ECONOMIC IMPACTS OF THE GREEN JOBS – GREEN NEW YORK PROGRAM

Report

Prepared for

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EXECUTIVE SUMMARY

For Phase II of the Green Jobs Green New York (GJGNY) Jobs Evaluation, ICF estimated the total economic impact of GJGNY-supported jobs and labor income in New York State. ICF used an input-output model, IMPLAN, to conduct the economic impact analysis. Using IMPLAN, ICF estimated the total impact of the 2014-2015 GJGNY program by modeling the successive rounds of spending that result from direct GJGNY-related jobs and labor income in New York State.

An economic impact analysis is an assessment of the contribution that economic activity can have on a regional economy. This analysis estimates the extent to which the GJGNY program supports additional economic activity statewide in New York, in 12 individual regions, and in disadvantaged communities identified throughout the State. To conduct this analysis, ICF relied on primary survey data of 2014 and 2015 GJGNY program full-time equivalent employees (FTE) and wages captured by a survey of trade allies and program partners conducted by NMR.[1] ICF used this survey data to create IMPLAN modeling scenarios for new, retained, and up-skilled and up-waged jobs. After conducting the statewide analysis of the 2014-2015 impacts associated with the GJGNY program, ICF conducted post-model regional analysis by apportioning total impacts (for jobs, labor income, gross state product (GSP), and output) based on the number of direct jobs in each region and disadvantaged community.

KEY FINDINGS

GJGNY program-related activity generates a significant economic impact throughout New York State. In addition to creating job opportunities for workers directly related to the GJGNY program (i.e., direct effects), the program generates job opportunities in industries that sell to and buy from sectors supporting the program (i.e., indirect effects) as well as in consumer goods and services industries to satisfy the increased demands resulting from the worker wages (i.e., induced effects). IMPLAN estimates the results of these direct, indirect, and induced impacts. Table ES-1 provides a summary of findings. According to ICF's analysis, the GJGNY program added 5,357 total jobs, over $297 million in labor income, and more than $463 million to New York's GSP in 2014 and 2015.

[1] For more information about the survey data, methodology and direct job calculations, see the Phase I GJGNY report, *Assessment of Job Impacts of the Green Jobs – Green New York Program*.

Table ES-1. Summary of Statewide GJGNY Total Impacts (Direct, Indirect, and Induced): 2014 - 2015

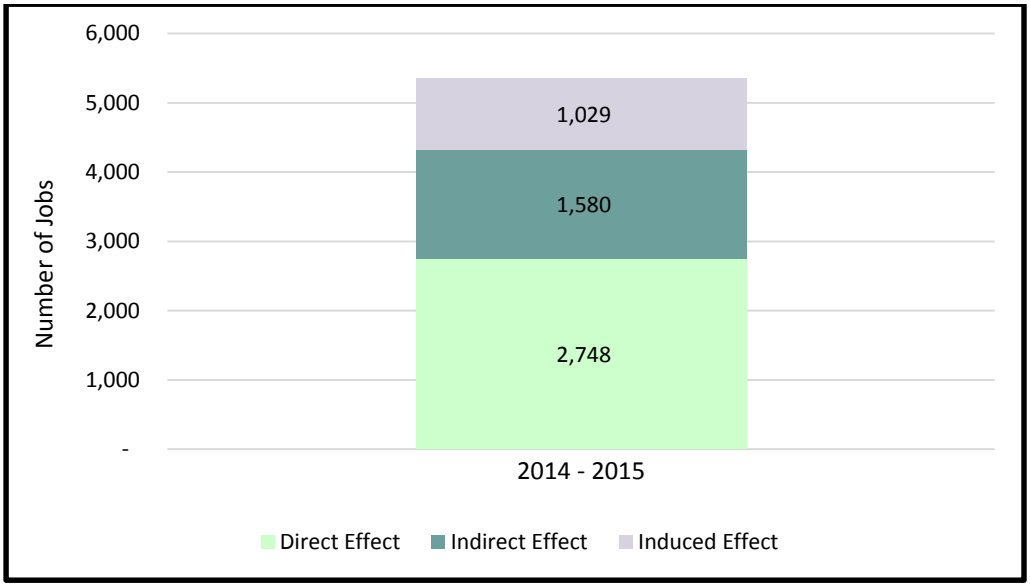
Description	New Jobs	Retained Jobs	Upskilled Jobs	Total Impact
Employment	3,906	1,437	14	5,357
Labor income ($ millions)	$211.0	$85.3	$0.8	$297.1
GSP ($ millions)	$333.6	$128.1	$1.4	$463.1
Output ($ millions)	$692.2	$251.3	$2.2	$945.8

Note: Numbers may not sum due to rounding.

Source: IMPLAN results.

Figure ES-1 provides a more detailed look at the job impacts. GJGNY's 2014-2015 total statewide job impact is 5,357 jobs. The figure reflects the 2,748 jobs directly engaged in the GJGNY program as well as the 1,580 indirect jobs generated by local purchases and 1,029 induced jobs in related and consumer industries.[2]

Figure ES-1. Total GJGNY Program Impacts on Employment in New York State, 2014 - 2015



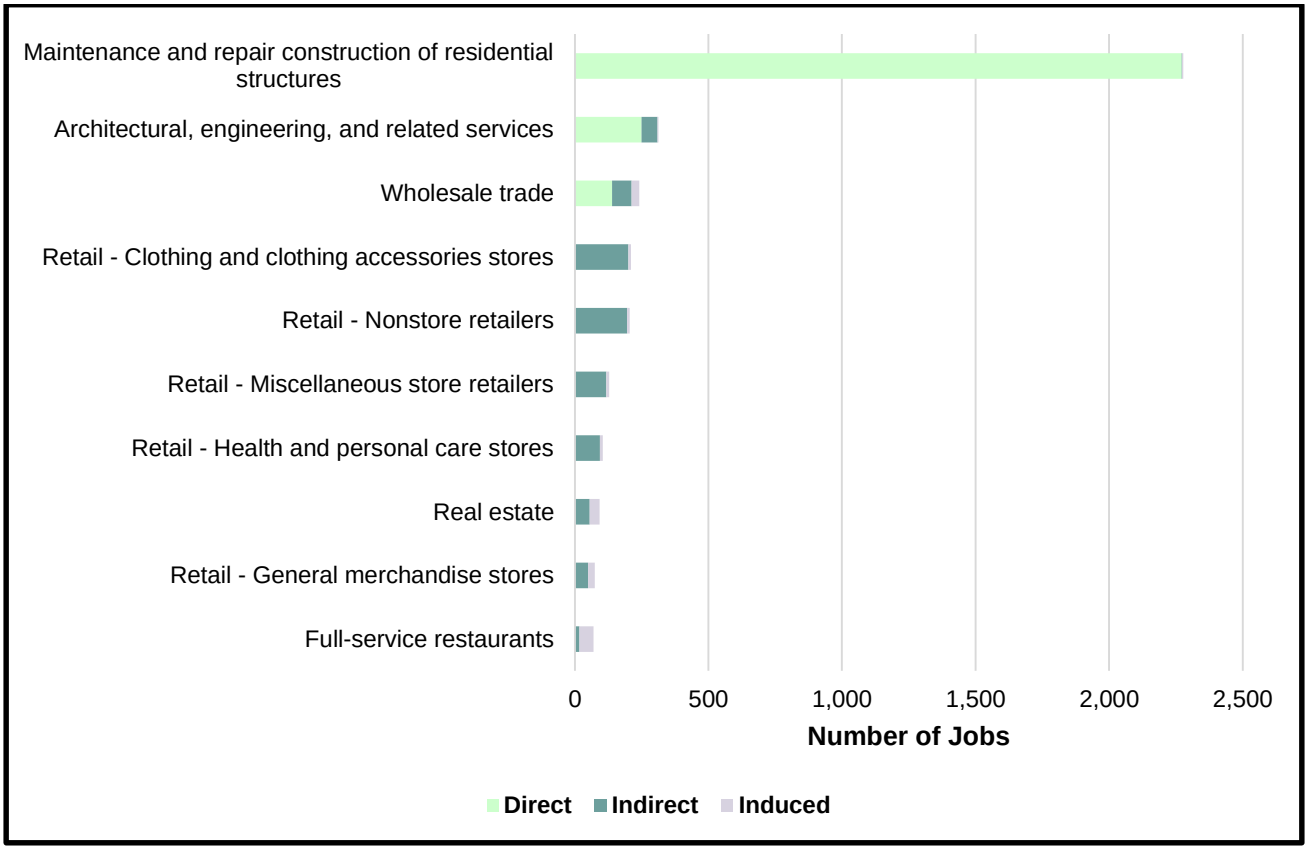
Note: Total job impact is 5,357 for 2014-2015.
Source: IMPLAN results.

[2] Findings reported in this analysis are modeled estimates and ICF acknowledges the implied false precision of reporting job figures that have not been rounded. Dollar figures are presented rounded to the nearest $1,000.

Because of the indirect and induced impacts (i.e., the multiplier effect), the sectors that are directly engaged in GJGNY are not the only ones that benefit. Jobs and wages associated with the GJGNY program effectively create new job opportunities and economic activity across the economy. This multiplicative effect highlights the importance of the GJGNY program not just for the growth of green industries, but for overall economic growth in the region. created.

Figure ES-2 shows the top ten industries regarding total job impacts in 2014-2015. Industries directly related to the GJGNY program, such as those in the construction sector and the architecture and engineering sector, benefitted the most in 2014-2015. Direct job growth drives three of the top ten sectors. Six of the top ten sectors—retail sectors, real estate, and wholesale trade—benefit exclusively from indirect and induced expenditures after the initial jobs are created.

Figure ES-2. Job Impacts for the Top 10 Sectors, Ranked by Total Employment: 2014 - 2015



Notes: The top ten sectors shown in this graph account for 3,718 total jobs, which represents 69% percent of the total job impacts for program years 2014-2015. The total job impact for 2014-2015 is 5,357.

Source: IMPLAN results.

In addition to a statewide analysis, ICF assessed the impact of the GJGNY program on New York State's 12 regions: Bronx, Capital, Central, Finger Lakes, Kings and Richmond, Long Island, Mid-Hudson/Westchester, New

York, North Country, Queens, Southern Tier, and Western New York. Program impacts were experienced most significantly in the Long Island region, with approximately 1,380 jobs and over $119 million in GSP. North County, New York, Mid-Hudson/Westchester, and the Capital region all had over 500 new jobs created. The Western region, Finger Lakes region, Southern Tier, and Central region each had between 100 and 500 new jobs created. This pattern is similar for GSP, labor income and output.

ICF's analysis also included a wage comparison of the annual average wage increase for up-skilled workers who were also up-waged. On average, up-skilled and up-waged workers experienced a 5% percent increase or an additional $.95 added to their hourly pay. Notably, the sectors that are core to the GJGNY program, such as residential remodelers, warm air heating and air-conditioning equipment and supplies merchant wholesalers, and heating and heating equipment manufacturers, all experienced higher-than-average wage increases, more than 24 percent, due to up-skilling.

IMPORTANT NOTES

For the following reasons, results from the GJGNY study should not be added or compared to results from jobs studies or analyses of other NYSERDA programs or portfolios.

- **Direct jobs (in FTEs) are point-in-time estimates by survey respondents.** This approach is one key way in which this GJGNY study differs from other jobs analyses conducted by NYSERDA that rely mainly on energy savings and program spending as inputs to macroeconomic modeling. This analysis does not incorporate impacts associated with consumer energy savings.

- **The economic impact analysis output is the gross number of jobs and is not net of the potential impacts of alternative spending of the GJGNY funds.**

Section 1

INTRODUCTION

Program Description

The Green Jobs Green New York (GJGNY) program creates jobs and increases labor income in New York State. However, the program has impacts beyond direct effects. The GJGNY program generates additional economic benefits, such as increased spending in the industries that support and are supported by direct program activity, and broader economy-wide benefits from increased labor income and consumer spending.

ICF estimated the total economic impact of the GJGNY program on the New York State economy. For this analysis, ICF used the IMPLAN model, an input-output model widely used by states and regions across the United States. The model estimated the impact generated by the "multiplier effect," which captures successive rounds of ripple spending resulting from direct jobs in the GJGNY program as well as the increased labor income from the program.

ICF conducted the analysis at the State and regional levels—including for each of the 12 regions in New York State and all disadvantaged communities. ICF used data on 2014 and 2015 GJGNY program FTE and wages captured by a survey of trade allies and program partners conducted by NMR[3] as the model inputs. ICF then used the IMPLAN model to analyze the total economic impact of the GJGNY program regarding jobs, labor income, gross state product (GSP), and output (i.e., industry activity) for the State and each region.

This report provides a detailed account of the modeling analysis to estimate the total impact of the GJGNY program during program years 2014 and 2015. In Section 2, ICF presents results first as a statewide summary of findings for 2014-2015, and then by each metric—employment, labor income, GSP, and output. This presentation of the results is followed by a discussion of impacts by job category and industry. After presenting the statewide results for program years 2014 and 2015, ICF reports findings at the regional level, which includes 12 regions, and for all disadvantaged communities in New York. The Methodology section then presents an overview of the methodology, which includes a brief discussion of ICF's approach as well as some important notes. Finally, the Appendix provides a more detailed discussion of the methodology including an overview of the IMPLAN model, and a discussion of input data configuration and the post-model analysis and detailed regional results.

[3] Phase I GJGNY *Assessment of Job Impacts of the Green Jobs – Green New York Program* Report.

Section 2

RESULTS, FINDINGS & CONCLUSIONS

This analysis of the GJGNY program assessed results at both the State and regional levels. The results are discussed by job type to demonstrate how the program components affect the State economy. Industry-specific results are provided to highlight the ways in which the program impacts other segments of the economy.

STATEWIDE RESULTS

GJGNY program activity generates an economic impact throughout New York State. The discussion below provides a summary of results as well as a discussion of results by each metric, including jobs, labor income, GSP, and output. ICF estimated the total economic impacts for program years 2014 and 2015.

Table 1 provides a summary of impacts on employment, labor income, GSP, and output. The total impact of the GJGNY program in program years 2014 and 2015 was 5,357 jobs, accounting for $297.1 million in additional labor income. For program years 2014 and 2015, the GJGNY program added $463.1 million to New York's GSP and $945.7 million in total economic output.

Table 1. Summary of 2014-2015 Statewide GJGNY Impacts

Impact Type	Employment	Labor Income ($ millions)	GSP ($ millions)	Output ($ millions)
Direct Effect	2,748	$144.1	$209.9	$549.7
Indirect Effect	1,580	$92.4	$148.7	$232.1
Induced Effect	1,029	$60.6	$104.4	$163.8
Total Effect	5,357	$297.1	$463.1	$945.7

Source: IMPLAN results. Note that numbers may not sum to total due to rounding.

In addition to the industries that are directly affected by the GJGNY program, some related industries benefit indirectly from the program's activity. These impacts are typically in up- or down-stream industries that sell to or buy from GJGNY employers or consumer goods industries that benefit from the increased income that the GJGNY program jobs might bring. Within the top ten sectors for total employment, the top three sectors that gained the most from GJGNY activity in 2014 and 2015 are driven by direct job growth in GJGNY-related industries (i.e. maintenance and construction, architecture and engineering, and wholesale trade). The remaining seven sectors are driven by indirect and induced impacts in consumer goods and service sectors (e.g., housing, food, retail). Total employment in the top three sectors accounts for 53% of all jobs created from GJGNY activities in program years

2014 and 2015. Indirect and induced jobs in the top ten sectors account for 20% of the program's total employment impact. Section 2.1.5 presents the economic impacts by industry sector.

The following sub-sections provide greater detail on the impacts for each of the four output metrics: jobs, labor income, GSP, and output.

2.1.1 Employment Impacts

Table 2 illustrates the relationship between direct, indirect, and induced employment impacts for new, retained, and upskilled jobs. Again, the direct impact value is driven by the GJGNY program activity in 2014 and 2015, as captured by the survey of GJGNY program participants by NMR in Phase I. The indirect impacts represent the employment created in related industries that, due to increased demand from the green activity, are producing more goods and services. When jobs are created in directly- and indirectly-related sectors, household incomes and consumer expenditures increase throughout the State, creating additional jobs, shown in Table 2 as the induced effect. Table 2 also highlights the impacts driven by new, retained, and upskilled jobs.

Table 2. Statewide GJGNY Impacts on Jobs: 2014 - 2015

Impact Type	Employment from New Jobs	Employment from Retained Jobs	Employment from Upskilled Jobs	Total Employment
Direct Effect	2,013	735	-	2,748
Indirect Effect	1,170	410	-	1,580
Induced Effect	723	292	14	1,029
Total Effect	3,906	1,437	14	5,375

Note: Total job impact is 5,357 for 2014-2015
Source: IMPLAN results.

Roughly 51 percent of the total jobs are created directly by the program, and the remaining 49 percent are attributed to indirect and induced spending (indirect jobs represent 30 percent of total jobs, and induced jobs represent 19 percent of total jobs). Statewide in 2014-2015, GJGNY jobs have a multiplier effect of 1.95, indicating that for every GJGNY job, 0.95 secondary and tertiary jobs are created.

2.1.2 Labor Income Impacts

Table 3 illustrates the direct, indirect, and induced effects of GJGNY wages on statewide labor income for new, retained, and upskilled jobs. Total labor income associated with the 5,357 direct, indirect, and induced jobs in program years 2014 and 2015 is $297.1 million. In 2014 and 2015, direct labor income also represents about 48 percent of total labor income, meaning that the remaining 52 percent comes from indirect and induced labor income (approximately 31 percent from indirect and over 20 percent from induced).[4]

Labor income is a particularly useful metric for assessing the impact of the GJGNY program because it accounts for the program's ability to add value by up-skilling current workers so that they receive a higher wage. In program years 2014 and 2015, GJGNY activities generated over $144 million of direct labor income in new and retained jobs and nearly $1 million of labor income from induced spending of upskilled jobs.

Table 3. Statewide GJGNY Impacts on Labor Income (Millions of Dollars): 2014 - 2015

Impact Type	Labor Income from New Jobs	Labor Income from Retained Jobs	Labor Income from Upskilled Jobs	Total Labor Income
Direct Effect	$ 100.4	$ 43.6	$ -	**$ 144.1**
Indirect Effect	$ 68.0	$ 24.5	$ -	**$ 92.4**
Induced Effect	$ 42.6	$ 17.2	$ 0.8	**$ 60.6**
Total Effect	$ 211.0	$ 85.3	$ 0.8	**$ 297.1**

Note: Total labor income impact for 2014-2015 is $297.1 million. Note that numbers may not sum to total due to rounding.
Source: IMPLAN results.

2.1.3 GSP Impacts

The GSP equals the economic output minus the value of the industrial inputs, such as raw materials, semi-finished goods, and other services purchased from domestic industries or foreign sources. Table 4 illustrates the direct, indirect, and induced effects of GJGNY program activity on GSP for new, retained, and upskilled jobs. In 2014 and 2015, the GJGNY program contributed a total of $463.1 million to the GSP of New York. Upskilled jobs contributed over $1 million to the New York GSP through induced spending, and the majority of GSP generated from new and retained jobs comes from indirect or induced spending. Unlike job impacts, where the contribution from the direct impact is higher than the combined indirect and induced impacts, more than 50 percent of the GSP comes from indirect and induced impacts.

[4] The sum of these two values does not equal 52 because of rounding.

Table 4. Statewide GJGNY Impacts on GSP (Millions of Dollars): 2014 - 2015

Impact Type	GSP from New Jobs	GSP from Retained Jobs	GSP from Upskilled Jobs	Total GSP
Direct Effect	$ 150.3	$ 59.6	$ -	**$ 209.9**
Indirect Effect	$ 109.8	$ 38.9	$ -	**$ 148.7**
Induced Effect	$ 73.4	$ 29.6	$ 1.4	**$ 103.0**
Total Effect	$ 333.6	$ 128.1	$ 1.4	**$ 463.1**

Note: Total GSP impact for 2014-2015 is $463.1 million. Note that numbers may not sum to total due to rounding.
Source: IMPLAN results.

2.1.4 Economic Output Impacts

Table 5 illustrates the direct, indirect, and induced effects of GJGNY program activity on economic output. Output represents the value of industry production, including inter-industry purchases of intermediate goods, raw materials, cost of energy, and other inputs. For manufacturing sectors, the economic output includes total sales with inventory change. For service sectors, the output is equal to total sales. For retail and wholesale trade, the output is equal to gross margin. In 2014 and 2015, output related to the GJGNY program was $945.7 million. Output related to the program's direct jobs accounts for roughly 60 percent of total output, with the remaining 40 percent attributable to indirect and induced spending.

Table 5. Statewide GJGNY Impacts on Output (Millions of Dollars): 2014 - 2015

Impact Type	Output from New Jobs	Output from Retained Jobs	Output from Upskilled Jobs	Total Output
Direct Effect	$ 405.5	$ 144.2	$ -	**$ 549.7**
Indirect Effect	$ 171.5	$ 60.6	$ -	**$ 232.1**
Induced Effect	$ 115.1	$ 46.5	$ 2.2	**$ 163.8**
Total Effect	$ 692.2	$ 251.3	$ 2.2	**$ 945.7**

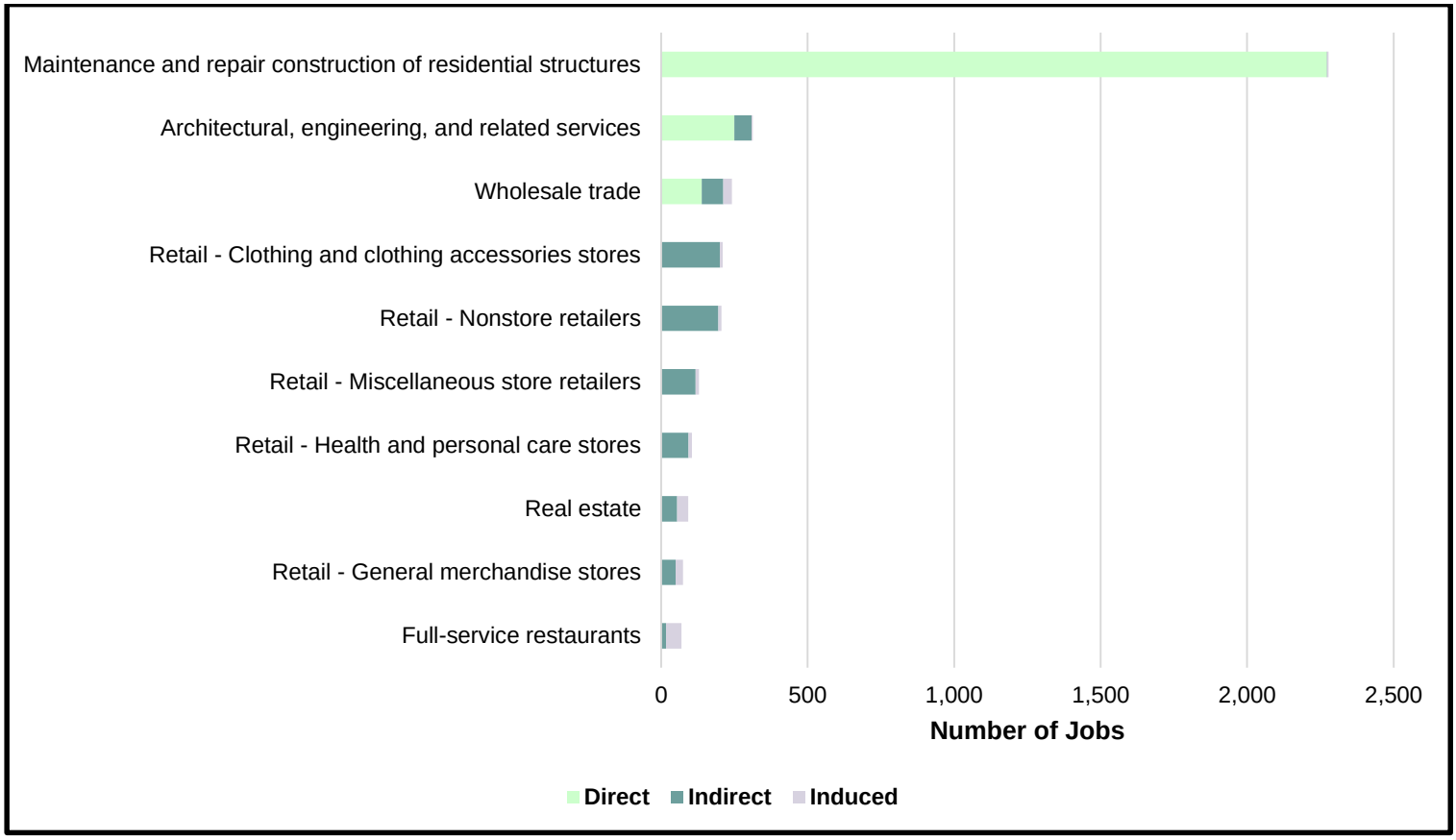
Note: Total output impact for 2014-2015 is $945.7 million.
Source: IMPLAN results.

2.1.5 Impacts by Industry

The previous discussions articulate the overall statewide effects of the GJGNY program. However, as shown in the next four figures, the bulk of GJGNY program impacts are concentrated in specific industries. Shown graphically in

Figure 1, it is clear that the architecture and engineering sector and the maintenance and repair construction sector benefitted the most in program years 2014 and 2015. Nearly all of the jobs in those two sectors are directly a result of the program. Wholesale trade benefitted from a combination of direct, indirect, and induced jobs. In contrast, retail, housing, and food services are driven exclusively by indirect and induced expenditures after the initial jobs are created.

Figure 1. Job Impacts, Top 10 Sectors, Ranked by Direct Jobs: 2014 - 2015



Notes: The top ten sectors shown in this graph account for 3,718 total jobs, which represents 69% percent of the total job impacts for program years 2014-2015. The total job impact for 2014-2015 is 5,357.

Source: IMPLAN results.

Table 6 shows the labor income, GSP, and output in addition to the jobs directly and indirectly created by the GJGNY program, by industry. The labor income, GSP, and output impacts are highest for the architecture and engineering and maintenance and repair construction sectors. The maintenance and repair construction sector—which includes sub-sectors such as HVAC installers, plumbing, drywall and insulation, electrical contracting, and renovation services— accounts for 37 to 48 percent of each metric (i.e., jobs, labor income, GSP, output) in 2014 and 2015. The architectural, engineering, and related services industry—which includes sub-sectors such as

inspection services and electrical contracting—accounts for between 4 to 6 percent of the impact for each metric in 2014 and 2015.

Table 6. Impacts by Sector, Top 10 Sectors Ranked by Job Impacts: 2014-2015

Description	Employment	Labor Income	GSP	Output
Maintenance and repair construction of residential structures	2,278	$120.6	$170.9	$454.1
Architectural, engineering, and related services	313	$20.9	$17.8	$51.7
Wholesale trade	241	$15.5	$37.1	$65.3
Retail - Clothing and clothing accessories stores	210	$8.1	$14.5	$20.6
Retail – Non-store retailers	206	$8.1	$20.5	$29.2
Retail - Miscellaneous store retailers	129	$4.9	$5.0	$6.7
Retail - Health and personal care stores	105	$5.2	$6.8	$9.8
Real estate	93	$3.4	$19.2	$24.6
Retail - General merchandise stores	74	$2.3	$3.8	$5.6
Full-service restaurants	70	$2.1	$2.3	$3.8

Note: Dollar figures rounded to the nearest thousands. Totals may not sum due to independent rounding.

Source: IMPLAN results.

REGIONAL RESULTS

For this analysis, New York State is divided into 12 regions: Bronx, Capital, Central, Finger Lakes, Kings and Richmond, Long Island, Mid-Hudson/Westchester, New York, North County, Queens, Southern Tier, and Western New York. As shown in Table 8, the five largest regions in terms of job impacts, labor income, GSP, and output account for nearly 79 percent of all GJGNY-related jobs in the State. The Long Island region—the region with the most job creation—accounted for 26 percent of all statewide jobs created by the program; GJGNY created 1,383 direct, indirect, and induced jobs on Long Island. GJGNY-related jobs on Long Island created an additional $76.7 million in labor income, $119.6 million in GSP, and $244.2 million in output for the region, each accounting for over one-quarter of the statewide impact.

Alternatively, GJGNY-related impacts are minimal in Queens, Bronx, Kings and Richmond, and North Country—each region accounting for less than one percent share GJGNY-related impacts, including for jobs, labor income, GSP, and output. Collectively, the bottom four regions accounted for only one percent of all GJGNY-related impacts. For more detailed results by region, see Appendix D.

Table 8. Total 2014-2015 Impacts Attributable to GJGNY, by Region

	Employment	Labor Income ($millions)	GSP ($millions)	Output ($millions)	Percent of Total Impact
Bronx	22	$1.20	$1.90	$3.90	0%
Capital	748	$41.50	$64.70	$132.10	14%
Central	162	$9.00	$14.00	$28.70	3%
Finger Lakes	286	$15.80	$24.70	$50.40	5%
Kings and Richmond	23	$1.30	$2.00	$4.10	0%
Long Island	1,383	$76.70	$119.60	$244.20	26%
Mid-Hudson and Westchester	677	$37.60	$58.60	$119.60	13%
New York	586	$32.50	$50.70	$103.50	11%
North County	785	$43.50	$67.80	$138.50	15%
Queens	12	$0.60	$1.00	$2.00	0%
Southern Tier	275	$15.20	$23.80	$48.50	5%
Western	397	$22.00	$34.30	$70.00	7%
Total	**5,356**	**$297.00**	**$463.00**	**$945.50**	**100%**

Notes: Dollar figures rounded to the nearest thousands. Totals may not sum due to independent rounding. Regional totals may not match overall total values due to rounding.

Source: IMPLAN results.

2.1.6 Impacts to Disadvantaged Communities

The following discussion presents the results of ICF's estimates for jobs, labor income, GSP, and output in disadvantaged communities throughout New York State. As shown in Table 9, the economic impact of the GJGNY program in 2014-2015 to disadvantaged communities includes 1,700 jobs, $94.3 million in additional labor income, $147.0 million in GSP, and over $300 million in output.

Table 9. Summary of GJGNY Impacts to Disadvantaged Communities, 2014-2015

	Employment	Labor income	GSP	Output
Direct Effect	872	$45.7	$66.6	$174.5
Indirect Effect	502	$29.3	$47.2	$73.7
Induced Effect	326	$19.2	$33.1	$52.0
Total Effect	**1,700**	$94.3	$147.0	$300.1

Note: Totals may not sum due to independent rounding.

Source: IMPLAN results

CONCLUSION

GJGNY program-related activity generates a significant economic impact throughout New York State. The total statewide impact of the GJGNY program in program years 2014 and 2015 is 5,357 jobs, 51 percent of which are direct jobs supported by the program. The GJGNY program similarly contributed $463.1 million to New York State's GSP in 2014 and 2015. The maintenance and repair construction sector is the largest beneficiary of the program. This sector, which includes HVAC installers, plumbing, drywall and insulation, electrical contracting, and renovation services, accounted for 37 to 48 percent of the jobs, labor income, GSP, and output associated with the program in 2014 and 2015. Long Island has benefited the most from the program, with over a quarter of the program's jobs and GSP (1,383 jobs and $119.6 million in GSP in 2014-2015). North County, New York, Mid-Hudson/Westchester, and the Capital region each saw over 10% of the total job creation impacts. Finally, the economic impact to disadvantaged communities in program years 2014 and 2015 includes 1,700 jobs, $94.3 million in labor income, $147.0 million in GSP, and $300.1 million in output.

Section 3

METHODOLOGY

APPROACH

An economic impact analysis is an assessment of the contribution that economic activity can have on a regional economy. This analysis estimates the extent to which GJGNY program activity in 2014 and 2015 supported additional economic activity statewide in New York, in 12 regions, and in disadvantaged communities identified throughout the State.[5]

To conduct this analysis, ICF relied on primary survey data of the 2014 and 2015 GJGNY program FTE and wages captured by a survey of trade allies and program partners conducted by NMR.[6] ICF used this data to create IMPLAN modeling scenarios for new, retained, and up-skilled and up-waged jobs. When the survey data did not provide wage information, ICF relied on publically-available data sources, such as the 2014-2015 Quarterly Census of Employment and Wages (QCEW), and extrapolated to determine the appropriate wage for each NAICS code.

After conducting the statewide analysis of program years 2014 and 2015 impacts associated with GJGNY program, ICF conducted a post-model regional analysis of statewide results by apportioning total impacts (for jobs, labor income, GSP, and output) based on the number of direct jobs in each region.

For a detailed discussion of the analysis methodology, see Appendix A.

IMPORTANT NOTES

For the following reasons, results from the GJGNY study should not be added or compared to results from jobs studies or analyses of other NYSERDA programs or portfolios.

[5] NMR determined disadvantaged community status by comparing the county unemployment rate with the state average. Cities and towns in counties with unemployment rates higher than that of the state average were classified as disadvantaged. County unemployment levels were determined based on data from the New York State Department of Labor (Website: http://labor.ny.gov/stats/LSLAUS.shtm).

[6] For more information about the survey data, methodology and direct job calculations, see the Phase I GJGNY report *Assessment of Job Impacts of the Green Jobs – Green New York Program*.

- **Direct jobs (in FTEs) are point-in-time estimates by survey respondents.** This approach is one key way in which this GJGNY study differs from other jobs analyses conducted by NYSERDA that rely mainly on energy savings and program spending as inputs to macroeconomic modeling. This analysis does not incorporate impacts associated with consumer energy savings.

- **Given the close linkage of GJGNY with ratepayer-funded programs, the survey research conducted by NMR that preceded this economic impact analysis carefully addressed attribution and worked to isolate the GJGNY impacts**. The survey approach to developing inputs to the economic impact modeling allowed NYSERDA to take a careful and deliberate approach to attribution. The attribution of jobs created was based on the percentage of program contract or incentive funding provided by GJGNY (as opposed to funding from other sources) and also survey responses by Home Performance with ENERGY STAR Program (HPwES) contractors on the influence of GJGNY program components on their level of activity.

- **The economic impact analysis output is the gross number of jobs and is not net of the potential impacts of alternative spending of the GJGNY funds.**

Appendix A: Detailed Methodology

This section outlines ICF's analytical approach, including an overview of the IMPLAN model, and a discussion of input data configuration and the post-model analysis.

INTRODUCTION TO THE MODEL

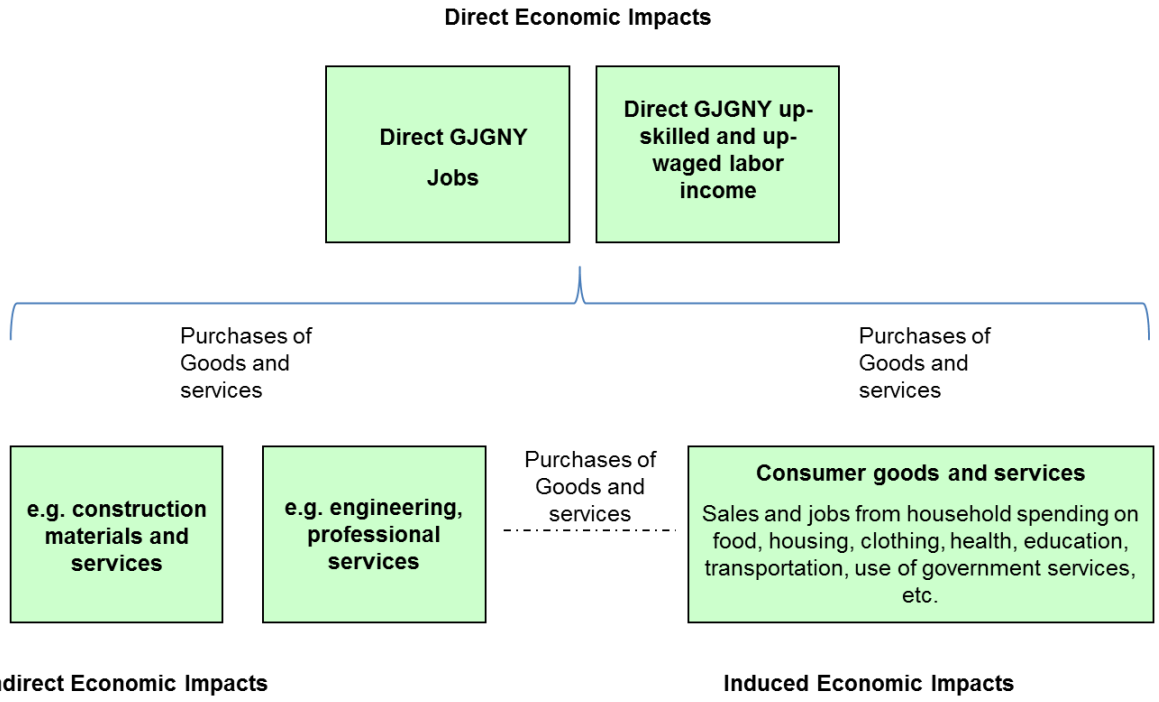
To estimate the economic impacts associated with the GJGNY program, ICF used the economic impact modeling software IMPLAN, a tool used by state agencies throughout the United States to assess regional impacts of programs and policies. The IMPLAN model is a propriety model created and maintained by the Minnesota IMPLAN Group (MIG). It is a static input-output framework used to analyze the effects of an economic stimulus on a pre-specified economic region; in this case, the State of New York. IMPLAN is considered static because the impacts calculated for any scenario by the model are estimates of the indirect and induced impacts annually. The IMPLAN model is based on the input-output data from the U.S. National Income and Product Accounts (NIPA) maintained by the Bureau of Economic Analysis. The model includes 536 sectors based on the North American Industry Classification System (NAICS). (See Appendix B for the IMPLAN industry sector – NAICS code crosswalk table.)

The model uses state-specific industry multipliers to trace and calculate the flow of dollars from the industries that originate the impact to supplier industries. Whenever new industry activity or income is injected into a regional economy, it initiates a "ripple" or multiplier effect that creates an economic impact in the region. The multiplier effect is generated because the recipients of the new income spend some percentage of that new income in the region and the subsequent recipients of that share, in turn, spend some share of it, and so on. The total spending impact of the new activity is the sum of these progressively smaller rounds of spending within the local economy. The total impact of this additional economic activity is collectively referred to as the induced impact and can be measured in terms of jobs, labor income, GSP, and output, among other metrics.

It should also be noted that IMPLAN does not distinguish between full-time and part-time employment. Therefore, impacts presented in this report equate to the actual number of "bodies" employed, rather than the amount of full-time employment activity generated. To ensure that only GJGNY jobs (or partial jobs) were attributed to the program's impact, ICF relied on FTE estimates reported in the survey conducted by NMR in Phase I to estimate the IMPLAN inputs

Figure 2 is a visual diagram of the modeling framework. It illustrates the relationship between the direct, indirect, and induced impacts. At the top is the direct economic impact from the jobs quantified in the survey conducted by NMR in Phase I. Indirect impacts are generated by spending in related industries that buy from or sell to GJGNY program industries. Induced impacts are generated across the economy by the consumer spending of individuals employed in the direct and indirect sectors. The GJGNY program generates additional labor income for up-skilled and up-waged workers, and the additional GJGNY-related income also creates additional induced impacts. By evaluating the total effect associated with these multiple rounds of spending, IMPLAN generates model outputs in terms of jobs, labor income, GSP, and economic output.

Figure 2. Economic Impact Analysis Framework



Source: ICF.

MODELING METHODOLOGY

ICF configured the inputs for the 2014-2015 modeling runs using the results of the survey conducted by NMR . NMR provided ICF with direct FTE and wage data for program years 2014 and 2015 from a survey of GJGNY program employers, by industry (e.g., construction) and job category (i.e., new, retained, up-skilled and up-waged).

The IMPLAN model accounts for employment in terms of the number of "bodies" who are employed instead. That is, one part-time worker and one full-time worker are each considered to be one "body." However, the definition of direct employment used by the survey conducted by NMR in Phase I was designed to more conservatively account for proportions of jobs that are supported by GJGNY, and thus the survey assessed GJGNY-related FTE

employment. To allow the model to accommodate the more specific employment inputs provided by NMR, ICF converted the direct FTE data obtained from the survey into job figures that the model could assess. ICF used the conversion tool provided by IMPLAN[7], which provides FTE-to-job ratios for each IMPLAN sector code. The conversion factors are simply the percent of jobs in an industry that are full-time (calculated as full-time workers divided by all workers). Therefore, the number of "bodies" will always be equal (in the case that 100 percent of jobs in the sector are full-time) or greater (when not all jobs in the sector are full-time) than the number of FTE. To convert the FTE data inputs to "bodies," ICF divided the number of FTEs by the conversion factor (or, by the percentage of jobs that are full-time), as outlined by IMPLAN. ICF did this for both new and retained jobs.

ICF used both the survey-collected direct jobs and wage information to calibrate the 2014-2015 input vectors to align with the specifics of GJGNY program jobs more closely. The labor income entered into the IMPLAN model was calculated directly from the wage data collected by the survey conducted by NMR in Phase I. To calculate the annual income associated with all jobs in a sector, ICF multiplied the hourly wage by 2,080 hours (the number of full-time hours in a year), and then multiplied that figure by the number of jobs in the sector. ICF extrapolated using available survey data, including average percent wage increases or ratios of known wage relationships to make comparisons within industries. When the survey did not provide wage data, wages were estimated by ICF using averages of other survey data or industry specific wage data reported in the 2015 Quarterly Census of Employment and Wages (QCEW) dataset for New York State.[8] Specifically, for industries in which the survey provided no wage data, ICF estimated the wage using industry-specific wages reported in the 2015 QCEW dataset.

Next, ICF analyzed the industry sectors associated with the direct jobs reported in the survey and mapped each direct job from the NAICS code to the respective IMPLAN industry code. In some cases, the IMPLAN codes were less granular than their cross-walked NAICS codes. For example, IMPLAN suggests that all construction activities (e.g., electrical, plumbing and HVAC installation, residential remodelers) be assigned to a general construction code. ICF believes the best approach to account for any sub-industry characteristics that may be lost in the NAICS-IMPLAN crosswalk is through labor income calibration. The NAICS Code – IMPLAN Crosswalk is presented in Appendix B. Of particular note is the fact that the IMPLAN construction sector aggregates many NAICS codes. Because of this aggregation, ICF's discussion of direct and total industry impacts in Phase II will differ from NMR's discussion of direct FTE by NAICS code in Phase I.

[7] MIG. IMPLAN to FTE Conversion.

[8] The Quarterly Census of Employment and Wages (QCEW), a cooperative program of the New York State Department of Labor and the U.S. Bureau of Labor Statistics, collects employment and wage data from employers covered by New York State's Unemployment Insurance (UI). QCEW data cover approximately 97 percent of New York's nonfarm employment, providing a virtual universe of employment and wage data, by industry, for private-sector employees as well as state, county, and municipal government employees insured under the New York State Unemployment Insurance (UI) Act. Employee categories not covered by UI include some agricultural workers, railroad workers, private household workers, student workers, the self-employed, and unpaid family workers. Source: https://data.ny.gov/Economic-Development/Quarterly-Census-of-Employment-and-Wages-Annual-Da/shc7-xcbw.

Table 10. IMPLAN Inputs for Jobs and Labor Income: 2015

	New Jobs	New Jobs Employee Compensation	Retained Jobs	Retained Jobs Employee Compensation
Maintenance and repair construction of residential structures	1,703	$ 66,620,242	569	$ 25,598,039
Architectural, engineering, and related services	144	$ 5,520,197	106	$ 4,537,512
Wholesale trade	138	$ 3,855,905	1	$ 26,000
Grantmaking, giving, and social advocacy organizations	13	$ 396,937	34	$ 1,401,853
Insurance carriers	1	$ 15,600	7	$ 294,909
Business and professional associations	1	$ 40,936	7	$ 495,040
Construction of new single-family residential structures	7	$ -	0	$ -
Individual and family services	1	$ 46,800	5	$ 176,800
Management consulting services	1	$ 79,523	4	$ 249,094
Heating equipment (except warm air furnaces) manufacturing	2	$ 61,072	3	$ 109,200
Junior colleges, colleges, universities, and professional schools	2	$ 108,888	0	$ -

Lastly, ICF created a template of modeling inputs comprised of a series of direct job vectors and associated labor income by industry for each job category. ICF created three modeling scenarios:

- **New jobs**: Workers hired during the 2014 and 2015 program years to support GJGNY-related work
- **Retained jobs**: Workers who were retained during the 2014 and 2015 program years specifically to support GJGNY program functions.
- **The labor income associated with up-skilled and up-waged jobs**: Workers who were provided up-skilling and subsequently higher wages to support GJGNY-related work.

For new and retained workers, ICF created input vectors by industry for direct jobs and associated labor income. For up-skilled and up-waged workers, ICF created an input vector that accounted for the labor income associated with the wage differential between their previous wage and their GJGNY-dependent up-skilled and up-waged rate.

After using direct job values from the survey conducted by NMR in Phase I to create the industry-specific input vectors, ICF used the survey-collected wage information to calibrate the 2014-2015 input vectors to more closely align with the specifics of GJGNY program jobs. To do so, ICF calculated labor income associated with each worker in each sector using the wage data provided by the survey. ICF used the GJGNY-specific labor income

reported in the survey to replace the default labor income provided by the IMPLAN model for each industry. Additional technical details regarding how ICF used the survey data to create the modeling inputs, including the sectors used for this analysis and model input tables, can be found in Appendix B.

OUTPUT METRICS

ICF presented the direct, indirect, induced, and total impact results for the modeling runs for each of the following metrics.

- Employment: Total jobs created by industry, based on the output per worker and output impacts for each industry.
- Employment multipliers: As a ratio, employment multipliers represent the total number of jobs that are created by the direct jobs. The employment multiplier calculated in this analysis can be used to estimate the total employment effect of any direct job estimate.
- Labor income: Total income associated with the increase in total jobs.
- GSP: Value added in the economy, and is the "catch-all" for payments made by individual industry sectors to workers, interests, profits, and indirect business taxes.
- GSP multipliers: Total additional amount of GSP that is created by the initial investment in the program.
- Output: Total value of the output from each industry, which is attributable to program jobs and industry spending.

POST-MODEL ANALYSIS

After producing state-level model outputs for the 2014-2015 runs, ICF apportioned the total impact regionally, based on the proportion of direct jobs reported in each region. With this approach, ICF estimated the total impact for each output metric for each of the 12 New York regions: The Bronx, Capital, Central, Finger Lakes, Kings and Richmond, Long Island, Mid-Hudson/Westchester, New York, North Country, Queens, Southern Tier, and Western region. Lastly, ICF estimated the impact for each metric to economically disadvantaged communities by apportioning total impacts based on the proportion of direct jobs that were identified as being located in economically disadvantaged communities, according to the survey conducted by NMR in Phase I.[9]

[9] For more information about the regions of analysis, see the Phase I GJGNY report *Assessment of Job Impacts of the Green Jobs – Green New York Program*.

Appendix B: NAICS to IMPLAN Crosswalk

Table 11. NAICS Code – IMPLAN Crosswalk

NAICS	NAICS Description	IMPLAN Code	IMPLAN Description
236115	New Single-family housing construction	59	Construction of new single-family residential structures
236118	Residential Remodelers	63	Maintenance and repair construction of residential structures
238150	Glass and Glazing Contractors, Windows		
238210	Electrical Contractor		
238220	Plumbing, Heating and Air-Conditioning Contractors		
238310	Drywall and Insulation Contractors		
333414	Heating Equipment Manufacturing	276	Heating equipment (except warm air furnaces) manufacturing
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	395	Wholesale Trade
522390	Loan servicing	434	Nondepository credit intermediation and related activities
524127	Direct Title Insurance Carriers	437	Insurance carriers
541330	Engineering Services	449	Architectural, engineering, and related services
541350	Building Inspection Services		
541611	Administrative Management and General Management Consulting Services	454	Management consulting services
541618	Other Management Consulting Services		
611310	Colleges, Universities, and Professional Schools	473	Junior colleges, colleges, universities, and professional schools
624190	Individual and Family Services	485	Individual and Family Services
813312	Environment, Conservation and Wildlife Organizations	514	Grantmaking, giving, and social advocacy organizations
813319	Social Advocacy Organizations		
813910	Business Associations	515	Business and professional associations

Source: NMR and ICF International.

Appendix C: Detailed Output Tables by Region

2014-15 Summary of Impacts to Bronx				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect		$599,000	$873,000	$2,287,000
Indirect Effect	7	$384,000	$619,000	$966,000
Induced Effect	4	$252,000	$434,000	$682,000
Total Effect	22	$1,236,000	$1,926,000	$3,934,000
2014-15 Summary of Impact Capital				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	384	$20,118,000	$29,314,000	$76,770,000
Indirect Effect	221	$12,906,000	$20,769,000	$32,414,000
Induced Effect	144	$8,460,000	$14,584,000	$22,880,000
Total Effect	748	$41,484,000	$64,668,000	$132,064,000
2014-15 Summary of Impacts to Central				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	83	$4,372,000	$6,371,000	$16,684,000
Indirect Effect	48	$2,805,000	$4,514,000	$7,045,000
Induced Effect	31	$1,839,000	$3,170,000	$4,972,000
Total Effect	162	$9,016,000	$14,054,000	$28,701,000
2014-15 Summary of Impact to Finger Lakes				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	147	$7,682,000	$11,194,000	$29,315,000
Indirect Effect	84	$4,928,000	$7,931,000	$12,377,000
Induced Effect	55	$3,231,000	$5,569,000	$8,737,000
Total Effect	286	$15,841,000	$24,694,000	$50,429,000
2014-15 Summary of Impacts to Kings and Richmond				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	12	$625,000	$911,000	$2,384,000
Indirect Effect	7	$401,000	$645,000	$1,007,000
Induced Effect	4	$263,000	$453,000	$711,000
Total Effect	23	$1,288,000	$2,009,000	$4,102,000

2014-15 Summary of Impact Long Island				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	709	$37,198,000	$54,202,000	$141,947,000
Indirect Effect	408	$23,863,000	$38,402,000	$59,933,000
Induced Effect	266	$15,642,000	$26,966,000	$42,304,000
Total Effect	1,383	$76,703,000	$119,570,000	$244,184,000

2014-15 Summary of Impact Mid-Hudson and Westchester				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	347	$18,218,000	$26,546,000	$69,521,000
Indirect Effect	200	$11,687,000	$18,808,000	$29,353,000
Induced Effect	130	$7,661,000	$13,207,000	$20,719,000
Total Effect	677	$37,567,000	$58,562,000	$119,594,000

2013 Summary of Impacts to New York				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	301	$15,759,000	$22,963,000	$60,137,000
Indirect Effect	173	$10,110,000	$16,269,000	$25,391,000
Induced Effect	113	$6,627,000	$11,425,000	$17,923,000
Total Effect	586	$32,496,000	$50,657,000	$103,451,000

2014-15 Summary of Impacts to North County				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	402	$21,100,000	$30,745,000	$80,518,000
Indirect Effect	231	$13,536,000	$21,783,000	$33,996,000
Induced Effect	151	$8,873,000	$15,296,000	$23,997,000
Total Effect	785	$43,509,000	$67,825,000	$138,510,000

2014-15 Summary of Impacts to Queens				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	6	$309,000	$450,000	$1,180,000
Indirect Effect	3	$198,000	$319,000	$498,000
Induced Effect	2	$130,000	$224,000	$352,000
Total Effect	11	$637,000	$994,000	$2,029,000

2014-15 Summary of Impact to Southern Tier				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	141	$7,390,000	$10,769,000	$28,202,000
Indirect Effect	81	$4,741,000	$7,630,000	$11,907,000
Induced Effect	53	$3,108,000	$5,358,000	$8,405,000
Total Effect	275	$15,239,000	$23,756,000	$48,515,000
2014-15 Summary of Impact to Western				
	Employment	**Labor Income**	**GSP**	**Output**
Direct Effect	203	$10,665,000	$15,540,000	$40,697,000
Indirect Effect	117	$6,842,000	$11,010,000	$17,183,000
Induced Effect	76	$4,485,000	$7,731,000	$12,129,000
Total Effect	397	$21,991,000	$34,281,000	$70,009,000

Note: Employment values are rounded to the nearest whole number, and dollar values are rounded to the nearest thousand. Numbers may not sum due to rounding.