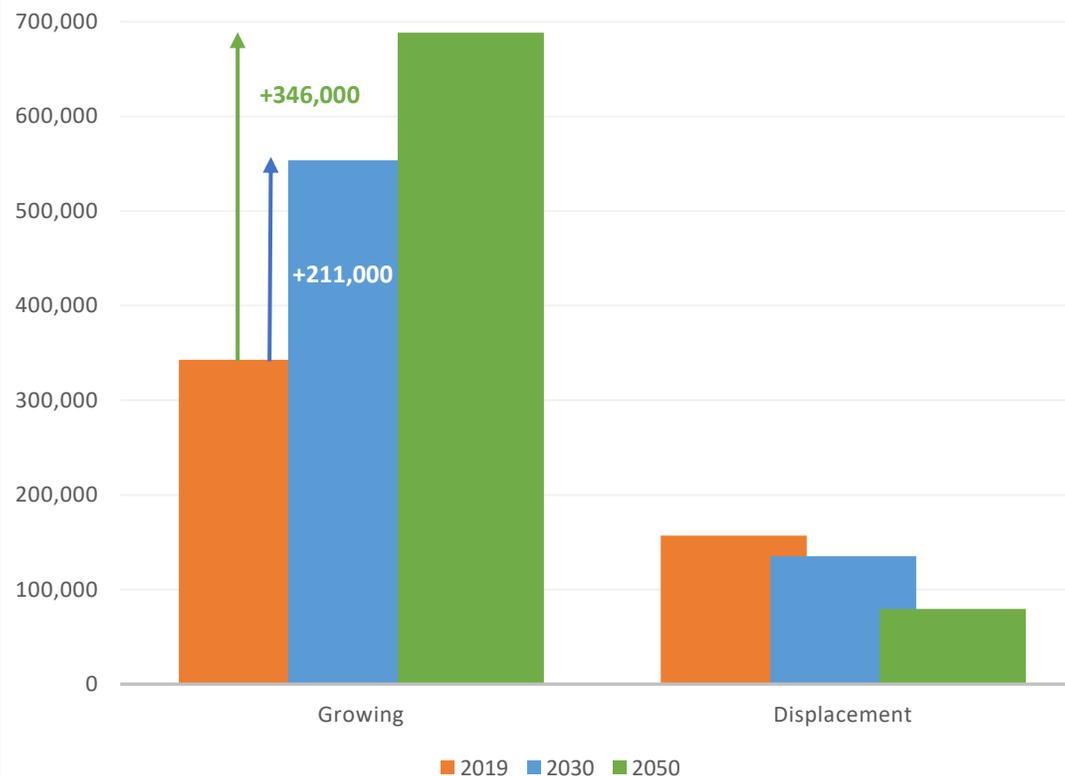
## Jobs Study

# Key Employment Findings: Overall Growth Sub-Sectors

## Scoping Plan scenario investments spur hundreds of thousands of new jobs in coming decades

Employment in growth sub-sectors increases by at least **211,000 jobs by 2030**, a 62 percent increase in the workforce from 2019 to 2030.

Employment grows in these sub-sectors by at least **346,000 jobs through 2050**.

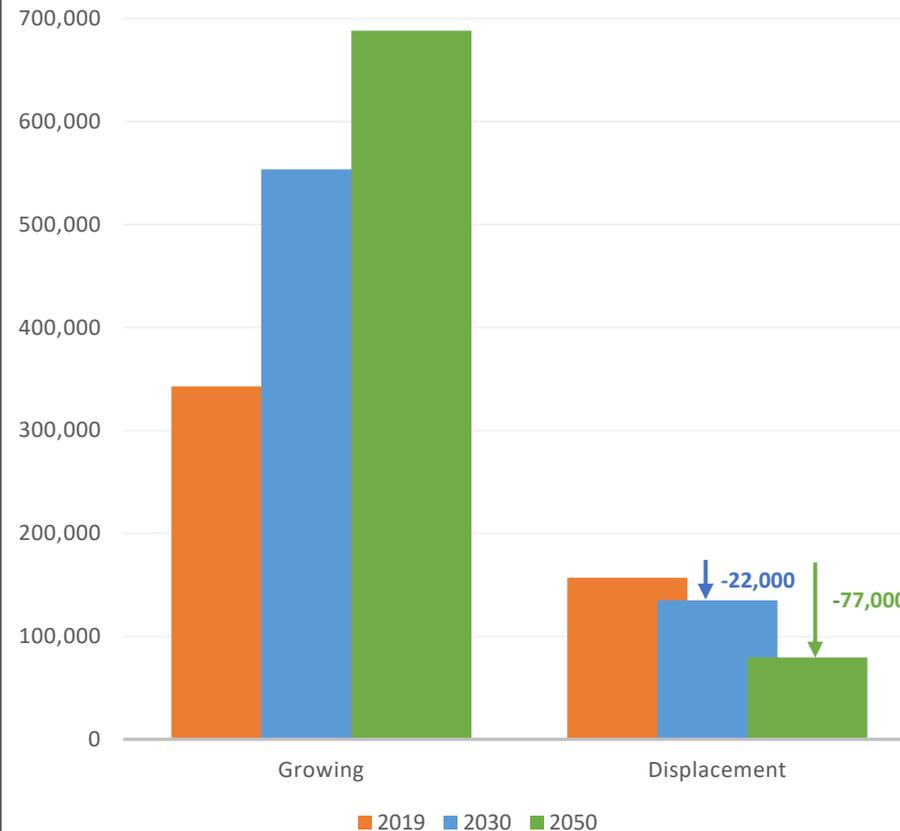


- Clean energy jobs, in their comparable sub-sectors, are expected to **grow at more than twice the rate** of annual growth from 2021 through 2030 as they experienced between 2016 through 2020, in the state of New York.
- By 2050, growth sub-sectors, in the state of New York will reach **nearly 700,000 jobs**.

## Jobs Study

# Key Employment Findings: Overall Displaced Sub- Sectors

## For every job displaced, 10 jobs are added by 2030 under the Scoping Plan scenarios

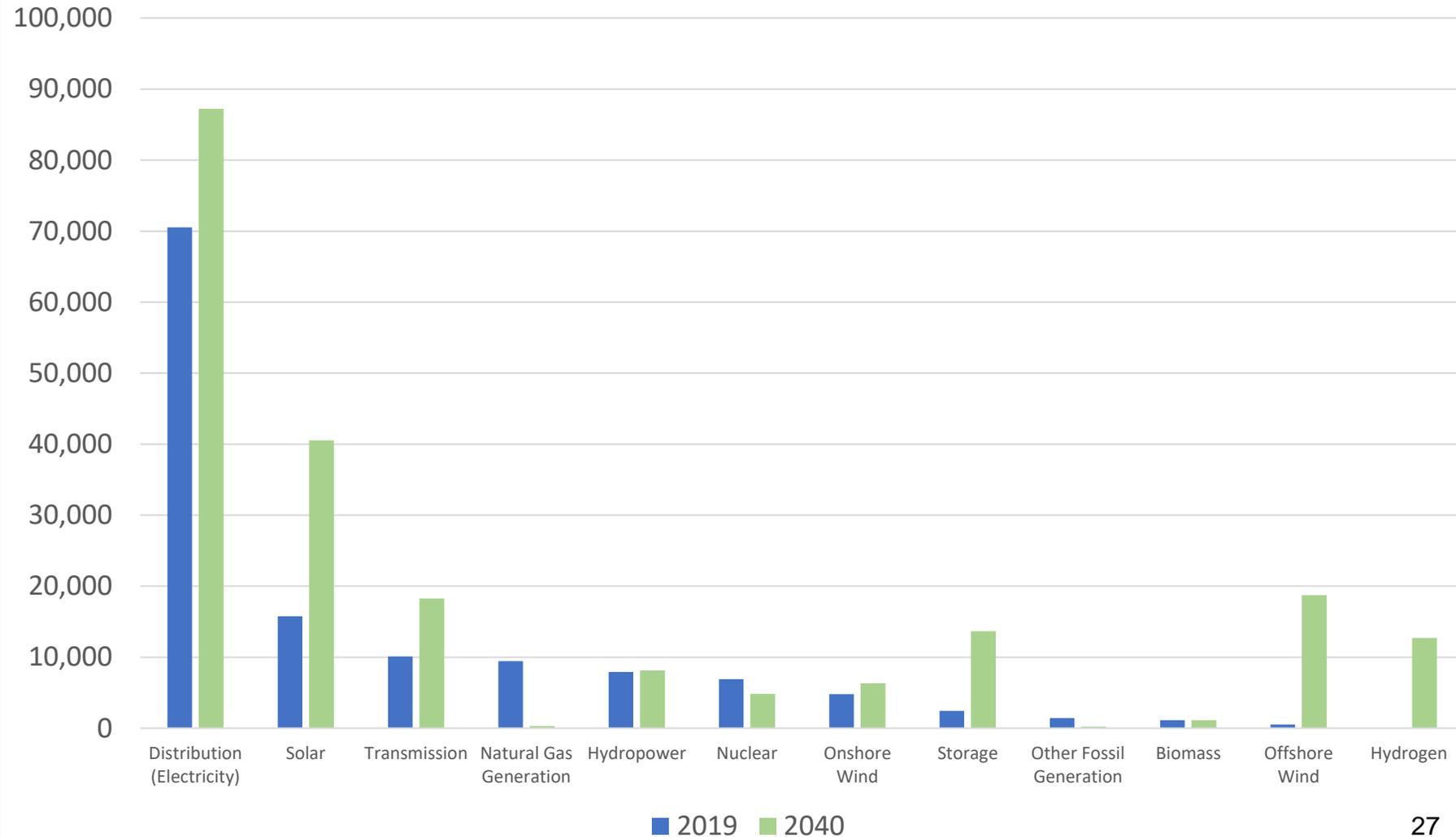


- Employment in the displaced sub-sectors **decreases by at least 22,000 jobs by 2030**, a 14 percent decrease in the workforce from 2019 to 2030.
- Employment **declines in these sub-sectors by at least 77,000 jobs through 2050**.
- In the displaced sub-sectors, from 2019 to 2030, one worker may be lost for every seven current workers, which **could be offset by retiring workers coupled with job transitions**

# Jobs Study

## Electricity Sector Jobs Changes: S2: LCF Scenario

Distribution (Electricity) and Solar sub-sectors, the two largest sub-sectors in electricity in 2019, will see considerable growth through 2040, Offshore Wind, Storage, and Hydrogen, are small sub-sectors in 2019 that experience considerable growth through 2040.

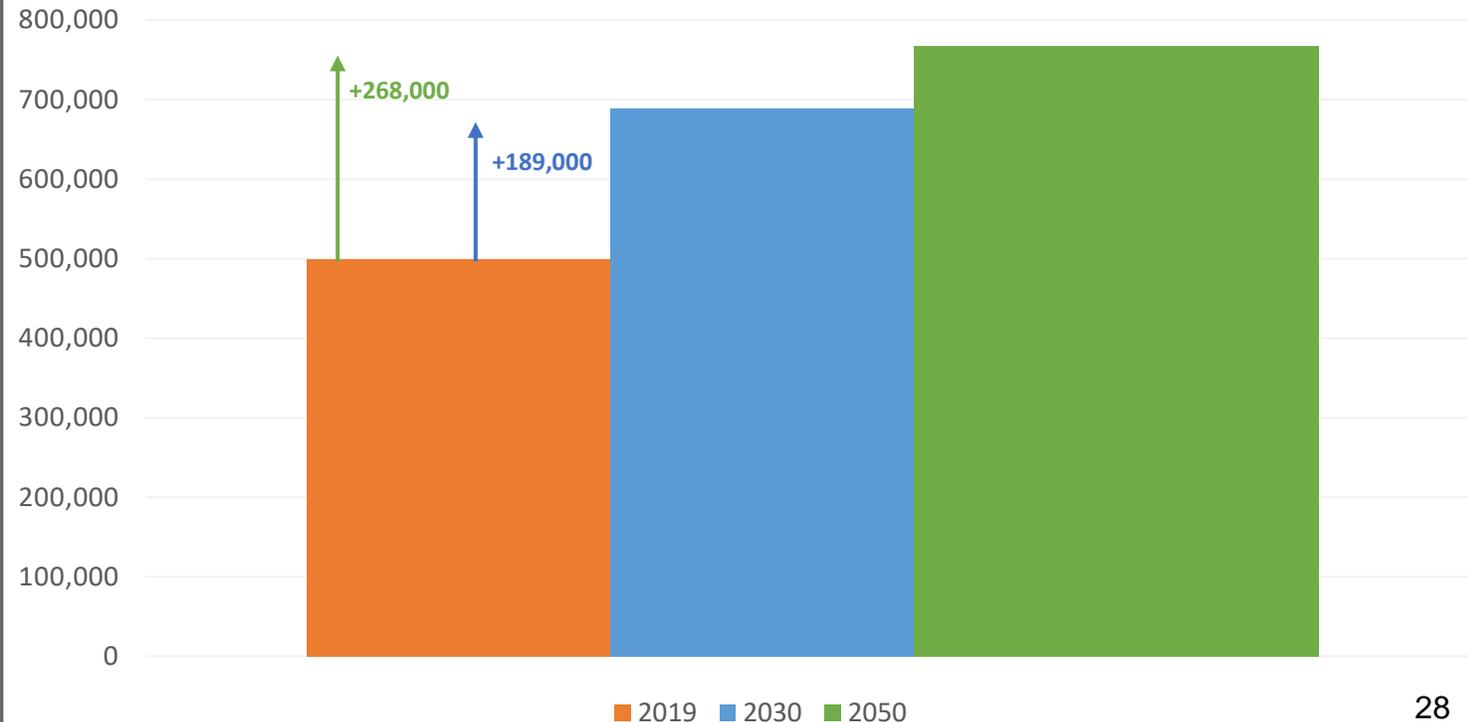


## Jobs Study

# Key Employment Findings: Overall

All four sectors, electricity, fuels, buildings, and transportation, will grow faster annually, from 2021 through 2030, than clean energy grew, annually, from 2016 to 2020, in the State of New York.

On net, overall employment in the four sectors grows by at least 189,000 jobs by 2030, a 38 percent increase from the 2019 workforce. Employment continues to grow in the four sectors by at least 268,000 jobs through 2050.





**Jobs Study**  
**Model**  
**Sensitivities**

## Jobs Study

# Model Sensitivities

1. Develop an analysis that examines if ***in-state manufacturing*** increased in the Buildings Sector and how would it impact employment and the economy.
2. Describe the key assumptions that were done for ***gas station closings***, and how changes to those assumptions would impact the model outcomes.

## Jobs Study

# Model Sensitivities: In-State Manufacturing

# Buildings Sector

## In-State Manufacturing for the Buildings Sector (2019)

	<u>Employment</u>	<u>In-State%</u>
• Commercial HVAC	220	(7%)
• Commercial Shell	1,360	(29%)
• Commercial Other	360	(4%)
• Residential HVAC	230	(8%)
• Residential Shell	1,190	(29%)
• <u>Residential Other</u>	<u>340</u>	<u>(9%)</u>
<b>Buildings (Manufacturing)</b>	<b>3,700</b>	<b>(14%)</b>

## Jobs Study

# Model Sensitivities: In-State Manufacturing

# Buildings Sector

## Example Products & Devices for each Buildings Sub-Sector (Commercial & Residential)

- **HVAC:** Air Conditioners, Heat Pumps, Furnaces & Boilers
- **Shell:** Paints, Coatings, Windows & Doors
- **Other:** Stoves, Lighting, Water Heating, Washers/Dryers (Residential) & Refrigerators

## Jobs Study

# Model Sensitivities: In-State Manufacturing

## Buildings Sector

### In-State Manufacturing for the Buildings Sector (2030) under S2:LCF

	<u>50%</u>	<u>100%</u>
• Commercial HVAC	2,670	5,340
• Commercial Shell	2,760	5,530
• Commercial Other	3,680	7,360
• Residential HVAC	3,320	6,630
• Residential Shell	4,910	9,810
• <u>Residential Other</u>	<u>1,620</u>	<u>3,250</u>
 <b>Buildings (Manu) Total</b>	 <b>18,960</b>	 <b>37,920</b>
 <b>Added over 2030 Base</b>	 <b>10,880 (&gt;2x's)</b>	 <b>29,840 (&lt;5x's)</b>

## Jobs Study

# Model Sensitivities: In-State Manufacturing

## Buildings Sector

### In-State Manufacturing for the Buildings Sector (2030) under S3:AT

	<u>50%</u>	<u>100%</u>
• Commercial HVAC	2,950	5,910
• Commercial Shell	2,770	5,530
• Commercial Other	3,690	7,370
• Residential HVAC	3,780	7,560
• Residential Shell	1,910	3,810
• <u>Residential Other</u>	<u>1,630</u>	<u>3,250</u>
<b>Buildings (Manu) Total</b>	<b>16,760</b>	<b>33,430</b>
<b>Added over 2030 Base</b>	<b>8,810 (&gt;2x's)</b>	<b>25,480 (&gt;4x's)</b>

## Jobs Study

# Model Sensitivities: Fueling Stations

- **Primary case**
  - Model gas station employment using projected fossil fuel consumption relative to 2019
  - Gas stations with convenience stores earn 61.1% of revenues from gasoline station sales; thus 61.1% of employment is scaled by fossil fuel demand, and 38.9% of employment is unaffected
  - All employment at gas stations without convenience stores is affected
- **Sensitivity Analysis 1**
  - Assume that gas stations with convenience stores adapt to the changing market environment and experience no job impacts
  - Gas stations without convenience stores experience declines in employment as in the primary case
- **Sensitivity Analysis 2**
  - Assume some gas stations with convenience stores install charging units, enabling some stations to avoid job displacement associated with declining fossil fuel consumption
  - Assume 50% of estimated Light Duty DCFC charging units are installed at these stations, at a rate of 4 charging units per gas station
  - Convert station closures to employment declines at average number of employees per establishment in Census data
  - Gas stations without convenience stores experience same declines in employment as in the primary case

## Jobs Study

# Model Sensitivities: Fueling Stations

Scenario	Baseline Jobs 2019	Displaced Jobs 2030	
		S2: LCF	S3: AT
Primary case	49,163	9,371	10,952
Sensitivity 1 <i>(% difference vs. base case)</i>		2,210 <i>(-76%)</i>	2,583 <i>(-76%)</i>
Sensitivity 2 <i>(% difference vs. base case)</i>		4,625 <i>(-51%)</i>	4,056 <i>(-63%)</i>

*Total jobs equal to sum of direct, indirect, and induced jobs across all industries (e.g., manufacturing, professional services, etc.)*

Effect on total job displacement across all subsectors:

- Sensitivity analysis 1: Total displaced jobs decreases from **21,600** to **14,500** (33%) in the LCF Scenario, and from **21,800** to **13,500** (38%) in the AT Scenario.
- Sensitivity analysis 2: Total displaced jobs decreases from **21,600** to **16,900** (22%) in the LCF Scenario, and from **21,800** to **15,000** (32%) in the AT Scenario.



**Jobs Study**  
**Secondary**  
**Employment**  
**Outlook**

## Jobs Study

# Secondary Employment Outlook (SEO)

1. IEO's are an estimate of how **the quantity of jobs** will change over time from 2019 to 2050 under the two investment scenarios for the four primary sectors (Buildings, Electricity, Fuels & Transportation). IEO's include induced employment.
2. SEO's are an assessment of how **the type, the location, and the quality of jobs** that will change from 2019 to 2030 under the two investment scenarios for the four primary sectors (Buildings, Electricity, Fuels & Transportation). SEO's do not include induced employment.

## Jobs Study

# Key Employment Findings: SEO

### Industry Findings

- All of the major industry categories, see a net increase of employment in the four sectors combined from 2019 to 2030, with the largest increases in construction and manufacturing.
- Just over three-quarters of total industry added jobs (2019 to 2030), in the growth sub-sectors, will be found in the construction industry.
- Over 80 percent of total industry jobs lost in the displaced sub-sectors, will be found in the Other Supply Chain industries, which include utilities, transportation & warehousing, wholesale, and retail industries.

### Occupational Findings

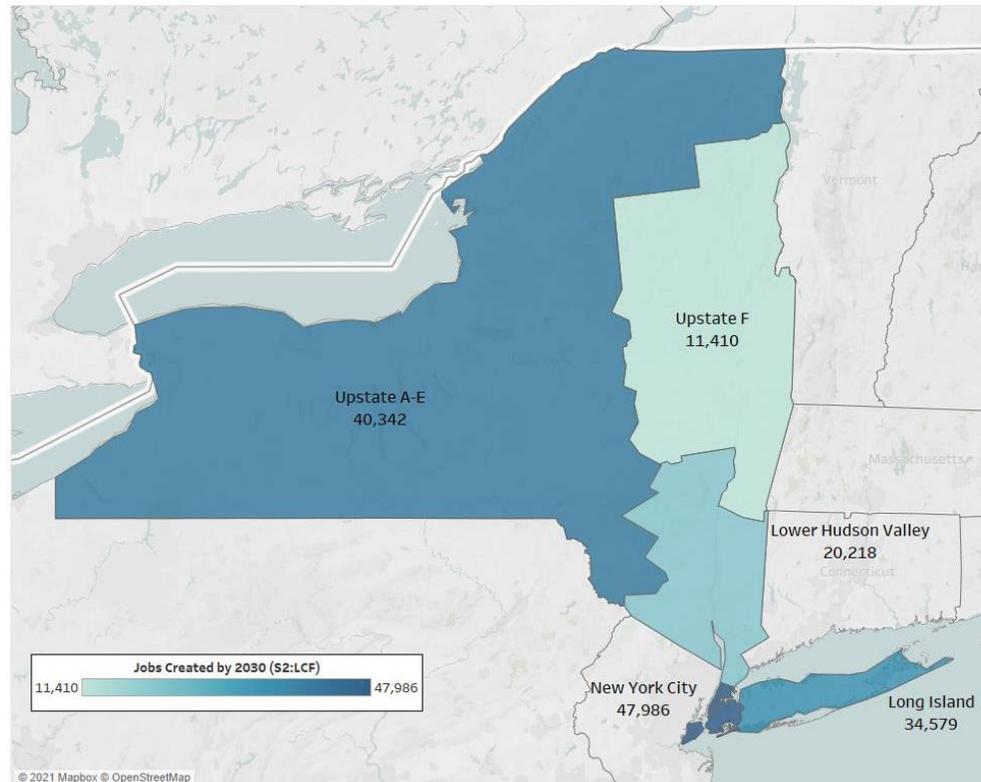
- Just under two-thirds of added jobs from 2019 to 2030, in the growth sub-sectors, will be found in installation and repair positions.

## Jobs Study

# Key Employment Findings: SEO

## Wage Findings

- 70 percent of jobs added in the growth sub-sectors, from 2019 to 2030, will be in the middle (\$28 to \$37 an hour) or higher (>\$37 an hour) wage paying category.
- 60 percent of jobs lost in the displaced sub-sectors, from 2019 to 2030, will be from the lower (<\$28 an hour) wage paying category



## Geographic Findings

- Net job growth can be found across the state, with each of the five regions, experiencing over 10,000 added jobs from 2019 to 2030.

# SEO Highlights: Electricity

## **Industry Profile**

- Approximately 40% increase in total sector employment by 2030
- The sector is projected to experience almost a doubling of Construction Industry employment by 2030

## **Occupational Profile**

- Growth sub-sectors see employment increases across all occupational categories with the most substantial increases (nearly two-thirds) projected for Installation & Repair professions
- Displaced sub-sectors see employment decreases across all occupational categories with the most substantial decreases (approximately a quarter) projected for Production & Manufacturing as well as Administrative positions

## **Wage Profile**

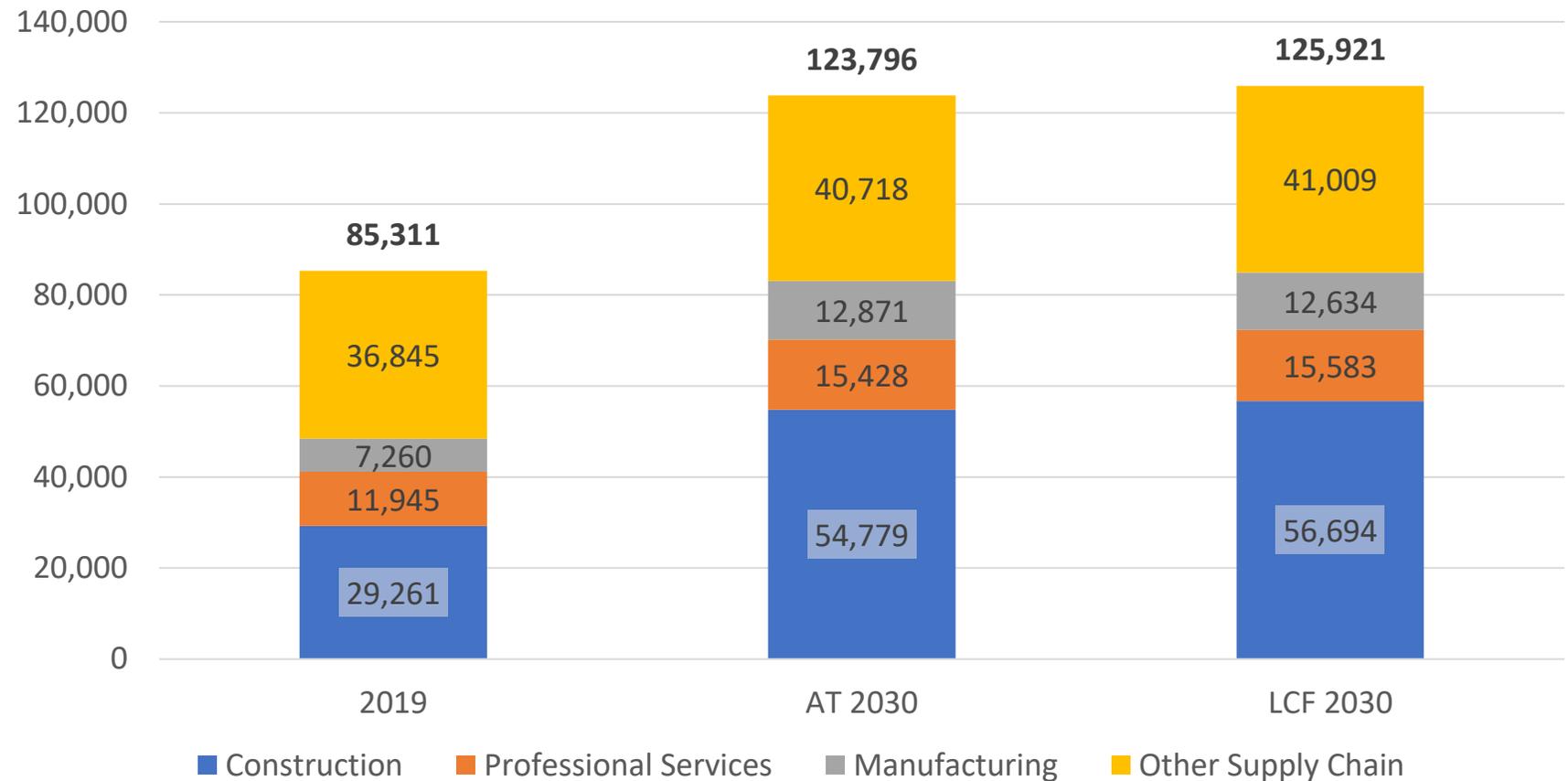
- Approximately half of all employment in this sector is found in the highest wage category (>\$37 an hour). From 2019 to 2030 the most growth will be found in the middle wage category (\$28 to \$37 an hour)

# Jobs Study

# SEO: Industry Profile: Electricity

# Growth Sub-Sectors

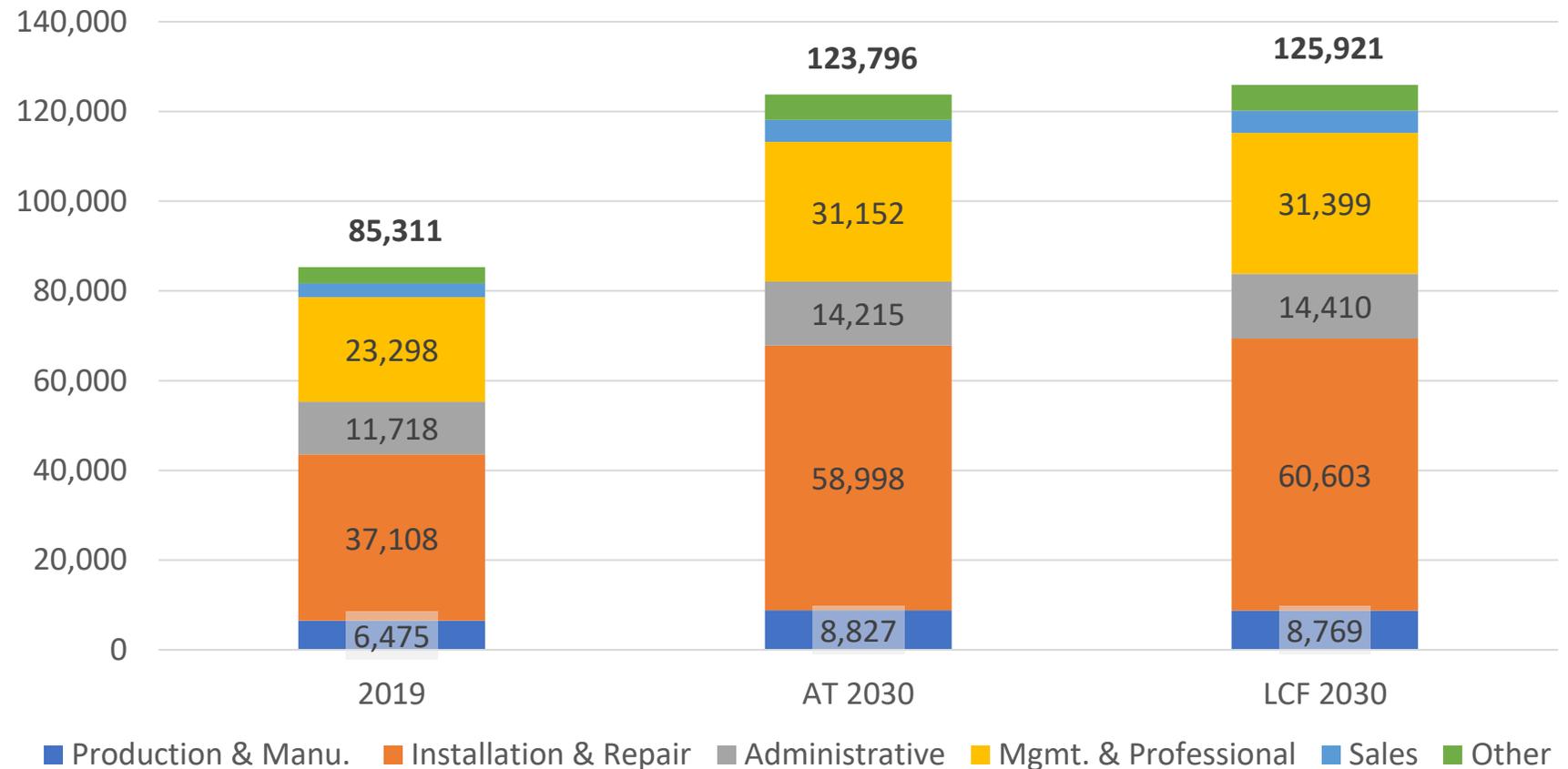
Electricity's growth sub-sectors (10) experience consistent growth in the professional services, manufacturing, & other supply chain industries with almost a doubling of the construction industry.



# Jobs Study

# SEO: Occupational Profile: Electricity Growth Sub-Sectors

**Electricity's growth sub-sectors expect consistent growth in all of the major occupational groups with a large increase in installation and repair positions.**

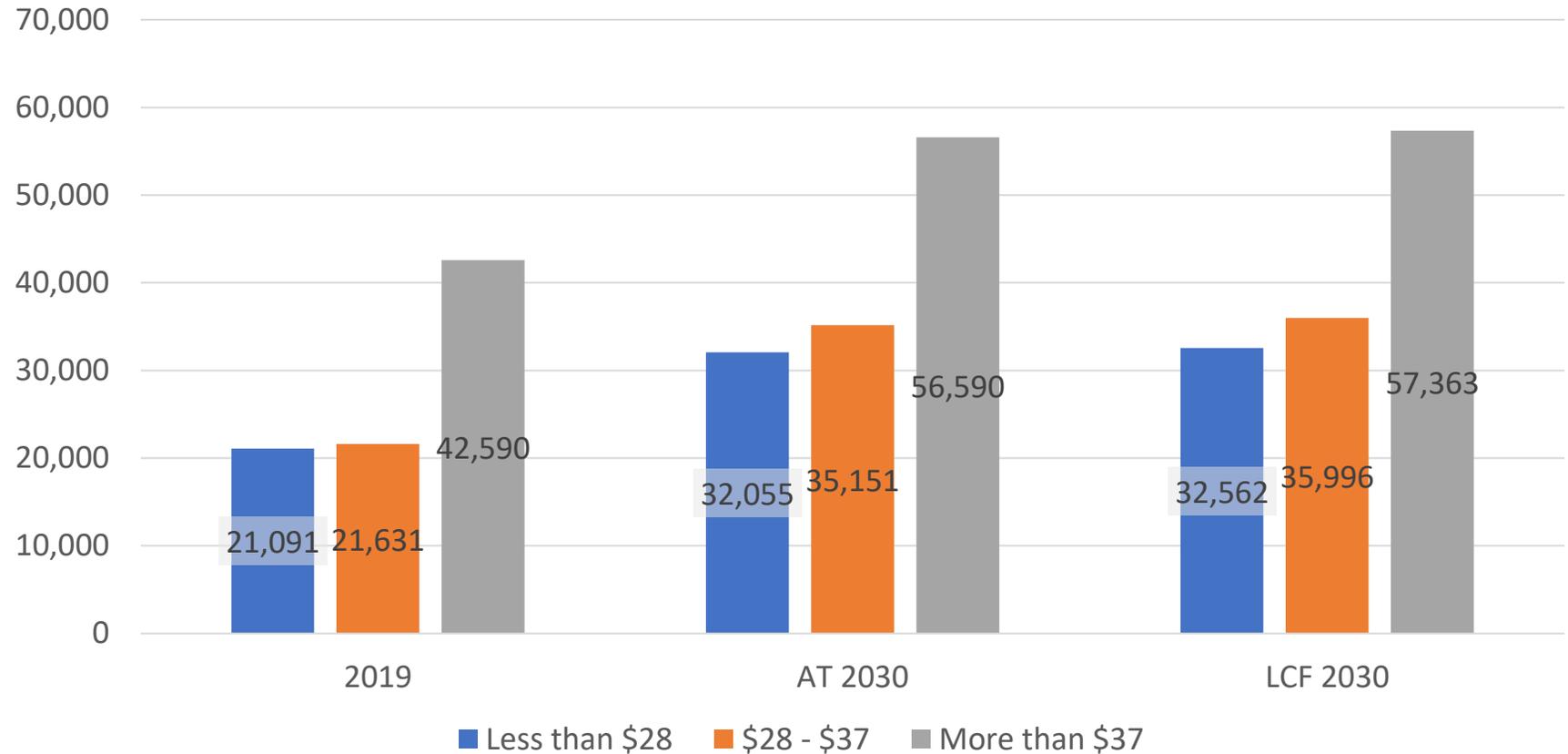


# Jobs Study

# SEO: Wage Profile: Electricity

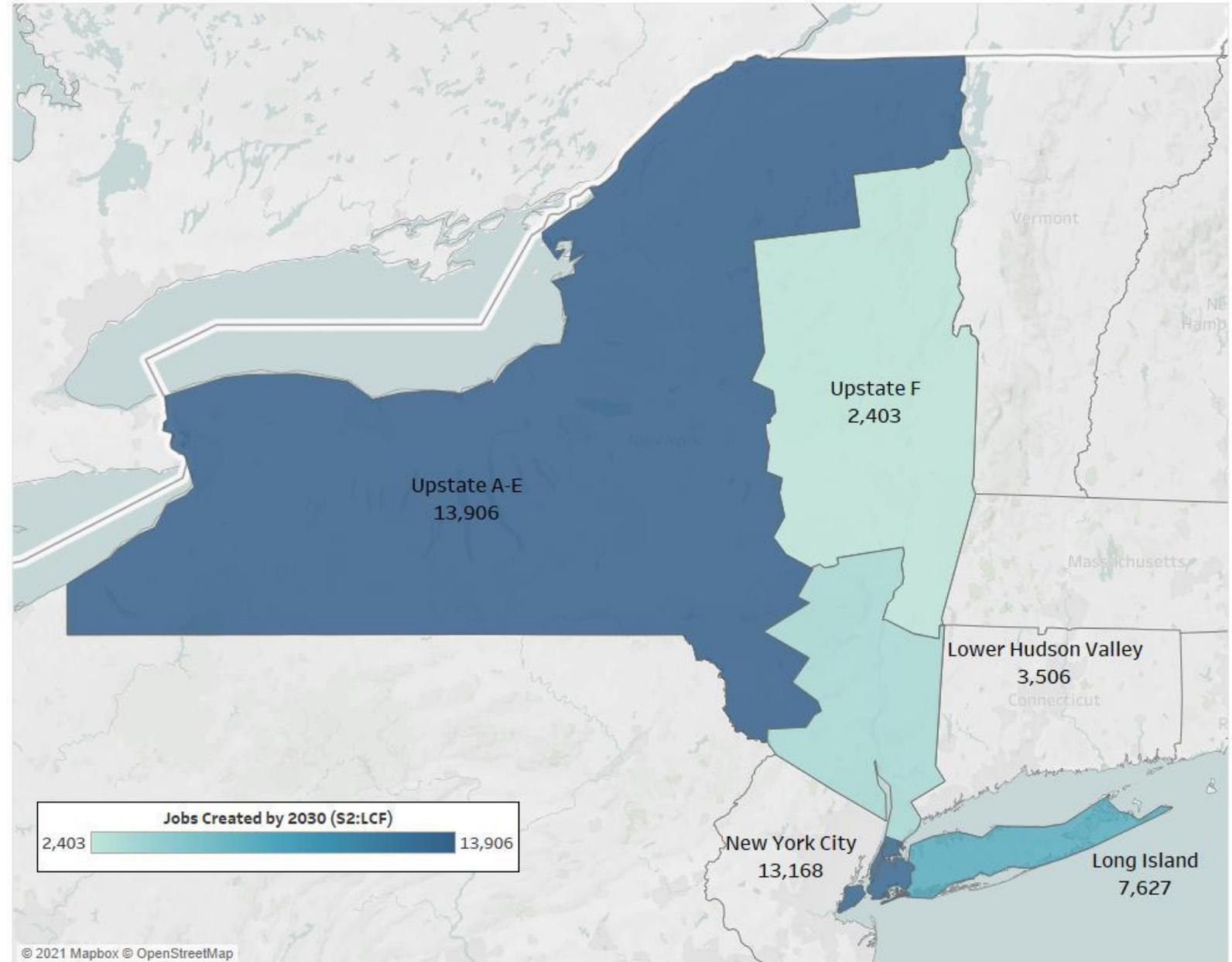
# Growth Sub-Sectors

Electricity's growth sub-sectors experience more growth in the middle tier (\$28 - \$37) and highest paying wage category (>\$37) compared to the lowest paying wage category (<\$28)



# Jobs Study

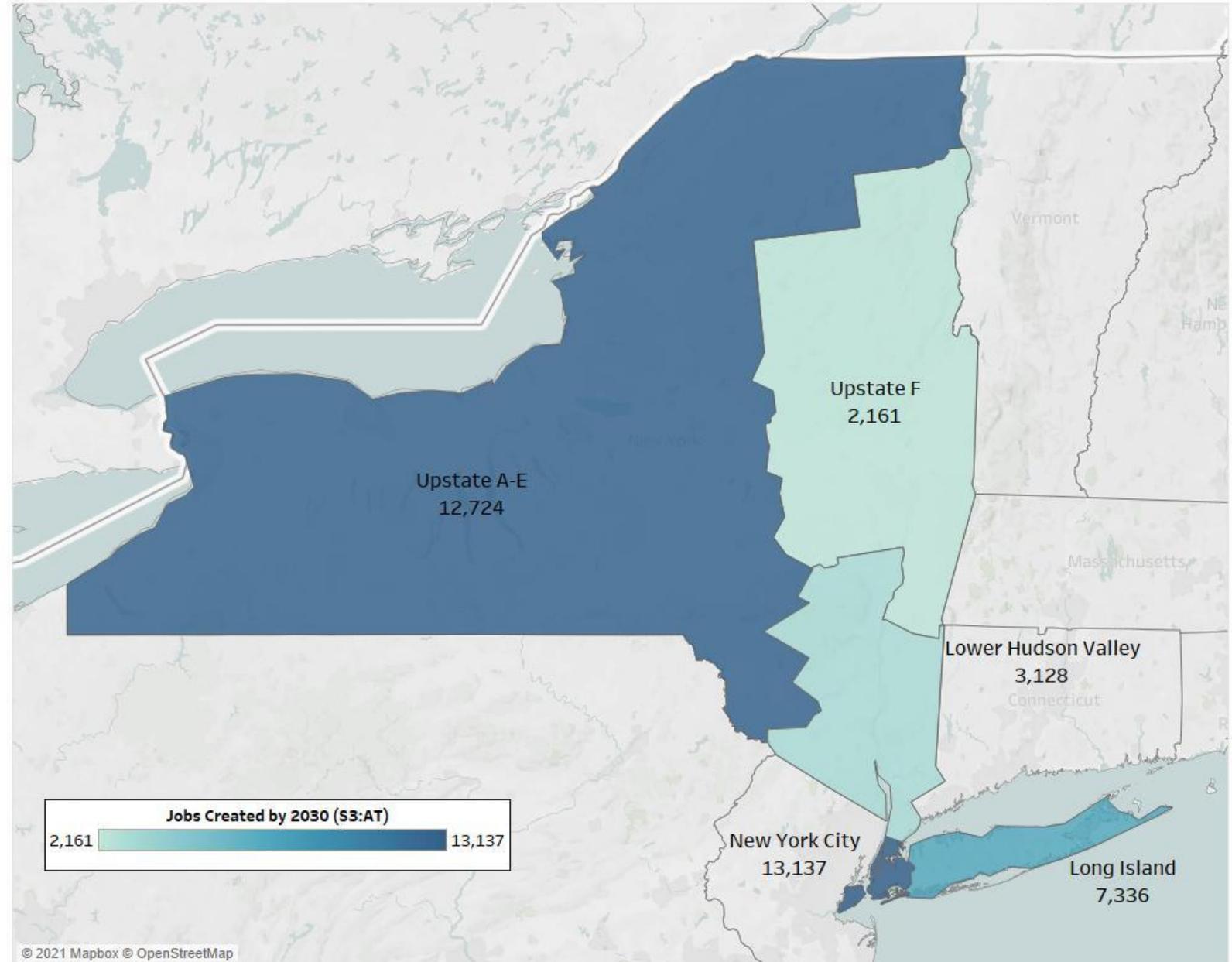
SEO:  
Geographic  
Profile:  
Electricity  
S2:LCF  
  
Growth  
Sub-Sectors



# Jobs Study

SEO:  
 Geographic  
 Profile:  
 Electricity  
 S3:AT

Growth  
 Sub-Sectors



# SEO Highlights: Fuels

## **Industry Profile**

- There is a 3% increase in employment in the LCF Scenario, and a 10% decrease in the AT Scenario by 2030. This is the only sector with considerable employment differences between scenarios
- The sector is projected to increase employment in the Construction industry, but decrease in all other industries

## **Occupational Profile**

- Growth sub-sectors see employment growth in all occupational categories, with larger increases in the LCF Scenario
- Decreases in employment in displacement sub-sectors mostly offset growth in other sub-sectors, largely due to jobs lost in Administrative occupations

## **Wage Profile**

- There is a 6% increase in workers in the higher wage category (>\$37) in the LCF Scenario by 2030
- About two-thirds of jobs lost under the AT Scenario are in the lower wage category (<\$28)

# SEO Highlights: Buildings

## **Industry Profile**

- Over 80 percent total increase in employment by 2030
- Four out of five jobs added are in the Construction industry

## **Occupational Profile**

- Employment increases across all occupational categories including Production & Manufacturing, Administrative, Sales, Management & Professional
- The most significant increase (over 80%) is projected for Installation & Repair occupations

## **Wage Profile**

- About one-third of workers are projected to be in the highest wage category (>\$37) by 2030
- The \$28 to \$37 wage category sees the largest increase in workforce, more than doubling by 2030

# SEO Highlights: Transportation

## **Industry Profile**

- Relatively flat total employment from 2019 to 2030
- Declines in Other Supply Chain industries are largely offset by major growth in Construction

## **Occupational Profile**

- Growth sub-sectors see employment increases across all occupational categories with the most substantial increases (over one-half) projected for Installation & Repair occupations
- Displaced sub-sectors see employment decreases across all occupational categories with the most substantial decreases (nearly one-third) projected for Administrative and Other (Gas station) positions

## **Wage Profile**

- Approximately 63% of all employment in this sector is in the lower wage category (<\$28 an hour) in 2019. From 2019 to 2030 the Transportation sector experiences a decline in the lower wage category and increases in the middle and higher wage categories.

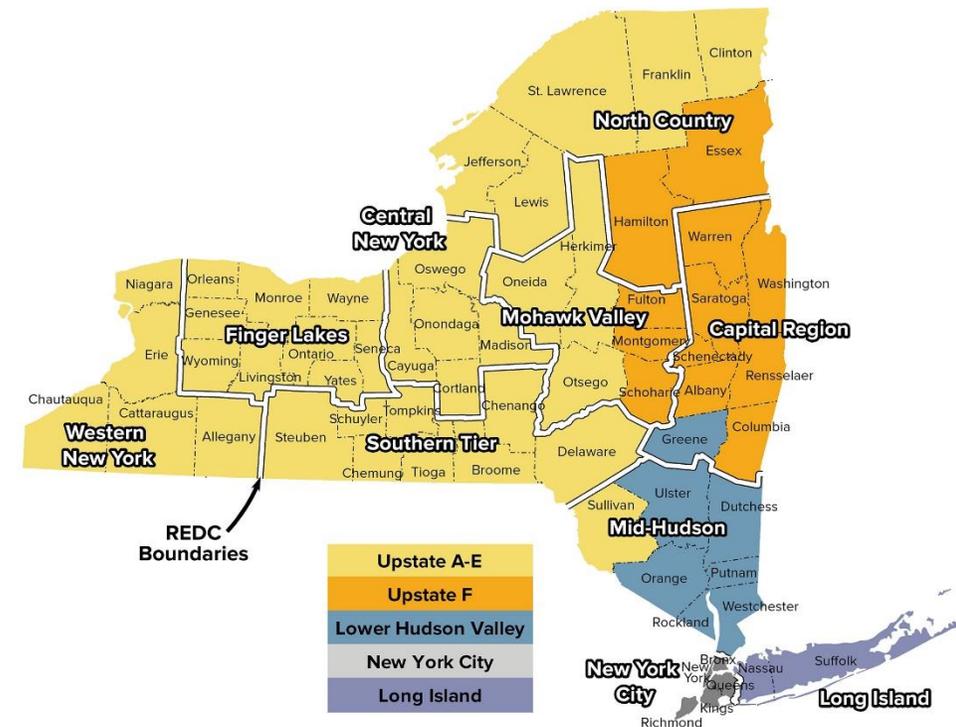


# Jobs Study Workforce Analyses

## Jobs Study

# Workforce Analyses

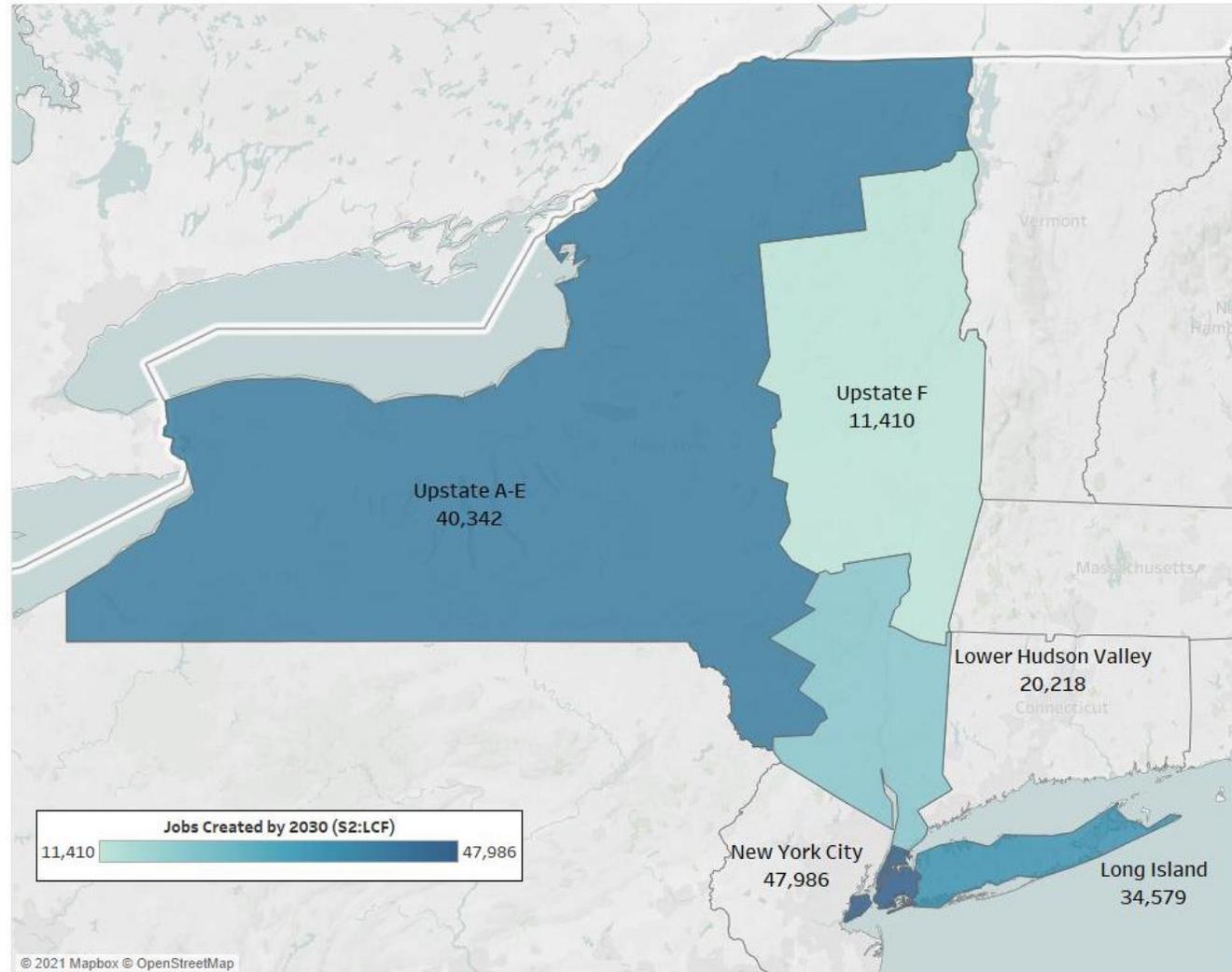
1. Describe impact of **employment** for NYS & 5 regions from the CAC Integration Analysis.
2. Evaluate how the model findings impact **sustainable wages**.



# Jobs Study Geographic Analysis

## 2030 S2:LCF

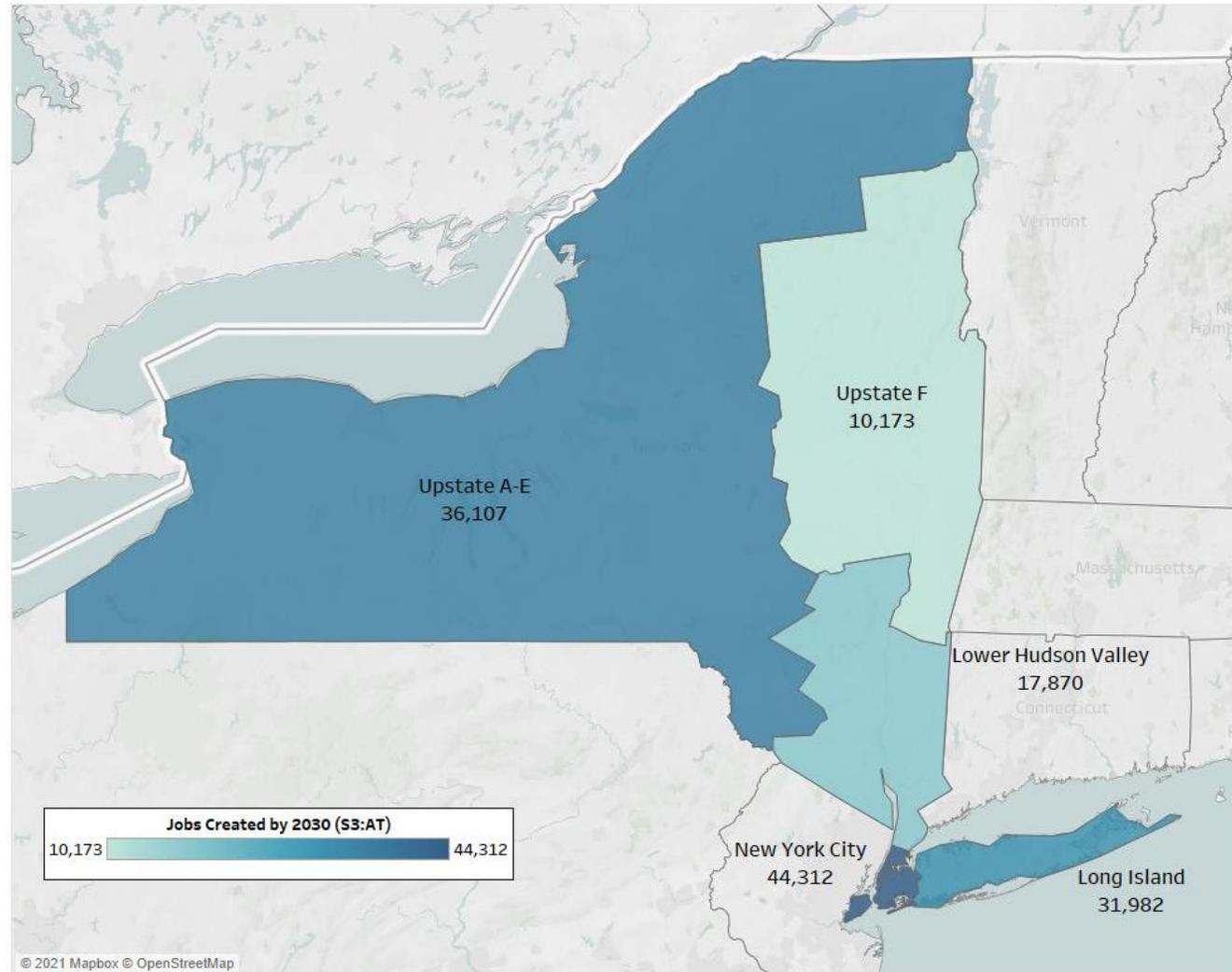
Of the 155,000 direct and indirect jobs created under this scenario, over 30 percent will be in the New York City region.



**Jobs Study**  
**Geographic Analysis**

**2030**  
**S3:AT**

The distribution of jobs created in this scenario is similar to S2:LCF, almost 60 percent of the 140,000 direct and indirect jobs created are in the Upstate A-E and New York City regions.



## Jobs Study

# Wage Analysis Highlights

- Wage categories were based on data from the 2019 living wage calculation for New York State (Living Wage Calculator, MIT).
- Middle wage positions (\$28 - \$37) see the largest increase in jobs, from 2019 to 2030, with the largest decline in lower wage positions (<\$28).
- The electricity sector has the highest proportion of higher wage positions (>\$37), with approximately half of employment falling in this category.
- The transportation sector has the highest proportion of lower wage positions (<\$28), with approximately 60 percent of employment falling in this category.

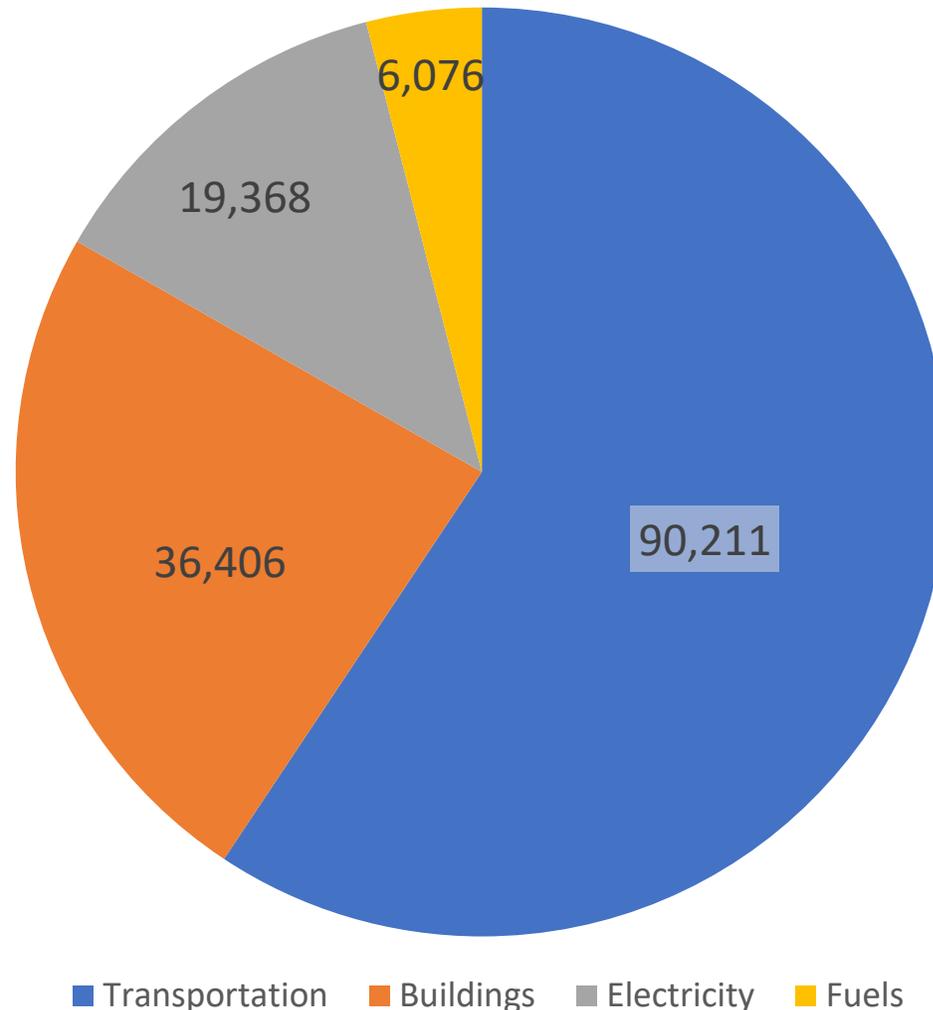
	All Four Sectors (Combined)			Change from 2019 to 2030	
	2019	AT 2030	LCF 2030	AT 2030	LCF 2030
<\$28	41%	37%	37%	-4%	-4%
\$28 - \$37	23%	28%	29%	6%	6%
>\$37	36%	34%	34%	-2%	-2%

**Jobs Study**

**Wage Analysis**

**2019 Baseline**

The 41% of workers (2019) in the four sectors with an hourly wage under \$28, can be largely found (~60%) in the Transportation sector.

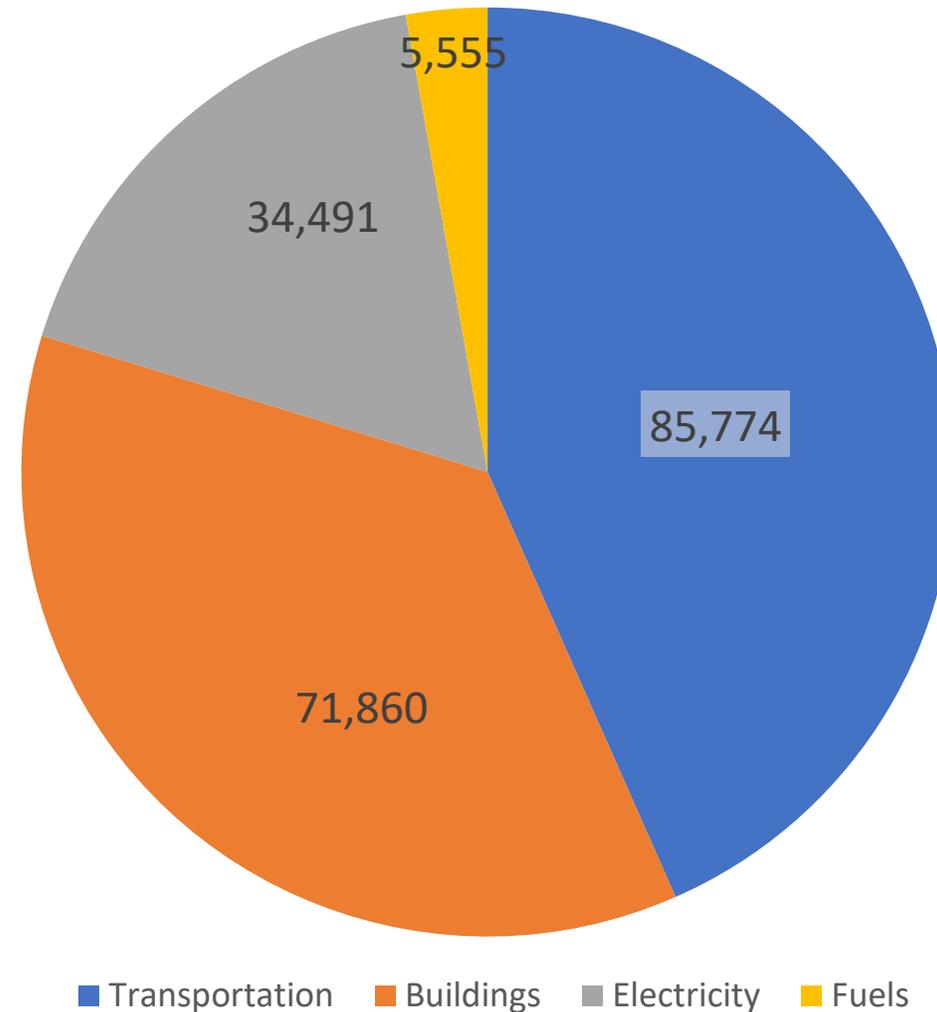


- **Typical occupations in this wage category include Transportation and Material Moving, Production, and Installation, Maintenance & Repair Occupations.**

**Jobs Study**  
**Wage**  
**Analysis**

**2030**  
**S2:LCF**

The 37% of workers (2030) in the four sectors with an hourly wage under \$28, are predominantly found in the Transportation or Building sector.



# Questions & Discussion

# Finalizing JTWG Workforce Recommendations

*Plus: Examples of State Programs Currently Underway*



**Climate Action  
Council**

# Just Transition Working Group Workforce Recommendations

## > CLCPA: The Working Group shall...

- *...advise the council on issues and opportunities for workforce development and training related to energy efficiency measures, renewable energy and other clean energy technologies, with specific focus on training and workforce opportunities for disadvantaged communities, and segments of the population that may be underrepresented in the clean energy workforce such as veterans, women and formerly incarcerated persons;*
- *...identify sector specific impacts of the state's current workforce and avenues to maximize the skills and expertise of New York state workers in the new energy economy;*
- *...advise the council and conduct stakeholder outreach on any other workforce matters directed by the council;*
- ***prepare and publish recommendations to the council on how to address: .... workforce development for trade-exposed entities, disadvantaged communities and underrepresented segments of the population***

## > These workforce recommendations:

- Have been updated in November 2021 to reflect findings of the Jobs Study
- Originated from preliminary/initial recommendations reviewed by the JTWG in March 2021, based on input from the JTWG, CAC Advisory Panels and stakeholder input
- Where applicable, build on activities already underway by NYSERDA/NYSDOL, others and address gaps

# Jobs Study: Key Findings Informing Workforce Training Recommendations\*

## Job Growth

- Employment in growth sub-sectors increases by at least 172,000 jobs by 2030, a 55 percent increase in the workforce from 2019 to 2030. Employment grows in these sub-sectors by at least 285,000 jobs through 2050.
- Over half of the new jobs will be found in the buildings sub-sectors (residential shell, commercial HVAC and residential HVAC). Employment in the Buildings Sector will see significant growth by 2030, continuing to add new jobs through 2050
- The next largest growth sub-sectors are solar and offshore wind electricity generation, and electric vehicle charging and hydrogen fueling stations. Employment in the 'Electricity Sector', specifically in the Solar, Offshore Wind, Onshore Wind, Other Generation, Distribution, Transmission, and Storage sub-sectors, will see a significant increase in jobs through 2030, continuing to add new jobs through 2040.

## Displaced Jobs: for every job displaced, 7 jobs are added by 2030

- Employment in the displaced sub-sectors decreases by at least 23,000 jobs by 2030, a 14 percent decrease in the workforce from 2019 to 2030. Employment declines in these sub-sectors by at least 82,000 jobs through 2050.
- In the displaced sub-sectors, from 2019 to 2030, one worker may be lost for every seven current workers, which could be offset by retiring workers coupled with job transitions
- About half of the displaced jobs are found in conventional fueling stations (gas stations)
  - These job losses could be reduced by 50% or more under sensitivities for charging station/amenity innovation
- Conventional fuel industries (Petroleum & Natural Gas) represent about one-quarter of the displaced employment

\* S2:LCF Scenario, Job Study

# Enabling Initiatives

Initiatives and components required for delivery	Implementation Lead	Time to Develop/Launch	Other key stakeholders
<p><b>1) Direct Displaced Worker Support:</b></p> <ul style="list-style-type: none"> <li>• Training fund, On-the-Job Training (OJT), <b>relocation support</b>, job fairs</li> <li>• More advanced support where facility <b>and business</b> closures are known ahead of time</li> <li>• Implement training and other support services while individuals are still working; leverage decarbonization-related roles at employers where appropriate (e.g., where business lines align) <ul style="list-style-type: none"> <li>• Retention: need to <i>retain</i> workers at plants where continued operation needed, as well as <i>retrain</i> workers</li> <li>• Leverage opportunities at dual-commodity utilities</li> </ul> </li> <li>• Identify distinct strategies and responses for key existing traditional energy sectors: Electric Power Generation, Transmission, Distribution, <b>Commercial Fueling Stations</b>, Storage Fuels, Motor Vehicles <ul style="list-style-type: none"> <li>• Recommended: Survey of conventional power plant <b>and fueling station</b> workforce to identify career status, future interests, timing needs, and other considerations</li> </ul> </li> </ul>	<p>NYSDOL</p>	<p><b>6-24 months for new efforts.</b></p> <ul style="list-style-type: none"> <li>• <i>Some initiatives such as OJT and job fairs already underway</i></li> </ul>	<p>NYSERDA, DPS, NYPA, unions, Workforce Dev. Institute, developers, training organizations, <b>owners/operators of facilities (power plants, fueling stations)</b></p>

# Enabling initiatives

Initiatives and components required for delivery	Implementation lead	Time to Develop/Launch	Other key stakeholders
<p><b>2. Further Evaluate, and Adopt Where Appropriate, Labor Standards</b> - Promoting good wages, benefits, local and targeted hiring, employer-led pre-apprenticeship and apprenticeship training through the following, where appropriate, feasible, and permitted by law:</p> <p><b>Project Labor Agreements, Prevailing Wage, and Community Benefits/Workforce Agreements.</b></p>	<p>NYSDOL, <b>NYSERDA</b></p>	<p>6-12 months</p> <ul style="list-style-type: none"> <li><i>Already in place where labor standards have been incorporated, e.g. large-scale renewable energy procurement solicitations (in alignment w/ 2021 Budget amendments to Labor Law)</i></li> </ul>	<p>NYSERDA, labor unions, clean energy developers and contractors, Workforce Dev. Institute</p>
<p><b>3. Targeted Financial Support for Businesses</b> to address diversity, equity, and inclusion (DEI) and build an inclusive clean energy economy (OJT, support for recruitment, <b>relocation</b>, training, hiring, job retention etc., for Disadvantaged Communities and MWBEs, design and installation firms, community-based organizations, start-ups; <b>capacity-building support to strengthen clean energy employers' DEI resources</b>)</p>	<p>NYSERDA</p>	<p>4-6 months</p> <ul style="list-style-type: none"> <li><i>Both NYSERDA and NYSDOL workforce training programs currently provide higher incentives and special allowances for MWBEs, hiring from DACs, etc.</i></li> </ul>	<p>NYSDOL, MWBEs, Start-ups, ESD, Chambers of Commerce</p>
<p><b>4. Develop Climate Justice and Clean Energy Training Curriculum and Programs focusing on high growth areas such as the buildings sector, solar and offshore wind, EV charging and hydrogen refueling</b> with focus on Disadvantaged Communities: Fund programs for K-12 Schools, Technical/P-TECH, Community Colleges and 4-year Colleges/Universities</p>	<p>NYSERDA, <b>DOL</b></p>	<p>12-18 months</p> <ul style="list-style-type: none"> <li><i>NYSERDA currently developing new initiative for education and training for K-12 schools in DACs, DOL's online training; Coursera</i></li> </ul>	<p>NYSDOL, SUNY, CUNY, NYPA, SED, representatives from K-12 schools, BOCES</p>

# Enabling initiatives

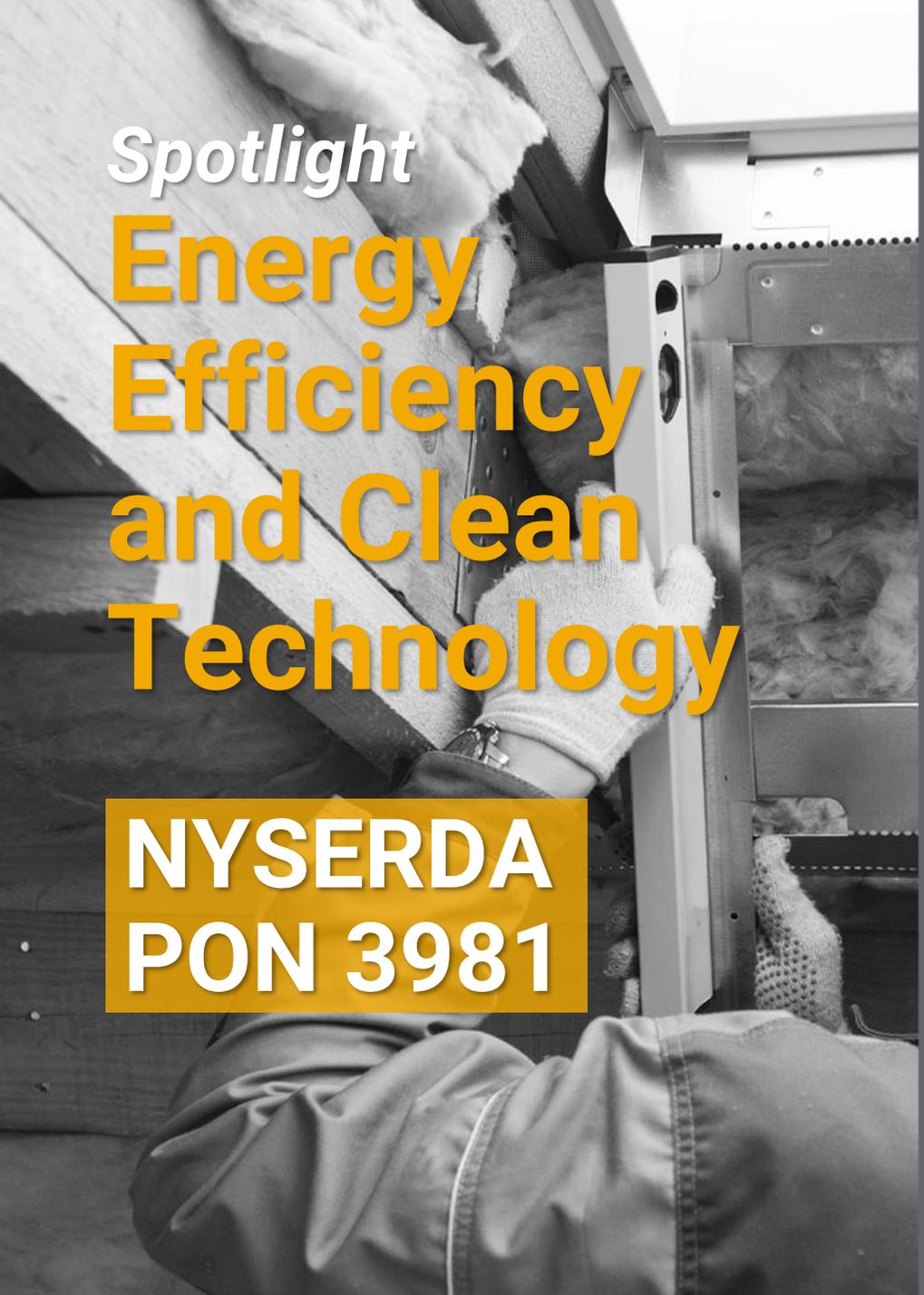
Initiatives and components required for delivery	Implementation lead	Time to Develop/Launch	Other key stakeholders
<p><b>5. Comprehensive Career Pathway Programs</b> (special focus on buildings, including building shell and HVAC (residential and commercial), large-scale renewables generation and EV charging and hydrogen refueling)</p> <p><b>Future Workers (primarily entry-level):</b>            Youth Build skills development programs, Job Corp programs, youth apprenticeships, pre-apprenticeships and internships (16-24 yr. olds)</p> <ul style="list-style-type: none"> <li>• Career awareness and supportive services for job placement</li> <li>• Climate Justice Job Corp Fellowships (entry-level and transitioning workers) and OJT</li> </ul> <p><b>Existing Workers (transitioning fossil fuel workers, manufacturers, clean energy workers, CBOs, MWBEs, SDVOBs, state/public workforce, etc.):</b></p> <ul style="list-style-type: none"> <li>• Technical Upskilling (curriculum and training equipment)</li> <li>• Career Advancement and management/leadership training</li> <li>• Training for fuel stations/other facility owners – new business models and services</li> </ul>	<p>NYSERDA</p>	<p>3-15 months for new initiatives with many career pathway projects underway including internship, fellowship and OJT, plus DOLS's online training tool, Coursera.</p> <ul style="list-style-type: none"> <li>• Career pathway training initiatives could target transitioning fuel station workers (EV charging station training)</li> </ul>	<p>NYS DOL, SUNY, CUNY, community-based orgs, labor unions, trade organizations, manufacturing associations including MACNY</p>

# Enabling Initiatives

Initiatives and components required for delivery	Implementation lead	Time to Develop/Launch	Other key stakeholders
<p><b>6. Community Engagement, Stakeholder Input, Market Assessments</b></p> <p><b>Finalize and Publish</b> Jobs Study</p> <p>Continued stakeholder engagement to identify/assess industry demand, training/curriculum needs; facilitating communication/forum to share needs and best practices; supporting industry opportunity awareness and recruitment efforts. <b>Survey of clean energy workers in addition to employers.</b></p> <p>Fossil Fuel <b>and Conventional Fuel Station</b> Workers: Understand and leverage transferrable skills with complementary training (in both energy and non-energy roles); surveys to understand worker plans for retirement and interest in retraining opportunities</p>	<p>NYSERDA</p> <p>NYSERDA and NYS DOL</p> <p>NYSDOL, NYSERDA, DPS</p>	<p>December 2021</p> <p>3-24 months</p> <p>3-18 months</p>	<p>CAC, Advisory Panels and Working Groups</p> <p>Unions, developers, manufacturers, building owners training orgs, trades associations, K-12</p> <p>Unions, trade, <b>retail fuel chains</b>, install firms, associations, large project developers, &amp; clean energy design</p>

# Enabling strategy summary

Initiative #	Description	Action Type	Ease of Implementation	Cost to Develop & Implement
1	Direct Displaced Worker Support	Enabling	Medium/Difficult	\$\$
2	Labor Standards: PLAs and Community Agreements	Enabling	Medium/Difficult	--
3	Targeted Financial Support for Businesses	Enabling	Easy	\$
4	CJ and CE Training Curriculum and Programs	Enabling	Medium	\$
5	Career Pathway Programs (new & existing workers)	Enabling	Easy	\$\$
6	Community Engagement, Stakeholder Input, Market Assessments	Enabling	Easy/Medium	\$



*Spotlight*

# Energy Efficiency and Clean Technology

**NYSERDA  
PON 3981**

## Program Goals

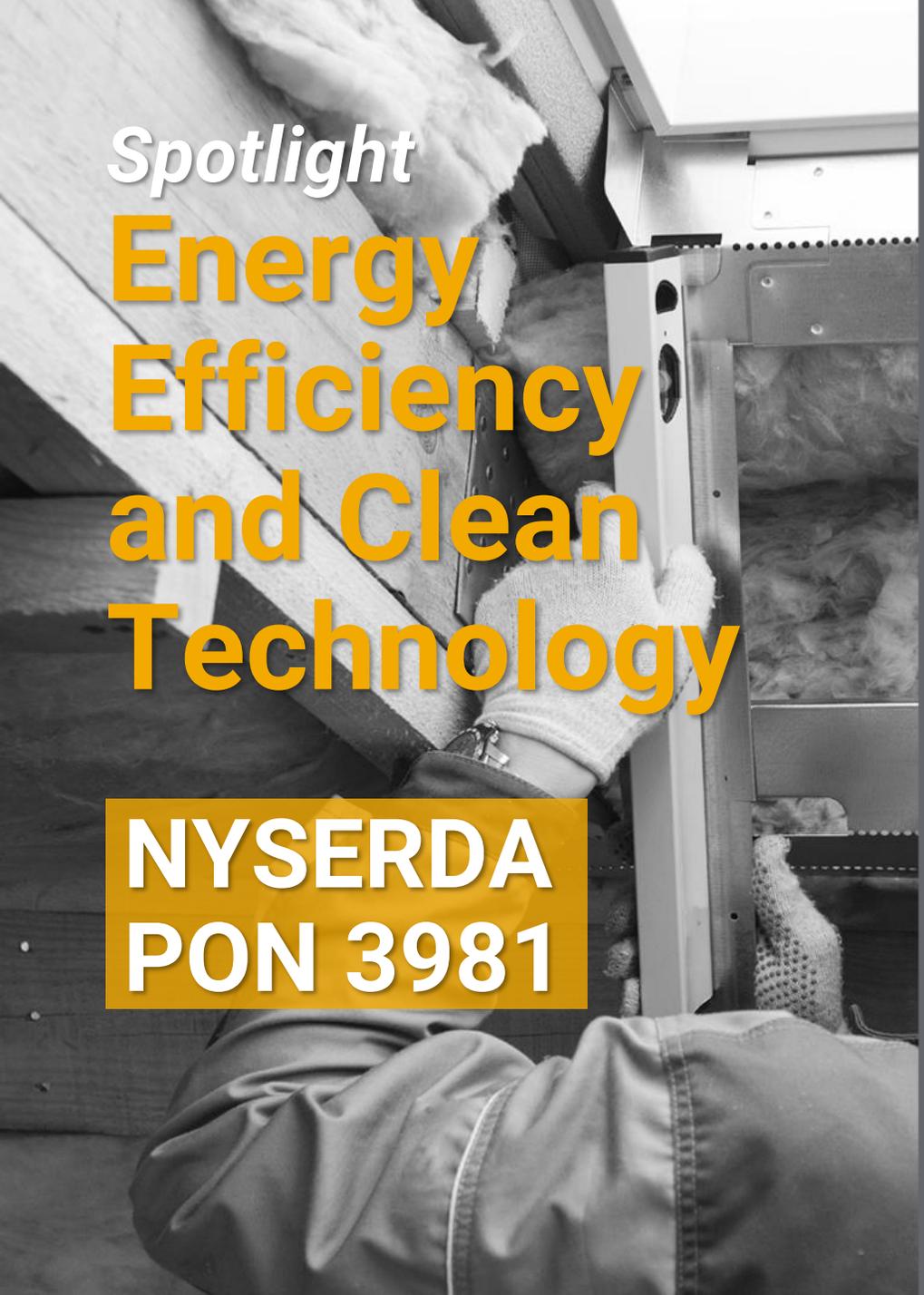
- > Technical high schools, community colleges, colleges and universities
- > Trade associations, manufacturers, equipment suppliers, distributors, unions
- > Firms and subcontractors that support engineering, procurement, construction, operations and maintenance
- > Renewable energy service providers, project developers and owners
- > Training and job placement intermediaries, community-based/non-profit organizations

## Eligible Activities

- > Building electrification/heat pump technologies
- > Insulation and air sealing; smart grid, energy storage
- > High-efficiency lighting, building automation and controls
- > EV maintenance and charging station installation
- > Large-scale, land-based renewable energy generation

## Eligibility Requirements

- > Training for existing workers or future workers
- > Technical training, plus soft and professional skills as appropriate
- > Industry partnerships to provide hands-on training and relevant work experience + clear job placement goals
- > For Career Pathway Projects: At least 50% of trainees from disadvantaged communities and priority populations and at least 80% of trainees must be placed into a paid internship, apprenticeship, full-time job or advanced formal training; wrap around services provided



*Spotlight*

# Energy Efficiency and Clean Technology

**NYSERDA  
PON 3981**

## Energy Efficiency and Clean Technology Training for New Workers (Career Pathways)

- > Must be driven by real business demand for new workers
- > Must combine rigorous and high-quality soft, professional, and clean energy technical skills training with job preparedness and placement support. Wrap-around services must be provided or leveraged when applicable
- > Minimum of 50% of trainees must be from priority populations/disadvantaged communities
- > Must include partnerships with businesses to inform skills training, provide hands-on training and work experience via OJT, internships, apprenticeships, pre-apprenticeships, and provide clear job placement goals for all trainees
- > At least 80% of trainees must be placed in an internship, apprenticeship, or job within 6 months of completed training
- > NYSERDA funding is 90% of total costs for projects that exclusively serve members of disadvantaged communities and/or priority populations; maximum funding of \$550,000 per project

# PON 3981 Project Examples

**Green Jobs Initiative-District Council (DC) 37 Education Fund; NYSERDA investment: \$247,000 Number of trainees: 480**

DC 37, the largest public employees' union in New York City, is developing a Green Jobs Initiative for AFSCME (American Federation of State, County, and Municipal Employees) / AFL-CIO. DC 37's curriculum offers fundamentals and advanced study, offering the opportunity for continuing education units and professionally recognized credentials that lead to career paths and advancement in renewable energy, green technology, building sciences, and environmental conservation and engineering. In addition to incumbent members, DC 37 will prepare candidates who have been pre-qualified for NYC's civil service exam; many of which reside in environmental justice zones.

**Energy Efficiency Workforce Training-New York State Weatherization Directors Association (NYSWDA);**

**NYSERDA investment: \$240,080 Number of trainees: 338**

NYSWDA is partnering with the Mohawk Valley Workforce Development Board to partner on a new energy efficiency training for low-income and environmental justice populations in the City of Utica. The training will lead to Building Performance Institute certifications and continuing education units for energy auditors, quality control inspectors, HVAC technicians, entry-level crew people and on-site crew leaders, providing new and existing workers with opportunities for upskilling and advancement in the energy efficiency industry.

# PON 3981 Project Examples

**Building Automation Systems (BAS) Training-Stacks + Joules; NYSERDA investment: \$249,995 Number of trainees: 540**

This partnership with Stacks + Joules, UA Maker Academy, South Bronx Community College, and Lower East Side Girls Club prepares high school seniors from low-income communities and designated environmental justice areas for jobs in the Building Automation System (BAS) industry.

**Building Operators Training - CUNY Building Performance Lab; NYSERDA investment: \$242,350 Number of trainees: 75**

This Building Operators Training Program prepares disengaged youth in Upper Manhattan and the South Bronx for entry-level jobs with local multi-family building operators and small businesses. The 72-hour training includes both classroom and hands-on learning and culminates in a 6-8-week internship in various building sites.

**Clean Tech Pre-Apprenticeship Program-SUNY Ulster; NYSERDA investment: \$249,700 Trainees: 598**

SUNY Ulster is partnering with YouthBuild and the Ulster County Sheriff's office to recruit high-risk youth and incarcerated individuals to participate in a green jobs training on building envelopes, heating, cooling and automation systems, photovoltaics, and passive solar technology. The courses lay the foundation for stackable micro-credentials that students can earn on their path towards an Associate of Occupational Studies in Clean Technology degree.

# PON 3981 Project Examples

## **Energy Auditor Training-Willdan Energy Solutions; NYSERDA investment: \$250,000 Number of trainees: 370**

Willdan Energy is providing skills training to individuals in underserved and environmental justice communities that meet Con Edison's requirements for energy auditors. Willdan's training ensures that energy auditors in the field have the foundational knowledge and enhanced technical understanding required for various building systems.

## **Energy Bootcamp-Green City Force (GCF); NYSERDA investment: \$180,993 Number of trainees: 180**

GCF is developing an Energy Bootcamp for graduates (ages 18-24) of its AmeriCorps workforce preparedness program. The training is based on a "pre-apprenticeship" framework, offering exposure, basic foundation training and hands-on experience as well as a direct connection to industry for full-time employment.

## **Energy Efficiency Training -Hudson Valley Community College (HVCC); NYSERDA investment: \$226,212 Number of trainees: 1,009**

HVCC is creating a comprehensive energy efficiency training pipeline for underemployed and low-income individuals that encompasses soft skills as well as job-related, on-the-job training, and college coursework, enabling opportunities for advancement in the building trades and energy efficiency-related careers. Industry partners have committed to offering experiential learning opportunities, including job "immersion" experiences, internships, and mentoring, for students at all levels, with opportunities for job placement upon completion of training.



Spotlight

# Climate Justice Fellowship

PON 4772

Funding: \$6M for 150 Fellowships over 3 years

Max Amount: \$40K per Fellow (incl. \$37K salary and \$3K in supportive services)

## Eligible Applicants

- > **Businesses:** NYS community-based organizations, universities, municipalities, climate tech investors/start-ups, venture development organizations, clean energy businesses or firms dedicated to advancing climate justice and clean energy priorities in disadvantaged communities
- > **Fellows:** New hires who are NYS residents and currently reside in a disadvantaged community or come from a priority population

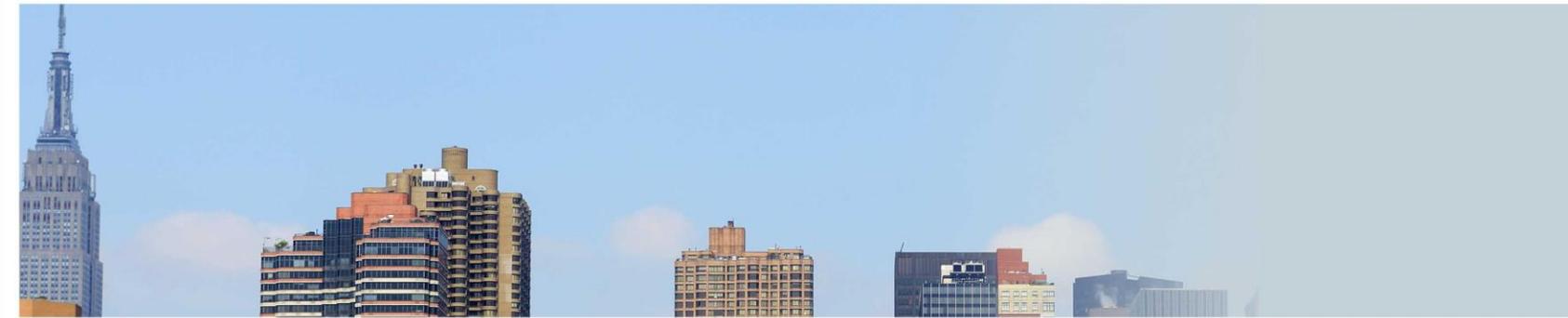
## Program Elements

- > **Duration:** 12 months, full-time (35-40 hours/week)
- > **Objectives:** provide training/mentoring for year-long, full-time fellowships, for individuals currently residing in disadvantaged communities or from a priority populations, to work within organizations and businesses that advance climate justice and clean energy priorities for disadvantaged communities.
- > **Support Services:** Professional development and mentoring plus comprehensive benefits

# Next Steps

- > **A sincere thank you from New York State for your service to this Working Group!**
  - With the lion's share of the Just Transition Working Group's efforts complete, these meetings are expected to wind down.
  - WG members may be convened for further potential collaboration and input during the analysis and refinement stages of the Scoping Plan process in 2022, including for any advising requested by the Council.
  - Co-Chairs Harris and Reardon may reach out to Working Group members to coordinate any future collaboration
- > **Upcoming Milestones**
  - Jobs Study Final Report will be completed and transmitted to CAC by end of December 2021
  - Draft Scoping Plan will be issued by the CAC by end of year as well
  - Public hearings and input will commence soon in 2022, leading to Final Scoping Plan
  - Stay up to date with meetings and materials on the [www.climate.ny.gov](http://www.climate.ny.gov) website
- > **Should you have any questions or input, don't hesitate to reach out to a member of the state staff team, or send an email to [jtwg@nyserda.ny.gov](mailto:jtwg@nyserda.ny.gov)**

**Thank you for  
attending!**



# Jobs Study Appendix

## Jobs Study

# Direction from Climate Act

### This study is meant to:

- Measure “***the number of jobs created to counter climate change***, which shall include but not be limited to the ***energy*** sector, ***building*** sector, ***transportation*** sector, and ***working lands*** sector”
- Examine the “***projection of the inventory of jobs*** needed and the skills and training required to meet the demand of jobs to counter climate change” as well as the “***workforce disruption due to community transitions*** from a low carbon economy”

## Jobs Study

# Direction from Climate Act, (cont'd)

- “Advise the council on ***issues and opportunities for workforce development and training*** related to energy efficiency measures, renewable energy and other clean energy technologies, with specific focus on training and workforce opportunity for ***disadvantaged communities***, and segments of the population that may be underrepresented in the clean energy workforce such as veterans, women and formerly incarcerated persons”

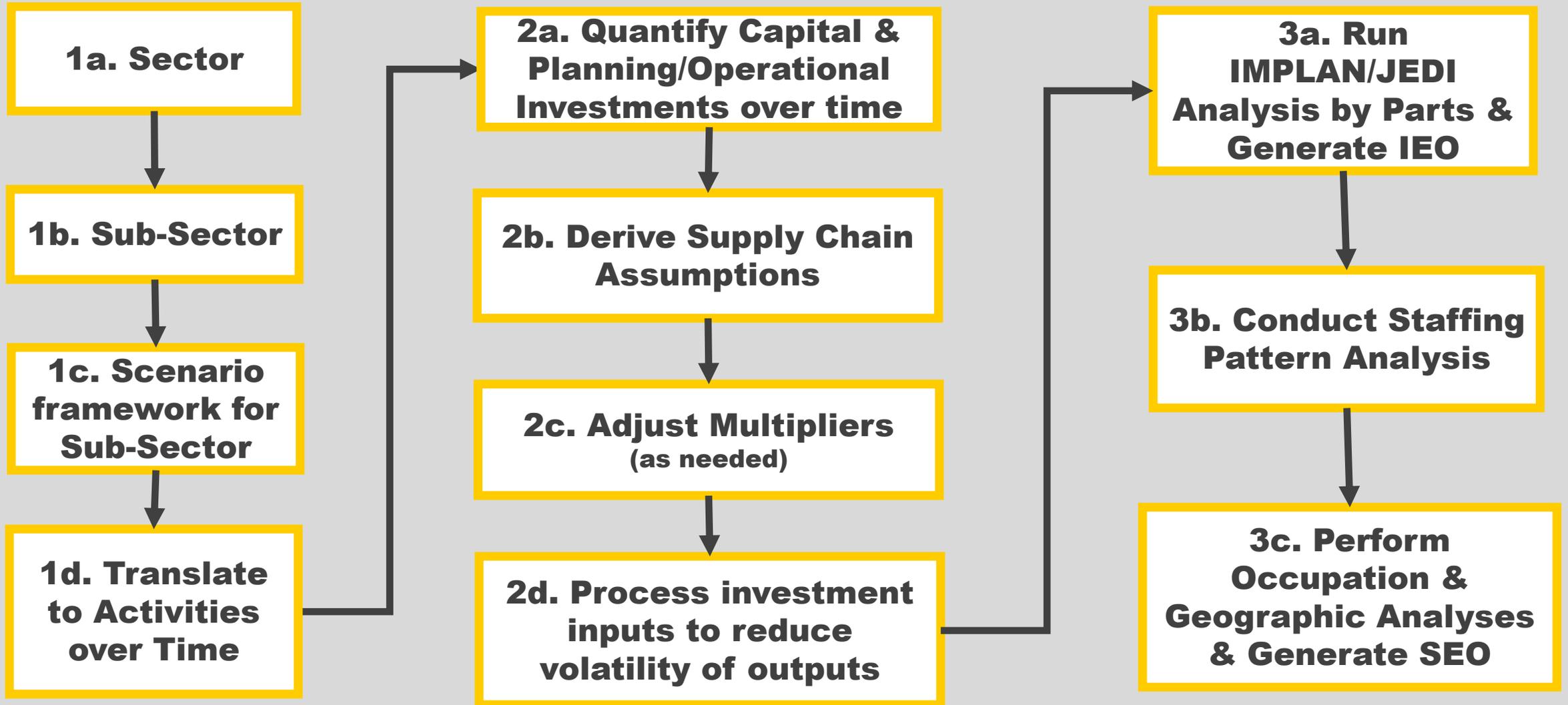
## Jobs Study

# Project Objectives

### **Project Objectives & Order of Operations**

1. Develop structure & framework of the employment impact model based on literature review (January – April)
2. Produce the employment model outputs by industry and occupation (May – November)
3. Examine the model sensitivities and workforce implications associated with model outputs & scenarios (November – December)

# Modeling Framework Overview



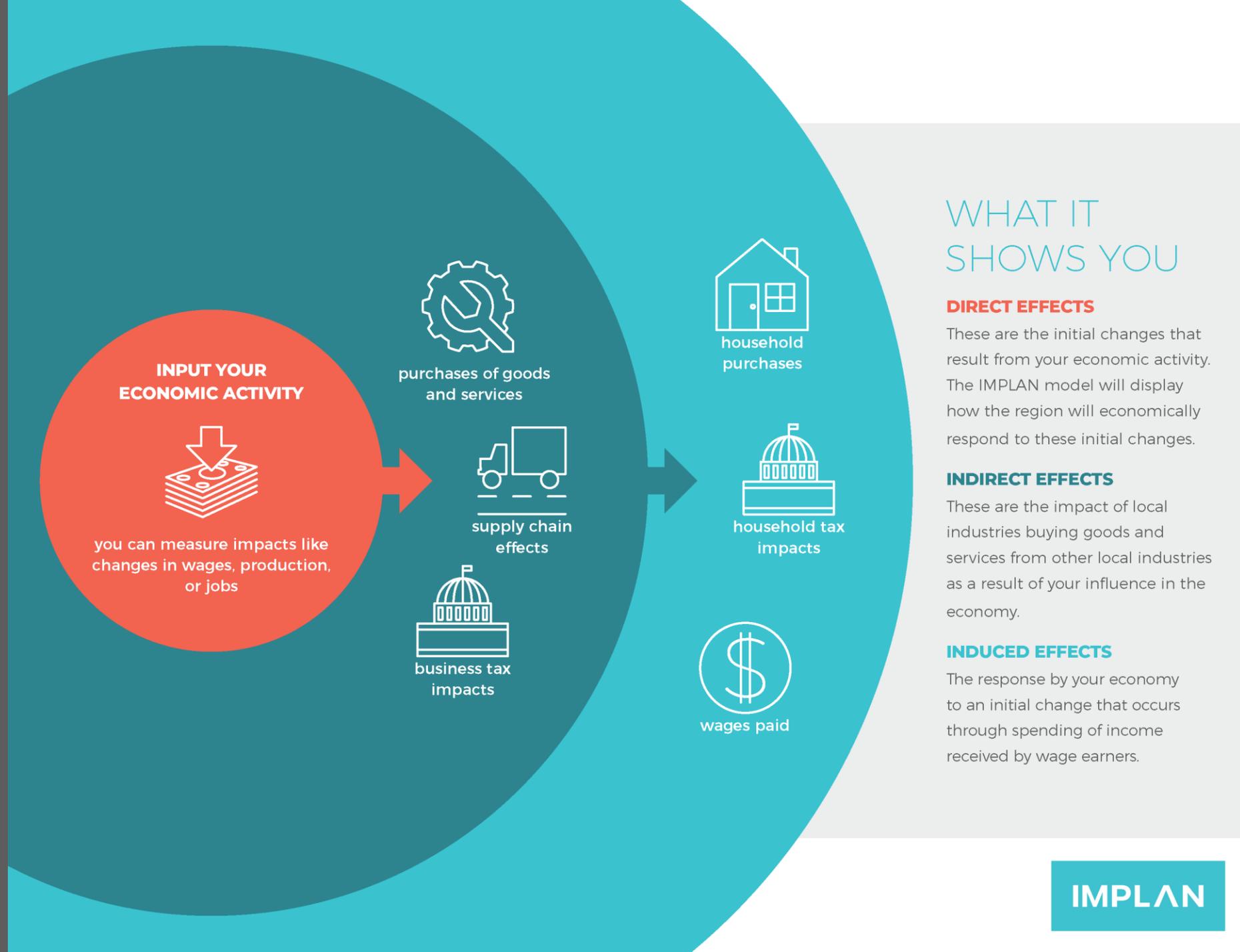
## Methodology Overview

# Summary of Input Output Models, IMPLAN, & JEDI

- IMPLAN & JEDI are Input-Output (I/O) models, that illustrate the interdependent relationships between different sectors of a national and regional economy.
- Investments or activities in a given sector are used as inputs into the model, to estimate the ripple or multiplier effect on business, household, and government expenditures and industry employment.
- IMPLAN is not an energy-specific industry analysis, but instead is focused on the overall employment impacts that would be felt across a given economic region, in this case the State of New York.

## Methodology Overview

# Summary of Input Output Models, IMPLAN, & JEDI



## Methodology Overview

# Summary of Input Output Models, IMPLAN, & JEDI

- JEDI (Jobs and Economic Development Impact) models are the National Renewable Energy Laboratory's (NREL) tools to estimate the local economic impacts of the construction and operation of power generation and biofuel plants. NREL provides JEDI models for various energy sub-sectors, including Onshore and Offshore Wind, Solar, and Biofuels.
- JEDI helps estimate job creation by running user input of project location, facility size, and year of construction, in combination with the built-in model defaults and economic multipliers.
- Buildings sector data was calibrated by an analysis of data on New York State's building electrification activities.



**Jobs Study**  
**Overview of**  
**Scenarios &**  
**IEO**

## Methodology Overview

# Overview of CAC Integration Analysis Scenarios

## Scenario Overview

- > Previous scenarios
  - *Reference Case*
    - *Currently implemented policies*
  - *Scenario 1: Advisory Panel Recommendations*
    - *Aggregate impacts of recommendations from Advisory Panels*
- > Scenarios that meet or exceed GHG emission limits, achieve carbon neutrality by midcentury
  - Foundational themes across **all** mitigation scenarios based on findings from Advisory Panels and supporting analysis
    - Zero emission power sector by 2040
    - Enhancement and expansion of transit & vehicle miles traveled reduction
    - More rapid and widespread end-use electrification & efficiency
    - Higher methane mitigation in agriculture and waste
    - End-use electric load flexibility reflective of high customer engagement and advanced techs
  - **Scenario 2: Strategic Use of Low-Carbon Fuels**
    - Includes the use of bioenergy derived from biogenic waste, agriculture & forest residues, and limited purpose grown biomass, as well as green hydrogen, for difficult to electrify applications
  - **Scenario 3: Accelerated Transition Away from Combustion**
    - Low-to-no bioenergy and hydrogen combustion; Accelerated electrification of buildings and transportation
  - **Scenario 4: Beyond 85% Reduction**
    - Accelerated electrification + limited low-carbon fuels; Additional VMT reductions; Additional innovation in methane abatement; Avoids direct air capture of CO<sub>2</sub>

## Methodology Overview

# Summary of CAC Integration Analysis Scenarios

### **Both Scenarios**

- Made considerable investments in Solar and Wind energy.
- Continued investments in transmission, distribution, and storage capacity.
- Invested in charging and hydrogen fueling stations.
- Made considerable investments in commercial and residential buildings.

### **Scenario 2 - Strategic Use of Low Carbon Fuels (S2:LCF)**

- Considerable investments in low carbon fuels (including liquid biofuels)

### **Scenario 3 - Accelerate Transition Away from Combustion (S3:AT)**

- Greater early investments in grid and electrification

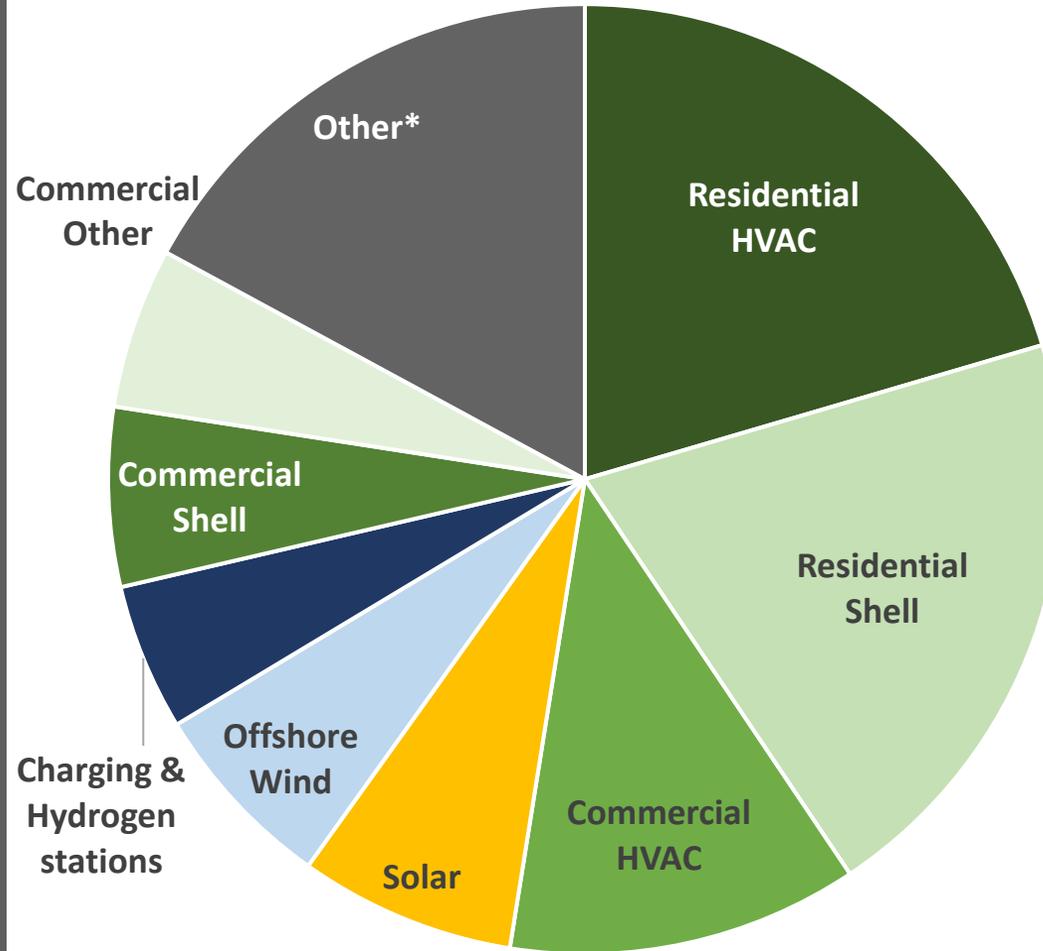


**Jobs Study**  
**IEOs for**  
**Primary**  
**Sectors**

# Jobs Study

Key  
Employment  
Findings:  
S2: LCF  
Scenario

Sub-Sectoral  
Breakdown of  
211,000 jobs  
Added by 2030



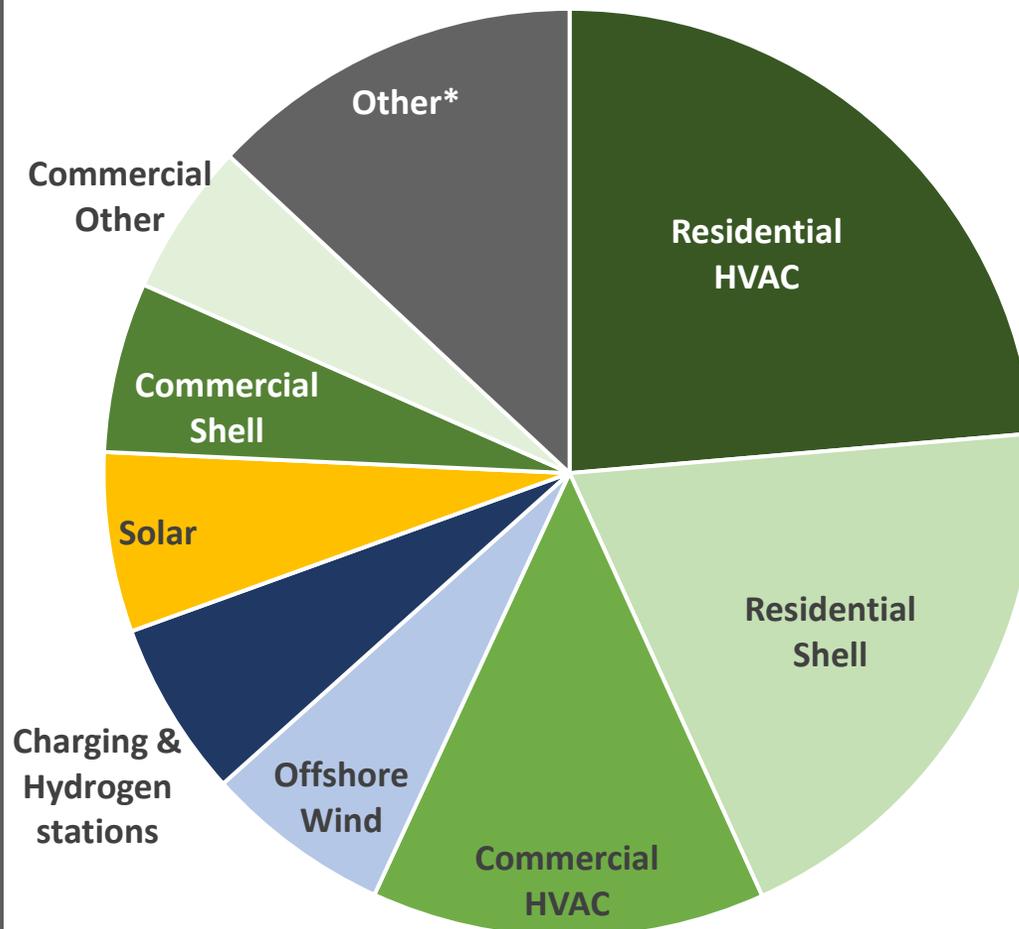
- Over half of the new jobs, in the growth sub-sectors, from 2019 to 2030, will be found in the buildings sub-sectors (shaded green)
- The next largest growth sub-sectors are solar and offshore wind electricity generation, and electric vehicle charging and hydrogen fueling stations

\* Includes Distribution (Electricity), Transmission, Storage, Other Generation, Bioenergy, Residential Other, Hydrogen, Onshore Wind, & Vehicle Manufacturing

## Jobs Study

### Key Employment Findings: S3: AT Scenario

### Sub-Sectoral Breakdown of 220,000 jobs Added by 2030



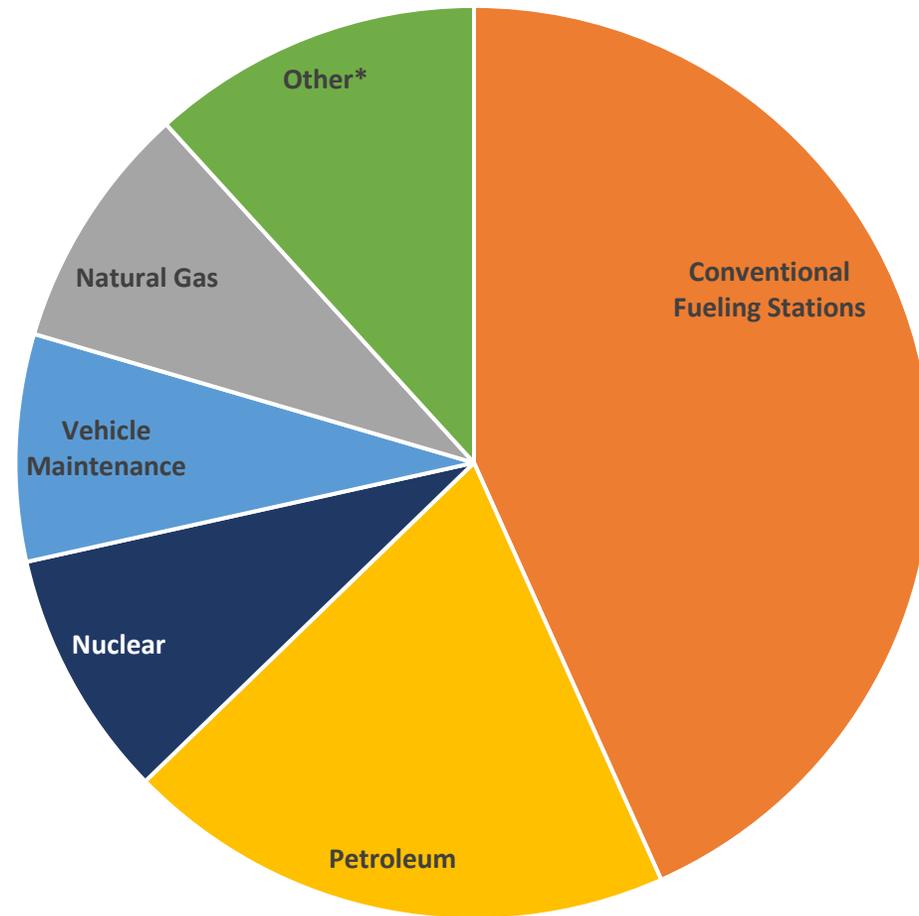
- With higher levels of investment in 2030, the buildings sector shows even more growth in the third scenario (S3:AT), compared to the second (S2:LCF)
- Offshore wind is one of the fastest growing sub-sectors, increasing from less than 1,000 jobs to almost 15,000 by 2030

\* Includes Distribution (Electricity), Transmission, Storage, Residential Other, Bioenergy, Onshore Wind, Hydrogen, Other Generation, Wholesale Trade, and Vehicle Manufacturing 87

## Jobs Study

### Key Employment Findings: S2: LCF Scenario

### Sub-Sectoral Breakdown of 22,000 jobs Displaced by 2030



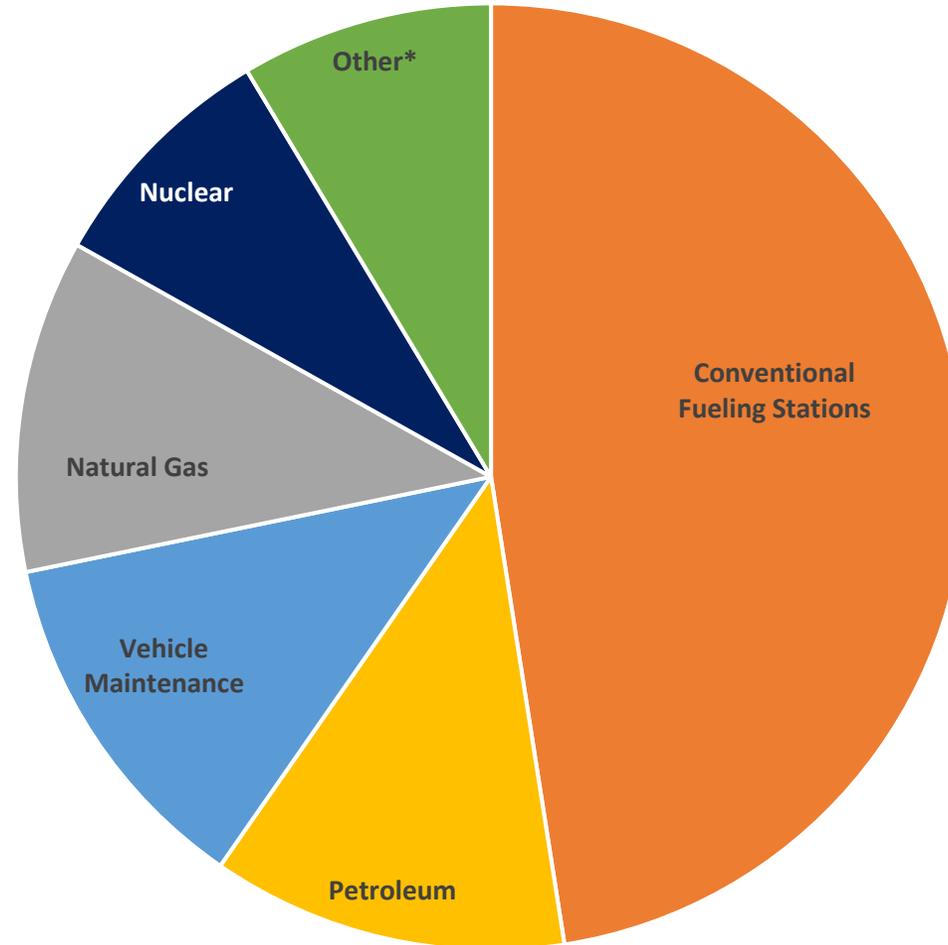
- **Conventional Fueling Stations represent over one-third of the displaced employment**
- **About one-quarter of displaced employment is in conventional fuel industries (Petroleum & Natural Gas)**

\* Includes Natural Gas Generation, Natural Gas Distribution, and Other Fossil Generation

## Jobs Study

### Key Employment Findings: S3: AT Scenario

### Sub-Sectoral Breakdown of 22,000 jobs Displaced by 2030



- **Displaced employment from Conventional Fueling Stations represents almost half of all displaced jobs in the third scenario (S3:AT)**

\* Includes Natural Gas Generation, Natural Gas Distribution, and Other Fossil Generation

## Jobs Study

# Key Employment Findings: Electricity Sector

**Employment in the ‘Electricity Sector’, specifically in the Solar, Offshore Wind, Onshore Wind, Other Generation, Distribution, Transmission, and Storage sub-sectors will grow to at least 207,000 by 2040**, an 83 percent increase from the 2019 workforce, and 94,000 jobs added. These growing electricity sub-sectors will also experience employment increases to at least 165,000 total jobs by 2030, a 46 percent increase (52,000 jobs added) from the 2019 workforce.

## Jobs Study

# Key Employment Findings: Electricity Sector (cont'd)

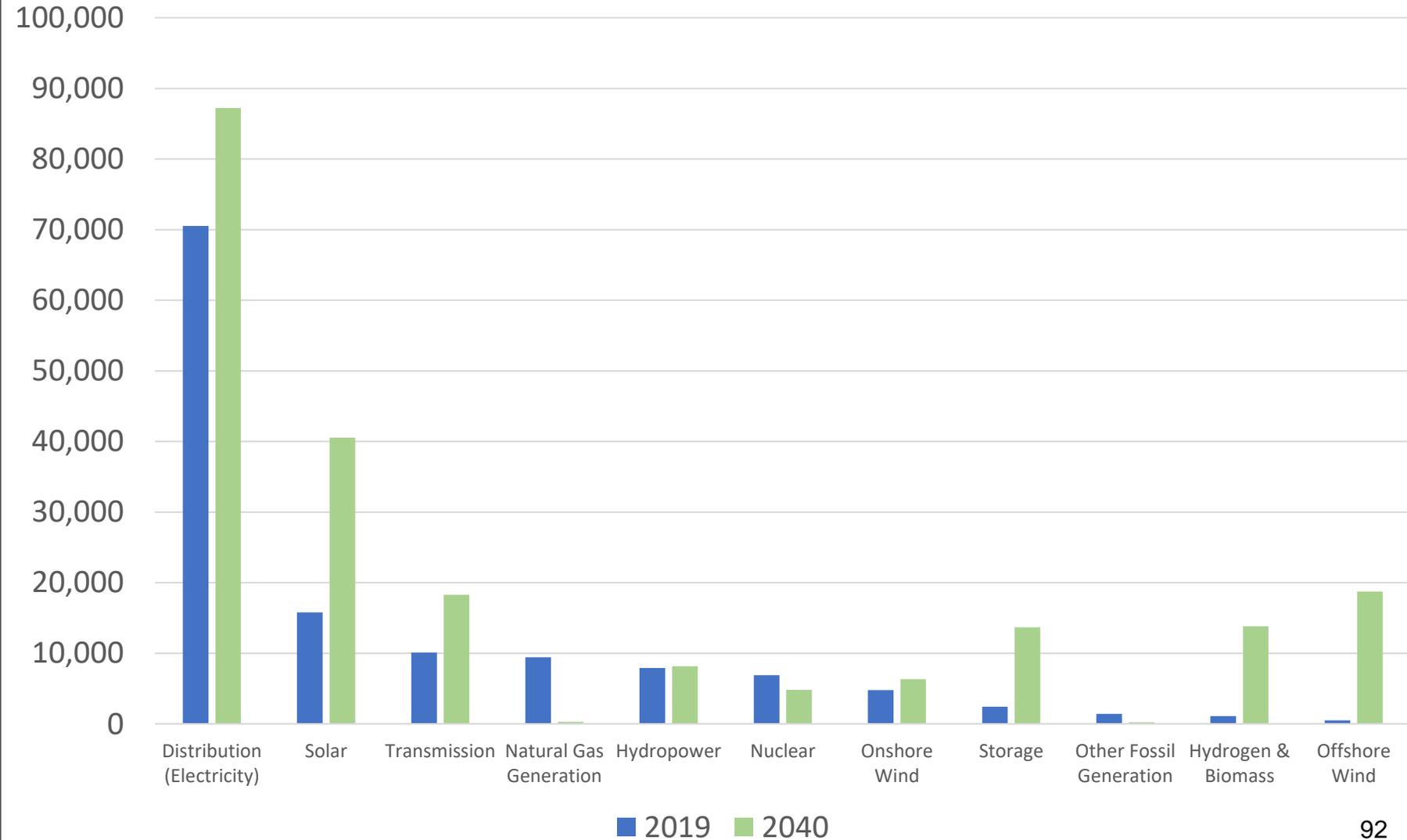
**Employment in the ‘Electricity Sector’, specifically in the Natural Gas Generation, Other Fossil Generation, and Nuclear sub-sectors falls to 5,000 by 2040**, a 70 percent decline compared to the 2019 workforce. Jobs continue to decline in these sub-sectors through 2050, reaching approximately 3,000 in the final year of the analysis.

**On net, overall employment in the Electricity Sector grows to at least 212,000 by 2040**, a 62 percent increase from the 2019 workforce, and 81,000 jobs added.

## Jobs Study

# Electricity Sector Jobs Changes: S2: LCF Scenario

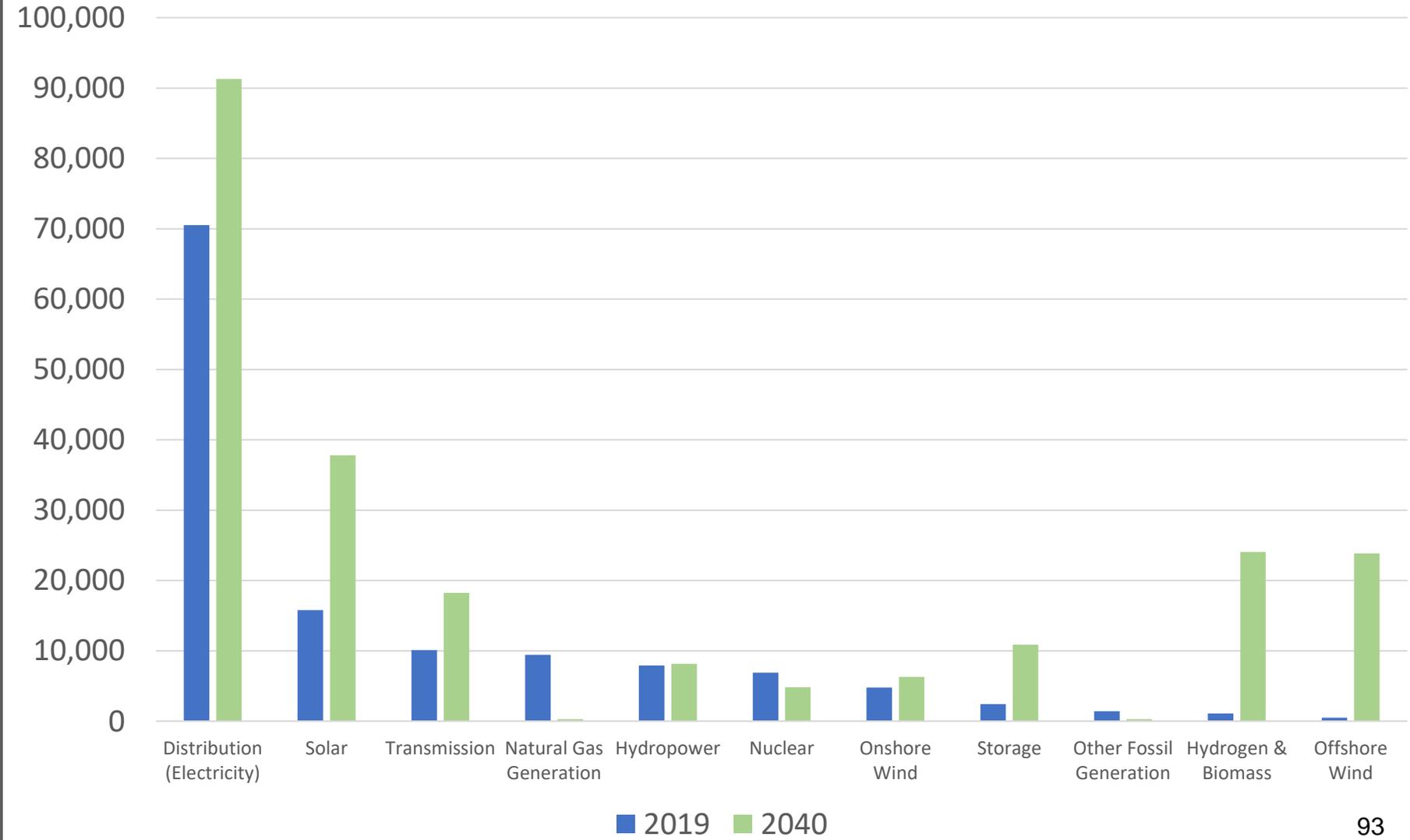
Distribution (Electricity) and Solar sub-sectors, the two largest sub-sectors in electricity in 2019, will see considerable growth through 2040, Offshore Wind, the smallest in 2019, will grow the most proportionally through 2040.



# Jobs Study

## Electricity Sector Jobs Changes: S3: AT Scenario

In the third scenario (S3:AT), employment growth increases more in Offshore Wind and Hydrogen & Biomass compared to the second scenario (S2:LCF).



## Jobs Study

# Key Employment Findings: Fuels Sector

**Employment in the ‘Fuels Sector’, specifically in the Hydrogen and Bioenergy sub-sectors will grow to as much as 11,000 by 2040, a four-fold increase from the 2019 workforce, and 8,000 jobs added. These growing Fuels sub-sectors will also experience employment increases to as much as 8,200 total jobs by 2030, over double (5,000 jobs added) the 2019 workforce.**

## Jobs Study

# Key Employment Findings:

## Fuels Sector (cont'd)

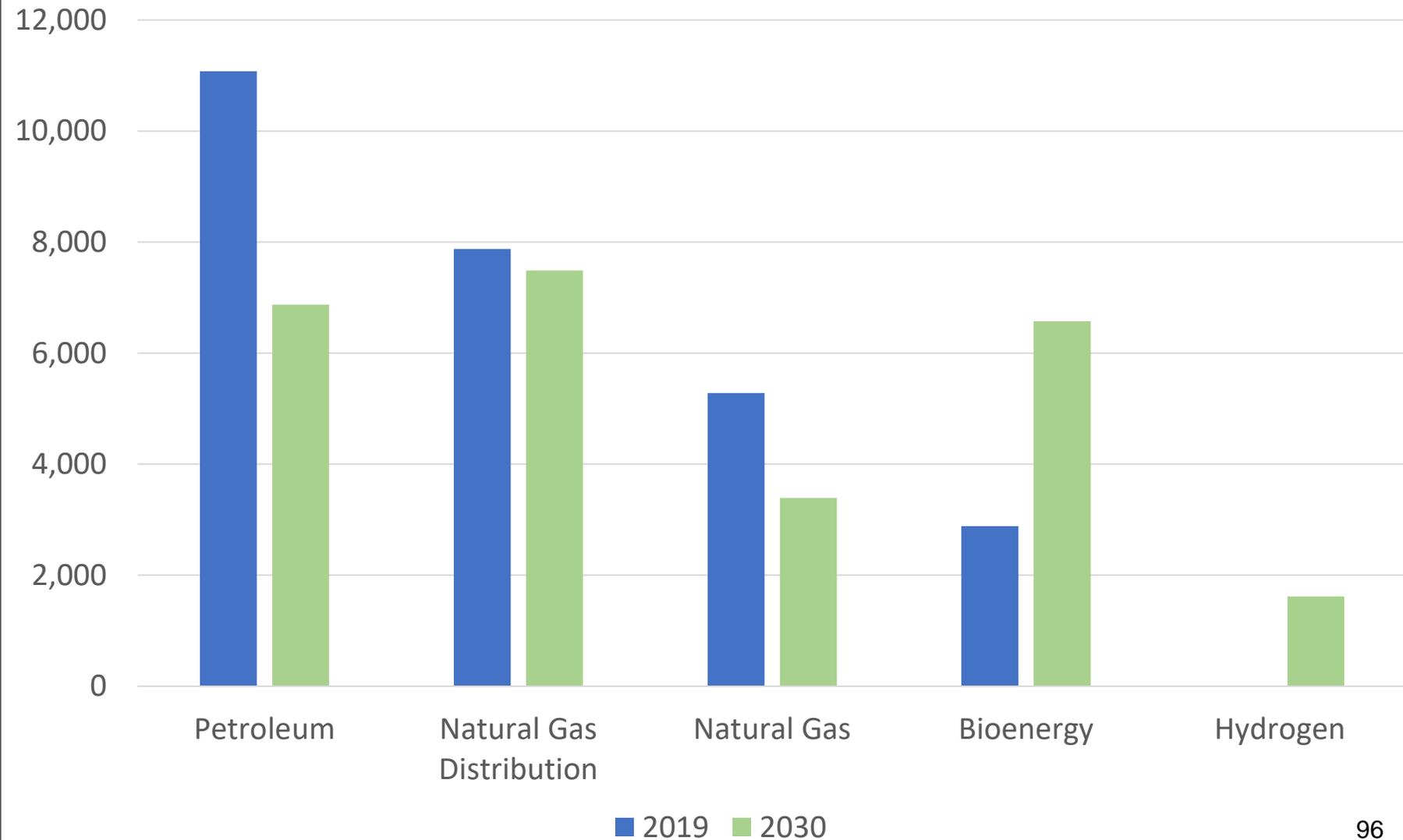
**Employment in the ‘Fuels Sector’, specifically, in the Natural Gas, Natural Gas Distribution, and Petroleum sub-sectors falls to as much as 8,700 by 2040, a 64 percent decline compared to the 2019 workforce. Jobs continue to decline in these sub-sectors through 2050, reaching about 1,000 in the final year of the analysis.**

**On net, overall employment in the Fuels Sector declines to as low as 24,000 by 2030, a 13 percent decrease from the 2019 workforce, and 3,500 jobs lost. Total jobs in the Fuels Sector continue to decline through 2050, reaching just over 7,000.**

# Jobs Study

## Fuels Sector Jobs Changes: S2: LCF Scenario

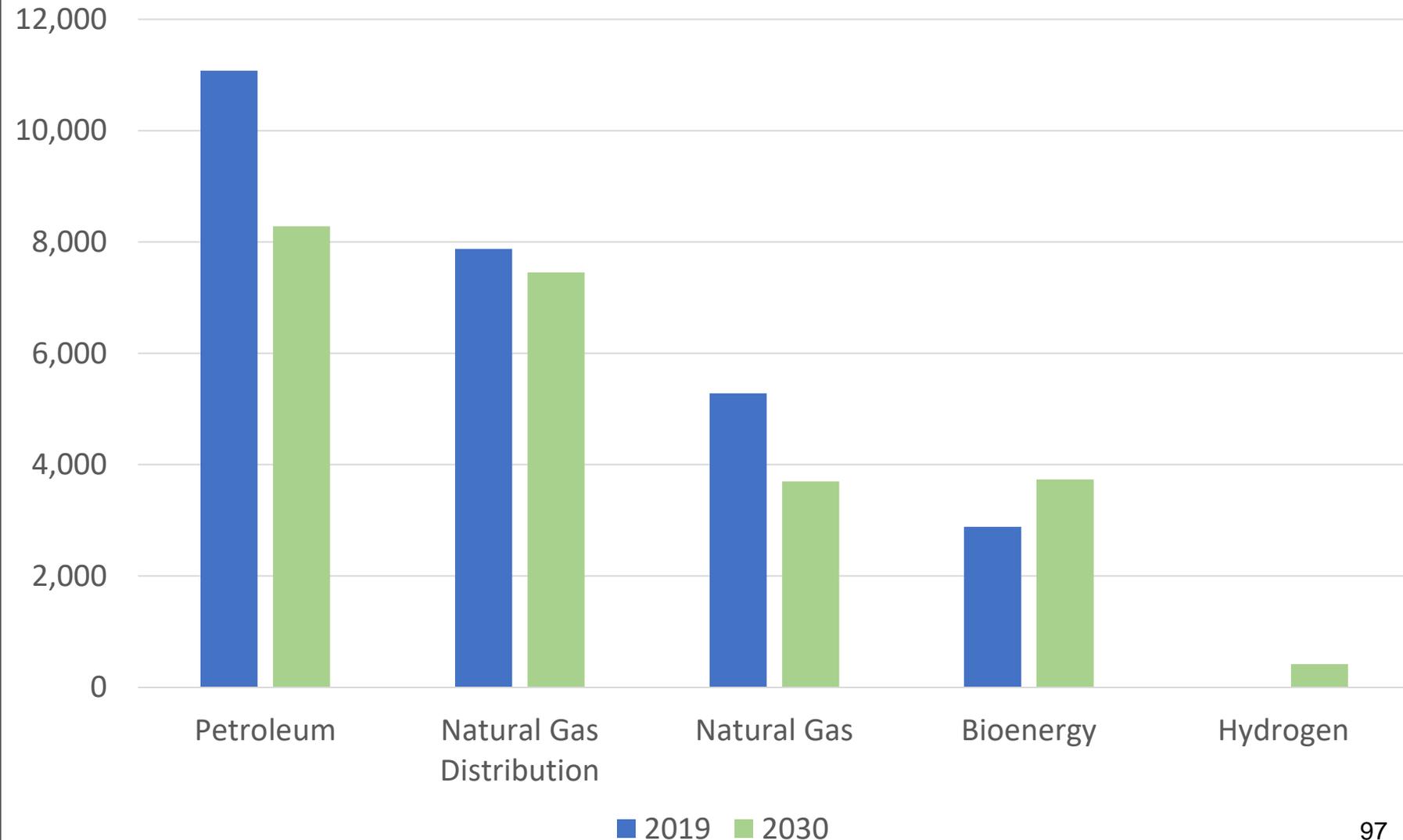
Displaced employment in the Petroleum and Natural Gas sub-sectors are largely offset by increased employment in Bioenergy and Hydrogen.



## Jobs Study

# Fuels Sector Jobs Changes: S3: AT Scenario

In the third scenario (S3:AT), the increased employment in Bioenergy and Hydrogen is considerably less than the second scenario (S2:LCF).



## Jobs Study

# Key Employment Findings: Buildings Sector

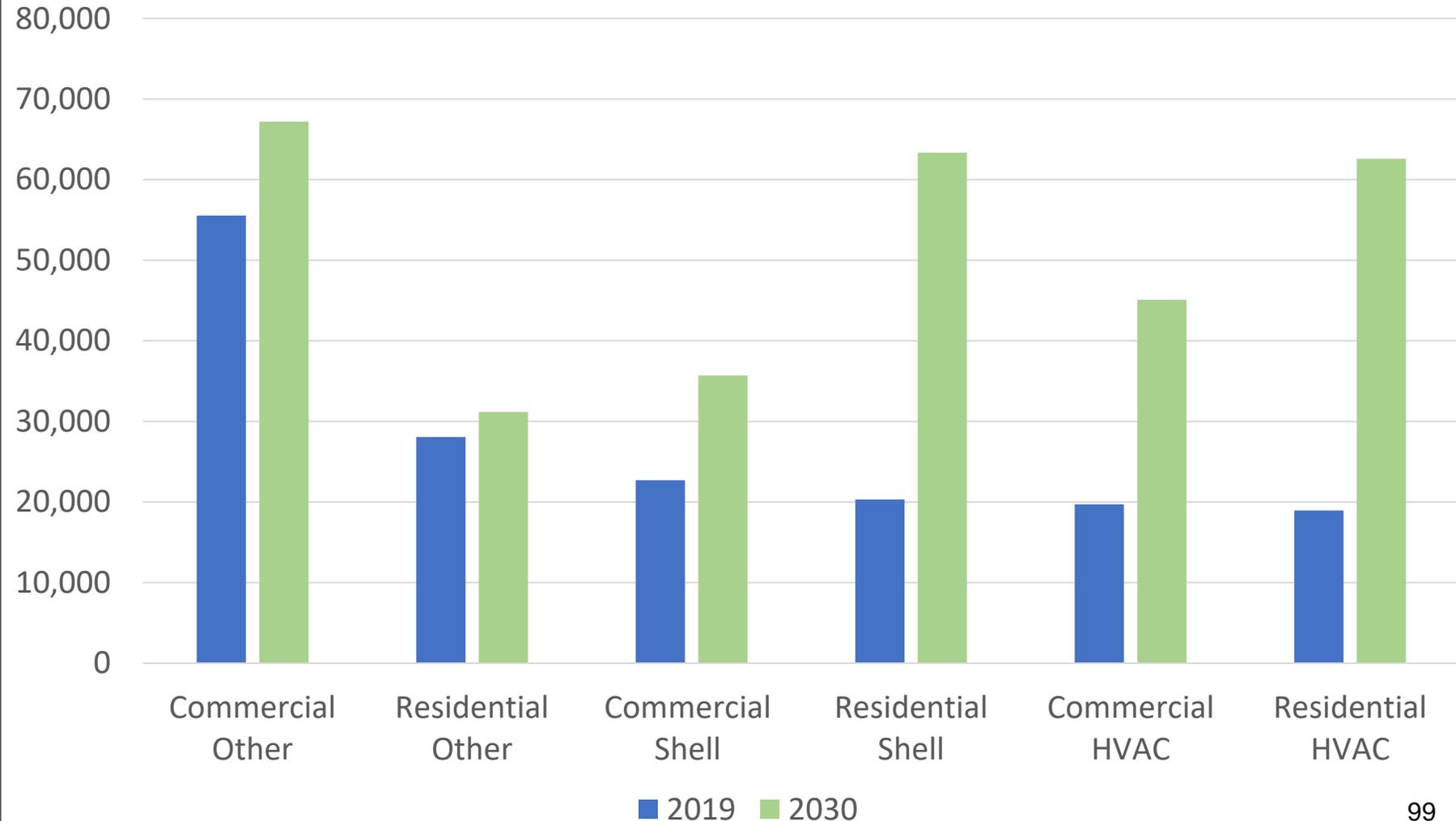
**Employment in the ‘Buildings Sector’ will grow to over 305,000 by 2030**, an 85 percent increase from the 2019 workforce, and almost 140,000 jobs added.

**On net, overall employment in the Buildings Sector grows to approximately 366,000 by 2040**, more than doubling the 2019 workforce by adding almost 201,000 new jobs. Total jobs in the Buildings Sector continue to increase through 2050, reaching about 405,000.

## Jobs Study

# Buildings Sector Jobs Changes: S2: LCF Scenario

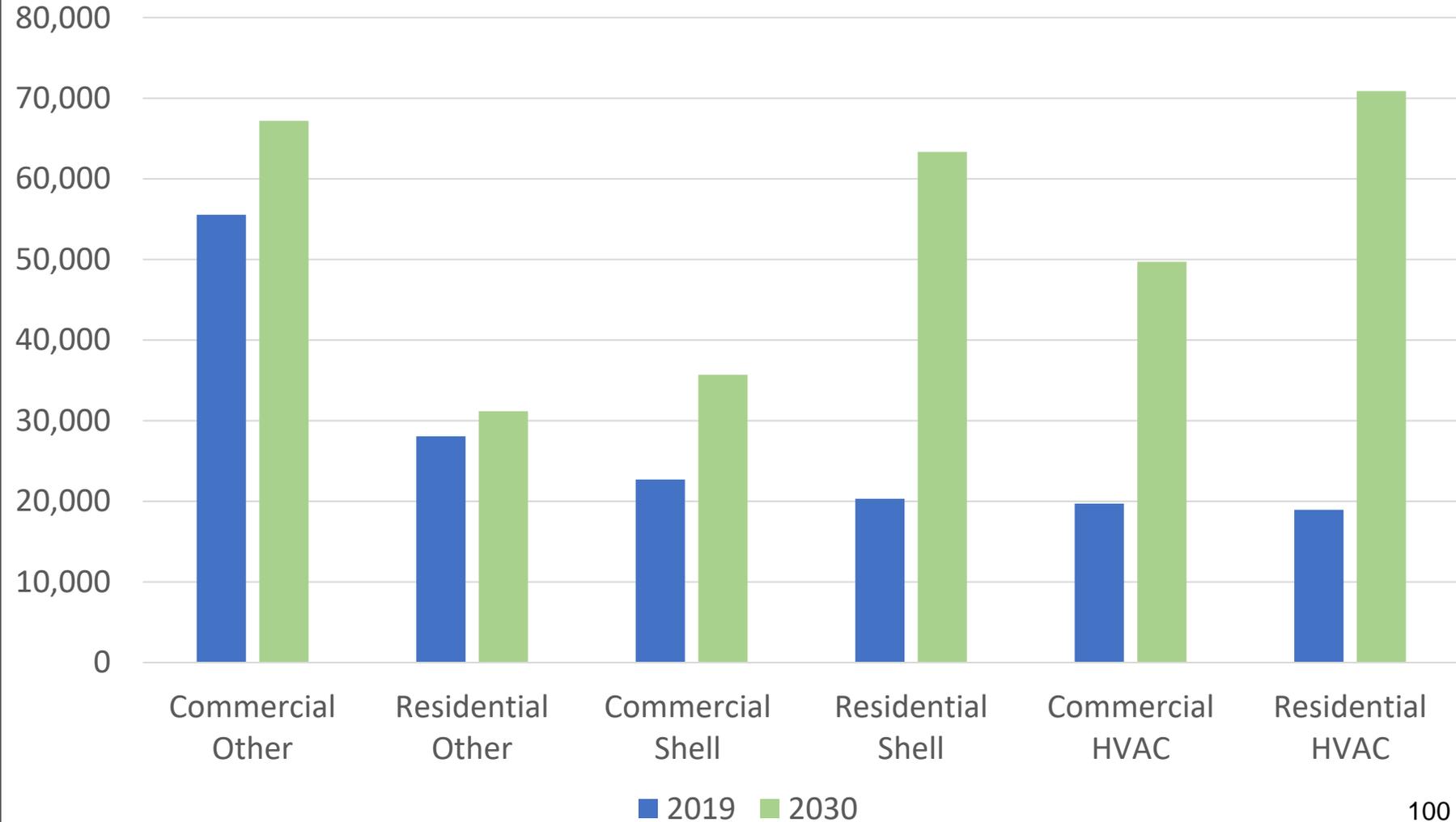
Employment in each of the Buildings sub-sectors increases from 2019 to 2030, with the largest increases found in Residential Shell, Commercial HVAC, and Residential HVAC.



## Jobs Study

# Buildings Sector Jobs Changes: S3: AT Scenario

Due to accelerated investments, the third scenario (S3:AT) sees even larger employment increases in the Buildings sub-sectors compared to the second scenario (S2:LCF).



## Jobs Study

# Key Employment Findings: Transportation Sector

**Employment in the ‘Transportation Sector’, specifically in the Vehicle Manufacturing, Wholesale Trade Parts, and Charging and Hydrogen Fuel Stations sub-sectors will grow to over 82,000 by 2040, a 34 percent increase from the 2019 workforce, and almost 21,000 jobs added.**

## Jobs Study

# Key Employment Findings:

## Transportation Sector (cont'd)

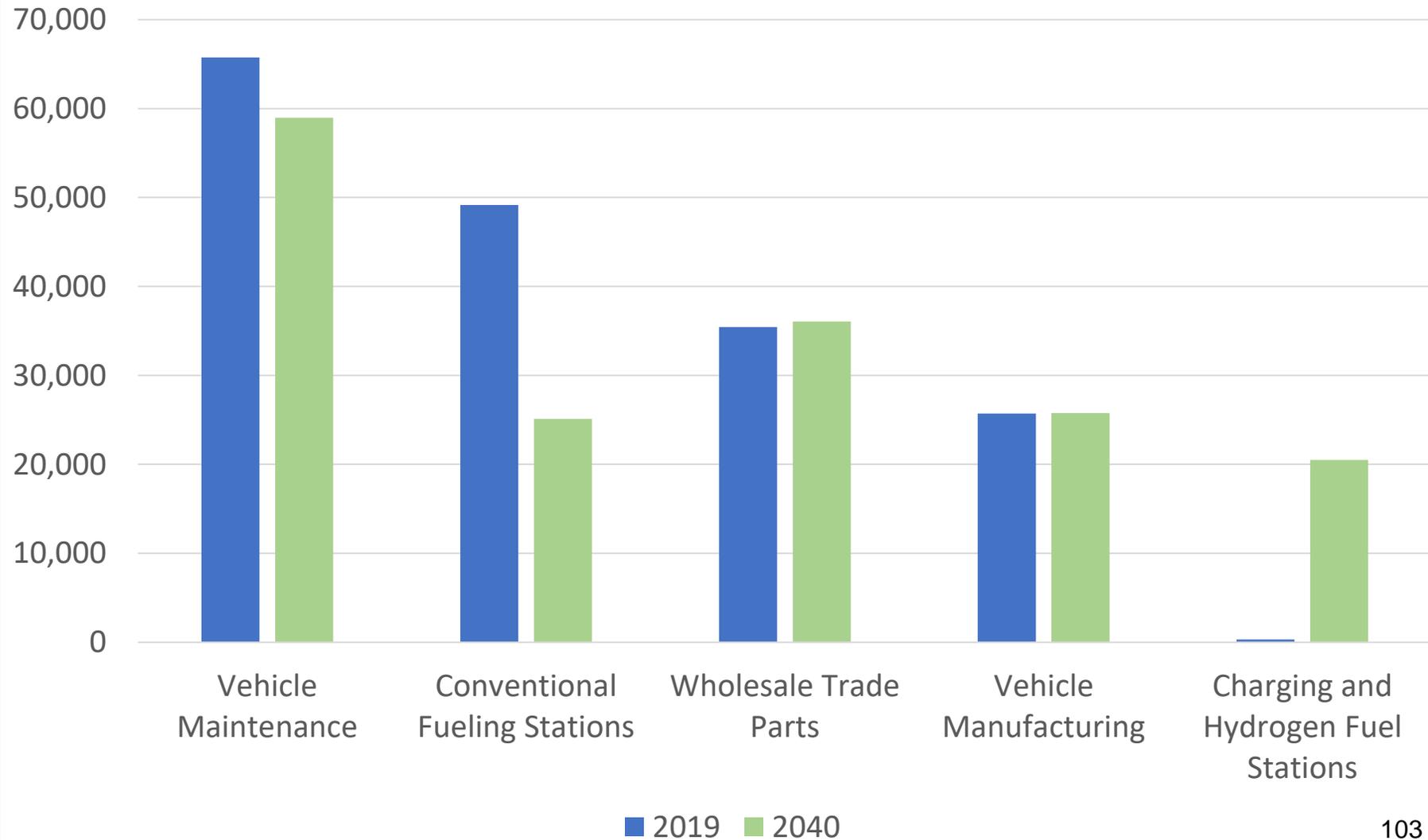
**Employment in the ‘Transportation Sector’, specifically in the Conventional Fueling Stations and Vehicle Maintenance sub-sectors falls to 84,000 by 2040, a 27 percent decline compared to the 2019 workforce. Jobs continue to decline in these sub-sectors through 2050, reaching about 75,000 in the final year of the analysis.**

**On net, overall employment in the Transportation Sector declines to approximately 176,000 by 2030, a decrease of less than 1 percent from the 2019 workforce, and 200 jobs lost. Total jobs in the Transportation Sector continue to decline through 2050, reaching about 165,000.**

## Jobs Study

# Transportation Sector Jobs Changes: S2: LCF Scenario

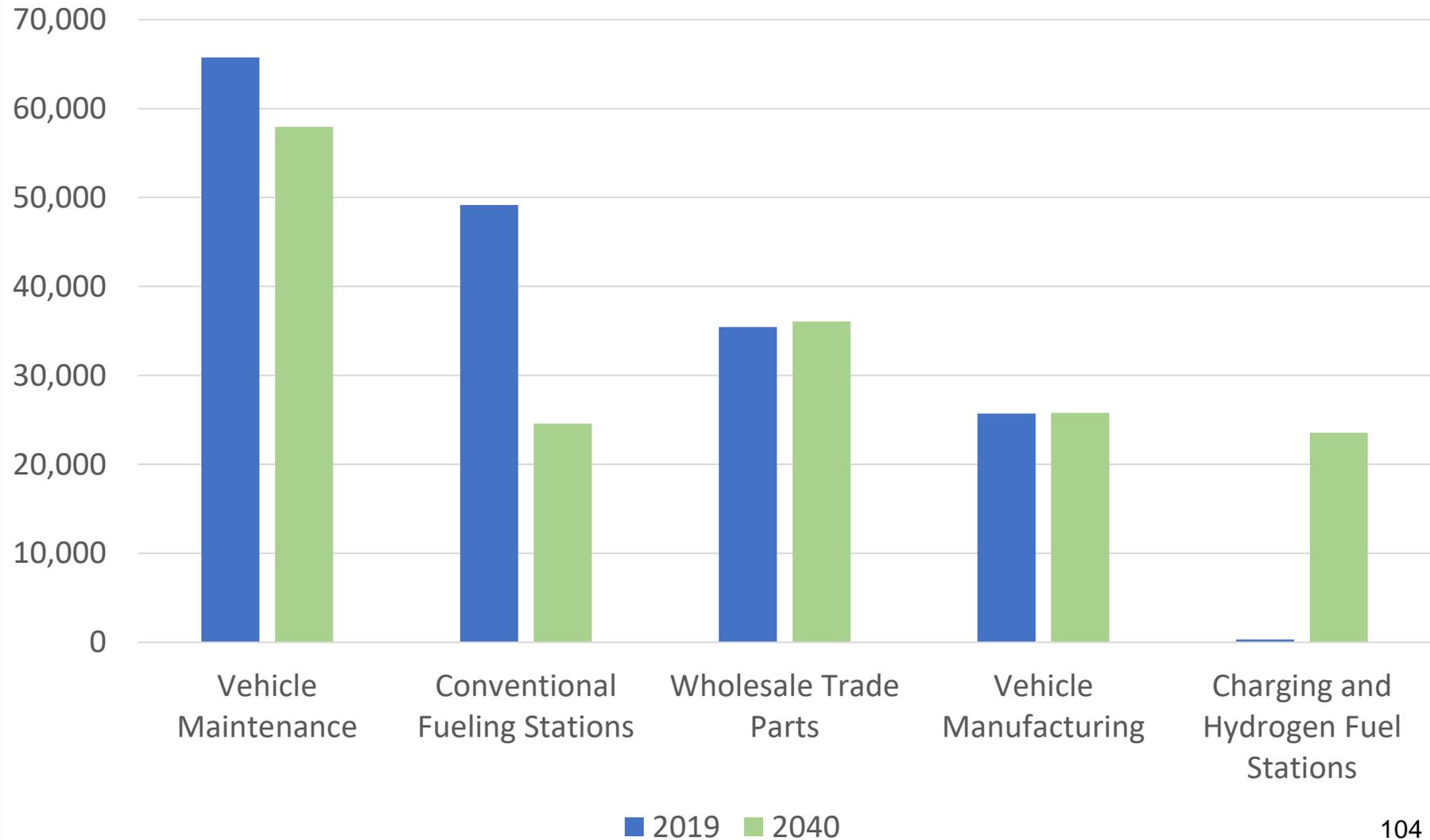
In this scenario, displaced employment in Conventional Fueling Stations and Vehicle Maintenance are somewhat offset by an increase in employment Charging and Hydrogen Fuel Stations.



## Jobs Study

# Transportation Sector Jobs Changes: S3: AT Scenario

The third scenario (S3:AT) is largely the same as the second scenario (S2: LCF), though does realize slightly greater employment in Charging and Hydrogen Fuel Stations due to accelerated investments in this infrastructure.



## Jobs Study

# Key Employment Findings: Overall

**Investments spur hundreds of thousands of new jobs in coming decades.** Employment in growth sub-sectors increases by at least 211,000 jobs by 2030, a 62 percent increase in the workforce from 2019 to 2030. Employment continues to grow in these sub-sectors by at least 346,000 jobs through 2050.

**For every job displaced, 10 jobs are added by 2030.** Employment in the displaced sub-sectors decreases by at least 22,000 jobs by 2030, a 14 percent decrease in the workforce from 2019 to 2030. Employment declines in these sub-sectors by about 77,000 jobs through 2050. Additional analysis will explore how job displacement could be offset by retiring workers coupled with job transitions.



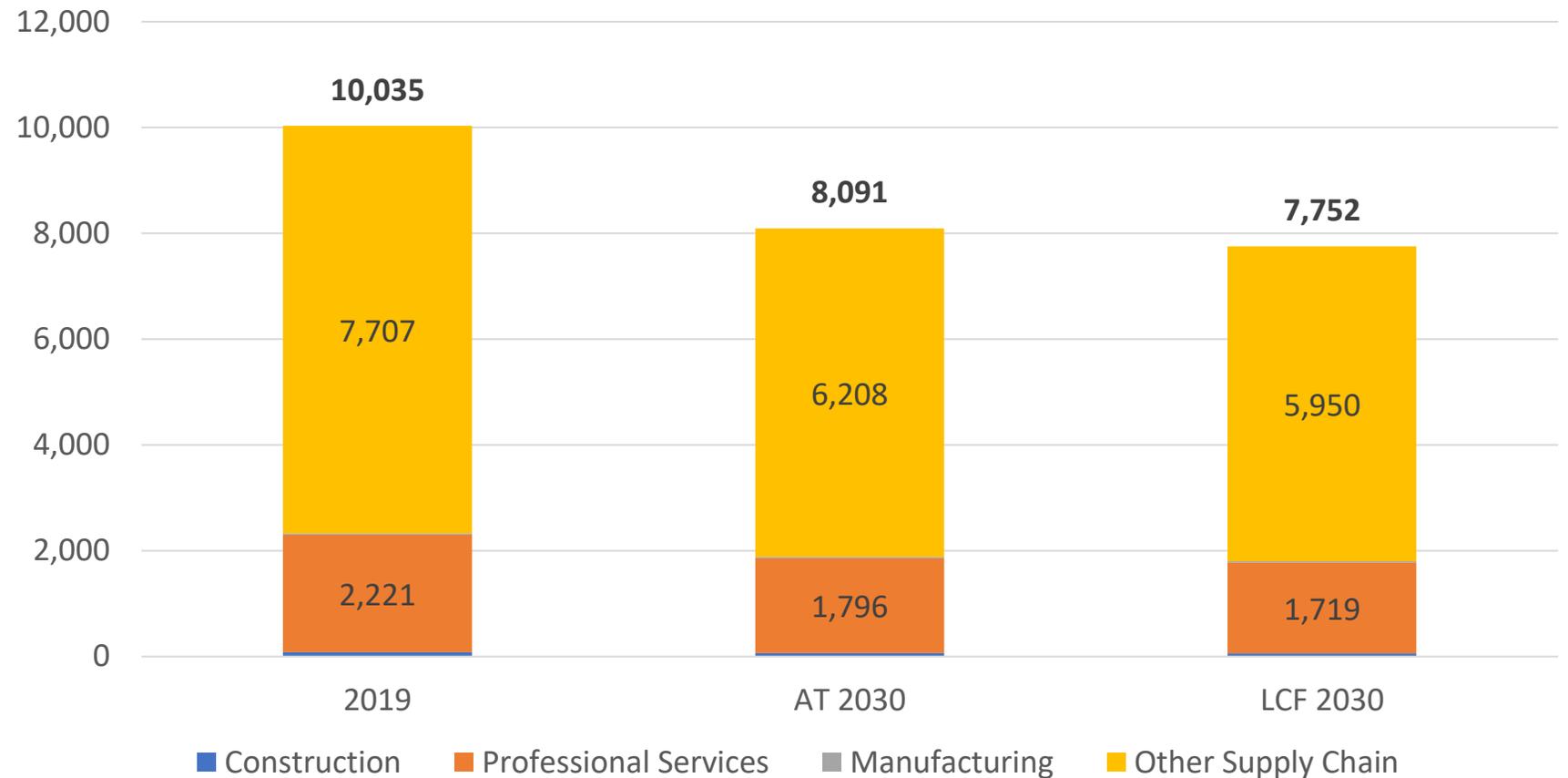
**Jobs Study**  
**Secondary**  
**Employment**  
**Outlook**  
**(Appendix)**

# Jobs Study

# SEO: Industry Profile: Electricity

# Displaced Sub-Sectors

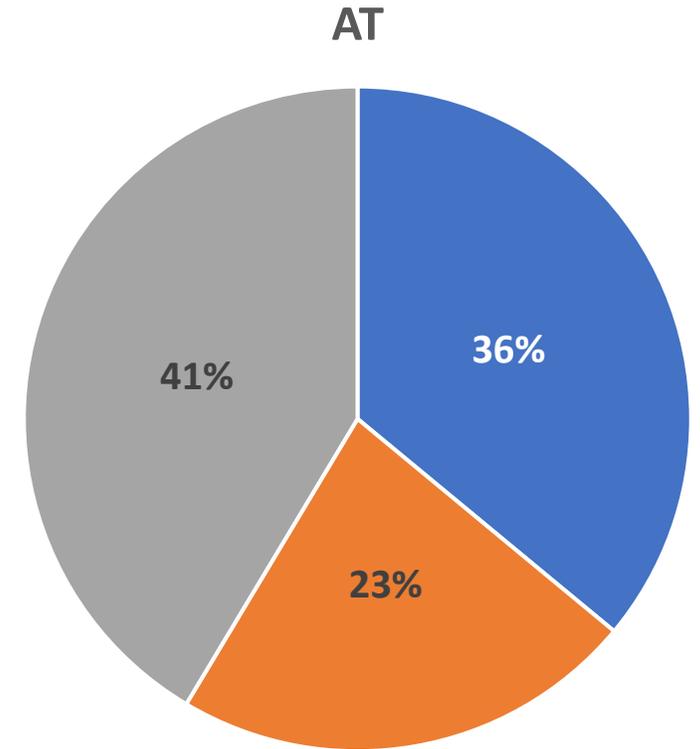
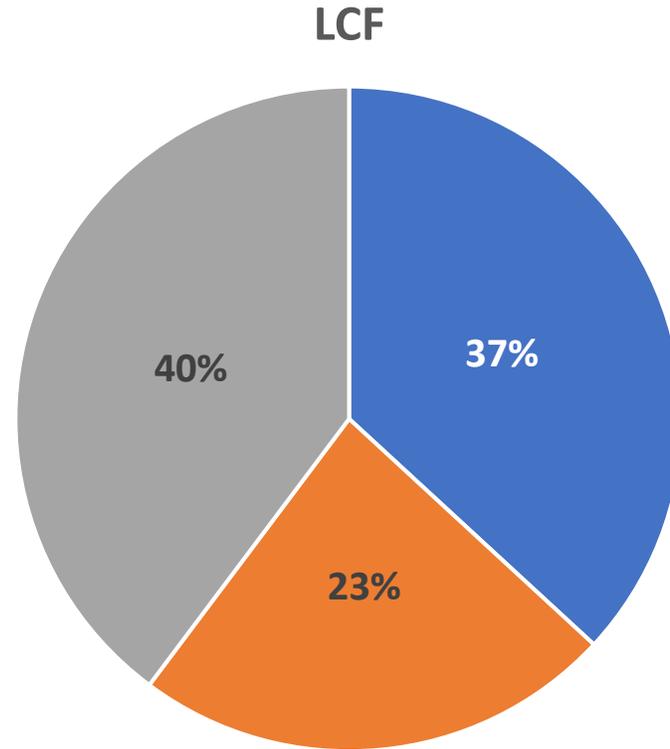
Industry employment in electricity's displaced sub-sectors (3) is almost entirely in Other Supply Chain (which includes Utilities) and Professional & Business Services.



# Jobs Study

SEO: Industry Profile: Electricity

Displaced Sub-Sectors  
Other Supply Chain

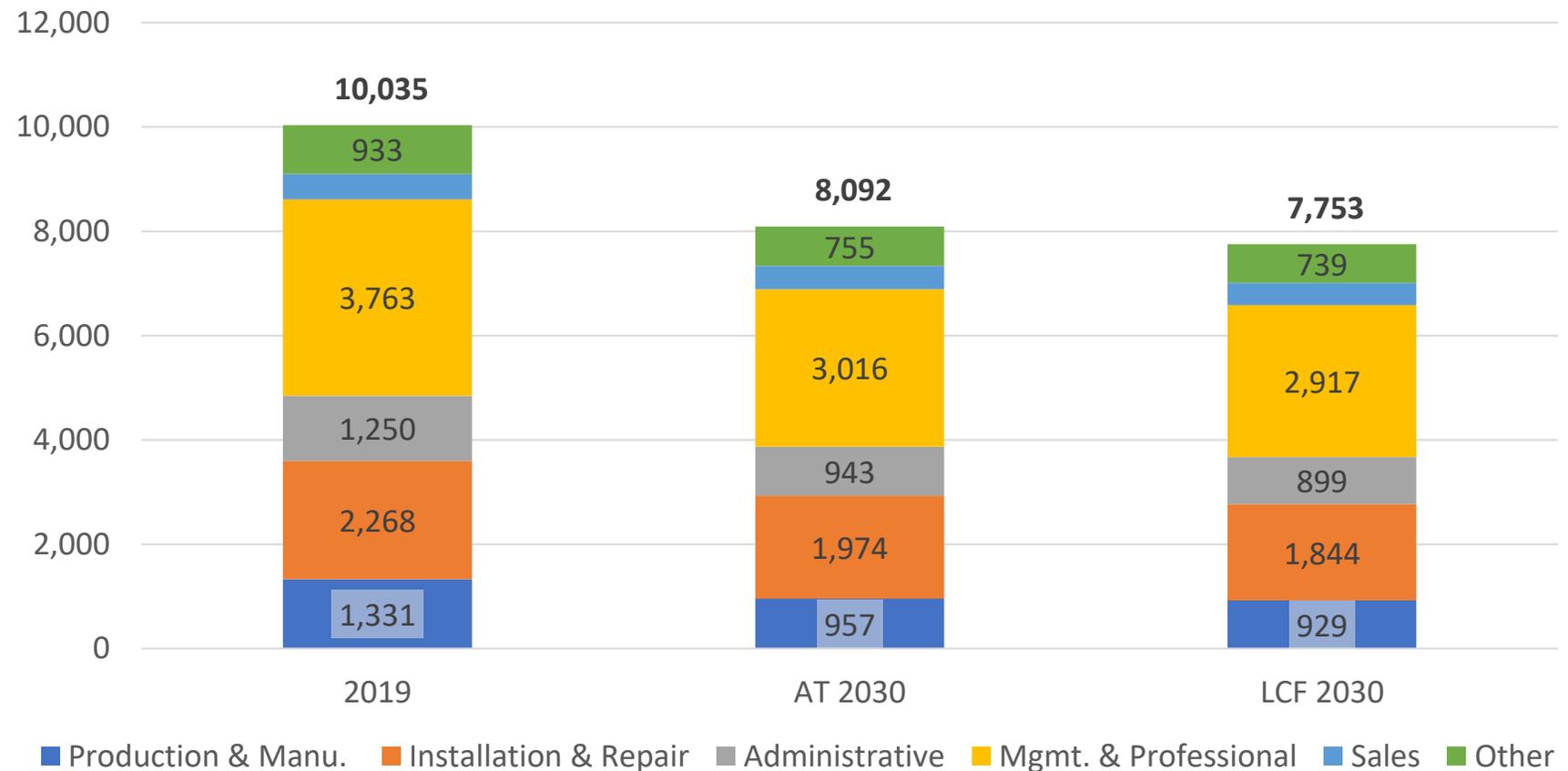


■ Wholesale ■ Utilities ■ Other

# Jobs Study

# SEO: Occupational Profile: Electricity Displaced Sub-Sectors

**Electricity's displaced sub-sectors show a consistent decline in the occupational profile of about a 20 percent decline in each of the occupational categories.**

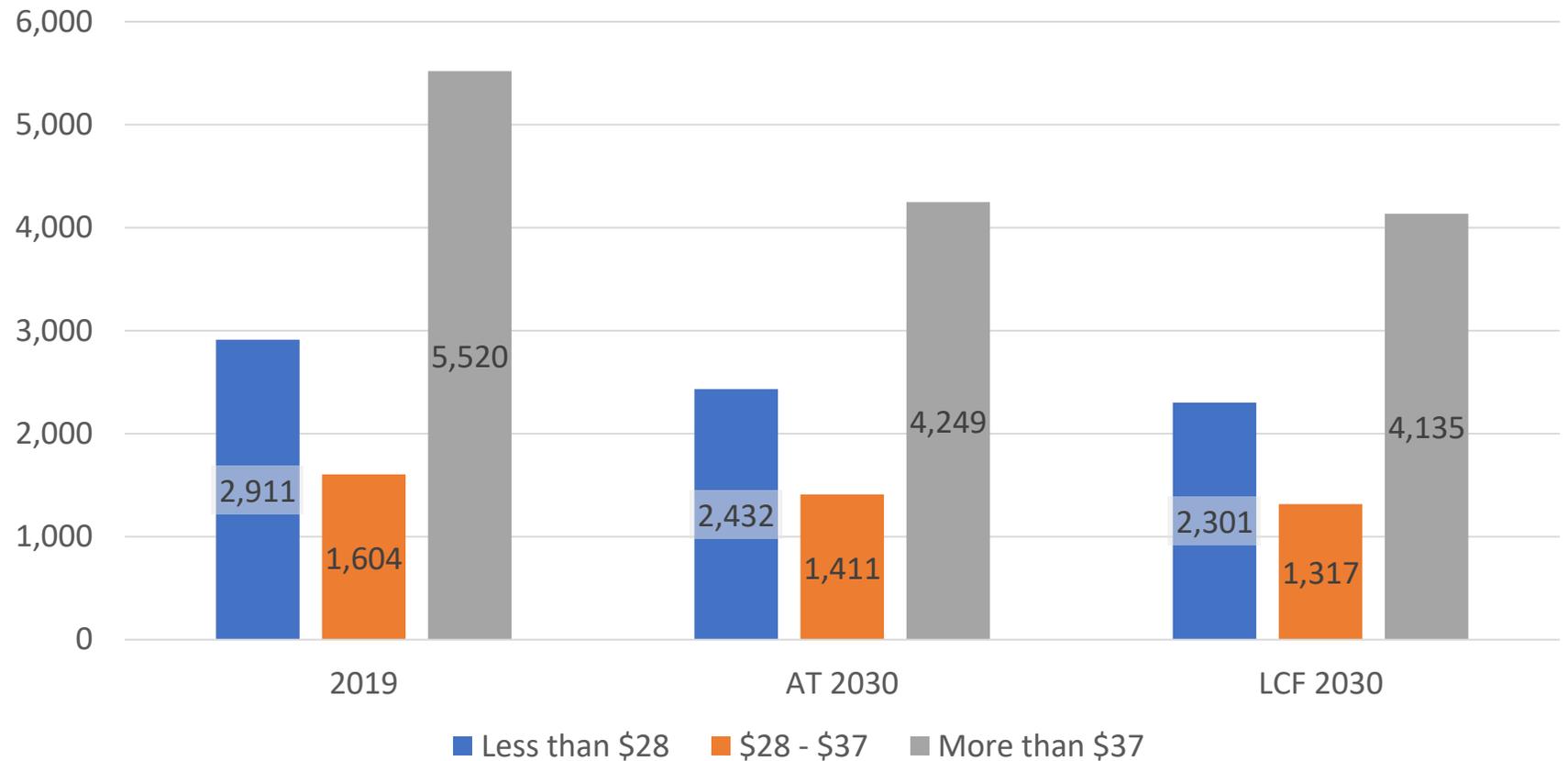


# Jobs Study

# SEO: Wage Profile: Electricity

# Displaced Sub-Sectors

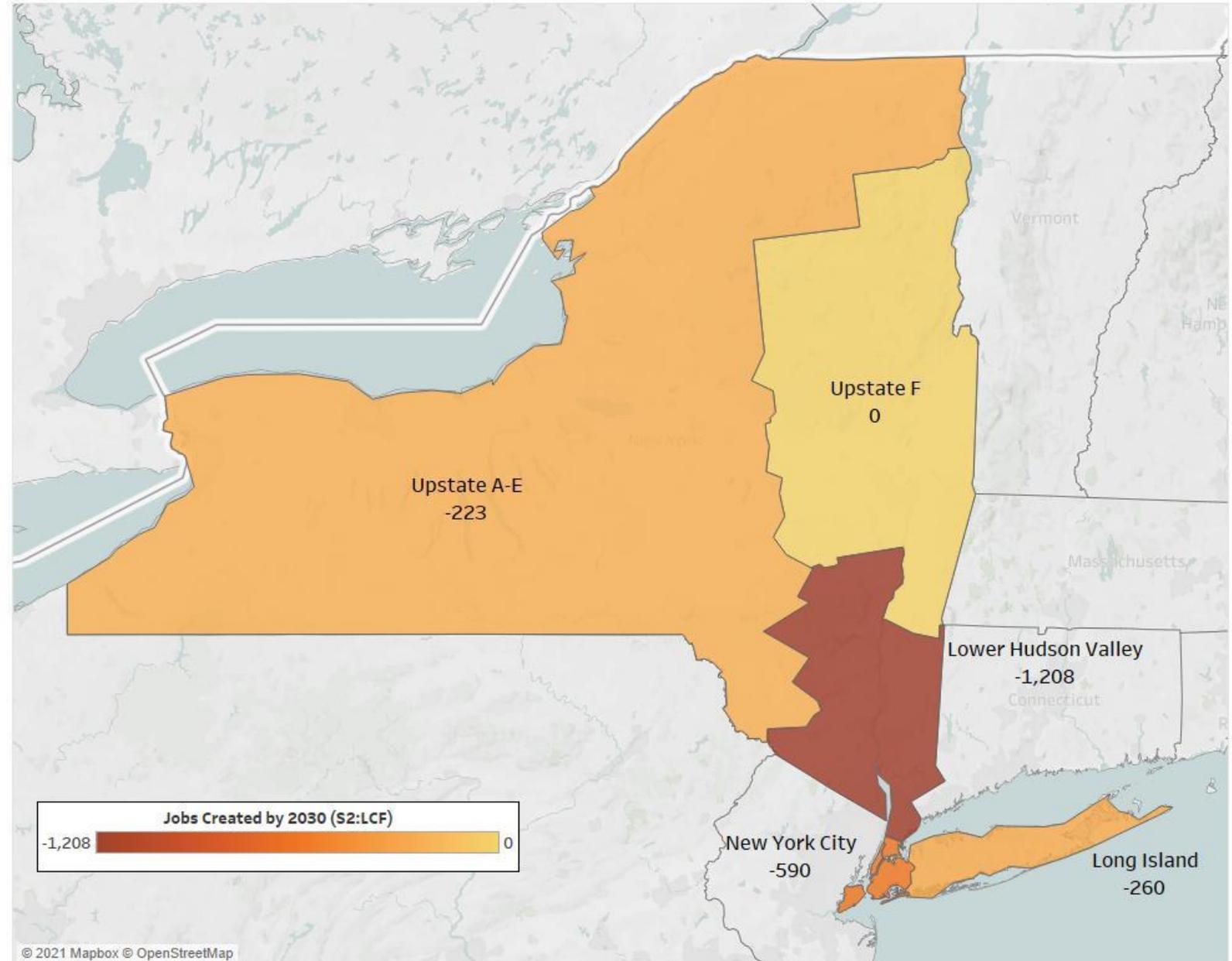
Electricity's displaced sub-sectors show declines in each of the wage categories, with the largest decline in the highest paying wage category (>\$37).



# Jobs Study

SEO:  
Geographic  
Profile:  
Electricity  
S2:LCF

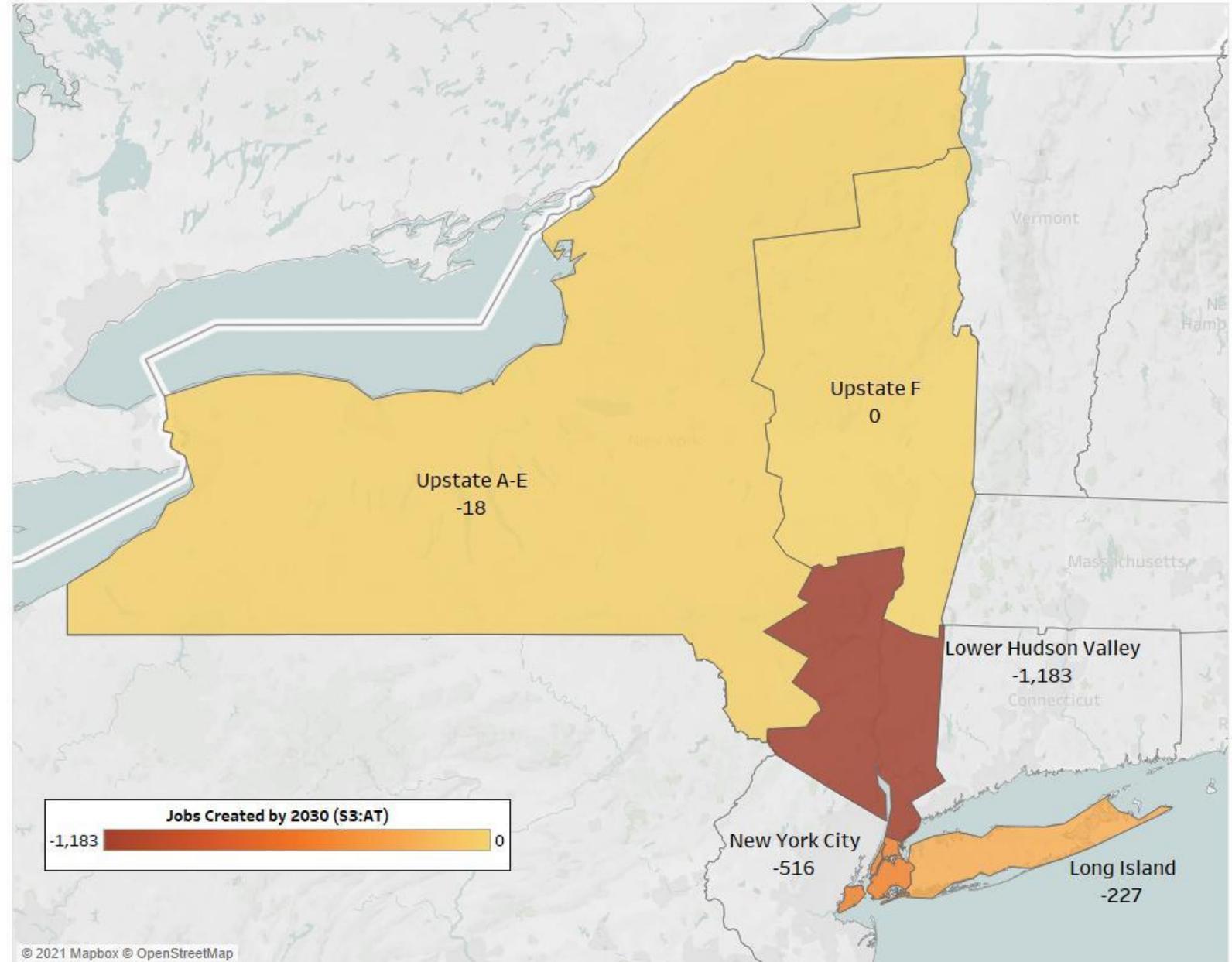
Displaced  
Sub-Sectors



# Jobs Study

SEO:  
 Geographic  
 Profile:  
 Electricity  
 S3:AT

Displaced  
 Sub-Sectors

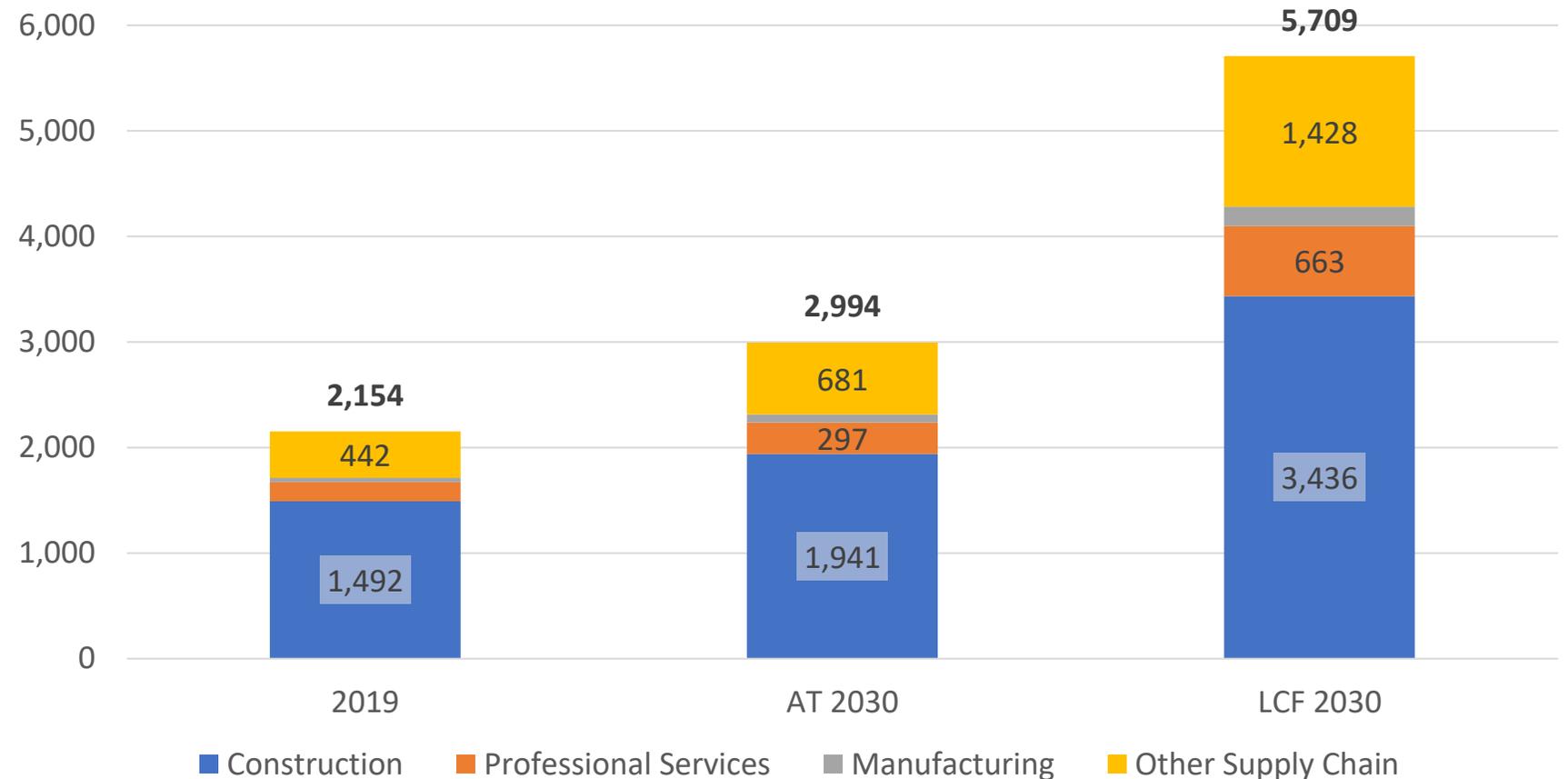


## Jobs Study

# SEO: Industry Profile: Fuels

## Growth Sub-Sectors

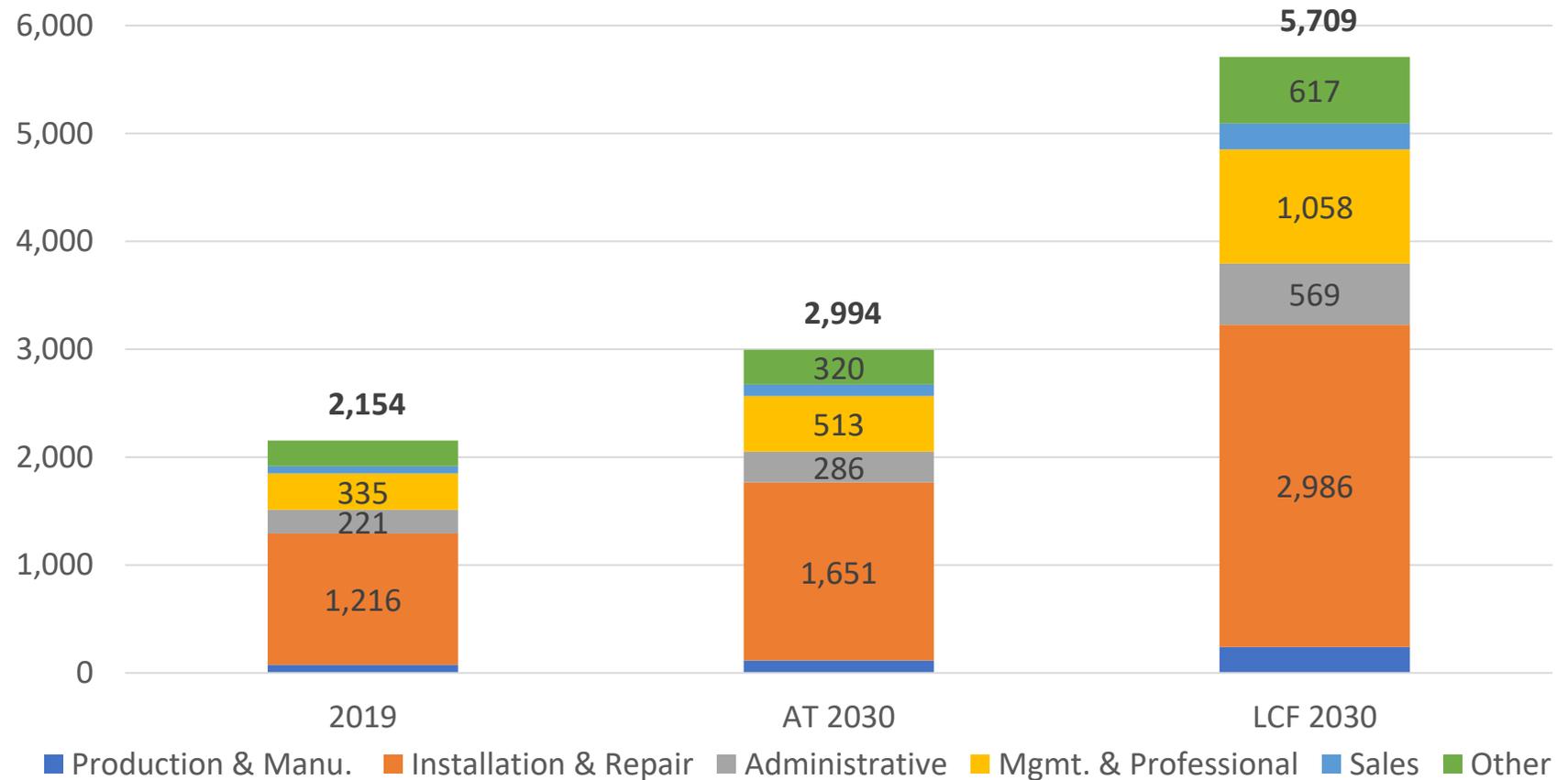
Fuel's growth sub-sectors (2) experience consistent growth in the professional services, manufacturing, & other supply chain industries with a more than doubling of the construction industry under the S2:LCF scenario.



## Jobs Study

# SEO: Occupational Profile: Fuels Growth Sub-Sectors

Fuel's growth sub-sectors expect some growth in all of the major occupational categories, with a majority of the positions found in installation and repair.

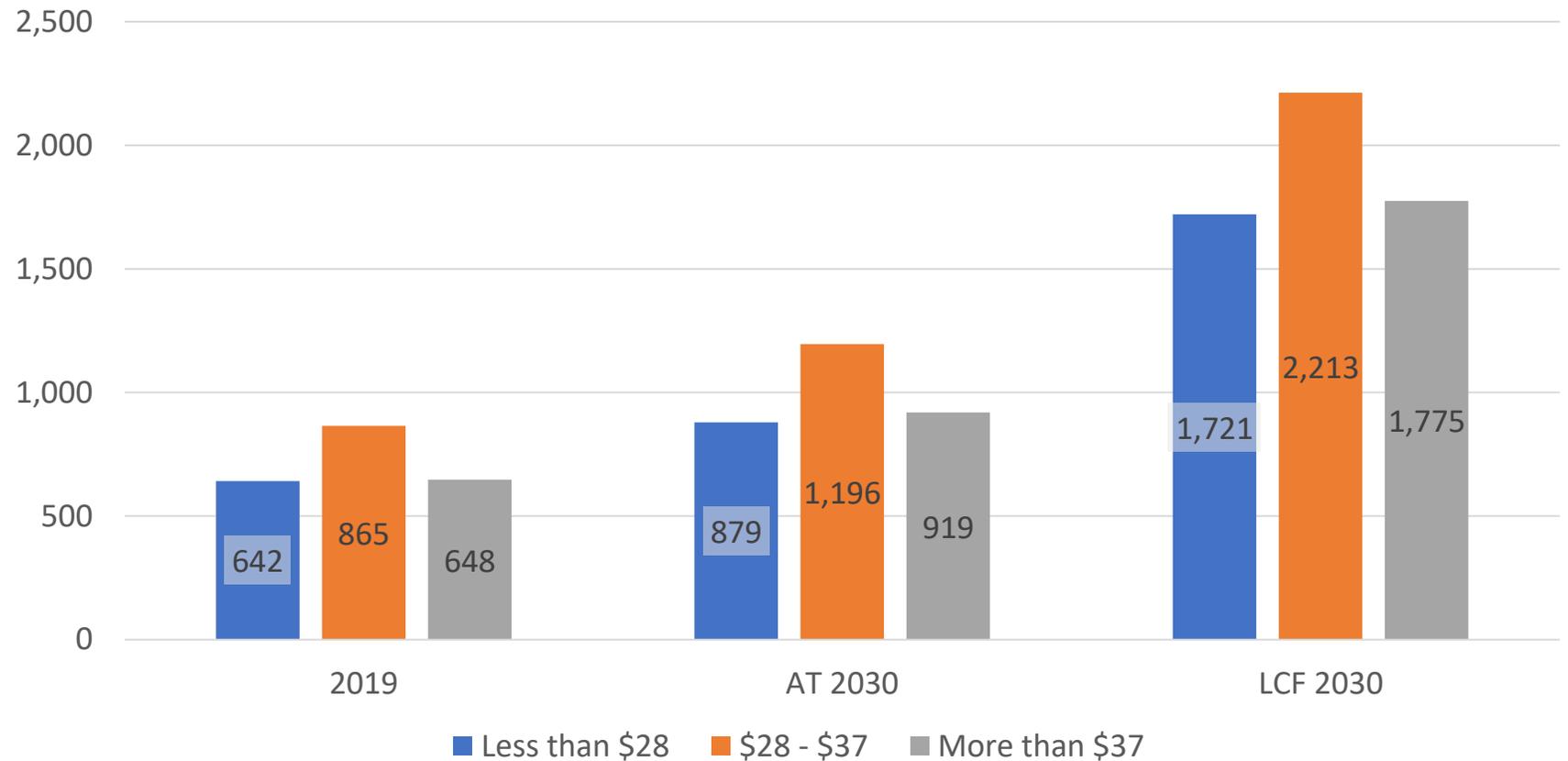


## Jobs Study

# SEO: Wage Profile: Fuels

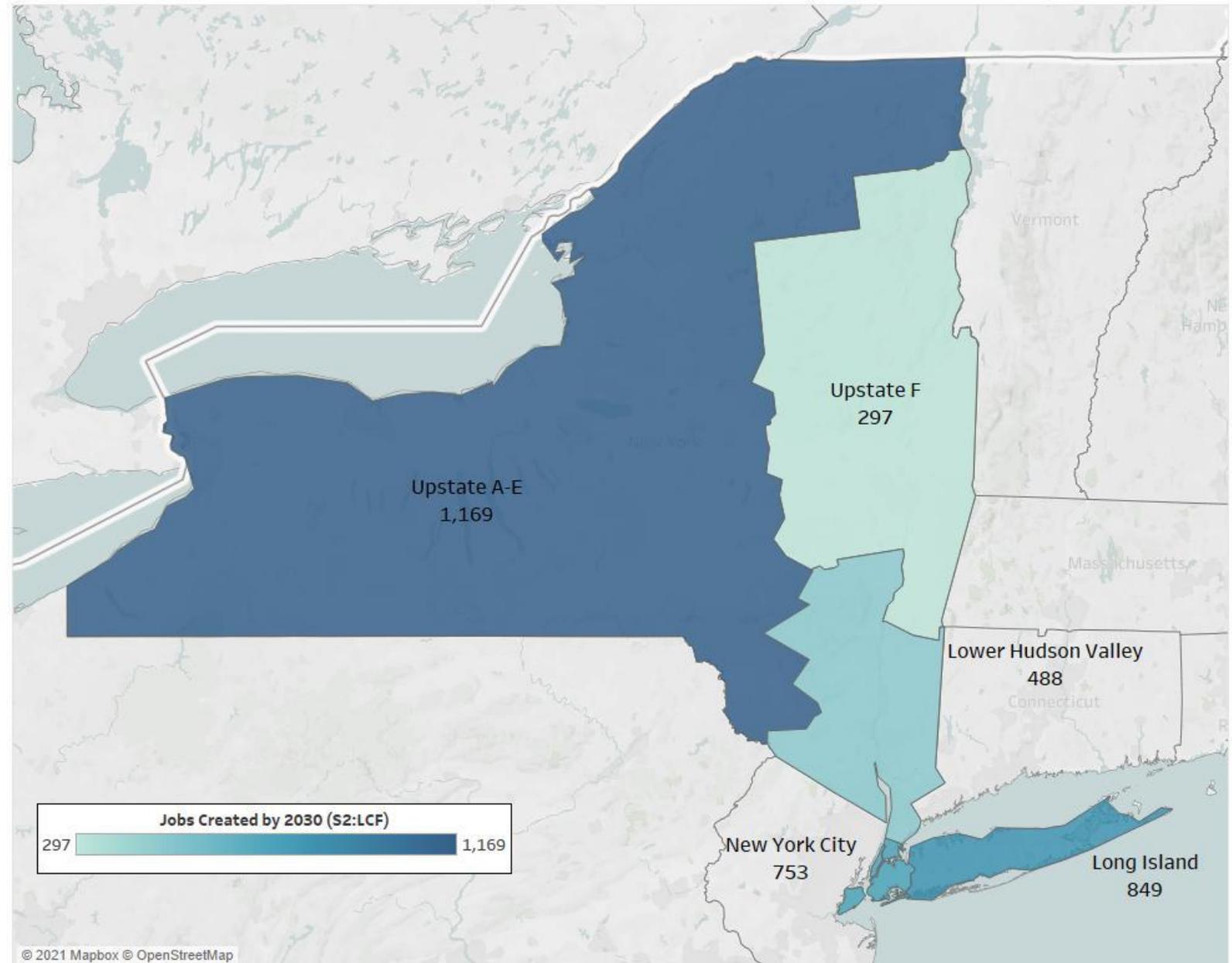
# Growth Sub-Sectors

Fuel's growth sub-sectors experience the highest growth between 2019 and 2030 in the highest wage category (>\$37) positions.



# Jobs Study

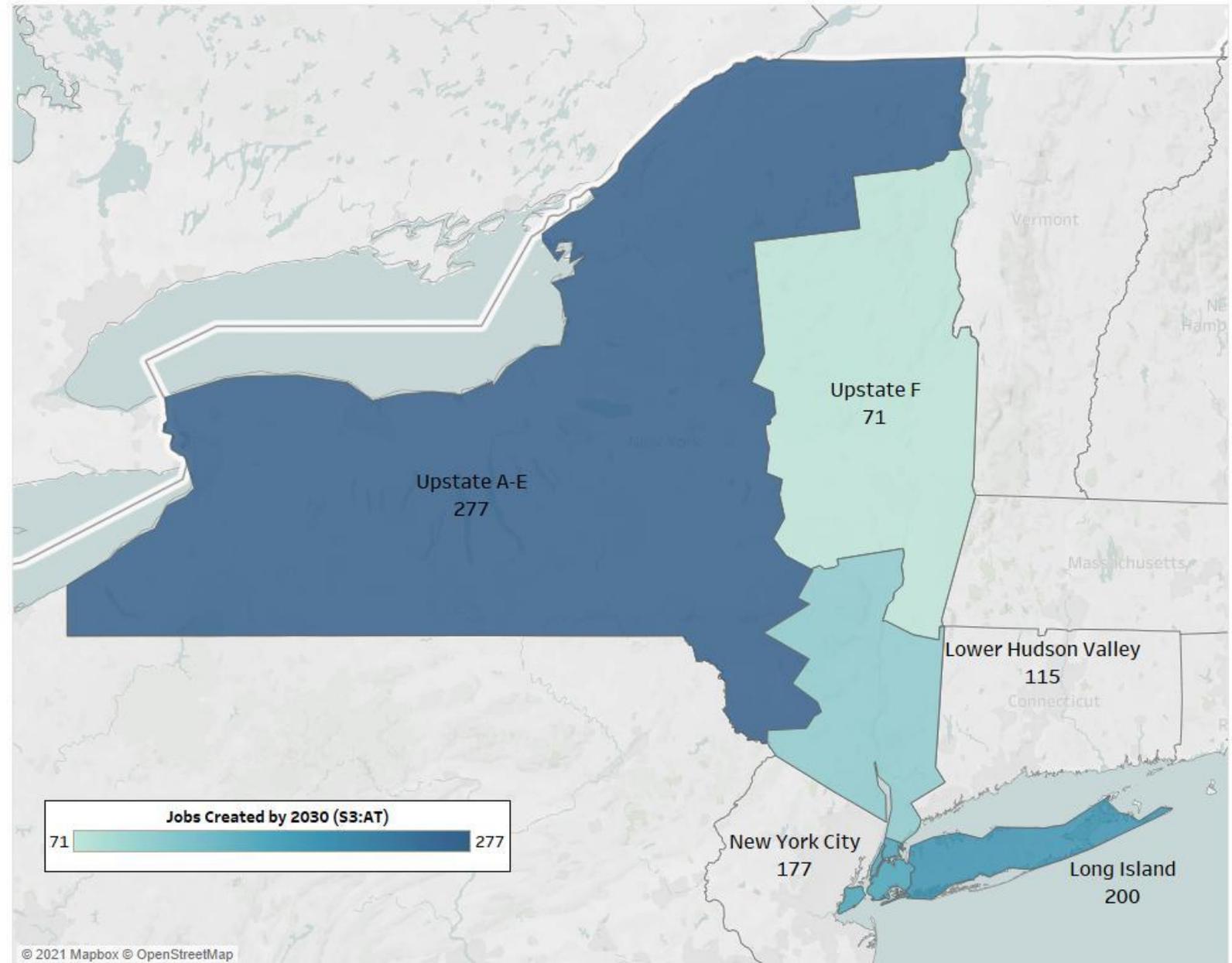
SEO:  
Geographic  
Profile:  
Fuels  
S2:LCF  
  
Growth  
Sub-Sectors



# Jobs Study

SEO:  
Geographic  
Profile:  
Fuels  
S3:AT

Growth  
Sub-Sectors

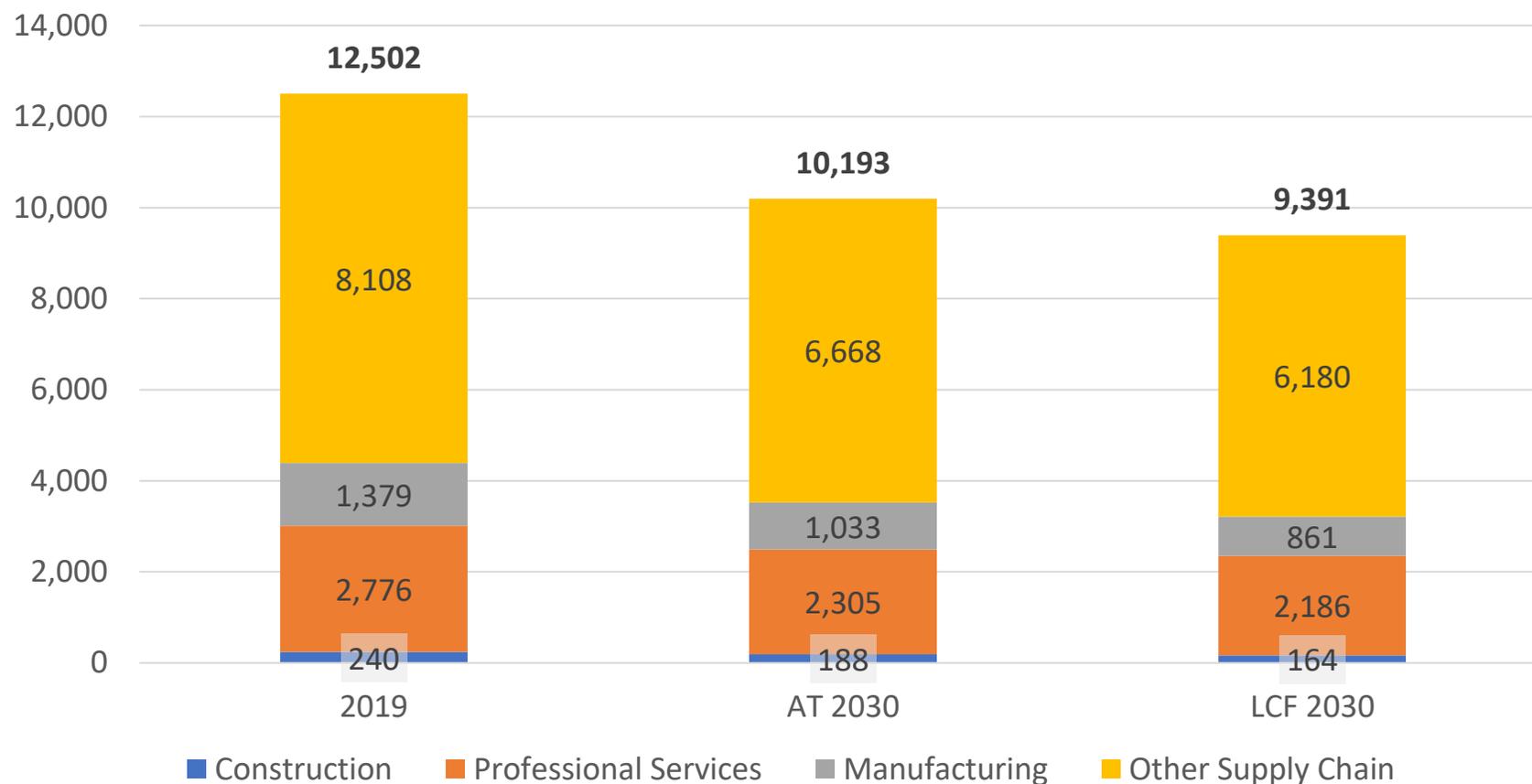


## Jobs Study

# SEO: Industry Profile: Fuels

## Displaced Sub-Sectors

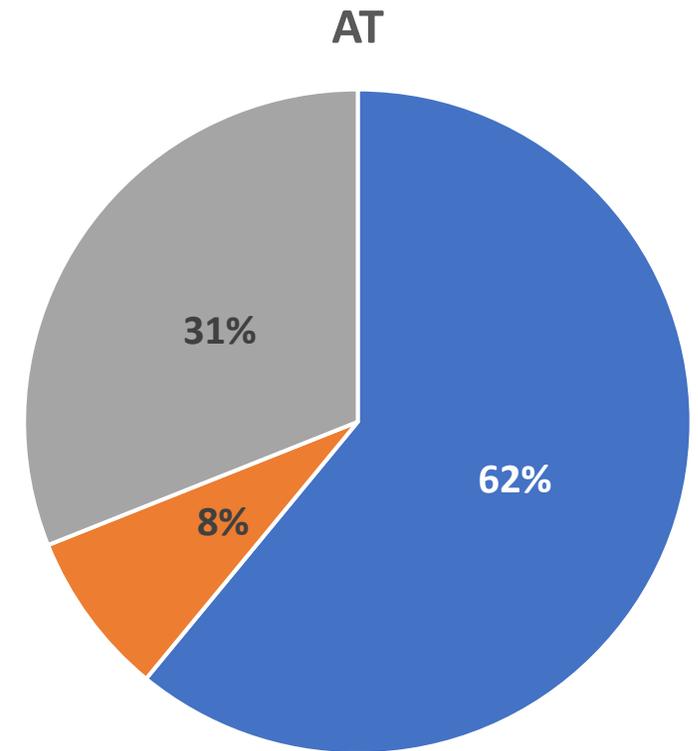
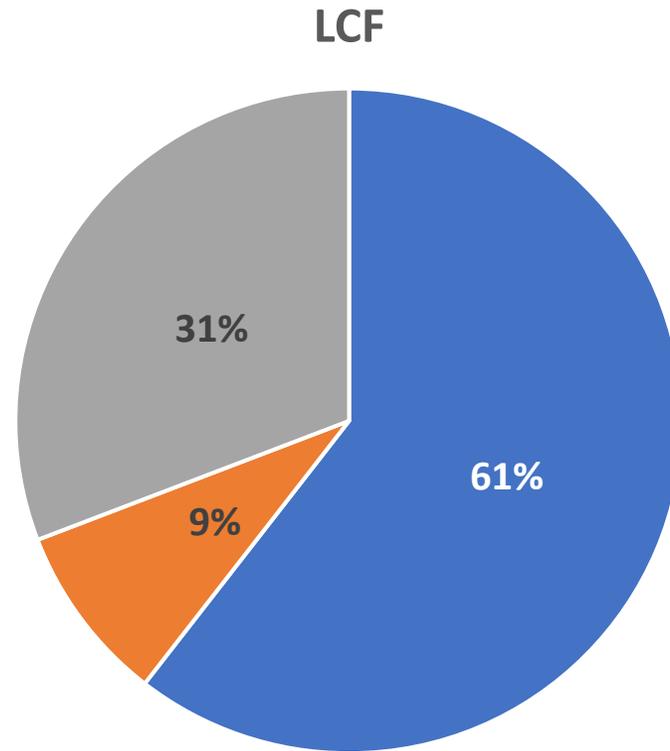
Industry employment in fuels displaced sub-sectors (3) is largely in Other Supply Chain (which includes Utilities) and Professional & Business Services, and to a lesser degree Manufacturing.



## Jobs Study

SEO: Industry  
Profile:  
Fuels

Displaced  
Sub-Sectors  
Other Supply  
Chain

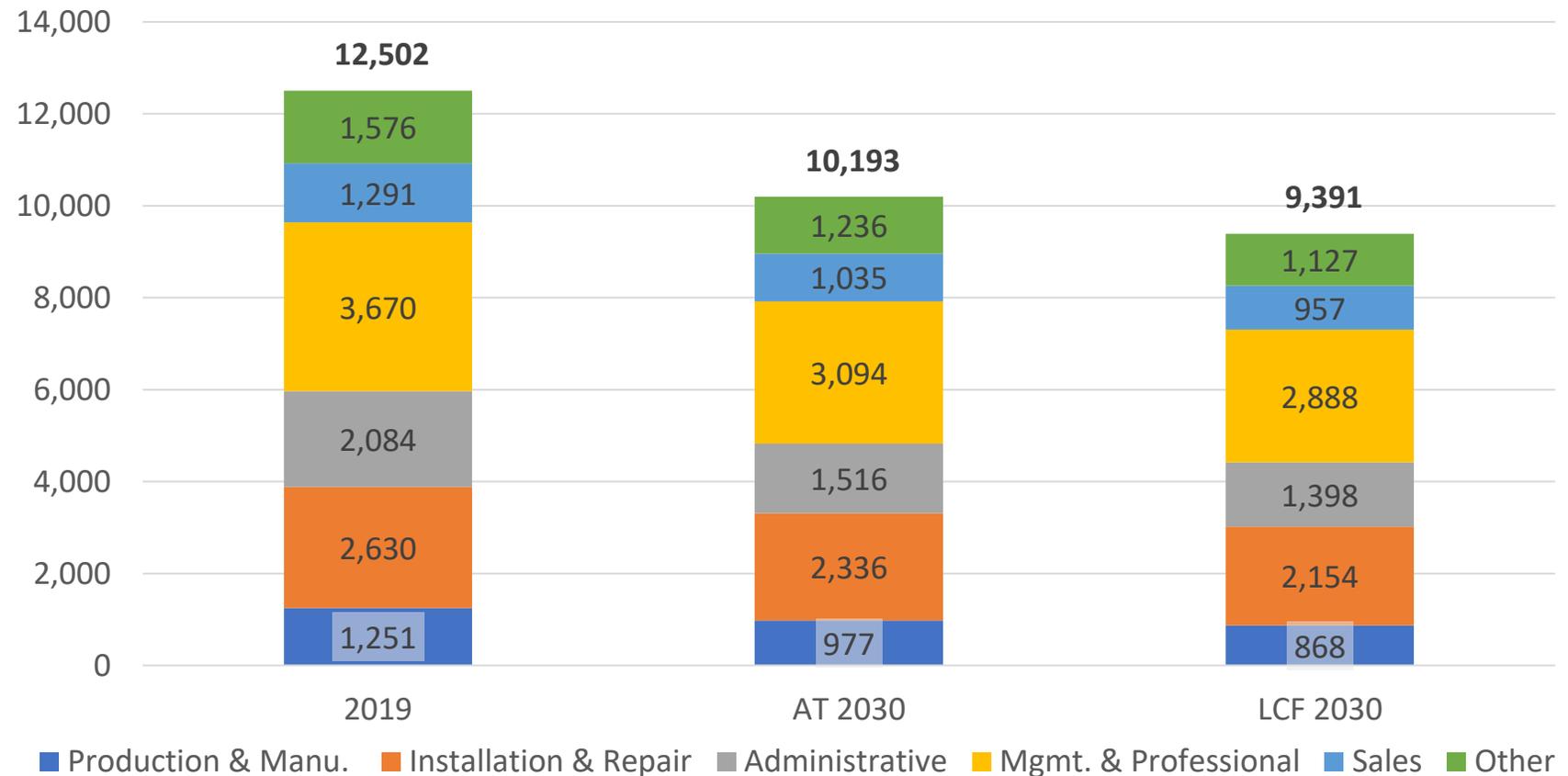


■ Wholesale ■ Utilities ■ Other

## Jobs Study

# SEO: Occupational Profile: Fuels Displaced Sub-Sectors

**Fuel's displaced sub-sectors show a consistent decline in the occupational profile of each of the occupational categories from 2019 to 2030.**

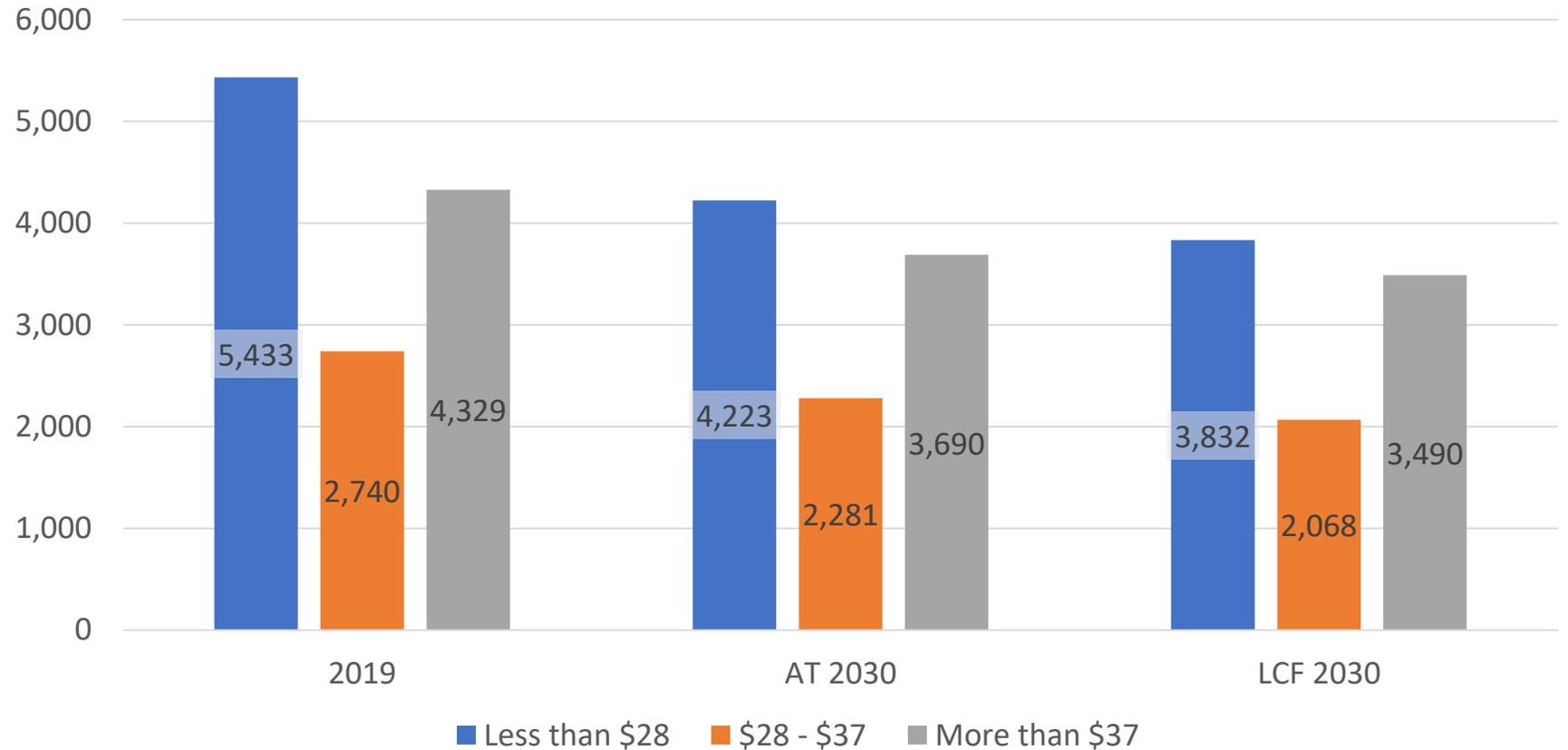


## Jobs Study

# SEO: Wage Profile: Fuels

# Displaced Sub-Sectors

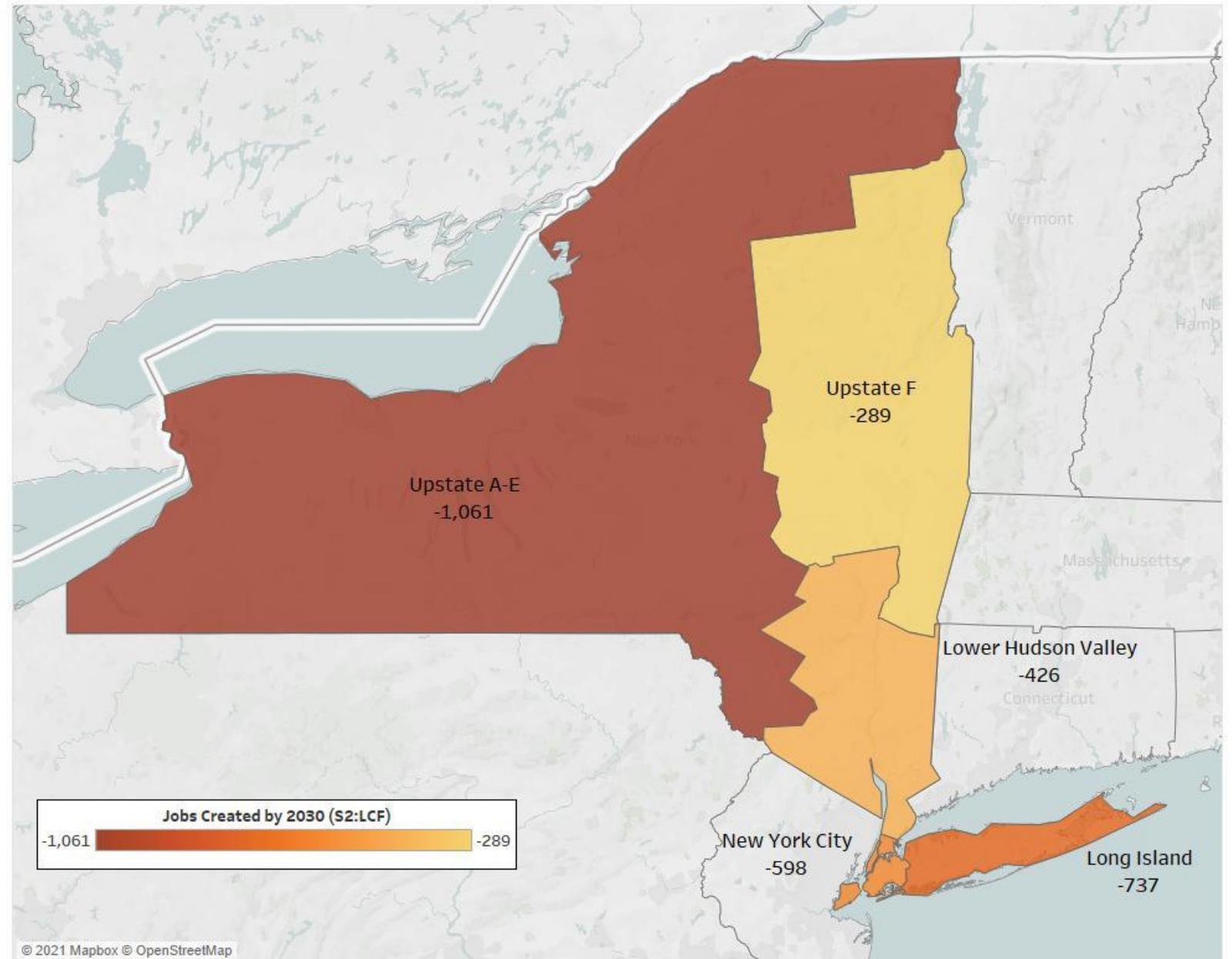
Fuel's displaced sub-sectors show the largest decline from 2019 to 2030 in its lowest paying wage category (<\$28).



# Jobs Study

SEO:  
Geographic  
Profile:  
Fuels  
S2:LCF

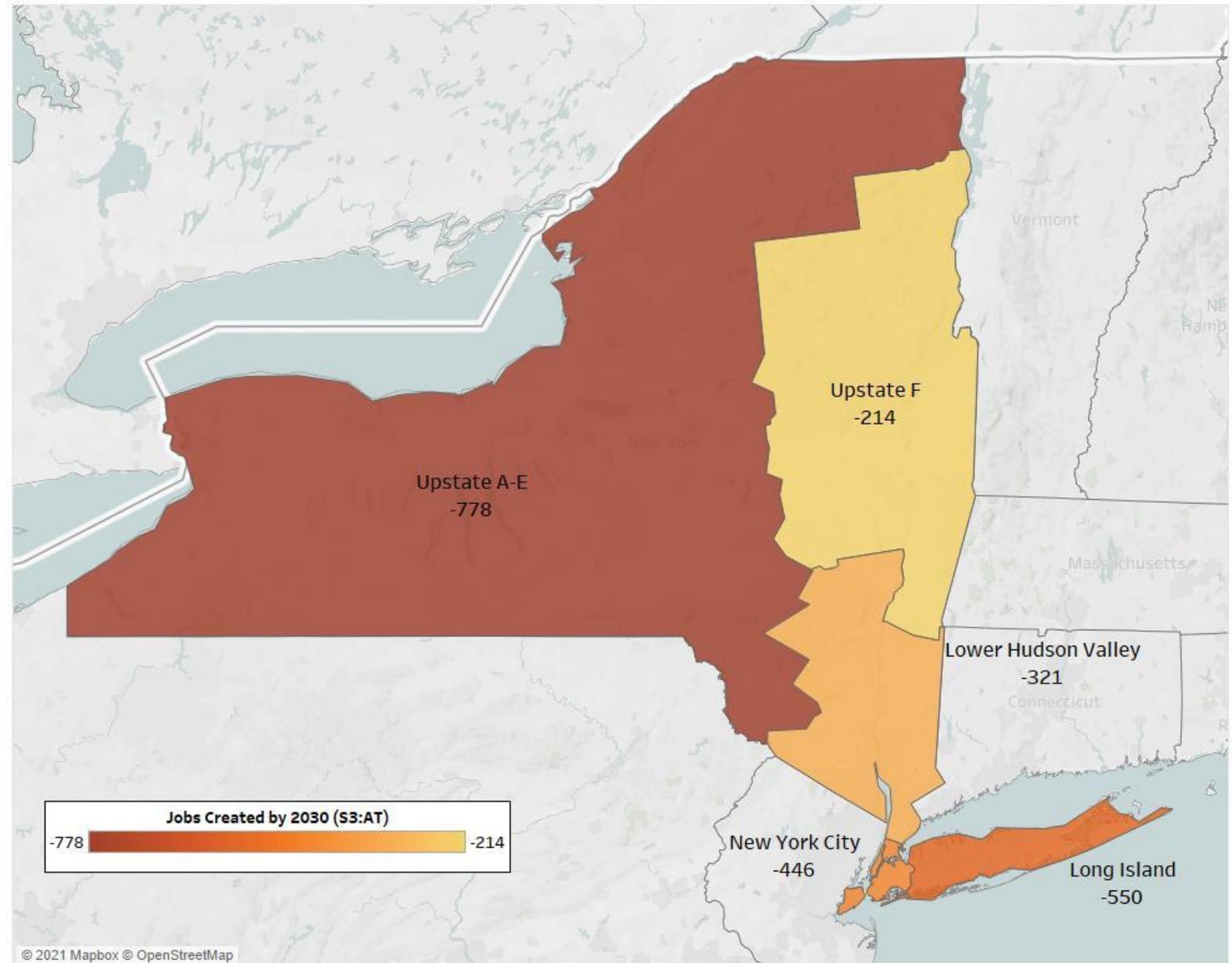
Displaced  
Sub-Sectors



# Jobs Study

SEO:  
Geographic  
Profile:  
Fuels  
S3:AT

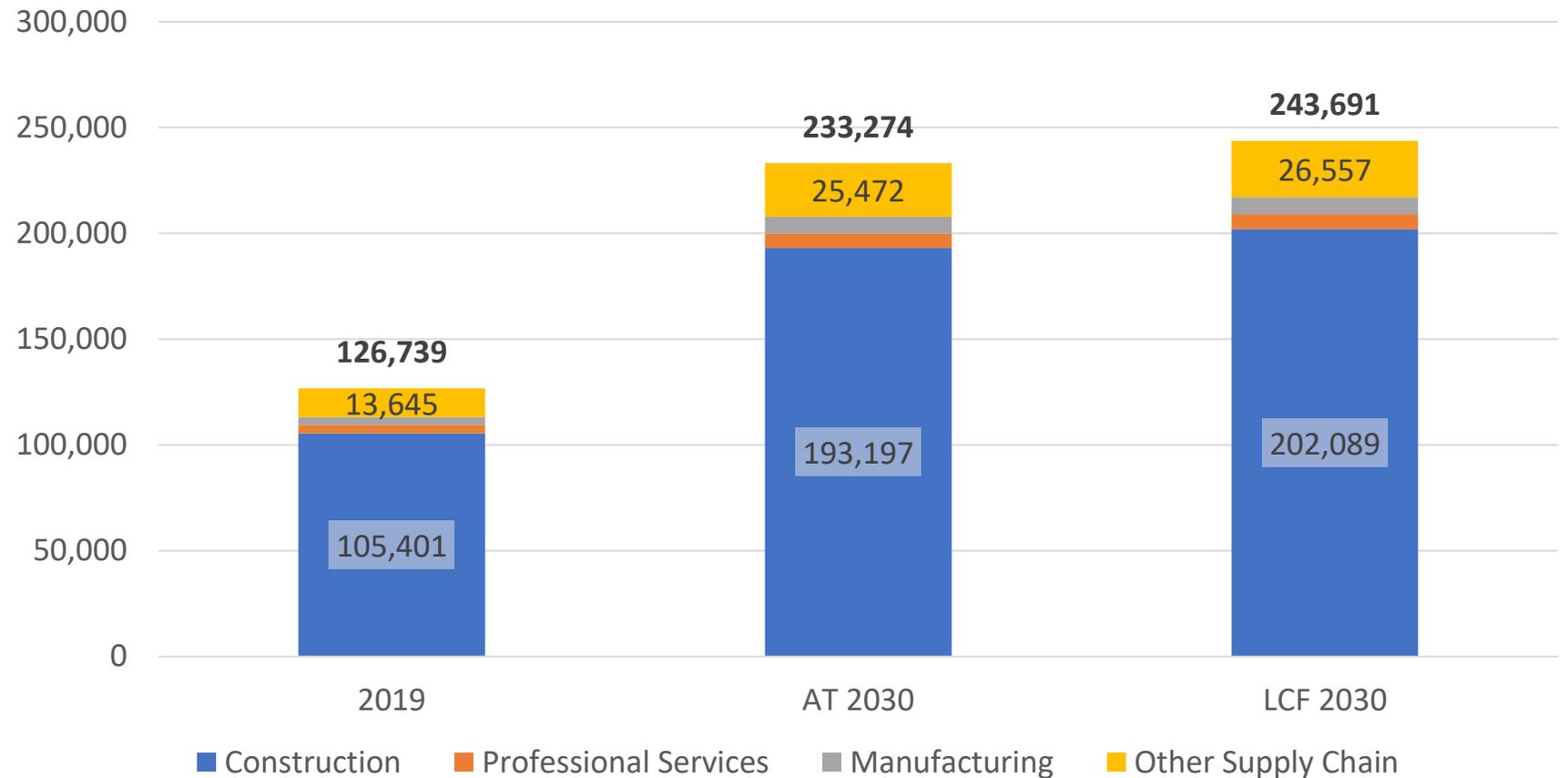
Displaced  
Sub-Sectors



## Jobs Study

# SEO: Industry Profile: Buildings

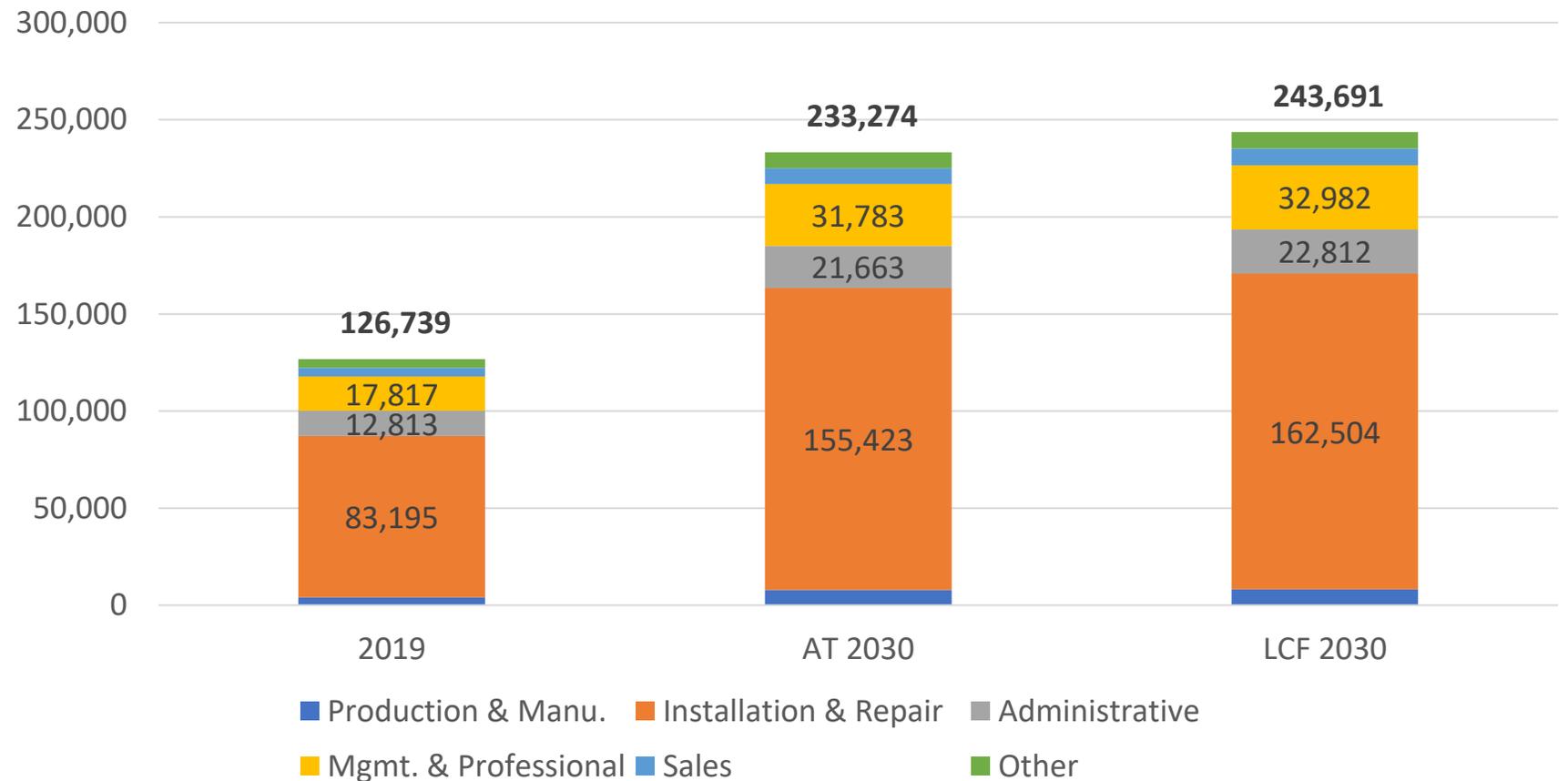
The Buildings sector experiences consistent growth in each of the industries, with the majority of employment found in the construction industry for both time periods and both scenarios.



## Jobs Study

# SEO: Occupational Profile: Buildings

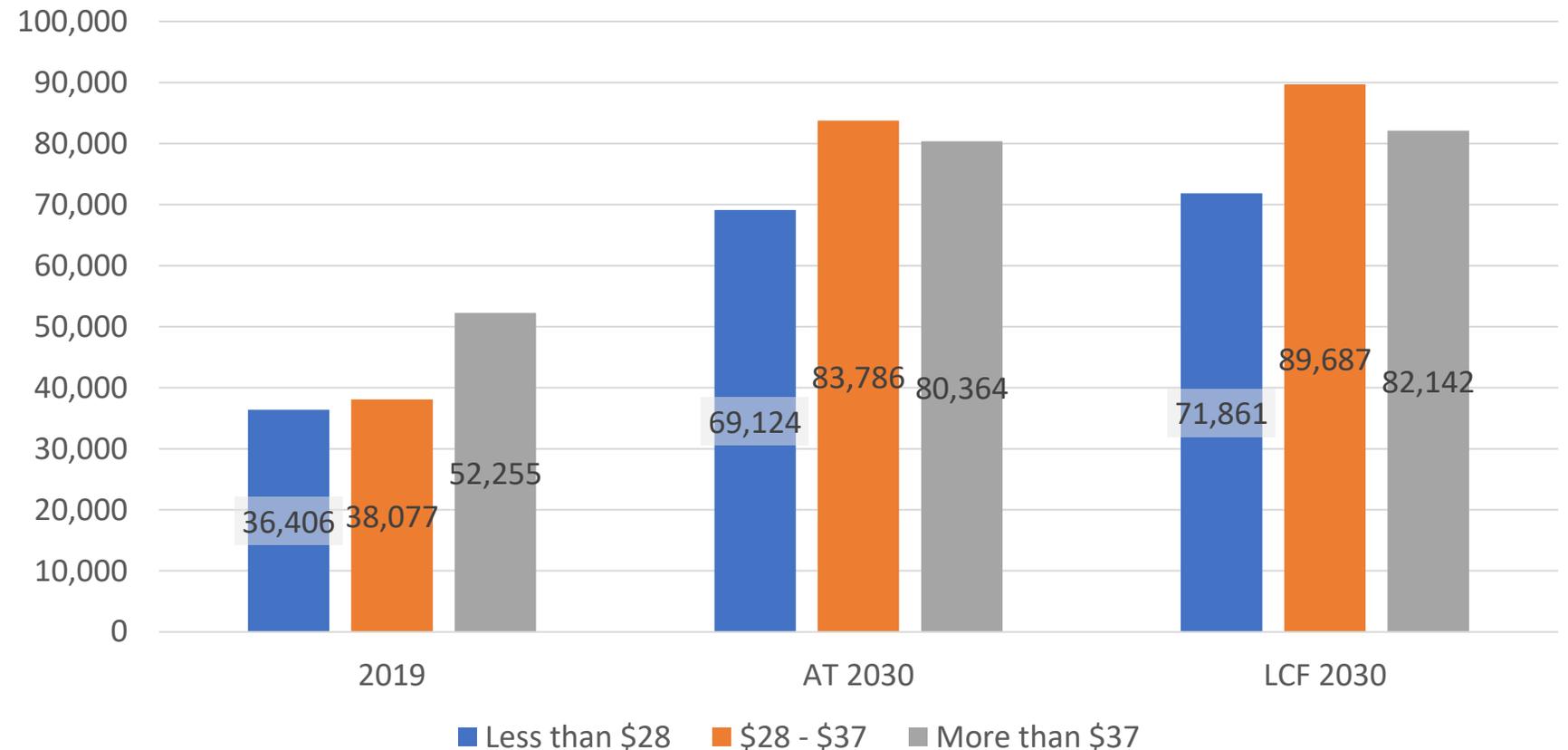
**Buildings' growth sub-sectors expect consistent growth in all of the major occupational groups with an almost doubling of installation and repair positions.**



## Jobs Study

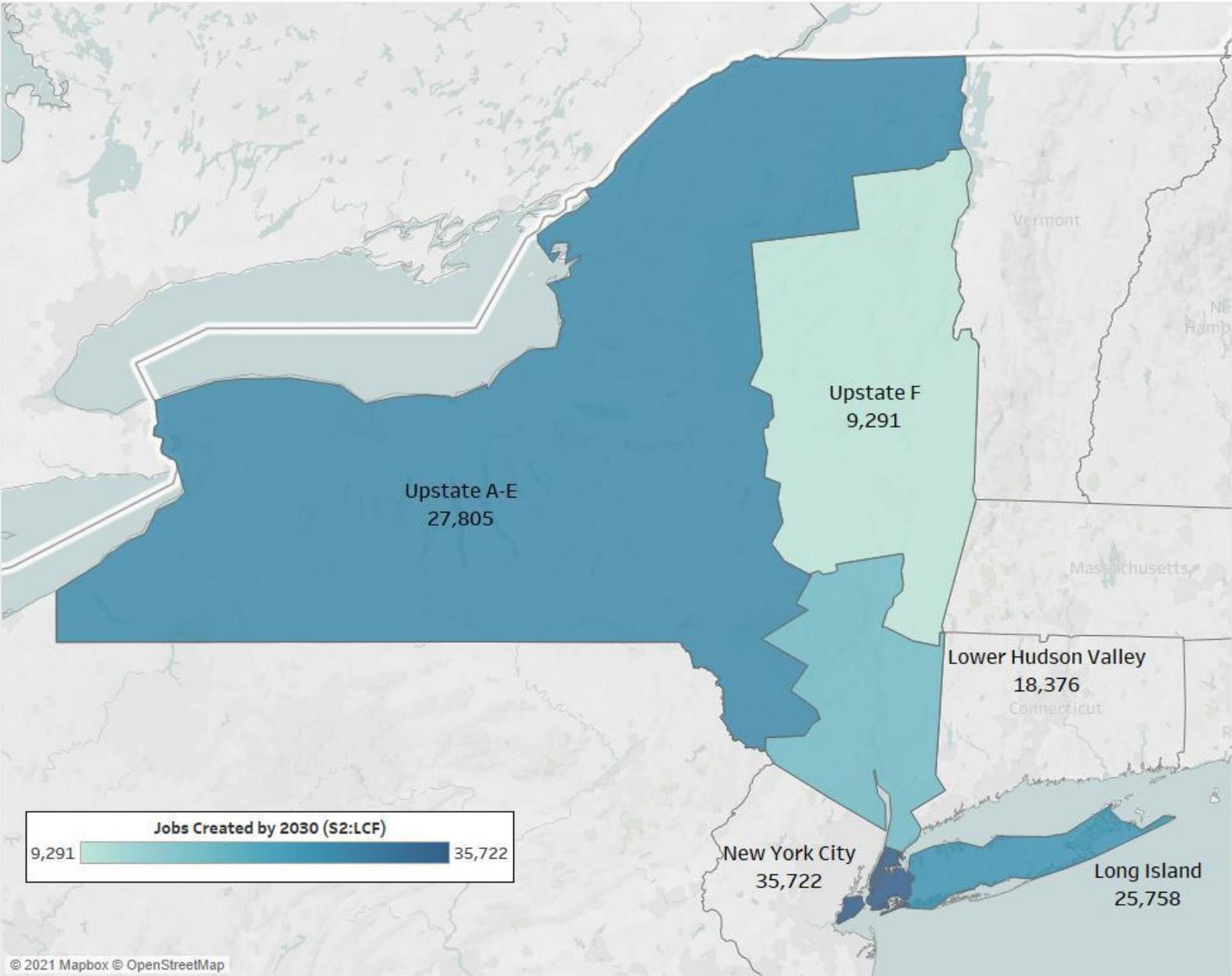
# SEO: Wage Profile: Buildings

**Buildings experience more growth in the middle tier (\$28 - \$37) wage category compared to the highest (>\$37) and lowest (<\$28) paying wage categories.**



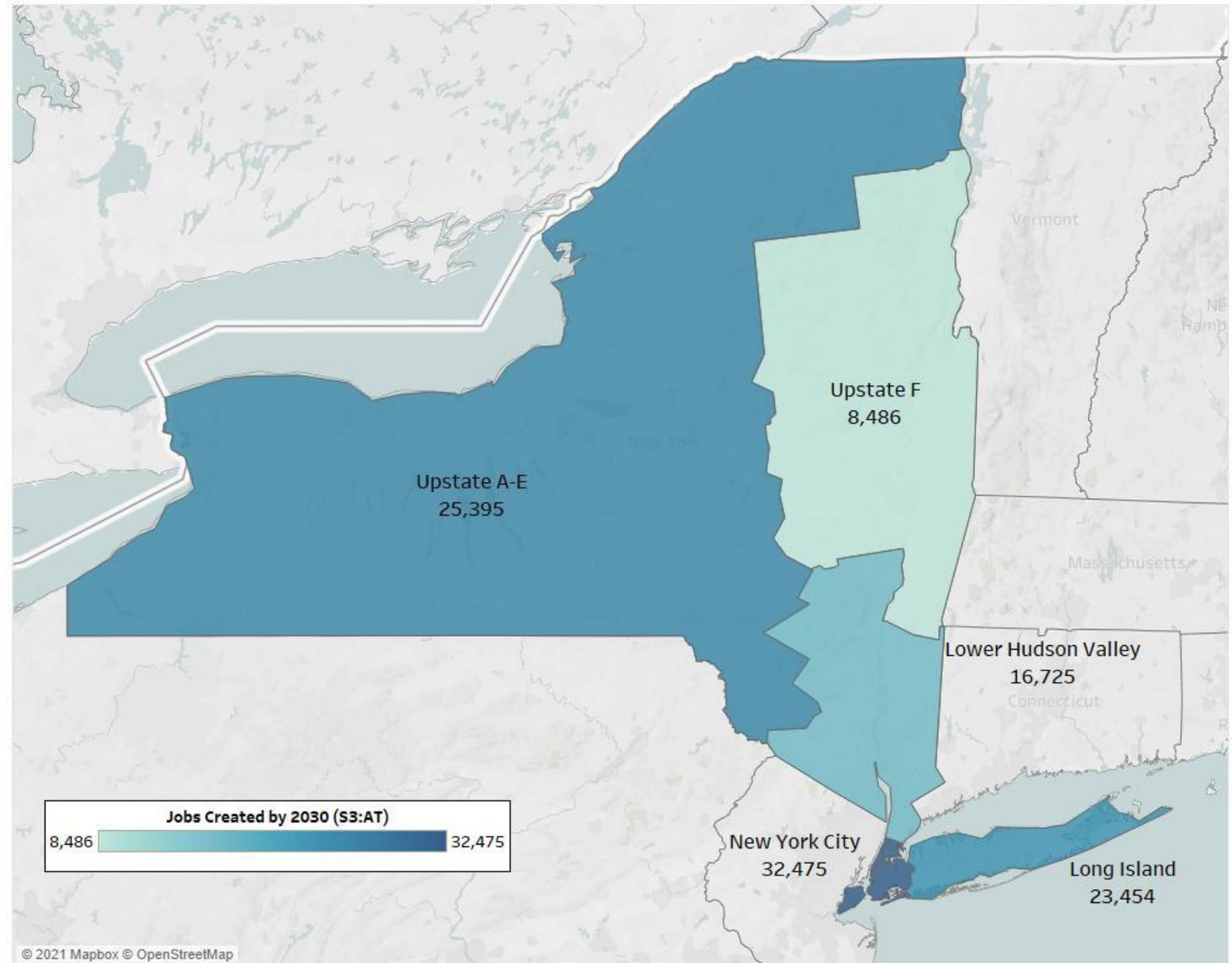
**Jobs Study**

**SEO:  
Geographic  
Profile:  
Buildings  
S2:LCF**



# Jobs Study

# SEO: Geographic Profile: Buildings S3:AT

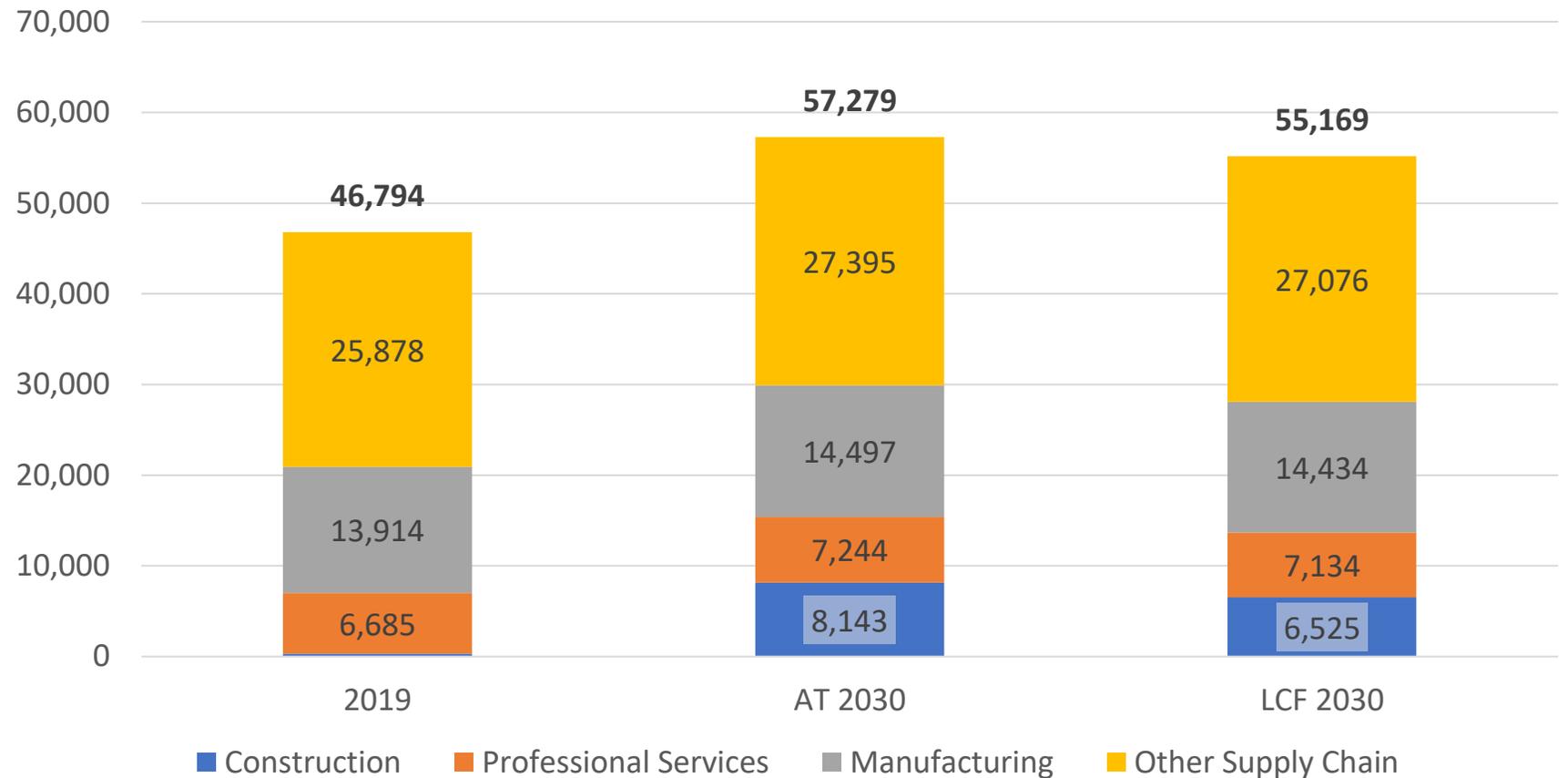


## Jobs Study

# SEO: Industry Profile: Transportation

# Growth Sub-Sectors

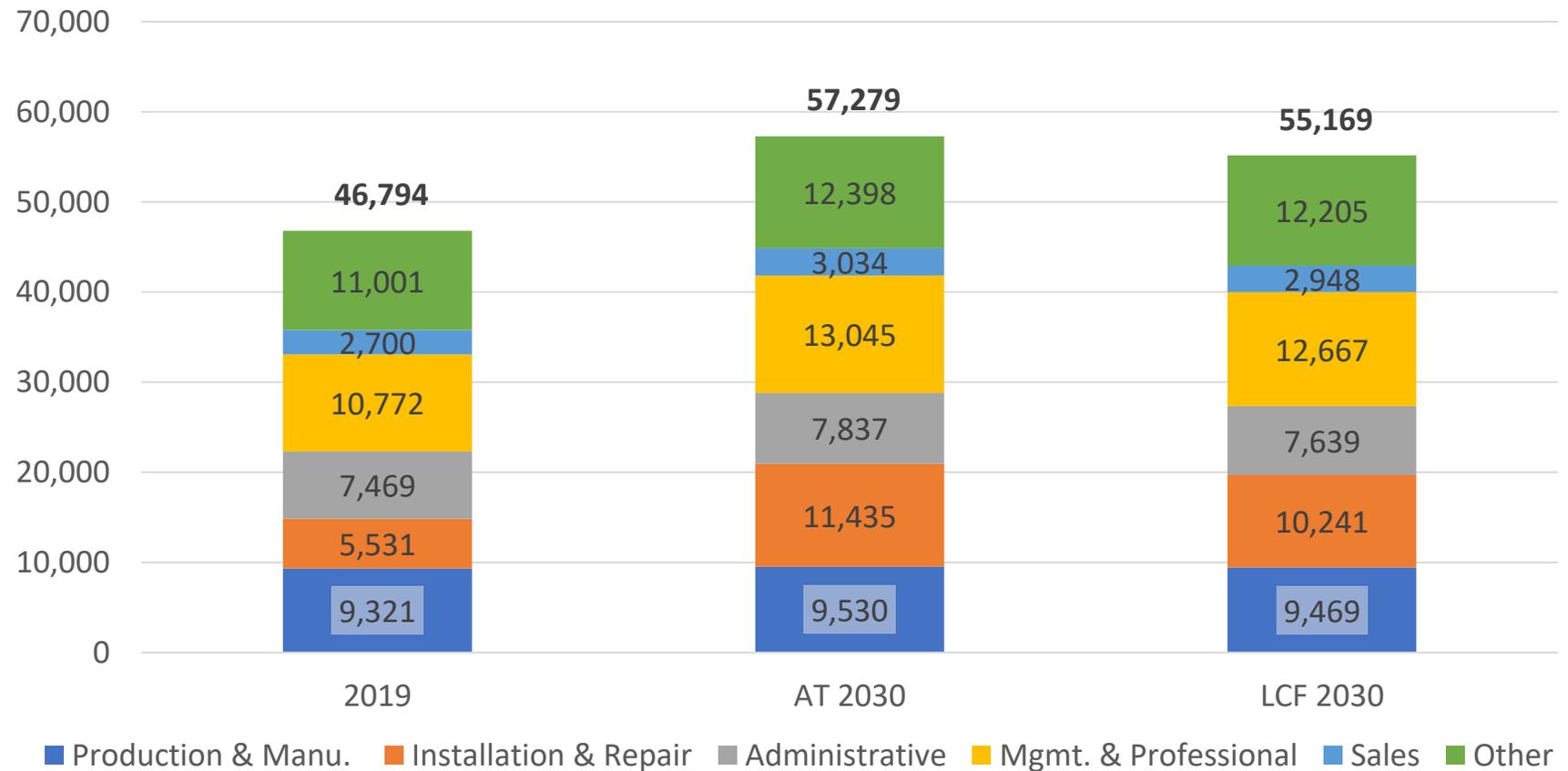
Transportation's growth sub-sectors (3) sees most of the industry growth from 2019 to 2030 in the construction industry.



## Jobs Study

# SEO: Occupational Profile: Transportation Growth Sub-Sectors

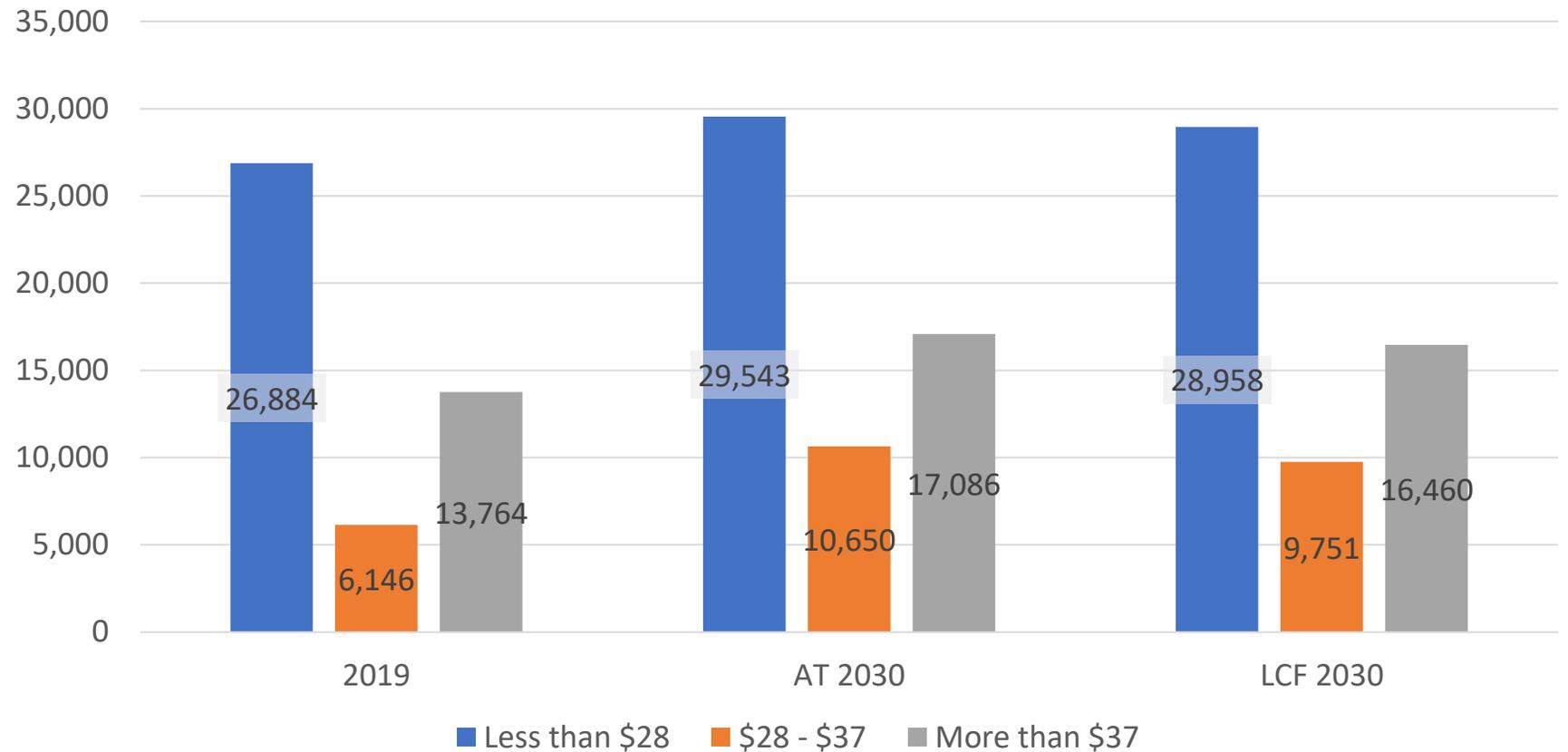
Transportation's growth sub-sectors expect small growth in all of the major occupational categories, except for installation and repair positions, which grow considerably.



## Jobs Study

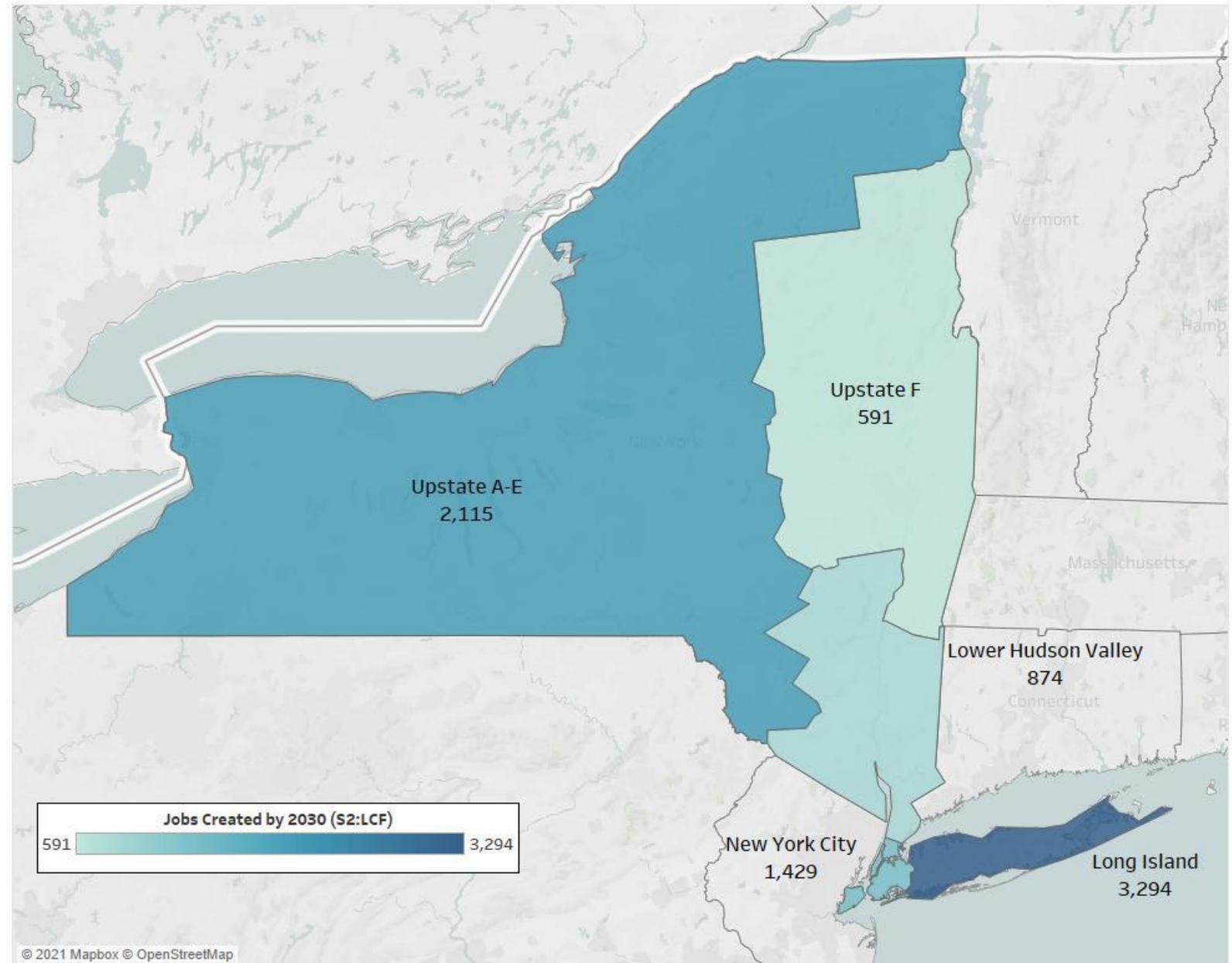
# SEO: Wage Profile: Transportation Growth Sub-Sectors

Transportation's growth sub-sectors showed the largest proportional increase in the middle wage category (\$28 to \$37) from 2019 to 2030.



# Jobs Study

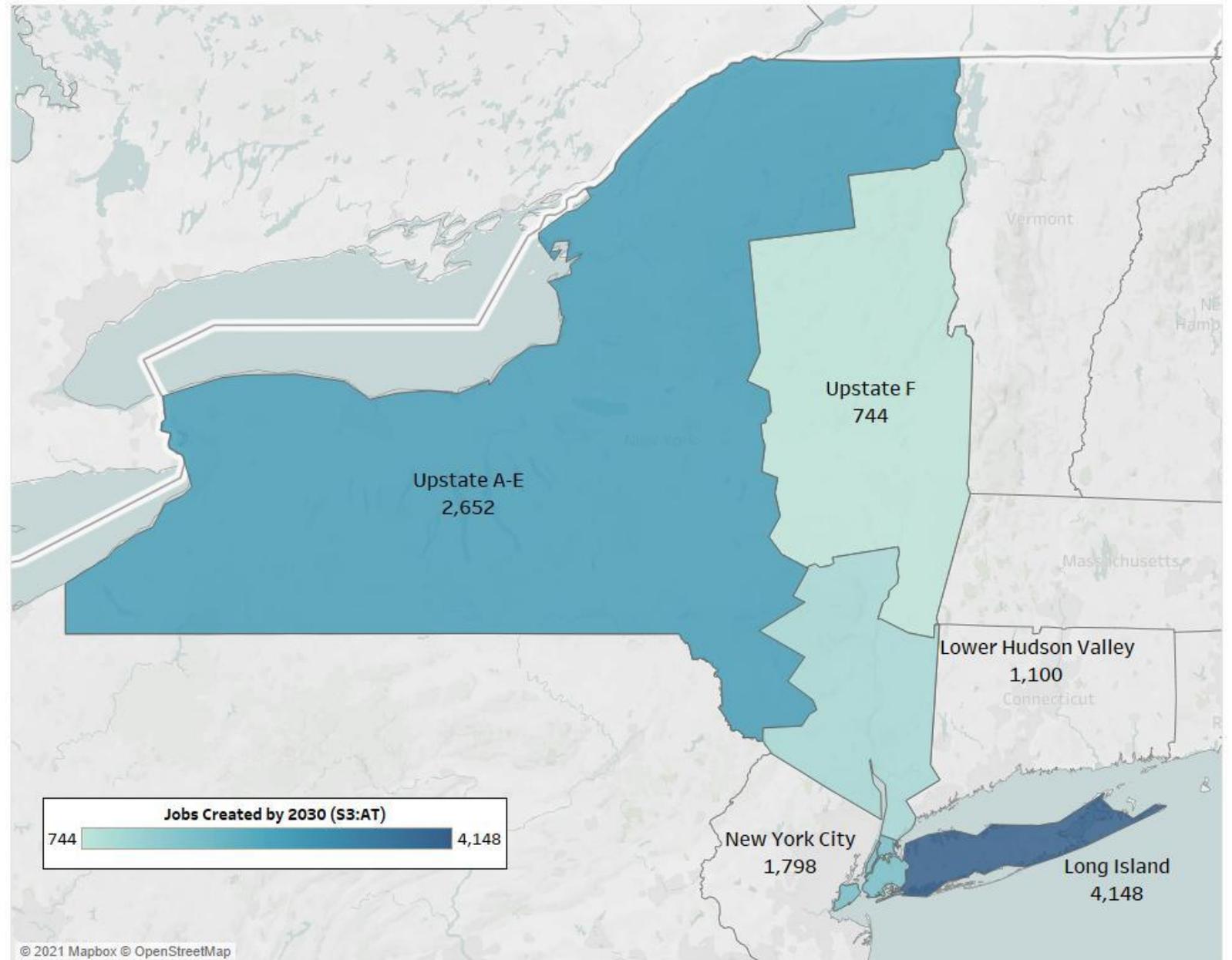
SEO:  
Geographic  
Profile:  
Transportation  
S2:LCF  
  
Growth  
Sub-Sectors



# Jobs Study

SEO:  
Geographic  
Profile:  
Transportation  
S3:AT

Growth  
Sub-Sectors

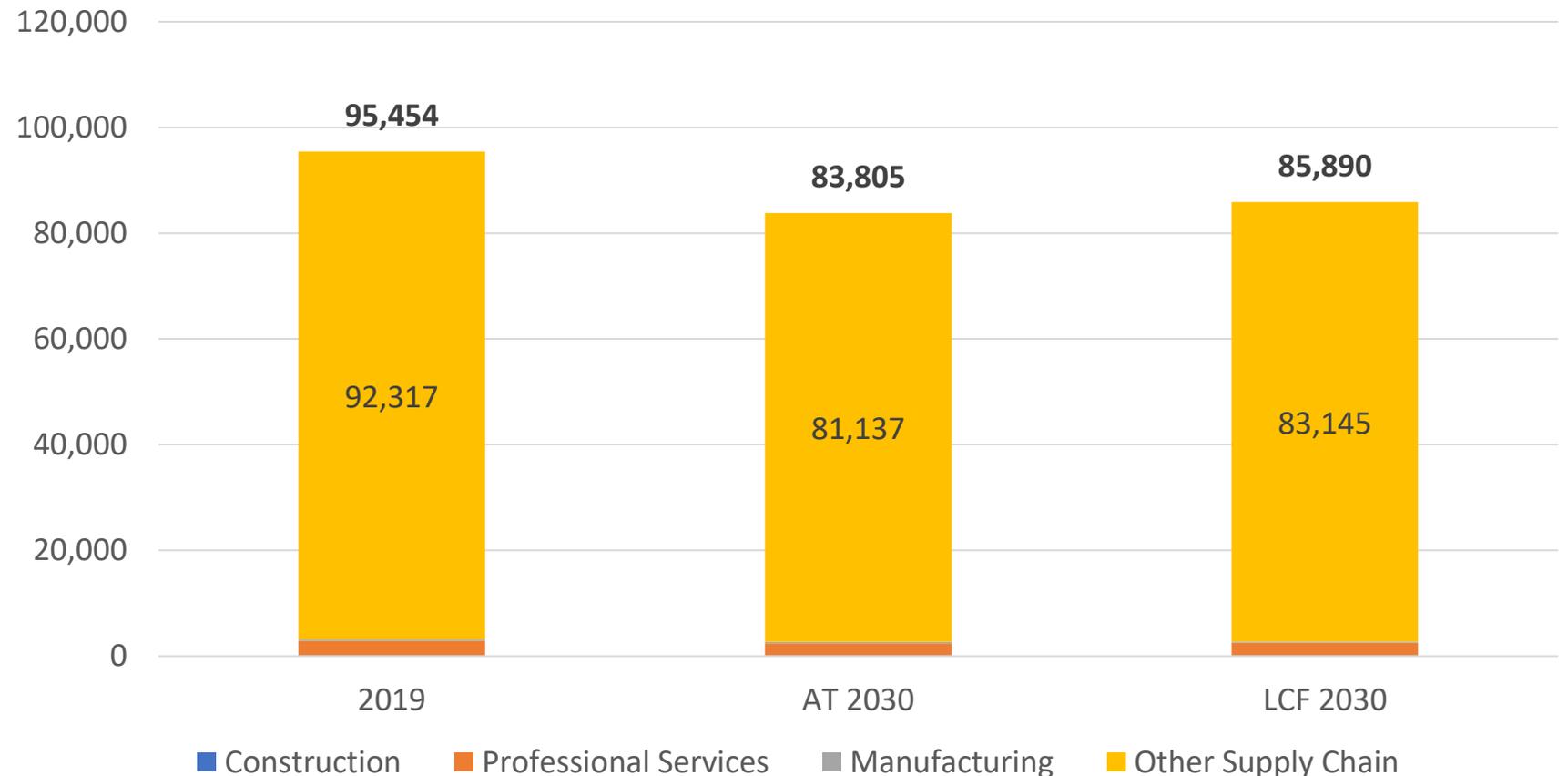


## Jobs Study

# SEO: Industry Profile: Transportation

## Displaced Sub-Sectors

Industry employment in Transportation's displaced sub-sectors (2) is amount entirely in Other Supply Chain which includes General Automotive Repair and General Freight Trucking.

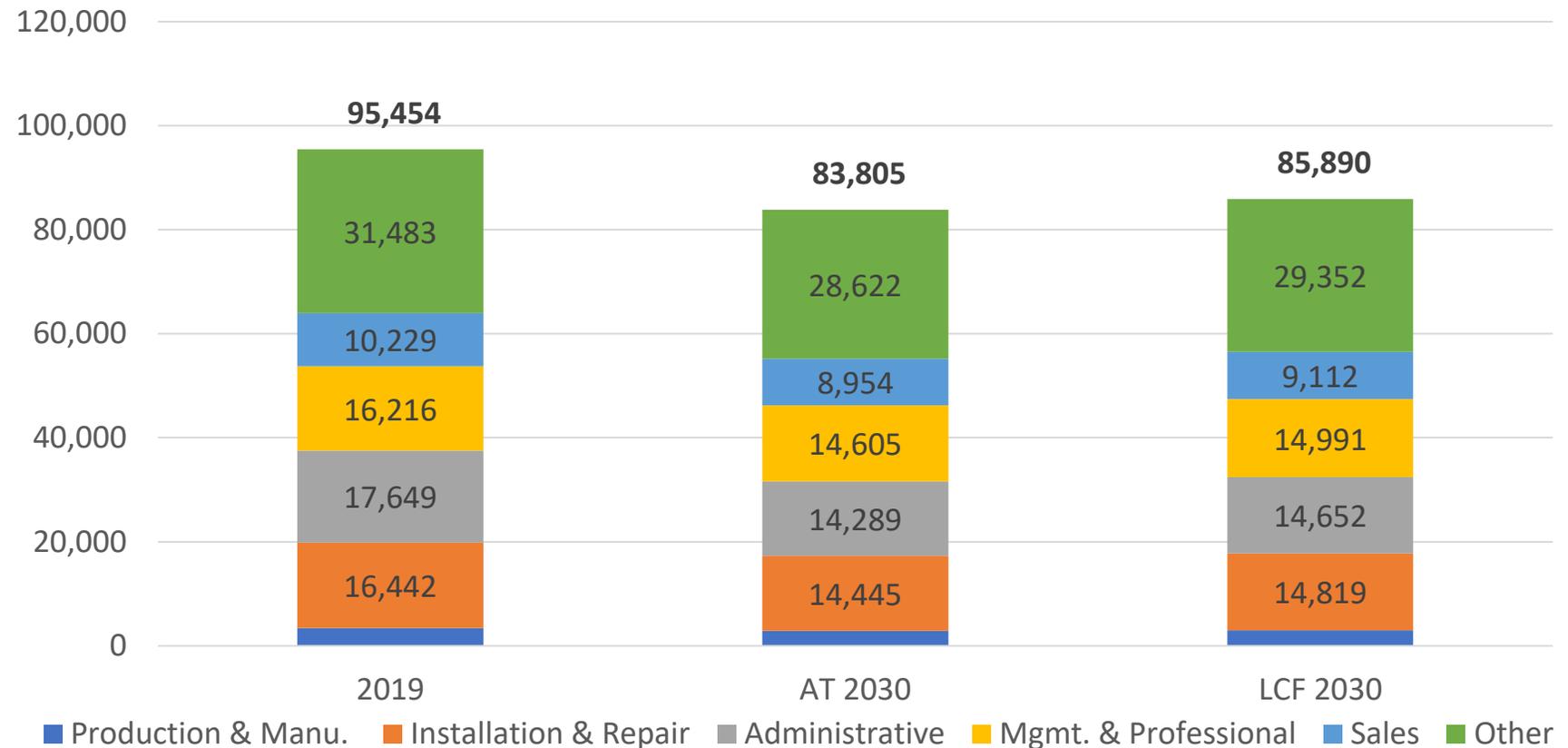


## Jobs Study

# SEO: Occupational Profile: Transportation

# Displaced Sub-Sectors

Transportation's displaced sub-sectors show a consistent decline in the occupational profile of each of the occupational categories from 2019 to 2030.

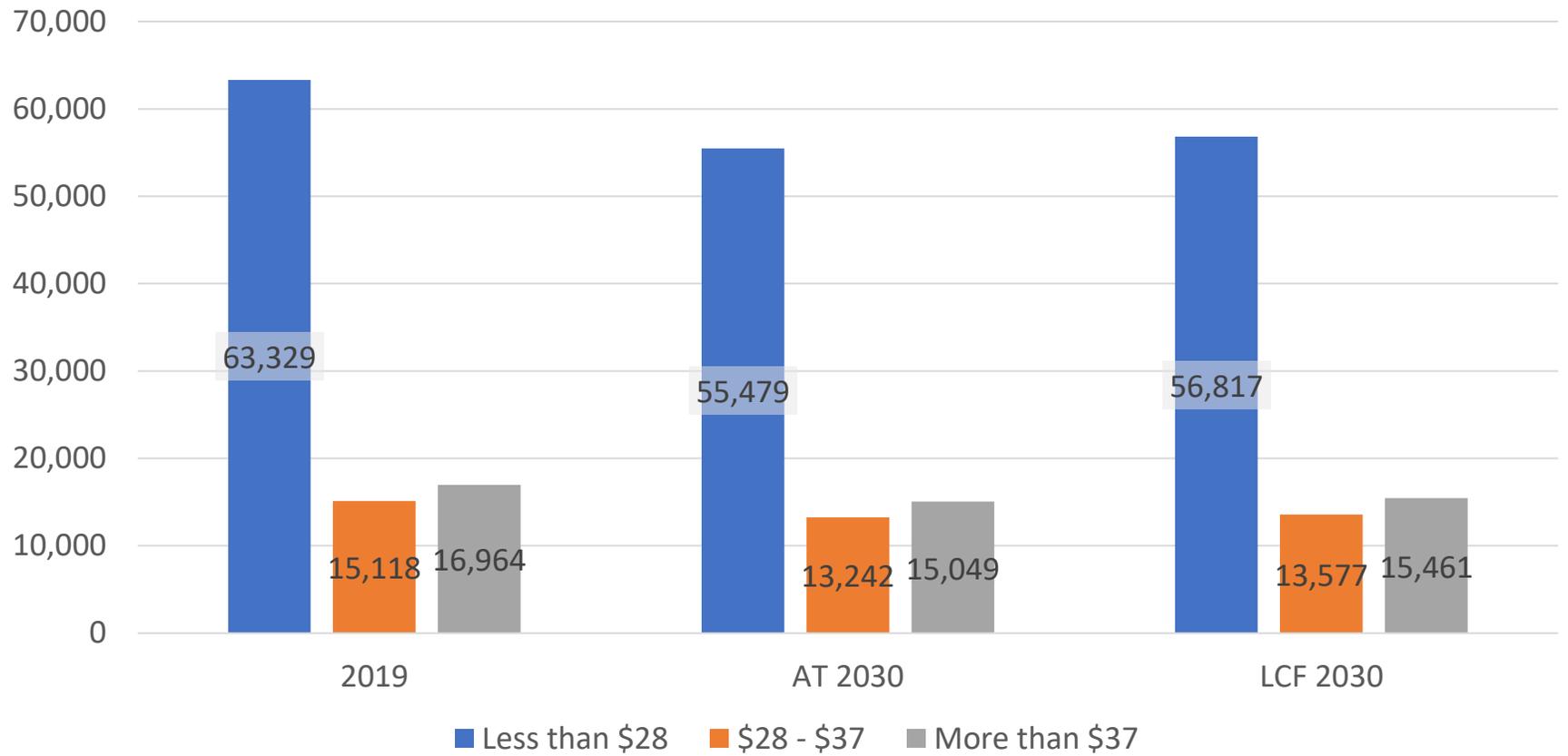


## Jobs Study

# SEO: Wage Profile: Transportation

# Displaced Sub-Sectors

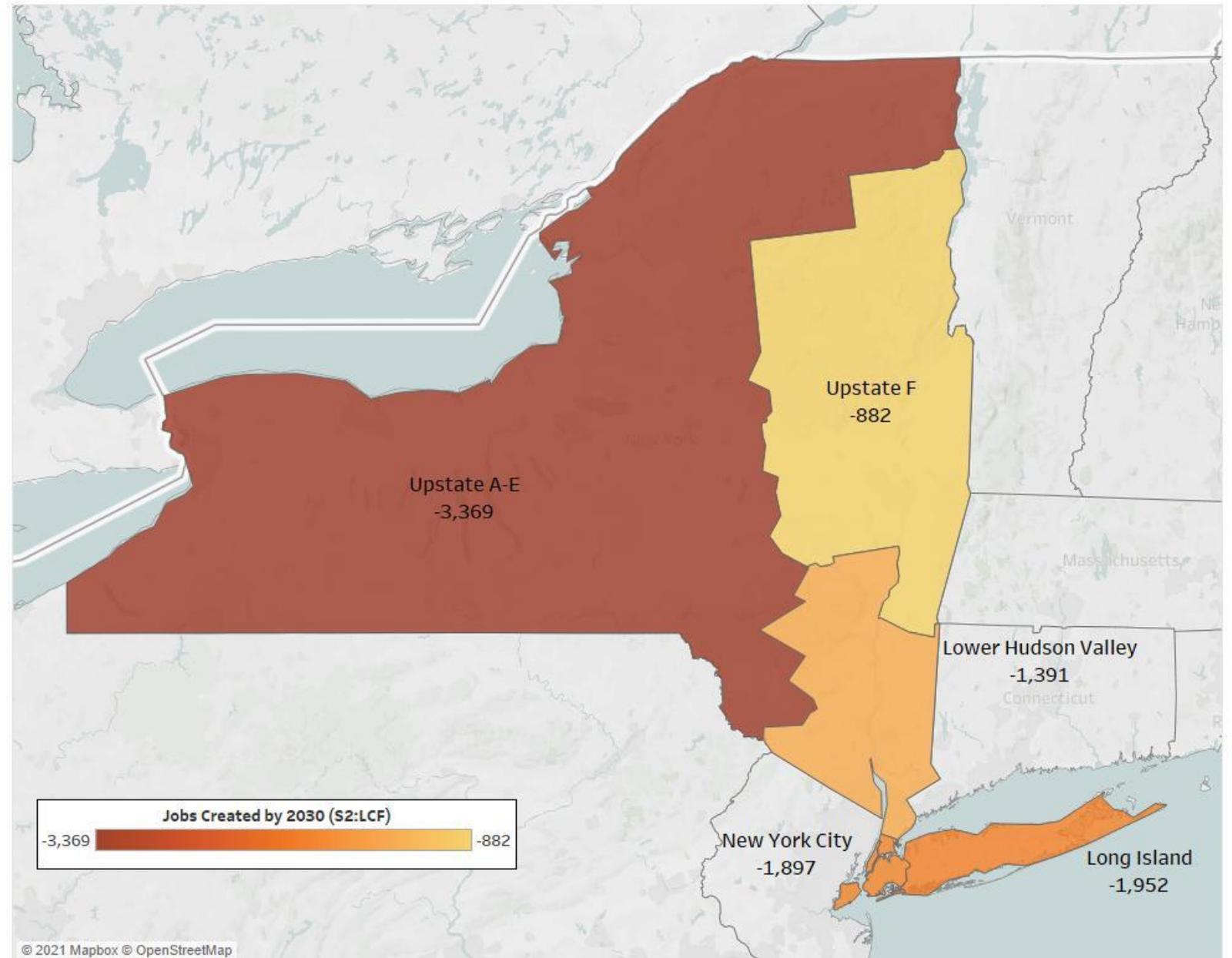
Transportation's displaced sub-sectors show the largest decline from 2019 to 2030 in its lowest paying wage category (<\$28).



# Jobs Study

SEO:  
Geographic  
Profile:  
Transportation  
S2:LCF

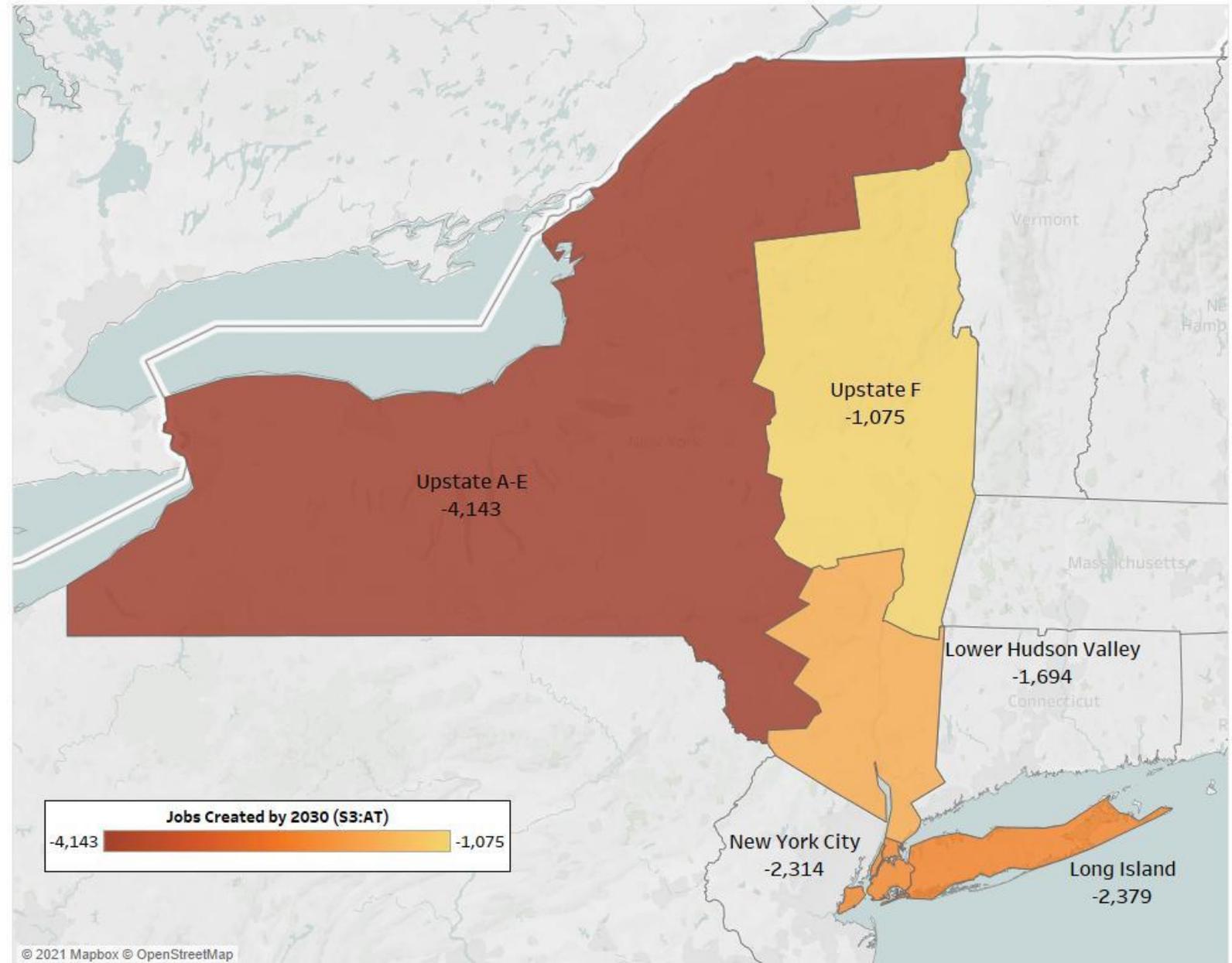
Displaced  
Sub-Sectors



# Jobs Study

SEO:  
Geographic  
Profile:  
Transportation  
S3:AT

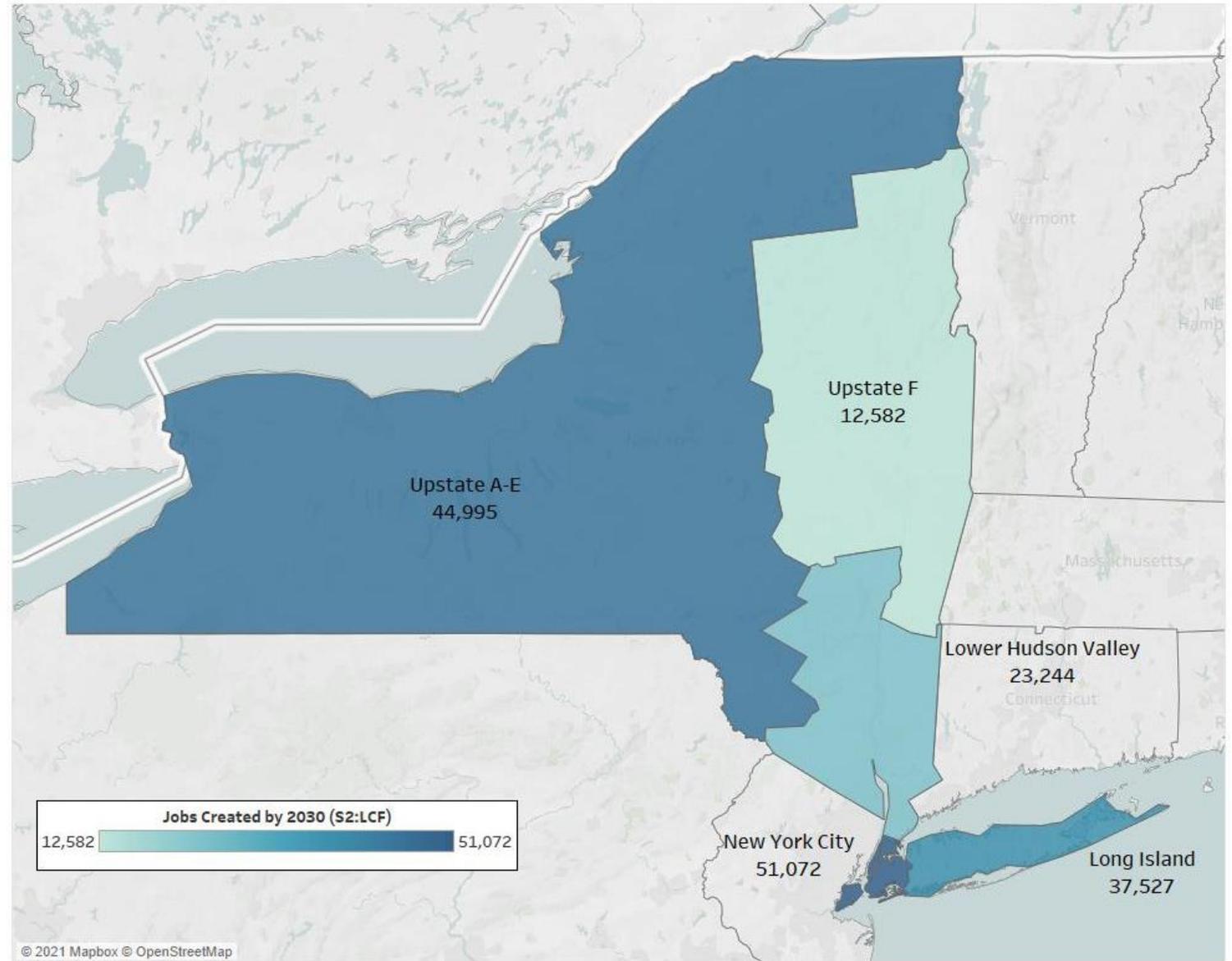
Displaced  
Sub-Sectors



## Jobs Study

# Geographic Analysis

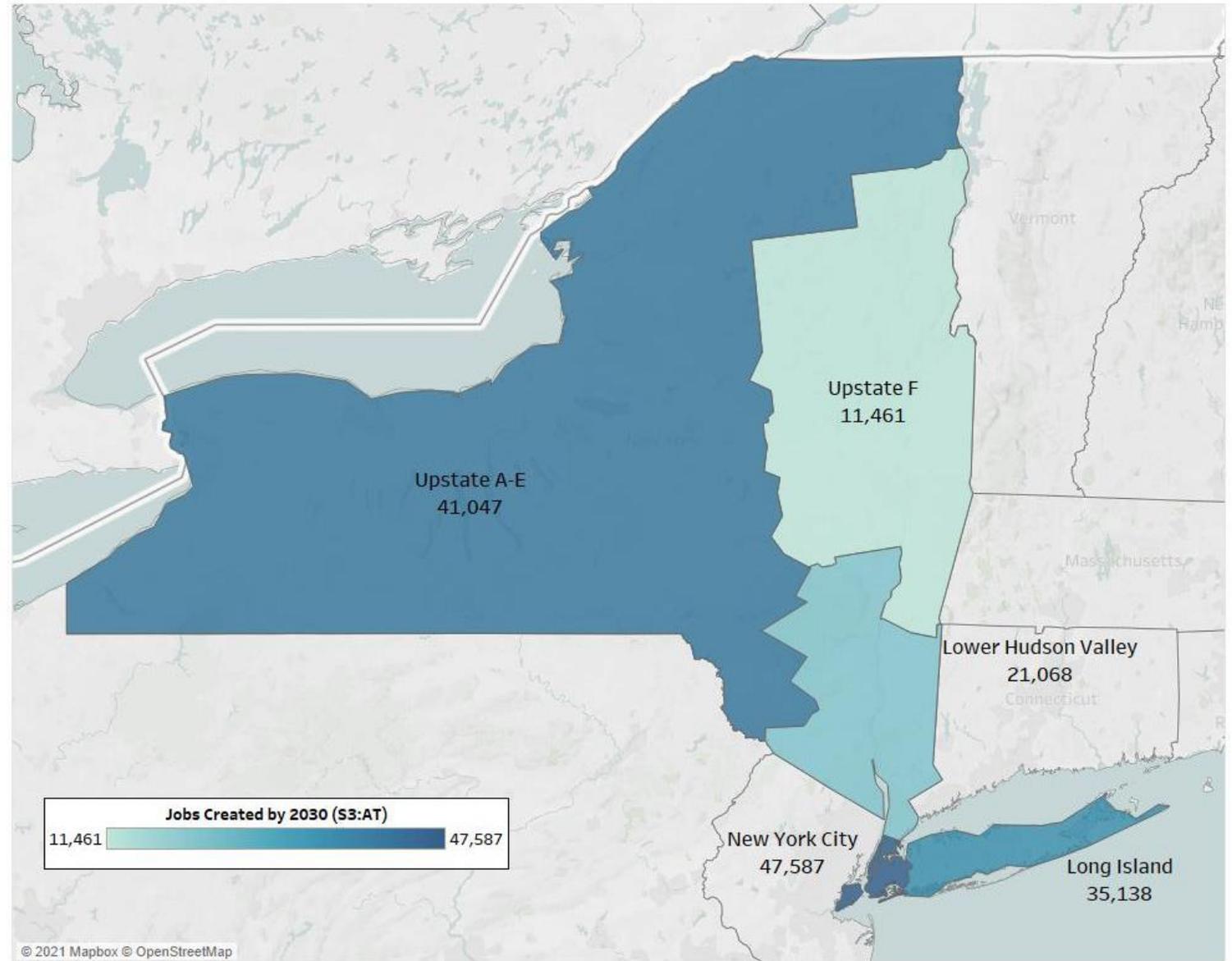
## 2030 Growth Sub-Sectors S2:LCF



## Jobs Study

# Geographic Analysis

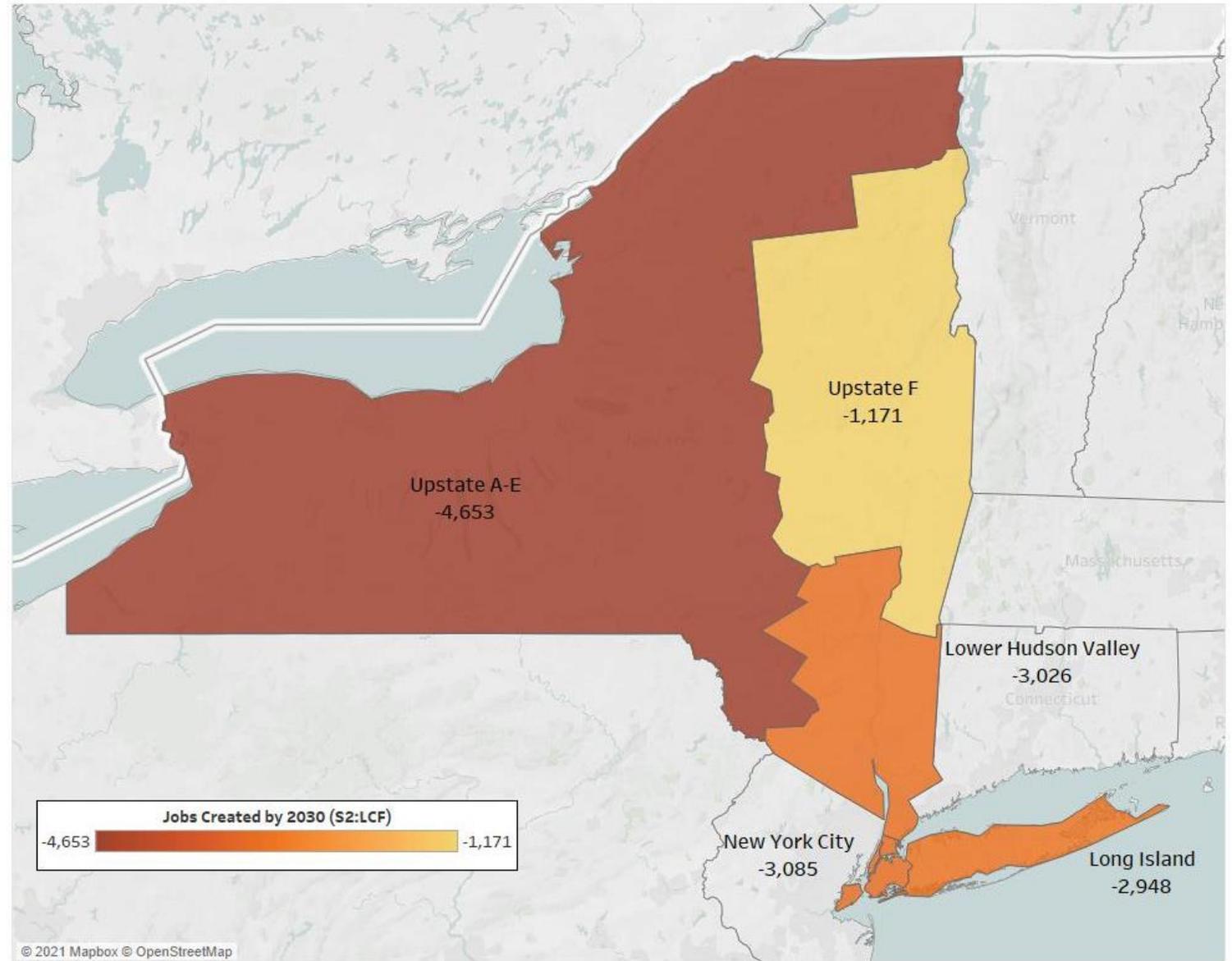
# 2030 Growth Sub-Sectors S3:AT



## Jobs Study

# Geographic Analysis

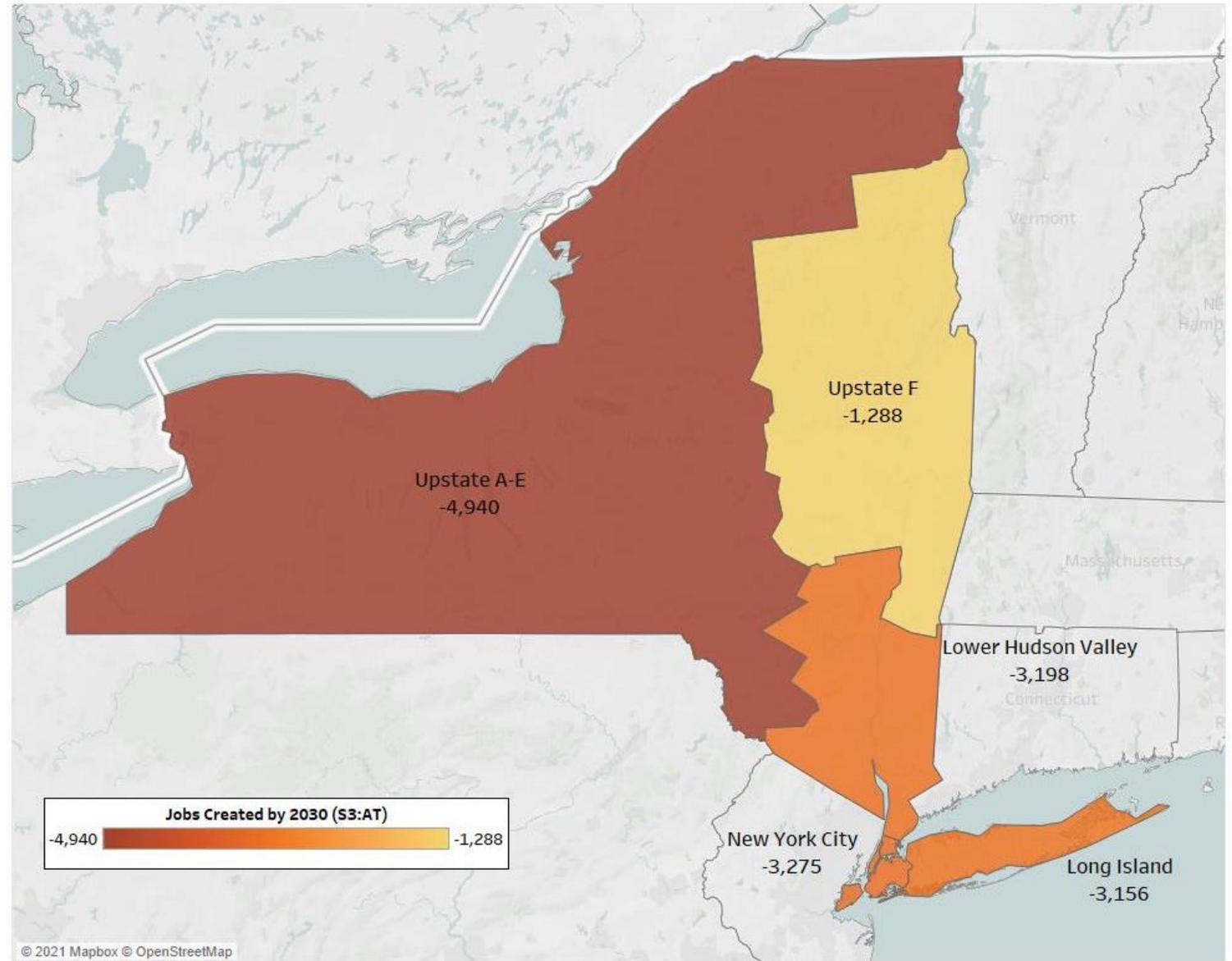
## 2030 Displaced Sub-Sectors S2:LCF



## Jobs Study

# Geographic Analysis

# 2030 Displaced Sub-Sectors S3:AT



**Jobs Study**  
**Wage**  
**Analysis**

**2030**  
**S3:AT**

Nearly 194,000 workers will earn under \$28 an hour in 2030 under this scenario, and the composition of this group of workers is similar to the LCF scenario.

