

NYSERDA TRANSPORTATION PROGRAM MARKET CHARACTERIZATION REPORT

Volume 2: New York State Transportation Market

Final

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1. Introduction

In 2014, New York State’s transportation sector consumed more than 1,073 trillion Btus of energy, or 39 percent of net energy consumption in the state. Approximately 92 percent of transportation energy consumption came from petroleum products. As a result of its reliance on the combustion of petroleum products, New York’s transportation sector was responsible for 74 million metric tons of CO₂-equivalent emissions in 2014, or 41 percent of all fuel-borne greenhouse gas emissions in the state.¹

Within this context, NYSERDA’s Transportation Program has identified several objectives:

- To reduce and diversify the energy consumed by the transportation sector;
- To minimize greenhouse gas emissions; and
- To create economic development opportunities in New York State.²

The current Transportation Program builds on decades of research conducted with state and federal funding. Beginning in 2016 with the transition to NYSERDA’s Clean Energy Fund (CEF), the Transportation Program adopted three focus areas: electric vehicles (EVs), public transportation, and mobility management. The Transportation Program encompasses three program areas – Product Development, Product Demonstration, and Product Deployment – that target distinct phases of the innovation chain but are intertwined through staff, resources, and their long-term outcomes.

The primary goal of this market characterization is to inform program planning and strategy by assessing the current state of the transportation industries operating in New York State. More specifically, the objectives are to:

- Characterize the size and design of the transportation market, including approximate market size, sub-segments (i.e., sectors), and company characteristics;
- Understand how the Transportation Program interacts with and influences different parts of the market, including identification of types of companies that could, or do, benefit from the program; and
- Identify areas where the Transportation Program is well-positioned to address market gaps or barriers.

Typically, a market characterization analysis (MCA) evaluates the market or market potential for a given technology or sector by collecting information on market size, baseline technology adoption rates, and other market conditions. The Transportation Program, however, supports a wide range of technologies

¹ The remaining 59 percent of emissions from fuel consumption are associated with the residential (20 percent), commercial (12 percent), industrial (six percent), and electric generation (21 percent) sectors. NYSERDA. 2016. Patterns and Trends – New York State Energy Profiles: 2000-2014. October 2016. <http://www.nysERDA.ny.gov/About/Publications/EA-Reports-and-Studies/Patterns-and-Trends>

² NYSERDA. 2015. Transportation Program: Product Development, Product Demonstration, and Product Deployment, Program Theory and Logic Model Report. August 2015. <https://www.nysERDA.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2015ContractorReports/2015-Transportation-LM-Report.pdf>

and strategies that may be used across multiple economic sectors and customer classes. As a result, conducting a traditional MCA for the Transportation Program is not feasible. Instead, Industrial Economics, Inc. (IEc) worked with NYSERDA to conduct a two-stage survey designed to elicit information from companies and organizations active in New York State’s market for transportation technologies and services.³ To reach as many companies as possible, IEc employed a “snowball” survey method that began with companies directly connected to the Transportation Program (Stage 1) and expanded to include those companies’ professional contacts (Stage 2).⁴

In addition to the survey, this report considers information from two NYSERDA databases. Concurrently with this MCA, NYSERDA developed an inventory of clean energy companies in New York State, including information on revenues, geographic location, and technology focus; one aspect of this effort focused on transportation-related companies. NYSERDA also collects information on funded projects in its research and development (R&D) Metrics Database. IEc extracted information on transportation companies and projects from these two databases and used the results to validate or fill in gaps in the survey results.

Table 1-1 summarizes this evaluation’s objectives and the associated methods. Additional detail on methods is provided in Section 6.

Table 1-1. Summary of Evaluation Objectives and Methods

		Method (Data Source)			
		Market Survey	Clean Energy Inventory	R&D Metrics Database	
Characterize the size and design of the transportation market	Understand the Transportation Program’s target audience	✓	✓	✓	Section 2
Understand how the Transportation Program interacts with and influences different parts of the market	Assess NYSERDA’s role in the market	✓	✓		Section 3
Identify areas where the Transportation Program is well-positioned to address market gaps or barriers	Inform improvements to NYSERDA’s Transportation Program	✓			Section 4

This report is Volume 2 of a five-volume MCA. The overall structure includes an executive summary (Volume 1); this study, which is the central market characterization (Volume 2); and two targeted studies of key market segments: a study on electric vehicles (Volume 3), and a study on transportation demand management services (Volume 4). Volume 5 contains supplemental appendices.

³ Throughout, this MCA uses the term “company” to refer to companies, organizations, or institutions active in New York State’s market for transportation technologies and services.

⁴ A “snowball” survey is a survey conducted in at least two, and sometimes multiple, rounds, in which respondents in each round identify respondents for the subsequent round from among their professional acquaintances. If, after one or more rounds of snowball sampling, respondents are largely referring individuals that have already been surveyed, this indicates that the “market” (or network) is well characterized, and that additional sampling may not provide new information. Thus, for this market characterization, the Stage 1 and Stage 2 populations are assumed to be part of a single, interconnected market.

2. Size and Design of New York State Market

The transportation system in New York State is one of the largest in the country. As of 2014, the state had nearly 115,000 miles of public roads (four percent of the national total) and more than 129 billion vehicle-miles traveled (VMT), the fourth highest in the country, behind only California, Texas, and Florida.⁵ At the same time, largely because of New York City’s extensive public transit system, more than 25 percent of state residents used public transit in 2014, a figure five times the U.S. average.⁶ The transportation market in New York State thus incorporates a large number of “consumers” of transportation technologies (e.g., drivers and users of public transit).

In addition, the state has many providers of transportation services (e.g., public transit agencies, commercial and institutional fleets, carshare and bikeshare companies, among many others) and companies developing innovative transportation technologies. These companies focus on a wide range of technologies, such as alternative fuel vehicles and infrastructure, marine transport, and communications-enabled intelligent transportation systems (ITS). These companies also span all stages of the innovation chain, from product development and testing to manufacturing to retail. Because of NYSERDA’s focus on clean transportation R&D, this report focuses on characterizing the size and design of the supply-side market.

2.1 Conceptual Market Map

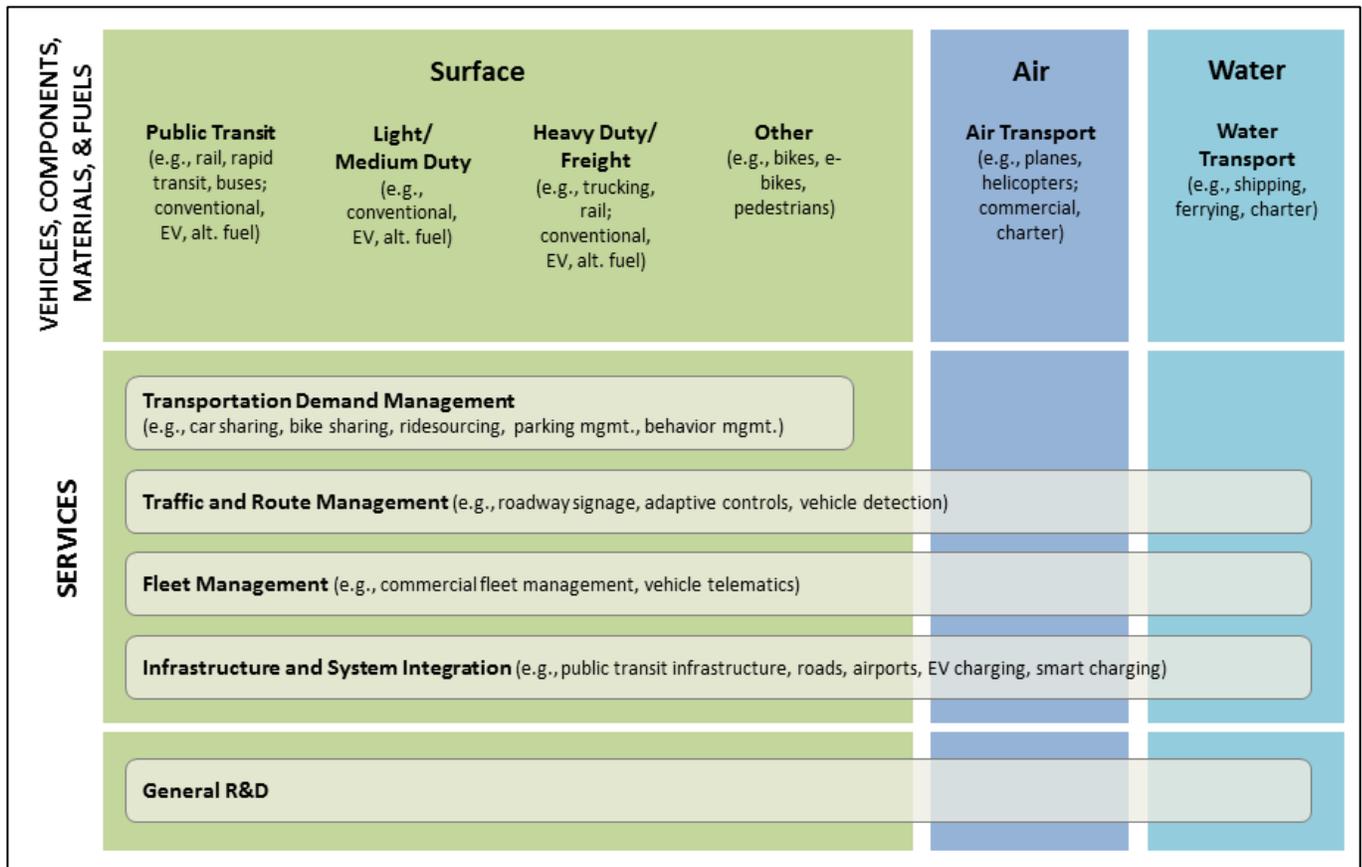
A conceptual map of the subsectors and services comprising the supply-side market for transportation-related technologies is shown in Figure 2-1. The figure represents the overall market for transportation technologies and is not specific to New York State. At one level, the market can be thought of as encompassing companies working on transportation-related products (i.e., vehicles, components, materials, and fuels), transportation services (i.e., transportation demand management, traffic and route management, fleet management, and infrastructure), and general R&D. Each of these sectors can also be subdivided according to transportation mode (i.e., surface, air, and water) or other distinctions, such as conventional or alternative fuel, or conventional or “intelligent” (i.e., communications-enabled) programming.

This conceptual map was developed to inform the survey by IEc, with input from NYSERDA and two academic researchers with expertise in transportation systems. The sectors shown in the map were also designed to align with the categorizations used in NYSERDA’s Clean Energy Inventory, to facilitate direct data comparisons. For additional discussion of the development of the map, see Appendix A.

⁵ U.S. Department of Transportation, Federal Highway Administration (FHWA). 2014. Highway Statistics Series. State Statistical Abstracts 2014: New York. Accessed on February 21, 2017. <https://www.fhwa.dot.gov/policyinformation/statistics/abstracts/2014/state.cfm?loc=ny>; and U.S. Energy Information Administration (EIA). 2017. State Profile and Energy Estimates: New York. Accessed on February 21, 2017. <https://www.eia.gov/state/data.cfm?sid=NY#EnergyIndicators>

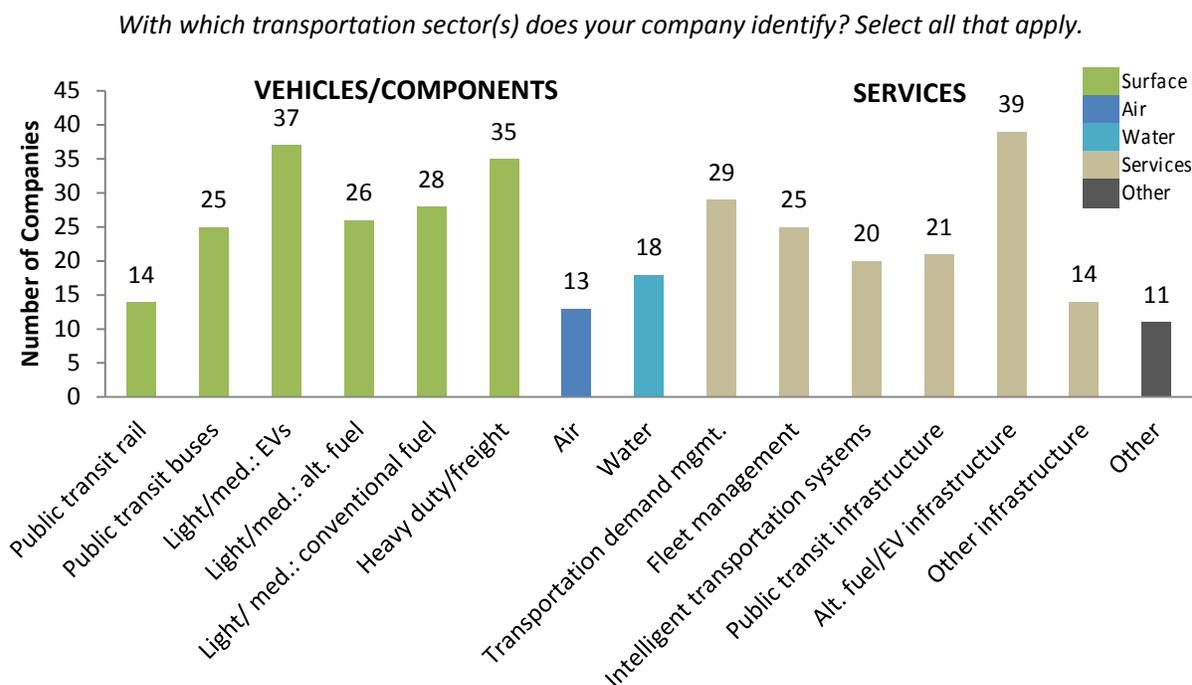
⁶ U.S. Energy Information Administration (EIA). 2017. State Profile and Energy Estimates: New York. Accessed on February 21, 2017. <https://www.eia.gov/state/data.cfm?sid=NY#EnergyIndicators>

Figure 2-1. Conceptual Map of Supply-Side Transportation Market



The results of the survey can be used to understand how each sector outlined above is represented by companies active in New York State. Using a framework similar to that presented in Figure 2-1, the survey asked respondents to identify all transportation sectors with which their company identifies (see Figure 2-2). Approximately 40 percent of companies selected only one sector; the majority selected more than one, and 20 percent selected five or more. EVs and EV infrastructure are particularly well represented among respondents. Those companies that identified with the EV sectors typically selected at least one other sector—most commonly alternative fuel vehicles, transportation demand management, or fleet management. The air transport, water transport, public transit rail, and other infrastructure sectors are the least well represented among respondents.

Figure 2-2. Sectors Represented by Survey Respondents



Importantly, the survey results presented here and throughout this report reflect a pool of respondents that were not randomly selected from the universe of potential respondents (i.e., transportation companies active in New York State). As described in Section 1, the full universe is not known. The results should therefore not be used to make inferences about characteristics of the total population of transportation-related companies in New York State; the results represent the opinions and characteristics of the respondents alone. These respondents largely reflect the companies that have interacted with NYSERDA.

To supplement the survey data and qualitatively address the effect of this limitation, IEC relied upon two existing NYSERDA databases:

- NYSERDA’s R&D Metrics Database, which provides information on all projects funded by the Transportation Program since its inception; and
- NYSERDA’s Clean Energy Inventory, which was completed in 2016 and attempted to catalogue all supply-side (e.g., R&D and manufacturing) companies operating in New York State’s clean energy economy. The Inventory did not focus on producers or providers of services related to transportation, so it provides only a partial insight into the broader market served by NYSERDA’s Transportation Program.

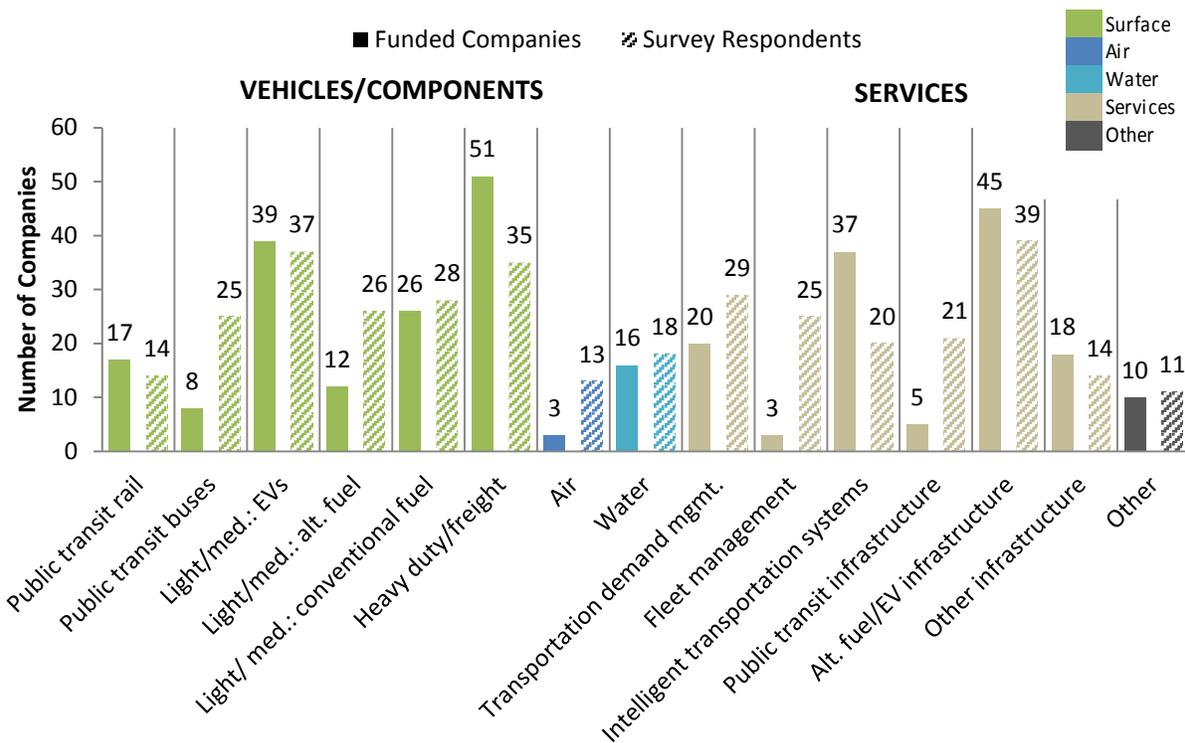
This analysis first compares the sector distribution from the survey results to the distribution implied by the Metrics Database. To analyze the data from the Metrics Database, IEC assigned each transportation

project to a sector based on its project description, and then aggregated the data by company to align with the company-level format of the survey.⁷

As shown in Figure 2-3, the distribution across sectors of survey respondents generally mirrors the distribution of all companies funded or supported by NYSERDA through the Transportation Program, as identified from project descriptions in the Metrics Database. The three sectors with the greatest number of funded companies also have the greatest number of survey respondents; these are the heavy duty/freight, alternative fuel/EV infrastructure, and EV sectors. This result is unsurprising, given NYSERDA’s recent policy focus on freight efficiency and EV adoption.

Some other sectors, such as public transit infrastructure, were more heavily represented in the survey results than the Metrics Database. Given the Transportation Program’s focus under the CEF on public transit efficiency, this could suggest an opportunity for increased NYSERDA engagement with companies active in the market.

Figure 2-3. Sectors Represented by Funded Companies and Survey Respondents



IEc then considered the aggregate distribution implied by all three data sources combined. The Inventory identified 134 companies active in the transportation market and grouped them into four sectors: alternative fueling infrastructure, traffic management, vehicles, and unknown. In analyzing the Inventory data, IEC excluded all companies that had responded to the survey to avoid double-counting. IEC then

⁷ In a few cases, more than one company received funding for a single project, but the Metrics Database identified these companies separately. IEC assigned each company to one or more sectors, based on all corresponding project descriptions.

collapsed the 14 sectors used in the survey and Metrics Database to align with the four used in the Inventory.⁸

Figure 2-4 presents the results of this aggregation. As shown, the largest number of companies identified with the vehicles sector, followed closely by alternative fuel/EV infrastructure. Traffic management (i.e., transportation services) encompasses a smaller number of companies overall.

Of note, all three data sources appear to miss large portions of the market when considered on their own. As expected, the three sources complement each other (in the case of the survey and the inventory, by design). All three source focus on different types of companies, as described in further detail in Section 6.

- The Metrics Database includes companies and organizations, predominantly focused on transportation R&D, that previously received funding from NYSERDA.
- The survey population overlaps with the Metrics Database in its initial stage, but also captures companies that are not connected to NYSERDA but were identified by companies connected with NYSERDA through the snowball sampling technique. In particular, these referrals expanded the survey's focus to include a larger number of public sector organizations.
- The Inventory focuses primarily on for-profit transportation technology development companies and captures the largest number of Transportation Program non-participants, although it also includes a number of companies from the Metrics Database and survey.⁹

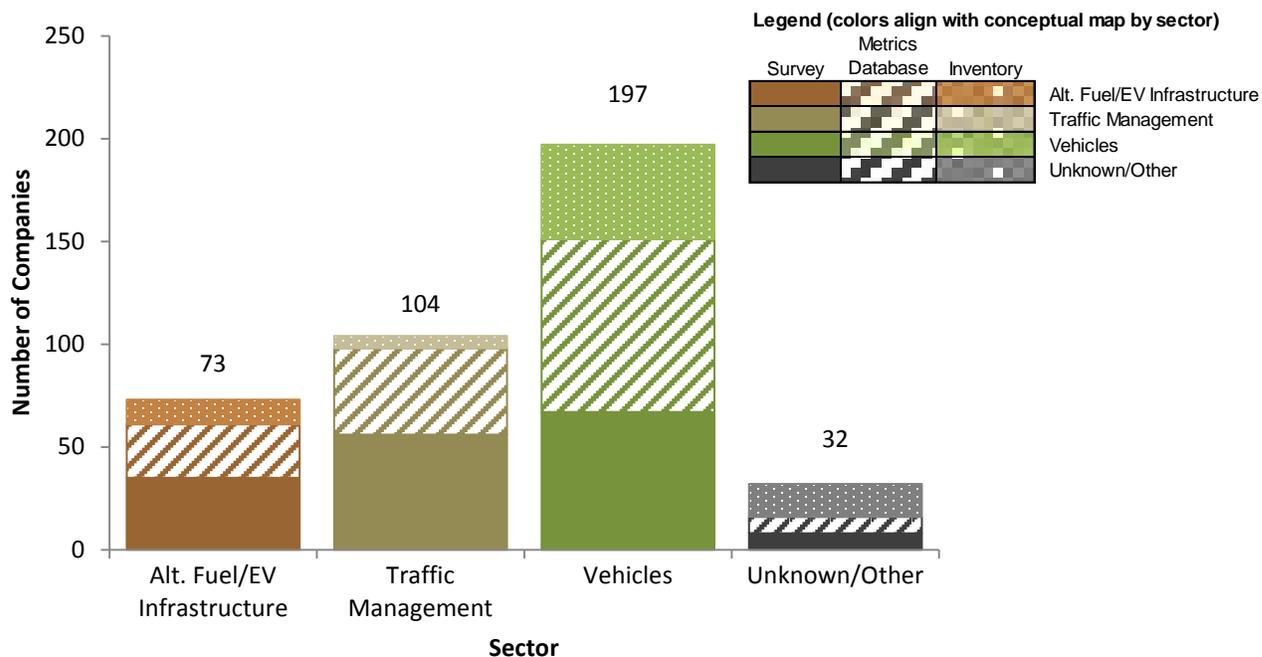
To aggregate data from all three sources, IEC first considers MCA survey respondents, then adds any additional companies from the Metrics Database; these two sources identify companies to which NYSERDA is connected, either directly or indirectly. Finally, IEC adds any additional companies from the Inventory; because these companies were not captured in either the survey or Metrics Database, they are assumed not to be connected to NYSERDA. As a result of this aggregation method, as shown in Figure 2-4, fewer companies are attributed to the Inventory than the other two data sources. The figure also shows that the Inventory identified a relatively small number of companies focused on transportation services and alternative fuel/EV infrastructure, which is not surprising given the Inventory's focus on for-profit technology development companies, rather than service providers.

⁸ The combined survey-Inventory data set uses four sectors, aggregated as follows:

1. Alternative fuel/EV infrastructure (Survey: alternative fuel/EV infrastructure; Inventory: alternative fueling infrastructure)
2. Traffic management (Survey: all services, except alternative fuel/EV infrastructure; Inventory: traffic management)
3. Vehicles (Survey: all surface modes, air, and water; Inventory: vehicles)
4. Unknown/other (Survey: other; Inventory: unknown)

⁹ The Inventory involved a survey of transportation technology development companies, as well as development of the final database. Because the MCA survey and the Inventory survey were conducted concurrently, overlapping companies were generally included in the MCA sample but not the Inventory sample. The Inventory database, however, includes information on these overlapping companies.

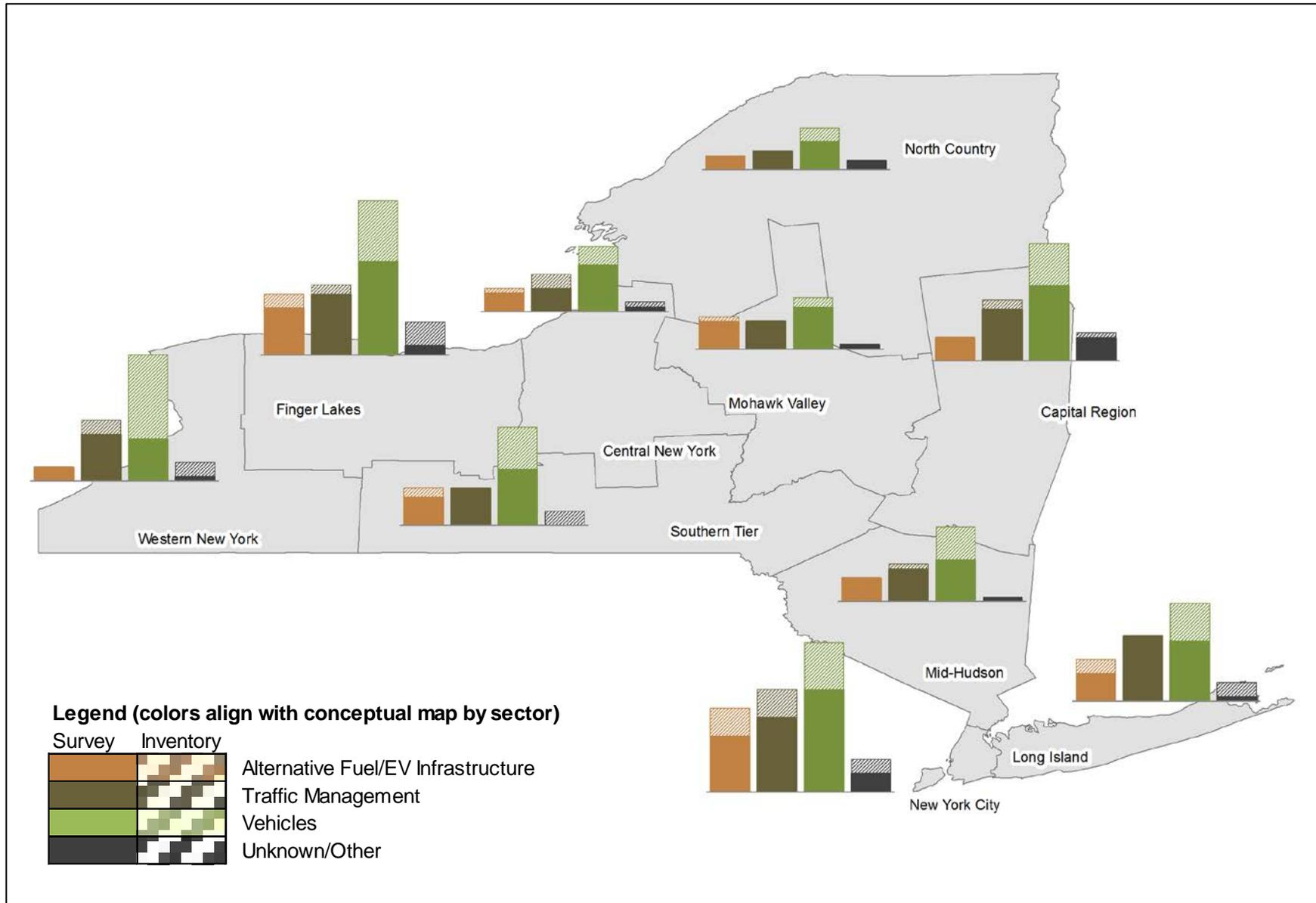
Figure 2-4. Sectors Represented by Survey Respondents, Metrics Database, and Inventory



IEc also considered how the market is distributed geographically. Both the survey and the Inventory include company-level geographic information, allowing IEC to map the companies included in those data sets by the New York State region(s) in which they are located. The Metrics Database does not include geographic information, so the distribution presented in Figure 2-5 encompasses only a portion of the companies known to participate in the market.

Figure 2-5 shows that more urban regions tend to have a higher number of companies. Each of the four sectors is represented in each region, however, and the distribution across sectors within each region follows a similar pattern, with the highest number of companies working in the vehicles sector, followed by traffic management and alternative fuel/EV infrastructure. It is also interesting to note that NYSERDA generally appears to be well connected, based on the relative number of survey respondents (primarily program participants) compared to Inventory companies (non-participants) in each sector and region. The exception to this is companies working in the vehicles sector in Western New York, where the survey identified nine companies while the Inventory identified an additional 18.

Figure 2-5. Regional Distribution of Companies by Sector (Survey Respondents, plus Additional Inventory Companies)

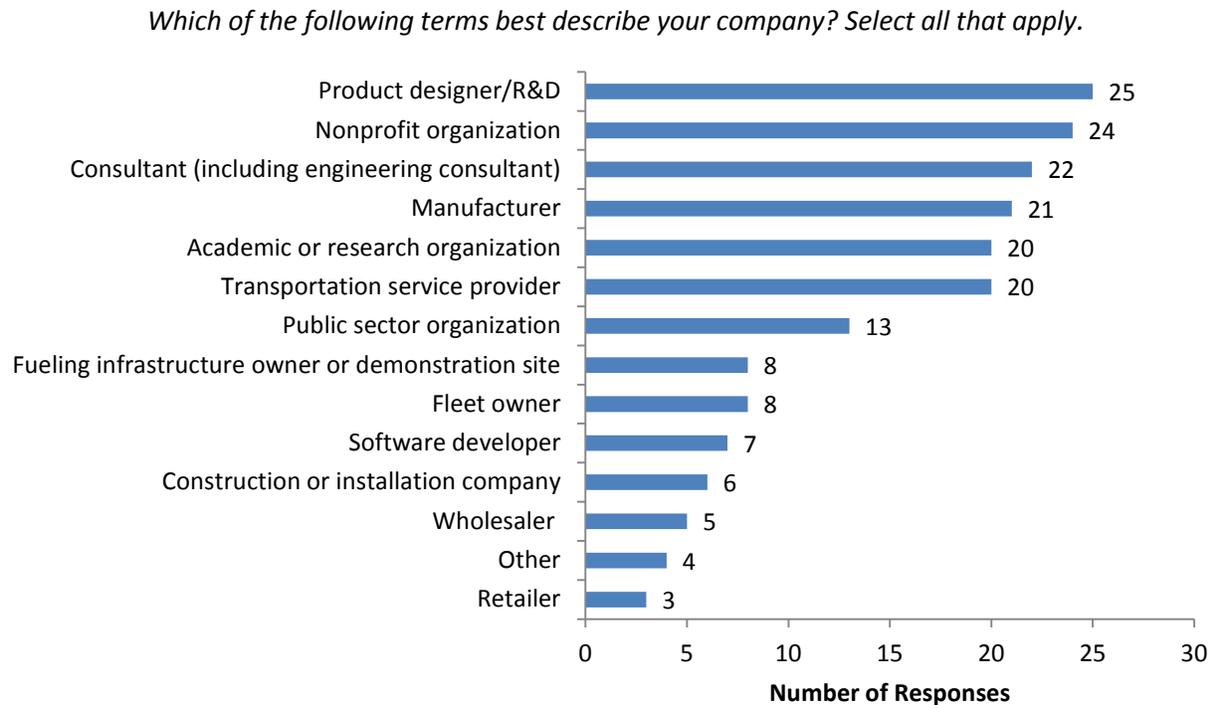


Conceptual Map by Company Type

Another way to map the market is by company type, or position in the innovation chain. Although distinctions by sector (i.e., technology focus) may be more important than distinctions by company type when establishing overall Transportation Program priorities, the presence of a variety of company types in a given market can increase the likelihood that new technologies move from product development to widespread adoption. Key gaps in the innovation chain may represent a focus area for the program.

To understand the distribution of the New York State transportation market by company type, IEC asked survey respondents to select all applicable descriptions of their company type from a defined list. As illustrated in Figure 2-6, the two most common company types among survey respondents represent very different portions of the transportation innovation chain: product designers/R&D companies, and nonprofit organizations. Few companies identified as software developers, construction companies, wholesalers, or retailers. Approximately 60 percent of respondents selected only one company type, with the remaining 40 percent choosing at least two; companies were less likely to identify with more than one company type than they were to identify with more than one sector. It is also interesting to note that a large number of survey respondents could be considered public-oriented organizations (e.g., public sector organizations, nonprofit organizations, academic or research institutions, transportation service providers), rather than private/for-profit companies. Subsequent analyses in this report examine differences in the priorities and market barriers of public organizations compared to private companies.

Figure 2-6. Company Types Represented by Survey Respondents

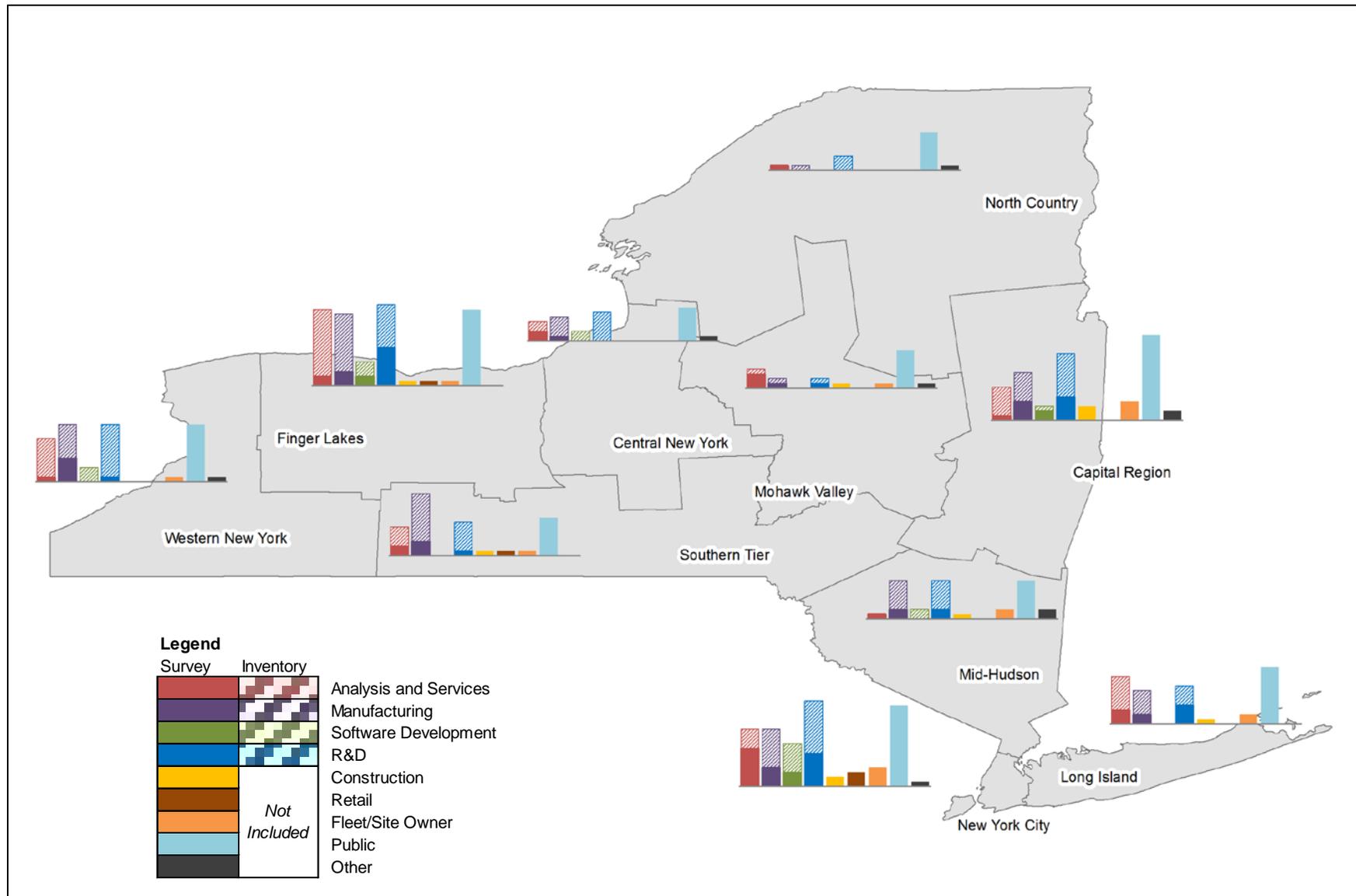


Similar to the analysis above of the market’s geographic distribution by sector, IEC combined survey and Inventory data on company type to generate a more comprehensive data set that supports examination of geographic patterns in company type across program participants and non-participants.¹⁰ (Company type data were not available from the Metrics Database.) As shown in Figure 2-7, in contrast to sectors, company types are less evenly distributed across the state and within each region. Interestingly, the figure shows that public organizations from every region responded to the survey. The figure also illustrates that many regions could be considered “innovation hot spots” where many stages of the innovation chain are represented, including critical product development stages such as R&D, manufacturing, and analysis and testing. In contrast, four regions – North Country, Mid-Hudson, Mohawk Valley, and Central New York – have both fewer companies overall and fewer companies in critical product development stages. Finally, the figure shows that a relatively large number of analysis and services, manufacturing, and R&D companies are not connected to NYSERDA, based on the relative numbers of survey respondents (primarily program participants) and Inventory companies (non-participants). This is particularly true for analysis and services companies in the Finger Lakes region and Western New York; for manufacturers in the Finger Lakes and Southern Tier; and for R&D companies in Central New York and Western New York. Although the survey included a number of company types that the Inventory did not, the additional categories are unlikely to be subsets of those in the Inventory because they are associated with technology deployment and the provision of transportation services, which were beyond the scope of the Inventory. These areas nevertheless represent a key focus of the Transportation Program. Additional discussion of companies’ interactions with NYSERDA and differences between program participants and non-participants is included in Section 3.

¹⁰ The combined data set uses nine categories, although only four were included in the Inventory. The “construction” and “other” company types from the survey were unchanged. Other sub-categories were aggregated as follows:

1. Analysis and services (Survey: consultant; Inventory: analytic testing and services)
2. Manufacturing (Survey: manufacturer; Inventory: component manufacturing, end product manufacturing)
3. Software Development (Survey: software developer; Inventory: software development)
4. R&D (Survey: product designer/R&D; Inventory: R&D and prototype development)
5. Retail (Survey: wholesaler, retailer)
6. Fleet/Site Owner (Survey: fleet owner, fueling infrastructure owner or demonstration site)
7. Public (Survey: transportation service provider, public sector organization, nonprofit organization, academic or research organization)

Figure 2-7. Regional Distribution of Companies by Company Type (Survey Respondents, plus Additional Inventory Companies)

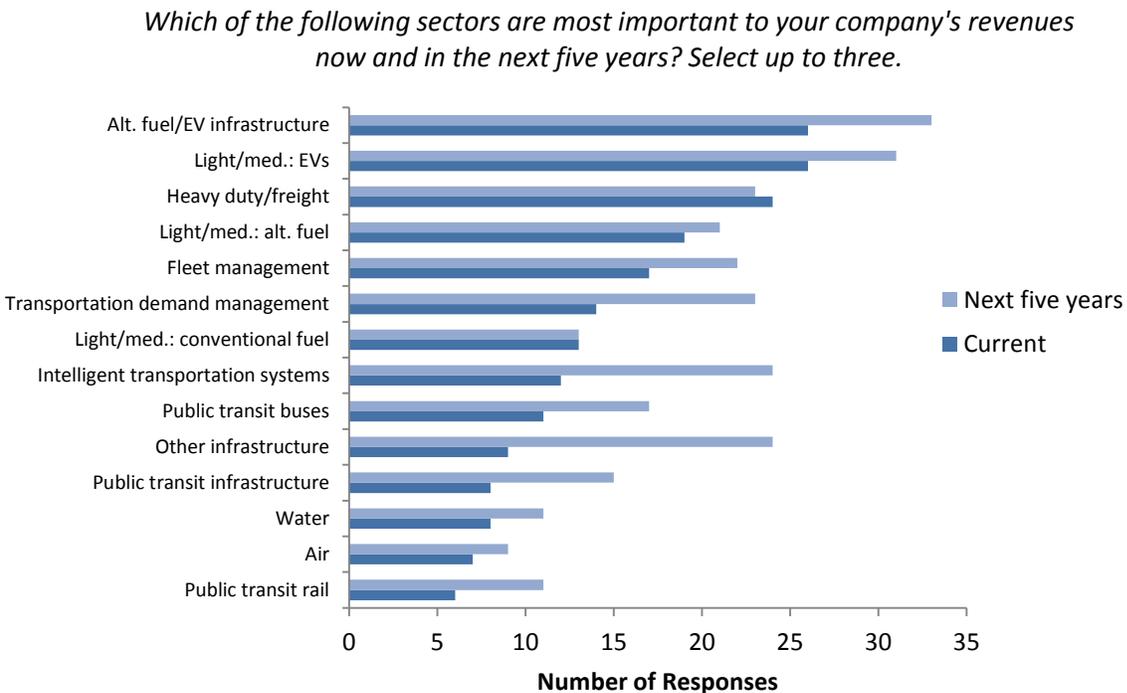


2.2 Emerging Transportation Priorities

In addition to asking respondents to identify *all* sectors with which their company identifies, the survey also elicited information on the relative importance of the various sectors to the market. Specifically, the survey asked respondents to identify which sectors are the most important to company revenues *now* (i.e., 2016, the baseline year for CEF and the year the survey was conducted), and *in the next five years*. Respondents identified the alternative fuel/EV infrastructure and EV sectors as the two most important sectors both now and in the next five years.

The difference between the aggregate responses to these two questions also indicates which sectors may be emerging in importance. As shown in Figure 2-8, all but two sectors were selected more frequently as important to company revenues in the next five years compared to 2016. Of the remaining two sectors, one declined marginally (heavy duty/freight), and one remained unchanged (conventional fuel vehicles). The largest areas of anticipated importance relative to current importance (e.g., the largest differences in the number of respondents listing a given sector as important in 2016 and five years in the future) are in the intelligent transportation systems (ITS) and infrastructure sectors.

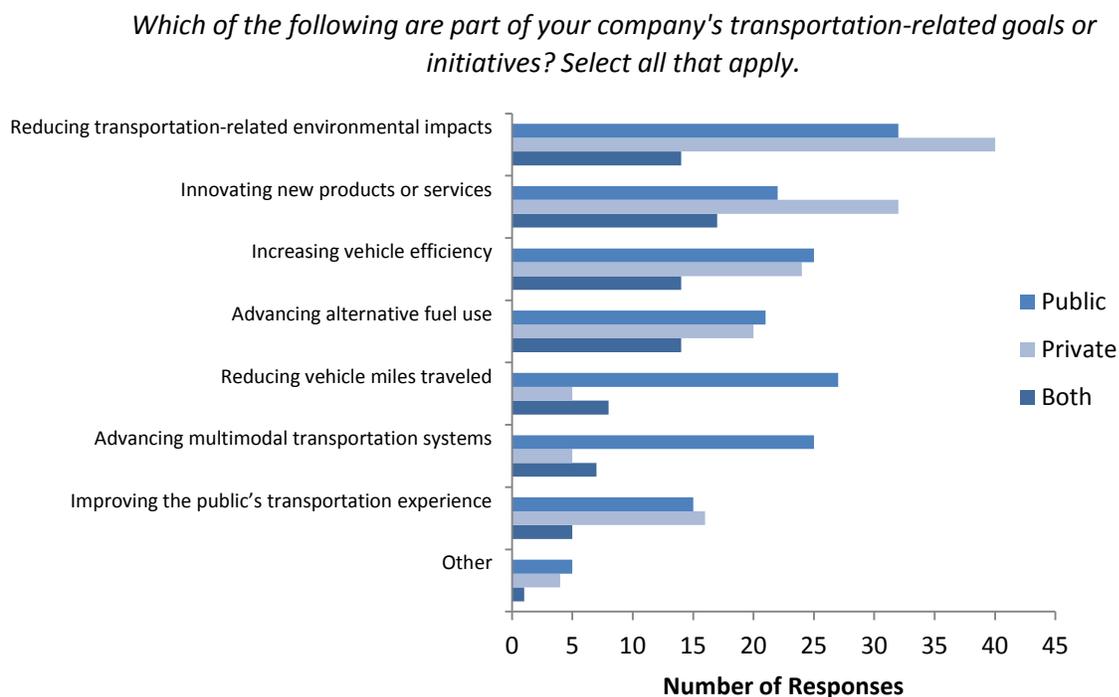
Figure 2-8. Emerging Important Sectors



Respondents selected the factors that are part of their company's transportation-related goals and initiatives to inform NYSERDA's understanding of companies' priorities. Figure 2-9 summarizes the chosen goals. As shown, the majority of respondents chose reducing transportation-related environmental impacts and innovating new products or services.

In analyzing responses to this question, IEc also considered whether a company’s goals vary according to company type—specifically, whether a company works in the public/nonprofit or private sector. Because the survey did not explicitly ask respondents to classify their company as public or private, IEc assumed for purposes of this analysis that all companies identifying as transportation service providers, public sector organizations, nonprofit organizations, and academic or research organizations could be considered “public” organizations.¹¹ In some cases, respondents selected both “public” and “private” company types (e.g., universities working on product development), and were classified by IEc as “both.” Although these classifications are not perfect, the resulting analysis reveals interesting differences in priorities. In particular, two goals were significantly more important to public organizations than private companies: (1) reducing vehicle miles traveled, and (2) advancing multimodal transportation systems. Private companies were more likely to select technology innovation and reducing environmental impacts than public organizations. The goals where both public organizations and private companies converge were increasing vehicle efficiency, advancing alternative fuel use, and improving the public’s transportation experience.

Figure 2-9. Transportation-Related Goals of Survey Respondents



2.3 Company Demographics

To further characterize the transportation market, survey respondents were asked to report on several demographic characteristics of their companies. Overall, these companies represent a wide range of

¹¹ This assumption is a rough rule-of-thumb and likely results in a small number of private companies being miscategorized. For example, vehicle telematics companies that selected “transportation service provider” would be classified as public organizations, despite being for-profit companies.

businesses in terms of size, age, sector, and type. The “average” respondent company has the following characteristics:

- Has all of its operations in New York State,
- Is located in New York City,
- Was established prior to 1990,
- Has fewer than 50 employees,
- Earned less than \$1 million in revenue during the previous fiscal year,
- Is a product designer/R&D company, and
- Works in the alternative fuel/EV infrastructure sector.

As expected, the majority of the companies in the survey have all of their operations in New York State (Figure 2-10) and sell most of their products/services in the state (Figure 2-11). There is a small group of companies (n=10) that have no operations or headquarters in New York State *and* receive more than half of their revenue from outside the state; these companies tended to have fewer than 50 employees and worked in a variety of sectors, the most common of which were EVs and fleet management.

Figure 2-10. Company Locations

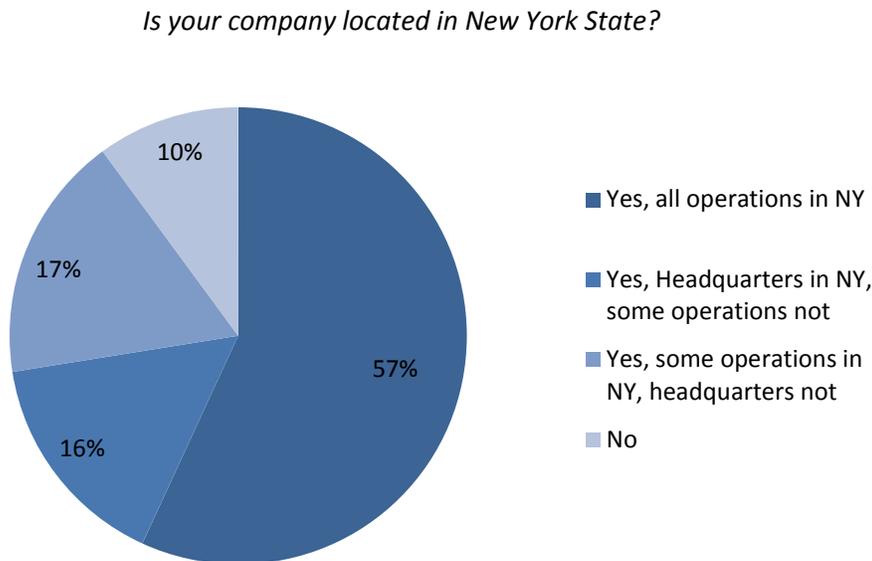
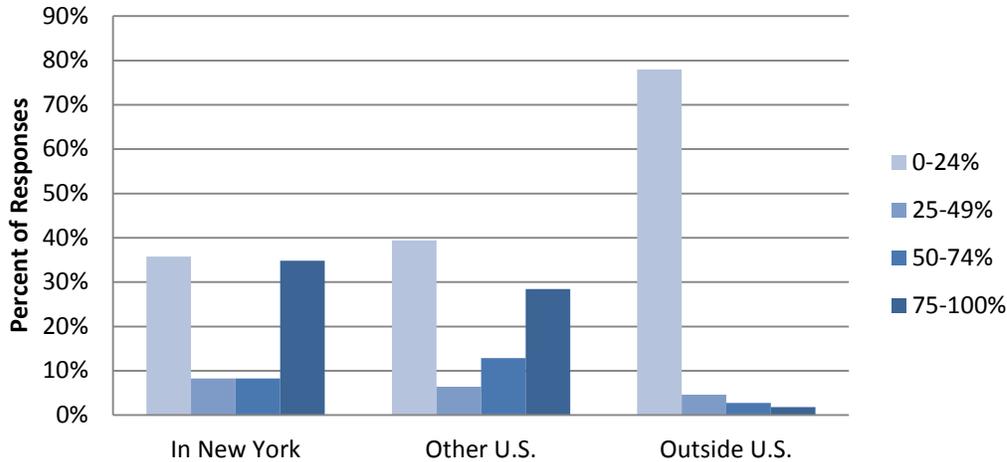


Figure 2-11. Company Revenues by Location

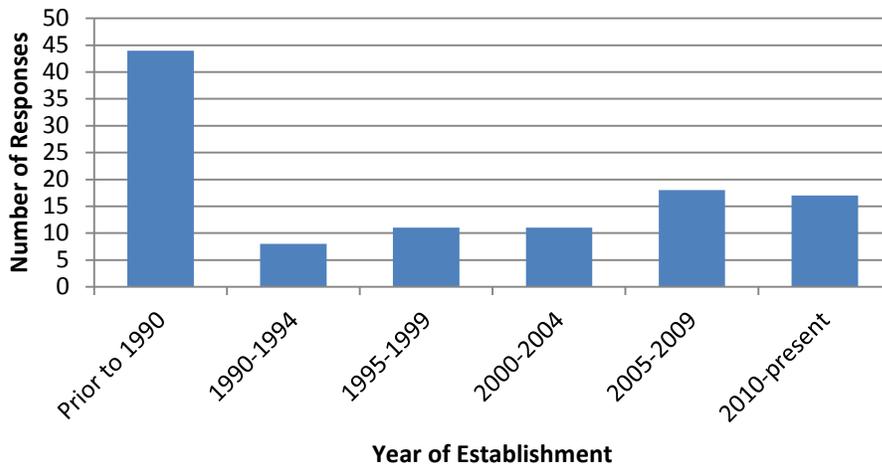
Approximately what percentage of your company's revenues are for products or services sold in the following three areas?



With respect to company age, 40 percent of respondent companies were established more than 26 years ago, prior to 1990; in contrast, 16 percent of companies are six years old or younger (established 2010-present) (see Figure 2-12). Figure 2-13 shows how this pattern varies by sector.¹² Surprisingly, a number of companies that work on EVs and alternative fuel vehicles were established prior to 1990. This result, together with the fact that most EV companies identified with multiple sectors, supports the conclusion that these companies were likely working in other sectors before beginning to work on EVs.

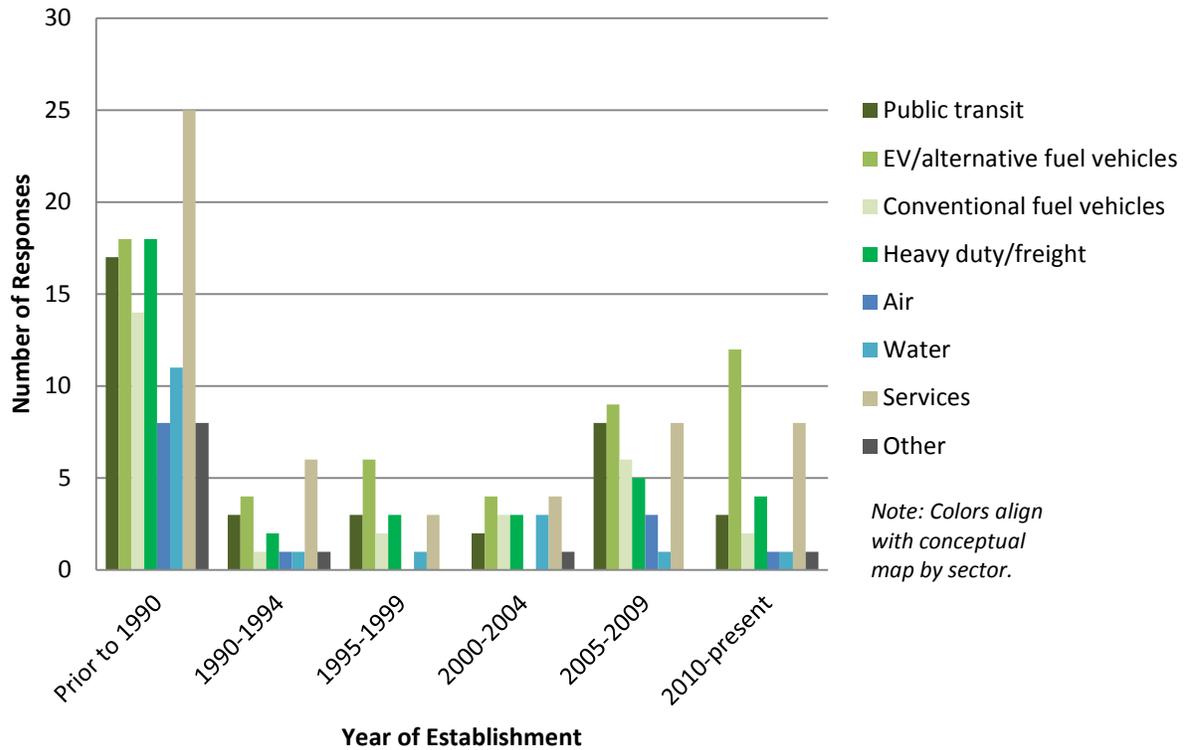
Figure 2-12. Year of Company Establishment

When was your company formally established?



¹² Figure 2-13 combines multiple sectors into technology-specific groupings. For this chart, public transit includes public transit rail, buses, and infrastructure; EV/alternative fuel includes light/medium duty EVs, light/medium duty alternative fuel vehicles, and alternative fuel/EV infrastructure; and services includes all transportation services.

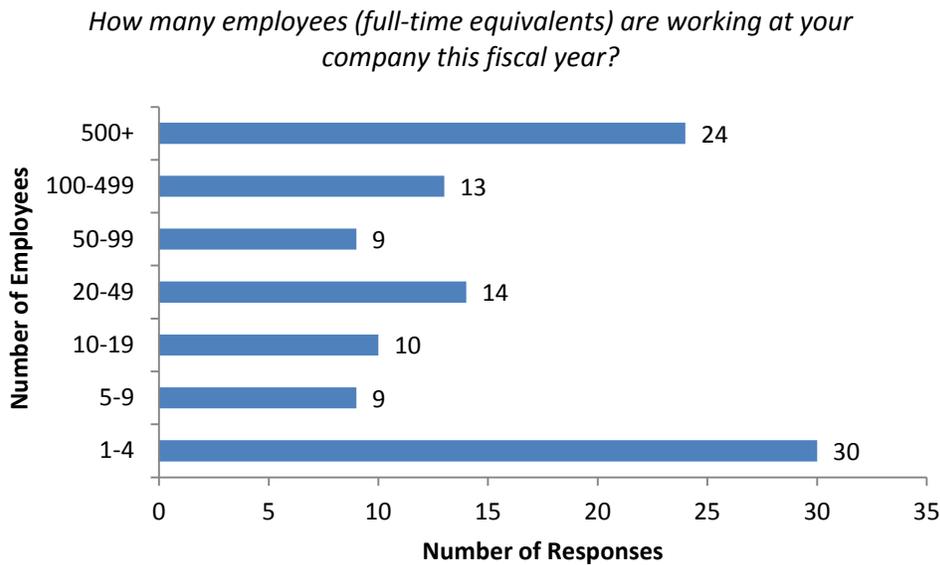
Figure 2-13. Year of Company Establishment by Technology Area (Sector Groupings)



As shown in Figure 2-14, companies’ employment estimates were also skewed towards the ends of the distribution, meaning that there were many small companies (1-4 employees) as well as many large companies (500+ employees). The distribution of employment by sector follows a similar pattern to the overall distribution across sectors within New York State, with no discernible differences between sectors.¹³

¹³ This distribution does not mirror overall state or national patterns in employment, which show less than one percent of companies with 500+ employees and more than 60 percent with four or fewer employees, according to 2012 data from the Small Business Administration. The distribution seen in this MCA is more similar to that of national transportation equipment manufacturing establishments, of which 29 percent have fewer than four employees, and 18 percent have 500+ employees. Source: Table 1, <https://www.sba.gov/advocacy/firm-size-data>

Figure 2-14. Number of Employees

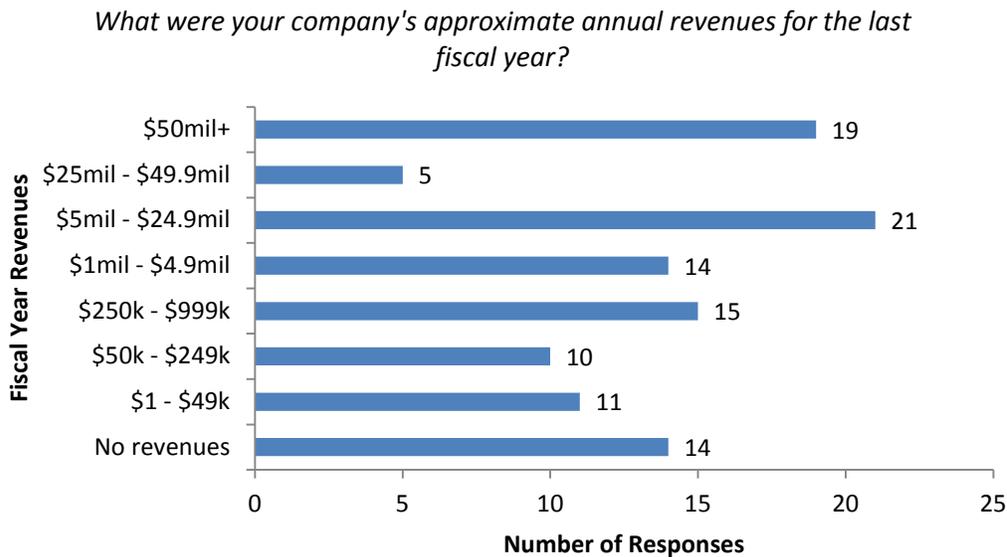


In contrast to employment, company revenue estimates are more evenly distributed, as shown in Figure 2-15. As that figure illustrates:

- 45 companies (41 percent of respondents) reported having revenues greater than \$5 million for the previous fiscal year, and
- 14 companies reported no revenues for the previous fiscal year.
 - Of those, 11 were established prior to 1990, one was established between 1990 and 1994, and two were established since 2010.
 - All except one identified as public, nonprofit, or academic organizations; the remaining company identified as a product designer/R&D company working in the EV, alternative fuel/EV infrastructure, and fleet management sectors.

Similar to the employment estimates, the distribution of revenues by sector follows the same pattern as the overall distribution, with no discernible differences between sectors.

Figure 2-15. Company Revenues for Previous Fiscal Year



2.4 New York State Market Summary

Integration of the data from the survey, Metrics Database, and Inventory provides some basis for an approximation of the size of New York State’s transportation market, in terms of participating companies and annual revenues. Based on the total across these sources, at least 372 companies appear to be active in New York State transportation market. This includes:

- 99 unique companies that responded to the survey;¹⁴
- 144 additional companies included in the Metrics Database;
- 72 additional companies included in the Inventory; and
- 57 non-respondents to the survey that were not included in either the Inventory or the Metrics Database.

Total annual revenues for the market, based on self-reported responses to the MCA survey and data from the Inventory, are estimated at between \$8.4 billion and \$8.9 billion. Importantly, this figure represents a rough approximation because it:

- (1) Includes only those companies that responded to the survey or are included in the Inventory, since revenue information is not collected in the Metrics Database and IEC did not attempt to extrapolate to the total number of companies in the market,

¹⁴ In some cases, IEC sent the survey to multiple individuals at large or diverse organizations, such as universities and public sector organizations. Multiple individuals from seven companies responded to the survey; the total number of responses was 109.

- (2) Represents company revenues as a whole, which for some companies may include sales of non-transportation products or services, and
- (3) Is subject to significant data quality issues, described below.

These limitations are likely to affect the estimate of total revenues in different ways: the first likely leads to an underestimate of total revenues, while the second likely leads to an overestimate of revenues. The third limitation (data quality issues) could lead to either an underestimate or overestimate but, as described below, it is not clear how to correct for the issues. The U.S. Census Bureau's Annual Survey of Manufactures estimates revenues for all New York State transportation equipment manufacturers (NAICS 336) at \$9.2 billion for 2015.¹⁵ This NAICS code may include some companies outside the scope of this MCA (e.g., military vehicle manufacturing) but may also miss a number of organizations (e.g., universities and research centers) that provide critical transportation R&D. In comparison with the estimate from the Census Bureau, the estimate of total revenues presented in this MCA is assumed to understate of the size of New York State's transportation market.

The estimate of total revenues of more than \$8 billion comes from summing estimates from the MCA survey and the Inventory. Annual revenues for the 99 companies represented in the survey are between \$1 billion and \$1.5 billion.¹⁶ In contrast, annual revenues estimated by the Inventory for the 115 companies that were not included in the survey are \$7.4 billion.¹⁷ The difference in magnitude is likely due to the following factors:

- **Differences in company type:** Of the companies in the Inventory database, 79 percent are for-profit companies, compared to an estimated 47 percent of survey respondents. Revenues for for-profit companies in the Inventory are on average \$40 million for privately-held companies and \$315 million for publicly-held companies. In contrast, companies identified as universities or academic institutions had average revenues of approximately \$1.7 million, and nonprofit organizations had average revenues of approximately \$523,000. Thus, based solely on the types of companies included in each data set, aggregate revenues for the survey respondents are likely to be proportionately lower than aggregate revenues for the Inventory companies.
- **Data discrepancies:** Perhaps more importantly, a number of discrepancies exist between the survey results and the Inventory. As a consistency check, IEC reviewed the information on company demographics (year of establishment, region, number of employees, and annual revenues) for the 19 companies that were included in both the survey and the Inventory. Only four of these companies had responses that were complete and consistent across both data sets. In some cases, the responses varied substantially; for example, one company was listed as having a single employee with annual revenues of \$216,000 in the Inventory database, while the same company estimated its employment at 500+ and revenues at greater than \$50 million in the survey. Discrepancies were apparent in each of the four fields compared. The large number of

¹⁵ U.S. Census Bureau. Statistics for All Manufacturing by State: 2015 Annual Survey of Manufactures. New York State, NAICS 336.

¹⁶ The range reflects the high and low endpoints of the revenue "bins" used in the survey. For the seven companies that had multiple respondents, IEC selected the highest estimated revenue bin.

¹⁷ The revenue field in the Inventory database is blank for 46 of the 115 companies. Many of these companies are for-profit companies and are unlikely to have zero revenues; thus, IEC assumes the blanks represent incomplete data.

and lack of discernable pattern in these discrepancies pose serious data quality issues that cannot be easily reconciled.

As a result of these uncertainties, it is not possible to precisely estimate the size of the transportation market in New York State. It is clear, however, that the market is large, representing hundreds of companies and more than \$8 billion in revenues each year.

3. NYSERDA's Role

A secondary focus of this MCA was to assess the extent and nature of NYSERDA's role in the transportation market. Accordingly, the survey was designed as a two-stage snowball survey in which Stage 1 included companies previously funded by the Transportation Program and Stage 2 included those companies' professional contacts. Data from NYSERDA's recent Clean Energy Inventory provide additional detail on Transportation Program non-participants not captured by the survey.

3.1 Interactions with NYSERDA

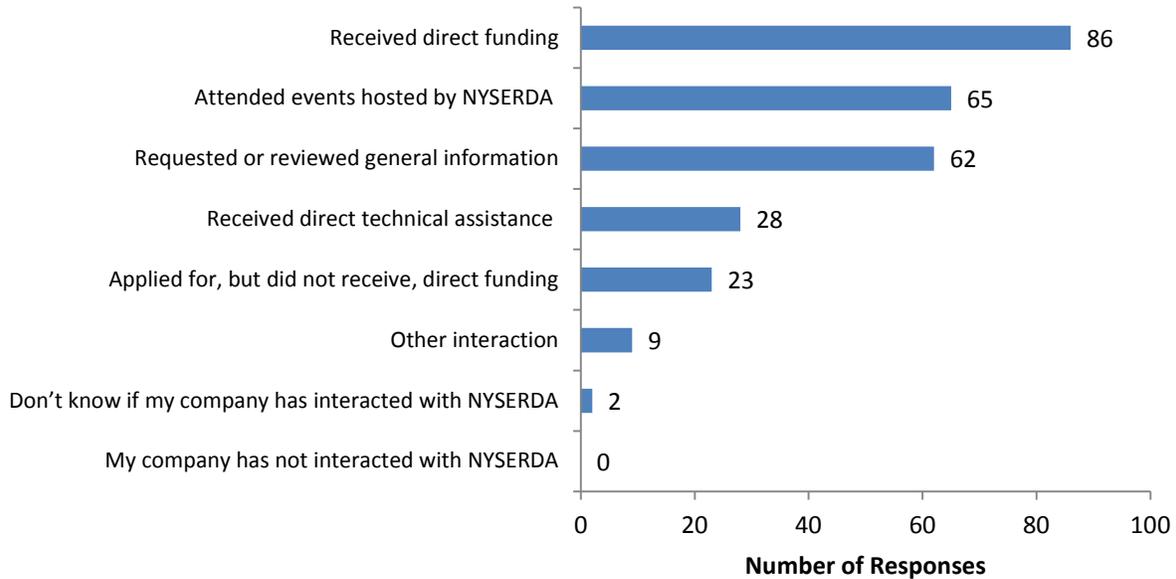
Despite the two-stage survey design intended to identify non-participants, nearly all companies (95 percent) had heard of NYSERDA before taking the survey. Key findings include:

- All but two companies that had previously heard of NYSERDA also knew that their company had interacted with NYSERDA in some way (two respondents were not sure; see Figure 3-1).
- The majority of these respondents (79 percent) received direct funding from NYSERDA.
 - This group included all but seven of the Stage 1 respondents (by survey design, all Stage 1 respondents' companies had received funding, but these seven individuals may not have been aware of this) and 62 percent of the Stage 2 respondents.
 - Only 11 respondents in Stage 2 had not received direct funding from NYSERDA.
- Most respondents had also attended events hosted by NYSERDA or requested or reviewed general information, including materials published by NYSERDA.
- Approximately one-fifth of respondents (n=23) had previously applied for but not received funding from NYSERDA; 17 of these respondents indicated that they had also at some point received funding.

The types of interactions companies have had with NYSERDA do not vary with respect to company size, although there is some variation with respect to annual revenues. In particular, almost half of the companies that reported that they applied for but did not receive funding are in the mid-range of the revenue distribution. Additionally, a few patterns emerge when looking at interactions by company type. First, wholesalers and retailers tended to apply for but not receive funding more often than other types of companies. Second, construction/installation companies and fleet owners tended to receive direct funding more often, while public sector organizations received funding less often. Third, retailers, fueling infrastructure owners, and public sector organizations tended to receive technical assistance more often than other company types; manufacturers and consultants received technical assistance less often. These patterns may change over time with changes in the funding priorities of New York State, NYSERDA, and the Transportation Program.

Figure 3-1. Interactions with NYSERDA (All Survey Respondents)

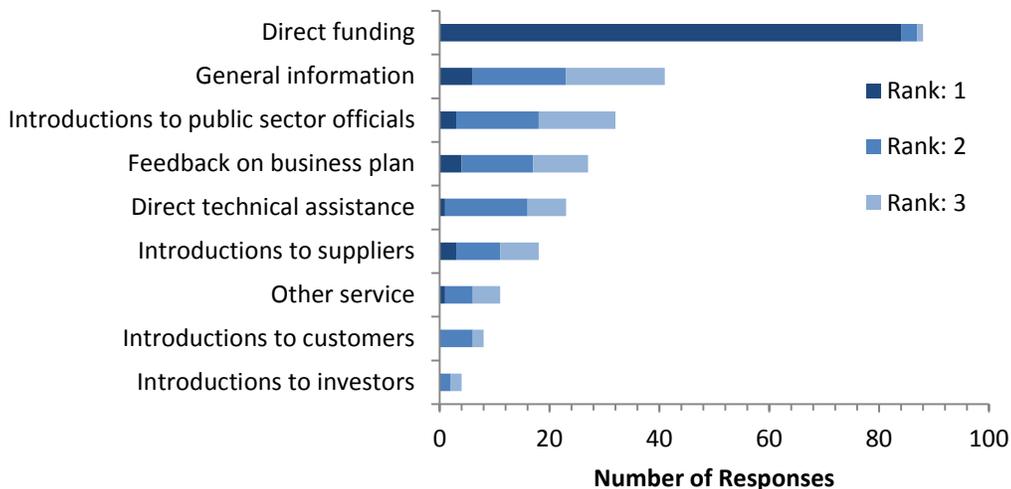
How, if at all, has your company interacted with NYSERDA in the past? Select all that apply.



Respondents were also asked to rank the top three most useful services they had received from the Transportation Program. As shown in Figure 3-2, direct funding was by far the most cited useful service; it was also the service most frequently ranked as number one. Respondents cited general information, introductions to public sector officials, and feedback on business plans as the next three most useful services. Public sector organizations also cited direct funding as the most useful service, followed by general information and direct technical assistance.

Figure 3-2. Most Useful NYSERDA Services

What are the three most useful services that you have received from the Transportation Program to help you achieve your business goals?



Approximately one-quarter of respondents (28 percent) reported that they would like NYSERDA to offer additional services beyond those that are already provided. The most requested additional services were:

- Requests related to funding—specifically, more opportunities for follow-on funding or referrals to other funding sources.
- Additional business development and networking support, including:
 - Introductions to collaborators, customers, and business partners;
 - Industry networking events; and
 - Other support for supply chain development (see Appendix A for additional detail).

Respondents who had not heard of NYSERDA before taking the survey or were not sure if their company had interacted with NYSERDA previously (n=7; spanning all sectors except air and water transport) indicated that they were most interested in receiving direct funding and introductions to public sector officials.¹⁸

3.2 Non-Participant Information

Because the survey results reflect a pool of respondents that were not randomly selected, the results should not be used to make inferences about the characteristics or opinions of the broader population. In addition, nearly all respondents had interacted in some way with NYSERDA before their involvement in the survey. Thus, the results of the survey may not represent the opinions of companies with little to no knowledge of NYSERDA or the Transportation Program—i.e., program non-participants.

IEc relied upon NYSERDA’s Clean Energy Inventory to supplement non-participant information from the survey. Surprisingly, the survey results show relatively little overlap with the Inventory. Of the 195 unique companies in the survey sample (see Section 6) and the 134 transportation companies in the Inventory, only 33 overlap.¹⁹ Of the 99 unique companies that responded to the survey, only 19 overlap. One additional company from the Inventory was included as a Stage 2 referral, and an additional 34 are represented in NYSERDA’s Metrics Database, either because they received funding from the Transportation Program prior to 2010 or received funding from another NYSERDA program. The remaining 66 companies in the Inventory appeared not to be connected to NYSERDA, either through the survey or the Metrics Database. This lack of overlap seems to be driven at least in part by differences in company types targeted by each data source; the Inventory focused on product developers and manufacturers; the survey, in contrast, captured research facilities and developers and providers of transportation services. Review of the data indicates that 79 percent of the companies included in the Inventory are for-profit companies, compared to an estimated 47 percent of survey respondents, reflecting

¹⁸ After comparing these seven survey respondents’ organizations to NYSERDA’s Metrics Database, three of the organizations have in fact worked with NYSERDA’s Transportation Program in the past. Most likely, the individuals responding to the survey were not involved in those efforts.

¹⁹ Although overlapping companies were generally excluded from the Inventory survey, they were included in the database. Thus, the concurrent design of the two surveys cannot explain this lack of overlap.

the Transportation Program’s projects with public sector transportation service providers and with universities and other research institutions.²⁰

Although the survey provided limited insight into program non-participants, the referrals provided by Stage 1 and Stage 2 respondents suggest that the R&D network may be relatively tight. Of the 61 unique referrals received from Stage 2 respondents, 25 had already been included in either the Stage 1 or Stage 2 sample, and 15 of the 36 “new” referrals were municipal or state agencies or associations; as discussed below, this survey was not designed to comprehensively survey these types of public sector organizations. Overall, although each of the three data sources relied upon in this analysis captured only a portion of the New York State market, the combination of all three is likely to present a fairly comprehensive picture. Remaining gaps that could be addressed in a more extensive snowball survey may include:

- **Non-participants active in New York State market but located elsewhere.** The Inventory, which provides the most comprehensive information on program non-participants, was designed to include only companies located in New York State, not those located elsewhere but active in the New York State market. As a result, some companies that could be potential Transportation Program partners may not be included.
- **Public sector organizations.** Although the survey ended up reaching a relatively large number of public sector organizations, most of which were referred by Stage 1 respondents, it was not designed to comprehensively identify those organizations. Thus, many public sector organizations and municipal transit agencies across the state may not have been included, as demonstrated by the large proportion of Stage 2 referrals that were transit agencies or associations. In addition, a number of the survey non-respondents that were not included in either the Inventory or Metrics Database appeared to be public sector organizations. The priorities and needs of these organizations may be similar to those reflected in survey results; however, the survey did not attempt to systematically reach out to public sector organizations across the state, so some gaps may remain.

²⁰ Because the survey did not ask respondents whether their company was for-profit, IEc categorized all company types other than transportation service provider, public sector organization, nonprofit organization, and academic/research organization as private/for-profit.

4. Gaps and Barriers in Market Development

To inform future Transportation Program strategy, the survey also asked respondents a series of questions about gaps and barriers in the transportation market, as well as outcomes related to NYSERDA-supported projects. In addition, the survey asked respondents about their company's level of interest in six key technologies that could be emphasized by the Transportation Program under the CEF. Their responses to those questions can help to identify potential opportunities for increased Transportation Program involvement.

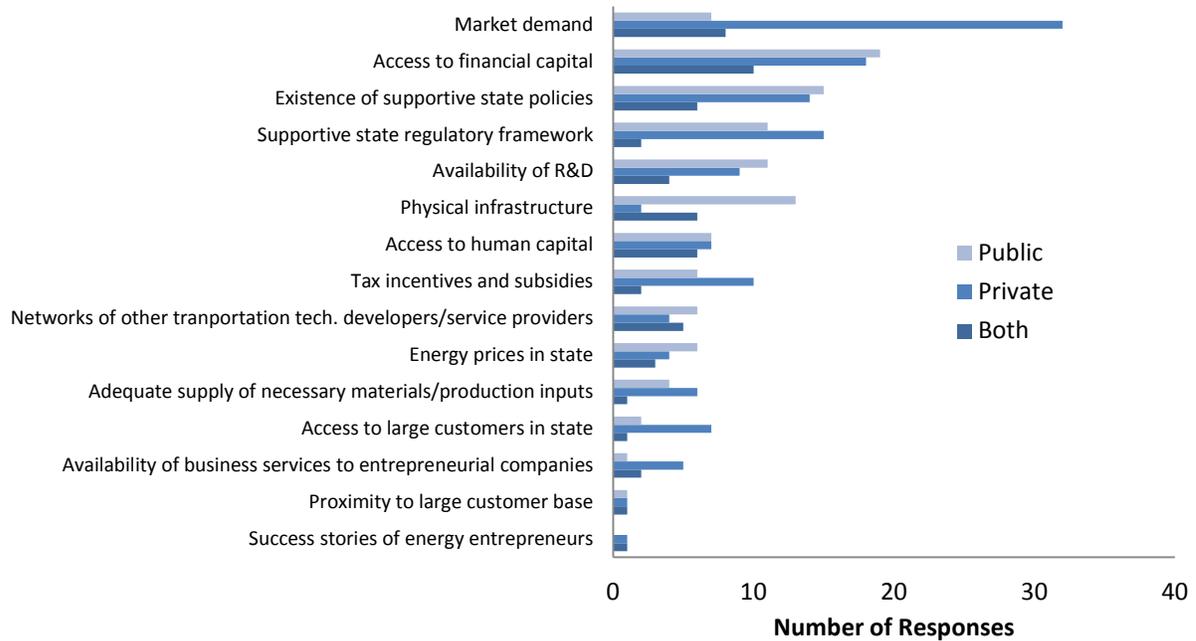
4.1 Influences and Barriers

To understand factors driving market development, the survey first asked respondents to select the factors that have the greatest influence on their company's technology development efforts. As shown in Figure 4-1, market demand and access to financial capital were cited most frequently across companies, although market demand was more important to private companies than public organizations. Respondents from both public organizations and private companies also reported that the existence of supportive state policies and a supportive state regulatory framework were highly influential.²¹ Physical infrastructure was much more influential for public organizations than private companies, while tax incentives and subsidies, access to large customers, and the availability of business services were more influential to private companies.

²¹ As designed, the survey intended "lack of supportive state policies" to refer to the need for specific policies, and "unsupportive regulatory framework" to refer to New York State's existing transportation regulation and policy that might present costs or difficulties for new technologies. The two are closely related, however, and respondents' open-ended explanations of their top influences and barriers indicate that the distinction between these two categories may be minimal in some cases.

Figure 4-1. Influencing Factors

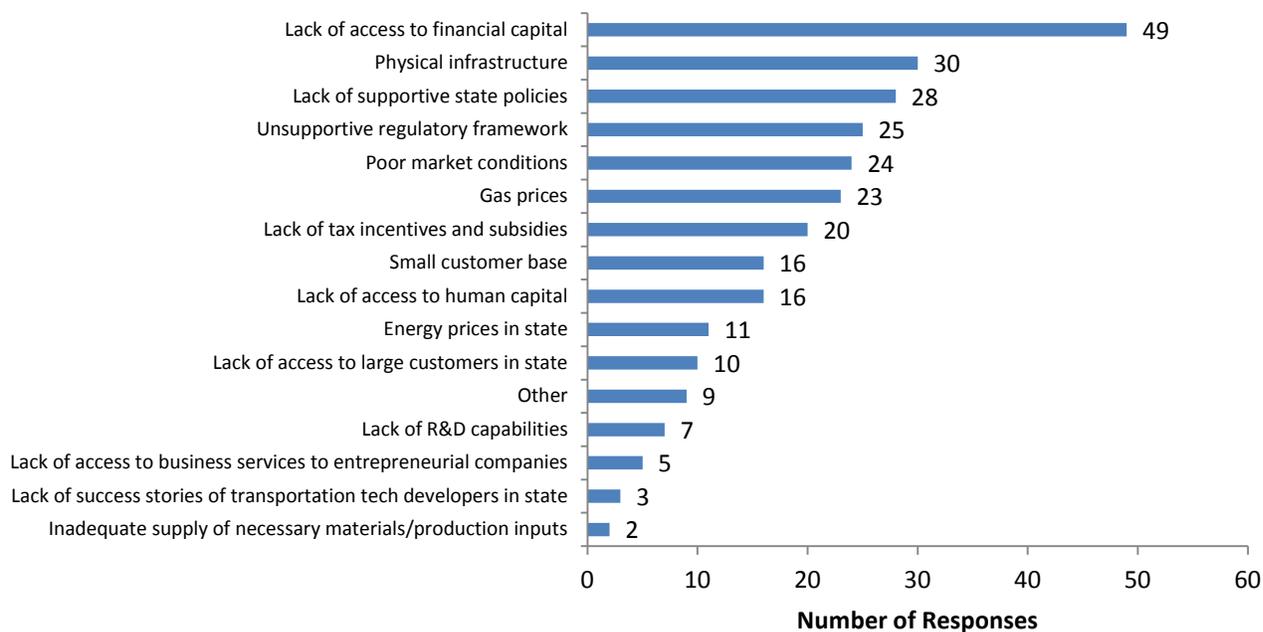
Of the following factors, which have the most influence on your company's transportation technology development efforts? Select up to three.



Respondents were then asked to select the factors that represent the greatest *barriers* to market development. Figure 4-2 summarizes companies' responses. The most common barriers mirror the factors with the most influence. In particular, access to financial capital appears to be both a major influence and barrier for respondents. Physical infrastructure, a lack of supportive state policies, an unsupportive state regulatory framework, and poor market conditions were also among the top reported barriers. When looking at barriers by company type, R&D companies, nonprofit organizations, and academic institutions noted the need for capital more frequently than other company types. When looking at barriers by sector, gas prices concerned EV companies specifically, which is consistent with their market focus.

Figure 4-2. Barriers to Development

Of the following factors, which currently present the greatest barriers to transportation technology development for your company? Select up to three.



4.2 Outcomes and Technologies of Interest

The survey also asked about specific outcomes of Transportation Program support to inform program strategy and evaluation. While focused on impacts, the survey was not designed to support a quantitative impact analysis. Rather, these findings qualitatively indicate where program areas of focus have been successful, and can help support framing for future program efforts. As noted above, 82 percent of respondents had received direct funding or technical assistance from NYSERDA. Of those, 83 percent reported that they are still selling, providing, or developing the product or technology supported by NYSERDA. This response did not differ substantially across sectors.

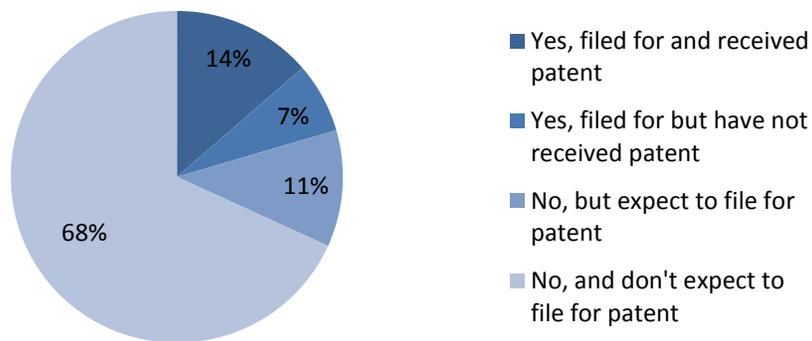
For those companies that are no longer pursuing development of NYSERDA-supported products or technologies, the most common reason cited was that customer demand was lower than expected. The majority of respondents (53 percent) reported that the Transportation Program was extremely or very influential in helping advance the product or service for which NYSERDA provided support. Companies that were no longer selling, providing, or developing NYSERDA-supported products or technologies were substantially less likely to say that NYSERDA was extremely or very influential (27 percent compared to 71 percent). The strength of this correlation is limited, however, by the small number of companies not still selling, providing, or developing NYSERDA-supported products or technologies (n=11).

Although most respondents are still selling, providing, or developing a NYSERDA-funded product or technology, only 11 percent have filed for and received a patent for that research (see Figure 4-3). Two-thirds of respondents (68 percent) have not filed, and do not expect to file, a patent for their research. This

implies that NYSERDA-supported projects may typically involve the adaptation of existing technologies, rather than development of new technologies. Most of the companies that have filed patents have filed three or fewer, all of which are design or utility patents. One company, however, which self-identified as a manufacturer and product designer/R&D company operating in the alternative fuel vehicles and water transport sectors, had filed 15 patents. In general, companies that had filed or planned to file patents most commonly identified as part of the heavy duty/freight sector, which may reflect NYSERDA’s previous focus on freight efficiency.

Figure 4-3. Patents Filed

Have you filed for any patents based on the research conducted with NYSERDA's support?

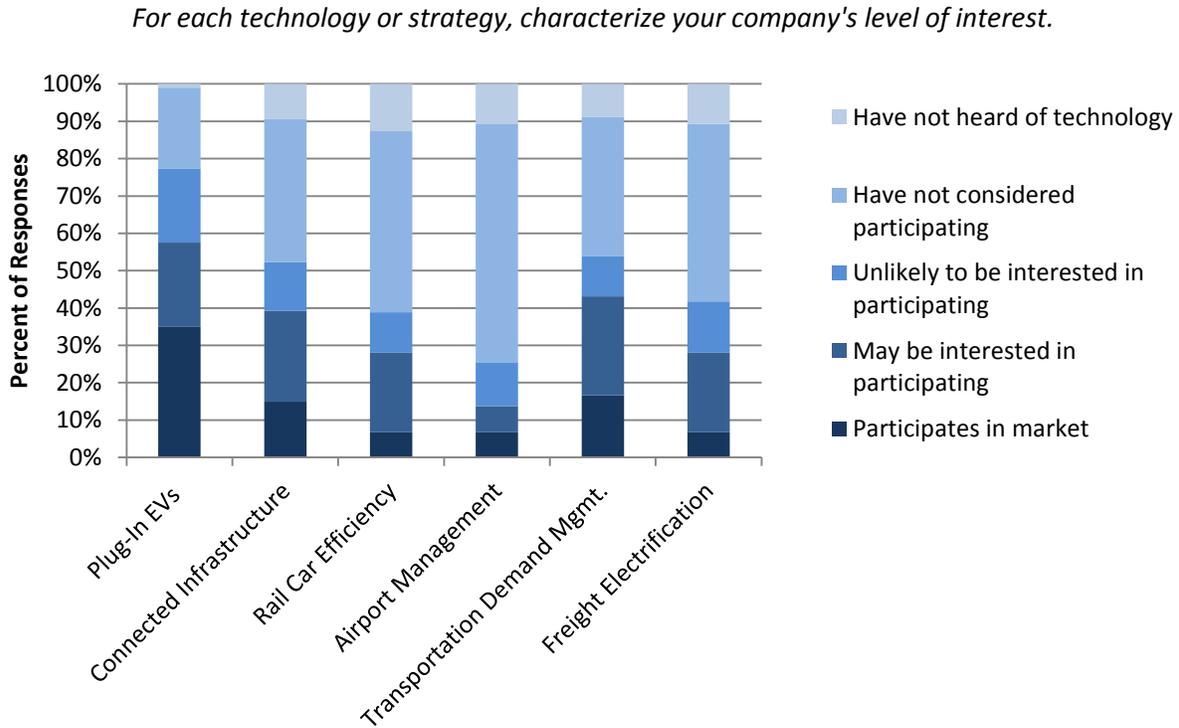


The survey also asked about companies’ interest in six specific transportation technologies and strategies to understand how those sub-markets are likely to change over time. These technologies and strategies were selected because each aligns with one of the Transportation Program’s focus areas under the CEF; each was also evaluated in one of a series of case studies conducted by IEC in 2016 and 2017. The results of these survey questions can therefore be combined with the conclusions of the case studies to better understand market gaps, barriers, and opportunities. The technologies are: plug-in EVs, connected infrastructure (e.g., adaptive traffic signals), rail car efficiency, airport management, transportation demand management (TDM), and freight electrification.

As shown in Figure 4-4, nearly 60 percent of respondents either currently participate or may be interested in participating in the market for plug-in EVs. Approximately 40 percent of respondents indicated that they currently participate or may be interested in participating in the markets for connected infrastructure and TDM. Relatively few respondents expressed interest in participating in the market for airport management. These responses mirror respondents’ indication of the sectors that are most important now and in five years, as shown in Figure 2-8. These responses also align with the results of IEC’s previous case studies, which indicated that the markets for EVs, TDM, and connected infrastructure are growing rapidly, while the market for the airport departure management system evaluated in the case study has limited potential for expansion. The case studies also indicated that, for EVs and connected infrastructure in particular, the need for additional R&D to address key technological and economic barriers is essential.

The markets for EVs and TDM are also hindered, to some extent, by low consumer awareness and engagement.²²

Figure 4-4. Technologies of Interest



²² The six case studies are available here:

- NYSDERDA. 2017. NYSDERDA Transportation Program Case Study: Leviton’s Electric Vehicle Charging Station Demonstration. March 2017. <https://www.nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2017ContractorReports/Transportation-Case-Study-Report-Leviton.pdf>
- NYSDERDA. 2017. NYSDERDA Transportation Program Case Study: KLD’s Adaptive Control Decision Support System for Traffic Management. January 2017. <https://www.nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2016ContractorReports/Adaptive-Control-Decision-Support-System-Traffic-Management-Transportation-cs.pdf>
- NYSDERDA. 2016. NYSDERDA Transportation Program Case Study: Public Transit Research and Development Funding for Alstom Transportation. September 2016. <https://www.nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2016ContractorReports/Alstom-Transportation-cs.pdf>
- NYSDERDA. 2016. NYSDERDA Transportation Program Case Study: Saab Sensis Advanced Airport Departure Manager. December 2016. <https://www.nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2016ContractorReports/Saab-Sensis-Advanced-Airport-Departure-Manager-Transportation-cs.PDF?la=en>
- NYSDERDA. 2016. NYSDERDA Transportation Program Case Study: Transportation Demand Strategies at the Buffalo Niagara Medical Campus. September 2016. <https://www.nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2016ContractorReports/2016-Transportation-Case-Study-Buffalo-Niagara-Medical-Campus.pdf>
- NYSDERDA. 2016. NYSDERDA Transportation Program Case Study: Electric Refrigeration Transportation Network. November 2016. <https://www.nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2016ContractorReports/2016-transportation-case-study-electric-refrigeration.pdf>

5. Conclusions

This market characterization demonstrates that the transportation market in New York State is large, both in terms of number of participating companies (at least 372) and annual revenues (more than \$8 billion), although this represents a small share (less than one percent) of New York State's 2015 gross domestic product.²³ The companies that constitute the supply-side market span many sectors, with a relatively strong emphasis on alternative fuel/EV infrastructure. All sectors are represented in New York State, although a few – including air transport, water transport, public transit rail, and other infrastructure – appear to encompass only a small number of companies. In addition, the companies active in the market are arrayed across the state, although they tend to cluster in more urban regions.

The MCA also suggests that NYSERDA plays a significant role in the market and has at least some interaction with all portions of the market. Despite the two-stage survey approach selected to reach as many non-participants as possible in the second stage, nearly all survey respondents had interacted with NYSERDA in the past; those companies generally also indicated that NYSERDA was extremely or very influential in the success of funded projects. Survey data also showed that NYSERDA is interacting with a wide range of companies by company size (i.e., employment and revenues), age, type, and sector.

However, as a comparison to NYSERDA's Clean Energy Inventory reveals, a number of companies remain unconnected to NYSERDA and beyond the reach of the survey. This is particularly true in the Finger Lakes region and Western New York for analysis and services companies; the Finger Lakes and Southern Tier for manufacturers; and Central New York and Western New York for R&D companies. A more extensive snowball survey building on the total market (i.e., all companies from the survey sample frame plus additional Inventory companies) could be useful in the future to ensure that the information presented in this MCA does not exclude key portions of the market.

When survey respondents were asked to identify important market influences and barriers, many cited access to financial capital. After funding, key barriers to market growth included physical infrastructure, a lack of supportive state policies, an unsupportive state regulatory framework, and poor market conditions. The emphasis on physical infrastructure mirrors the statement by many respondents that infrastructure will be one of the most important sectors to their company's revenues five years from now.

The results of this market characterization point to several areas where the Transportation Program is well-positioned to address market barriers, as well as other implications for program strategy:

- **Consider engaging in additional outreach:** One of the most revealing findings of this MCA was that each of the three data sources relied upon (the survey, Inventory, and Metrics Database) miss substantial parts of the market when considered separately. Based on the non-participant data from the Inventory, the companies that NYSERDA has not interacted with are likely to be for-profit companies focused on technology development and manufacturing, R&D, and analysis and testing, primarily located in the western half of the state. Without more information on these companies, it is not known whether they are a target market for Transportation Program support.

²³ U.S. Bureau of Economic Analysis (BEA). Regional Data: Gross domestic product (GDP) by state (millions of current dollars). New York State, 2015. https://www.bea.gov/iTable/index_regional.cfm

The Transportation Program may want to examine these companies to determine whether they represent technologies, regions, or other areas of future focus.

- **Continue providing, and consider expanding, business development support:** Although survey respondents indicated that they were most interested in receiving direct funding, respondents' second- and third-choice responses, as well as open-ended feedback, suggested that introductions and business development support were particularly valuable to private-sector companies. Consistent with their citing of unsupportive policies and regulatory frameworks, companies also cited introductions to public sector officials as one of the most useful services NYSERDA could provide. Respondents also offered a number of suggestions for business development support, including requests for industry networking events and other forums for connecting potential business partners. Based on this feedback, NYSERDA should continue providing business development support, while considering whether there are new ways to facilitate connections among partners.
- **Maintain focus on intelligent transportation systems (ITS) and EV sectors:** Survey respondents indicated that ITS is likely to grow in importance over the next five years, while the EV sector is likely to remain important. Additionally, a large number of companies are interested in participating in these markets, both of which clearly align with the Transportation Program's focus under the CEF. As a result, the Transportation Program should continue to support R&D projects in these areas.

6. Methods

The primary data source for this evaluation is a survey of companies active in New York State's transportation market. In addition, IEC analyzed data from two NYSERDA databases, the Clean Energy Inventory and the R&D Metrics Database. Each source is described below.

6.1 Market Survey

With subcontractor APPRISE, IEC surveyed companies active in New York State's market for transportation technologies and services. The survey was conducted in two stages: Stage 1 began with all companies that had received funding from the Transportation Program between 2010 and 2016, and Stage 2 included additional companies referred by Stage 1 respondents. The Stage 1 survey was conducted between June and August 2016, and the Stage 2 survey was conducted during October 2016. The survey was administered online and over the phone by APPRISE. Email invitations to participate in the survey were sent by NYSERDA; reminder emails were sent by APPRISE.

Both stages used the same survey instrument, which could be completed in approximately 15 minutes. The instrument was organized into six sections and relied on skip logic to bypass questions not relevant to particular respondents. The survey organization was as follows:

- Part I: Background information (e.g., company characteristics, transportation goals)
- Part II: Influence and barriers (i.e., factors that influence or hinder a company's transportation operations)
- Part III: Familiarity with and services received from NYSERDA's Transportation Program
- Part IV: Outcomes of interest (e.g., sales, patents) – This section applied only to companies that had received direct funding or technical assistance from NYSERDA in the past.
- Part V: Level of interest in selected transportation technologies – This section gauged companies' interest or participation in the markets for six transportation technologies that could be emphasized under the CEF.
- Part VI: Survey referrals – Respondents were asked to identify the companies most important to their transportation operations in the New York State market, to be included in the Stage 2 survey sample. This section was optional.

Prior to launching each stage of the survey, APPRISE sent the instrument to five individuals from the sample to pre-test the clarity and organization of the questions. Based on feedback from these pre-tests, IEC revised Part VI of the instrument to include fewer questions, to minimize requests for sensitive information, and to allow respondents to skip any or all questions. The final survey instrument is included in Appendix B.

Upon receiving survey results from APPRISE, IEC analyzed the responses to multiple-choice questions to identify the most common responses. For open-ended questions, IEC conducted a formal coding analysis

to identify trends in responses. Detailed results of the survey, including a list of analyses conducted but not included in this report, are included in Appendix C.

Table 6-1 summarizes participation in the survey. Overall, 109 individuals responded across both stages, for a 48 percent overall response rate. This exceeded IEC’s target of 100 completed responses. The 109 responses received represent 99 unique companies, out of 195 unique companies in the sample.²⁴

Table 6-1. Survey Respondents and Response Rate

Stage	Number in Sample	Sample Description	Number of Respondents	Response Rate
Stage 1	136	Transportation Program funding recipients from 2010-2016	76	56%
Stage 2	89	Referrals from Stage 1 respondents	33	37%
Total	225		109	48%

6.2 Review of NYSERDA Databases

To validate and fill in gaps in the survey responses, IEC also analyzed information from NYSERDA’s Clean Energy Inventory and R&D Metrics Database. The Clean Energy Inventory was completed by NYSERDA in October 2016 and includes basic information on 134 transportation technology development companies located in New York State. NYSERDA’s R&D Metrics Database includes information on every project funded to date by the Transportation Program. By integrating information from these three data sources, IEC was able to provide a more comprehensive assessment of the transportation market in New York State. Table 6-2 summarizes the information extracted from each of these databases and how it was used to supplement the survey results.

Table 6-2. Summary of MCA Data Sources

Source	Type of Respondents	Type of Data Used	Use in MCA
MCA Survey	<ul style="list-style-type: none"> • Predominantly program participants • Includes transportation service providers and nonprofit/public sector organizations 	<ul style="list-style-type: none"> • Company-level data • Company characteristics, influences, barriers, interactions with NYSERDA, outcomes, interest in selected technologies 	<ul style="list-style-type: none"> • Primary source for participant data • Limited non-participant data
Clean Energy Inventory	<ul style="list-style-type: none"> • Predominantly non-participants • Predominantly private companies 	<ul style="list-style-type: none"> • Company-level data • Company characteristics, technology sectors 	<ul style="list-style-type: none"> • Primary source for non-participant data (technology sectors, geographic locations, revenues)
R&D Metrics Database	<ul style="list-style-type: none"> • Program participants 	<ul style="list-style-type: none"> • Project-level data • Technology focus of funded projects 	<ul style="list-style-type: none"> • Technology sectors of funded projects

²⁴ In some cases, IEC sent the survey to multiple individuals at large or diverse organizations, such as universities and public sector organizations. Multiple individuals from seven companies responded to the survey.

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