WORK PLAN FOR MARKET CHARACTERIZATION ANALYSIS FOR THE TRANSPORTATION PROGRAM

Final

Prepared For:

The New York State Energy Research and Development Authority (NYSERDA)

Jonathan Steiner and Jennifer Phelps, Project Managers

Prepared By:

INDUSTRIAL ECONOMICS, INCORPORATED (IEc)

2067 Massachusetts Avenue
Cambridge, Massachusetts 02140
617/354-0074

Cynthia Manson, Project Manager

Consulting Team:

Industrial Economics, Incorporated (IEc)

APPRISE

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Program Description

In 2012, New York State's transportation sector consumed more than 1,040 trillion Btus of energy, or 41 percent of the total energy consumed in the state. Approximately 92 percent of this energy came from petroleum products, such as gasoline and diesel fuel.[1] As a result of its reliance on the combustion of petroleum products, the transportation sector was responsible for 68 million tons of CO_2-equivalent emissions in 2012, 40 percent of all fuel-borne greenhouse gas emissions.[2] Given the large percentage of New York State's energy use and emissions attributed to the transportation sector, NYSERDA's recent Clean Energy Fund (CEF) Proposal identifies the development of advanced sustainable transportation systems as one of its strategic priorities.[3] Within this context, the goal of NYSERDA's Transportation Program is to commercialize and deploy transportation technologies, products, systems, and services that reduce energy consumption and provide cost-effective greenhouse gas emissions reductions.

NYSERDA's Transportation Program focuses on reducing and diversifying the energy consumed by the transportation sector, minimizing emissions, and creating economic development opportunities in New York State.[4] 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. Together, these areas support the development of surface transportation, including electric vehicle (EV) infrastructure, and emerging technologies to improve rail, marine, and air transportation system efficiency.

The current program builds on decades of research conducted with state funding (including statutory and System Benefits Charge, or SBC) and federal funding. Beginning in 2016, the Transportation Program will receive funding from the CEF. Preliminary discussions about the transition to the CEF suggest that the Transportation Program is likely to focus on three key areas beginning in 2016, including: public transit (e.g., efficiency of the New York City subway system), mobility management (e.g., strategies to reduce single-occupancy vehicle use and smart infrastructure, such as adaptive traffic signal controls), and electric vehicles.

[1] NYSERDA. 2014. Patterns and Trends – New York State Energy Profiles: 1998–2012. November 2014. Available at: http://www.nyserda.ny.gov/Cleantech-and-Innovation/EA-Reports-and-Studies/Patterns-and-Trends.

[2] Ibid.

[3] NYSERDA. 2015. Case 14-M-0094, Proceeding on Motion of the Commission to Consider a Clean Energy Fund, Clean Energy Fund Information Supplement. June 25, 2015. Pages 142-145.

[4] NYSERDA. 2015. Transportation Program: Product Development, Product Demonstration, and Product Deployment, Program Theory and Logic Model Report. August 2015.

Evaluation Scope

The purpose of this market characterization analysis (MCA) is to assess the current state of the "transportation industries" operating in New York State – i.e., companies and organizations; their resources and stakeholders; and customers and markets. Leveraging and extending existing data and research already produced by NYSERDA and other organizations, the primary objectives of the MCA are to:

- Identify the companies and organizations operating in New York State that could benefit from or partner with NYSERDA's program initiatives.
- Assess the extent to which these companies and organizations already interact with NYSERDA, or have adopted new technologies or products supported by NYSERDA's Transportation Program.
- Identify recent trends in the commercialization and/or market adoption of key transportation-related technologies in New York State and more broadly, which can support efforts to understand how the NYSERDA Transportation Program has performed.[5]
- Characterize the ways in which NYSERDA's Transportation Program interacts with different parts of transportation technology markets.[6]
- Identify areas of the transportation market where the Transportation Program is uniquely positioned to use its limited resources for greater impact.

Typically, a MCA characterizes the active 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 and strategies (e.g., electric vehicle charging stations, regenerative braking devices for New York City's subway system, real-time adaptive traffic signal controls, and transportation demand management) that may be used across multiple economic sectors and customer classes. In addition, preliminary discussions about the transition to the CEF have highlighted three broad focus areas for the program (public transit, mobility management, and electric vehicles), each of which may encompass a wide variety of projects and technologies. As a result, conducting a traditional MCA for the Transportation Program is not feasible, and understanding the market potential for transportation technologies requires an innovative approach.

To address the cross-sectoral nature of NYSERDA's Transportation "market," IEc proposes to initially define this market as the set of organizations and companies working on, using, or potentially able to use technologies or initiatives that the program has supported, basing this universe on information from NYSERDA's R&D Metrics Database and communication with program staff. To collect information on these market segments, IEc proposes to conduct consultative interviews with academic and industry experts to develop a conceptual market map and initial assessment of NYSERDA's involvement with

[5] Specific indicators of commercialization and market adoption that may be evaluated in the MCA include product sales, market share, and level of awareness of or interest in the product by transportation technology companies and organizations in New York State. Appendix A includes survey questions related to some of these indicators; additional indicators will be identified for the targeted market reviews following selection of the focus technologies. (See discussion later in this work plan.)

[6] For example, the Transportation Program may provide general information dissemination; technical assistance; funding; introductions to new customers, suppliers, manufacturers, or investors; business development support; or other services. See Appendix A for draft survey questions regarding the ways in which NYSERDA's Transportation Program may interact with market actors.

particular market segments. IEc proposes to then survey organizations in these market segments to gather information about their products, markets, transportation-related goals and initiatives, barriers to achieving those goals, and relationships with other organizations in NYSERDA's transportation market. This survey will capture a broad set of technologies, organizations, and market segments, both within and outside of New York State, that may benefit from or influence Transportation Program initiatives. The survey instrument and overall survey design will be developed with input from market experts.

In addition to characterizing the market for both production and adoption of transportation technologies, the survey will support future market impact assessment by including baseline and/or trend questions about the program's desired outcomes and priorities, and verifying the role that NYSERDA has had in different areas of the market. To support a future impact evaluation, survey questions will solicit information from program participants on key technology commercialization and adoption rates, replications of demonstration projects, greenhouse gas emissions reductions, or other metrics decided in consultation with NYSERDA.

The survey will serve as the primary method for characterizing the transportation market, and will both validate and extend the map of market segments developed through consultations with academic and industry experts. In addition, to complement and broaden survey results, IEc will also review program information, published literature, and other readily available information, including data from NYSERDA's inventory of New York State's clean energy economy (currently underway). Finally, IEc will develop a formal market assessment for two key technologies or strategies supported by the program. This will provide additional detail on the market context for those technologies/strategies, including, for example, organizations not included in the survey, potential for changes in the market over time, or comparisons to similar markets in other states.

[Updated December 2016:] Based on discussions with NYSERDA evaluation and program staff and the initial results of the market survey, the two focus assessments will cover transportation demand management strategies and electric vehicles. These technology areas are included as focus areas under the CEF, and have the potential to substantially reduce statewide greenhouse gas emissions. These technology areas have also received support from multiple Transportation Program areas (Product Development, Demonstration, and Deployment).

The survey and targeted reviews are designed to describe the scope of transportation activities and technologies affected by the Transportation Program to support market impact assessments, as well as to inform program strategy in the context of the CEF, including the three key focus areas identified above. The following evaluation questions will guide the Transportation MCA, but may be refined based on the types of responses received through the survey and communication with NYSERDA regarding program priorities under the CEF:

Transportation Program Network

1. With which organizations and companies has NYSERDA developed ties through its Transportation Program initiatives? In which markets and sub-markets do these organizations and companies participate?

    a. What types of transportation technologies are these companies and organizations pursuing and/or using?

    b. Are these companies and organizations focused on deploying transportation technologies for use in New York State, or developing transportation products or services for commercial sales more broadly?

c. How has NYSERDA interacted with these companies and organizations (i.e., types of services provided, multiple projects or rounds of funding, participation in larger project team, etc.)?

d. What is the relative market size of the various sub-markets to which NYSERDA is connected (e.g., in terms of employment, revenue, number of participating companies and organizations)?

2. At which stages of the supply chain do the companies and organizations to which NYSERDA is connected operate?

Outside of Transportation Program Network

3. With which potentially relevant organizations and companies has NYSERDA not yet developed ties through its Transportation program initiatives?

    a. How do these companies and organizations define the markets in which they operate? Do these markets represent potential opportunities for NYSERDA involvement?

    b. Should and, if so, how can NYSERDA most effectively target and provide useful services to these organizations and companies?

Outcomes, Barriers, and Opportunities for NYSERDA-Supported Technologies[7]

4. How have the commercialization and/or market adoption of technologies/strategies supported by NYSERDA changed over time, in New York State or elsewhere? How is market demand likely to change in the future?

5. Where are there opportunities for increased adoption of supported technologies/strategies in New York State?

    a. What are the most important market or regulatory barriers to increased adoption of technologies/strategies supported by NYSERDA?

    b. Should and, if so, how could NYSERDA most effectively assist in reducing these barriers?

The MCA will rely on existing studies and data on transportation technology-related companies, resources, and drivers and barriers wherever possible. We will also collect new data, primarily through surveys. In addition, we will coordinate with other NYSERDA studies, such as the ongoing clean energy inventory, to ensure that existing data are utilized wherever possible and that analyses are aligned.

Data collected for this MCA will also support a future impact evaluation for NYSERDA's Transportation Program, by providing baseline data that may help to answer questions such as:

[7] *These evaluation questions may be further refined in collaboration with NYSERDA for the targeted market reviews, following initial results of the survey. For updated information, see the December 2016 Addendum to this work plan.*

- Have technologies supported by NYSERDA been adopted in the New York State market and/or realized commercial sales beyond New York State?
- How well are companies and organizations participating in the Transportation Program performing as compared to non-participating companies and organizations?
- Have desired program outcomes been realized as a result of adoption and/or commercial sales of supported technologies?

Work Plan

To address the questions in the previous section, IEc will apply a mix of qualitative and quantitative research techniques. The outcomes of earlier research steps will inform subsequent steps and approaches. Tasks include:

- Task 1: Project Initiation, Work Plan Development, and Project Management
- Task 2: Background Research: Analysis of R&D Metrics Database and Consultative Interviews
- Task 3: Survey
- Task 4: Targeted Market Characterization Reviews for Key Supported Technologies
- Task 5: Analysis
- Task 6: Final Report

Task 1. Project Initiation, Work Plan Development, and Project Management

This document serves as the final work plan for the Transportation MCA. It includes the purpose and scope of the study, the questions to be addressed, and the data sources and methods to be employed. This work plan was revised based on input and feedback from NYSERDA. IEc will use the final work plan to prioritize and guide progress throughout the project.

The budget for this task also includes resources for ongoing project management.

Task 2. Background Research: Analysis of R&D Metrics Data and Consultative Interviews

Task 2 lays the foundation for the rest of the study. IEc will aggregate data collected from projects funded by the Transportation Program, and will subsequently work with several carefully selected experts to understand this information in the context of broader transportation markets. The results of this task will inform both Tasks 3 and 4, by providing IEc with a broad view of the transportation markets with which the NYSERDA program interacts. The sub-tasks under Task 2 include:

- Review and aggregate data in NYSERDA's R&D Metrics Database, and other program sources as available, on projects funded under the Transportation Program;
- Conduct "consultative" interviews with three academic experts and up to three industry experts; and
- Develop a transportation "market map" with information about basic market segments, notes on market actors and activities, and key definitions.

Under the first sub-task, IEc will review data from the R&D Metrics Database on projects funded through the Transportation Program, to characterize the range of technologies, companies, and organizations that the program has supported, and the level and timing of NYSERDA support. This effort will also enable IEc to collect data on key outcome metrics for funded projects, such as fuel consumption reduced or dollars saved, that can be used in a future impact evaluation. IEc understands that the R&D Metrics Database provides relatively complete data on funded product development and demonstration projects, but does not contain data on product deployment projects; IEc will therefore supplement data in the R&D

Metrics Database with other program materials, as available. This information will help IEc to define the particular transportation-related markets served by the Transportation Program, including those operating within and beyond New York State.

Under the second sub-task, IEc will conduct consultative interviews with three academic experts in transportation technologies, and up to three industry experts. These expert consultations will provide broader context for information on funded projects obtained from the R&D Metrics Database and other program materials, as available. IEc will discuss with the experts how to define the markets for supported technologies, the key issues related to development and deployment of supported technologies, and the key upstream and downstream market actors influencing the development of and/or potentially adopting the supported technologies.

IEc will seek to interview experts whose areas of expertise cover the full range of program activities, including product development, demonstration, and deployment. Dr. Jeremy Michalek, Professor of Mechanical Engineering and Engineering & Public Policy at Carnegie Mellon University, and Dr. Yeganeh Mashayekh Hayeri, post-doctoral research fellow at the University of Pennsylvania, have both agreed to participate in this effort as academic experts on electric vehicles and transportation demand reduction, respectively. IEc has also identified Dr. Constantine Samaras, Professor at Pardee RAND Graduate School, as another potential academic expert. IEc will ask these experts to provide their assessment of the key sub-markets in New York State's transportation industry, with discussion of the key technologies and companies in each sub-market. IEc will also work with these experts and NYSERDA to identify appropriate industry experts for consultative interviews, as needed.

The key deliverable for Task 2 will be a market map outlining the technologies supported by NYSERDA's transportation program and IEc's initial assessment of the market segments in which participating companies and organizations participate (developed as the third sub-task). To accompany the market map, IEc will also prepare a brief memorandum outlining high-level conclusions about NYSERDA project coverage of transportation market segments. The results of the expert consultations will also inform the development of the survey instrument in Task 3. Because the expert interviews are intended to provide broader contextual information that informs later stages of the evaluation, IEc will not develop formal interview guides.

Task 3. Survey

The purpose of this task is to deepen the characterization of the State's transportation market with survey data, reaching a wide group of stakeholders that includes both those already connected to the NYSERDA Transportation Program and those not. The survey results will enable IEc to describe and define the market segments covered by NYSERDA's Transportation Program, in addition to validating the market map developed through consultations with industry experts under Task 2. Outputs of the survey research will answer Questions 1 and 2 (companies and organizations connected to NYSERDA and their respective connections to the broader market), Question 3 (potentially relevant companies and organizations not yet engaging with the Transportation Program), Question 4 (trends in commercialization of and market demand for supported technologies), and Question 5 (opportunities to increase market adoption of supported technologies). In addition, the survey will collect data on: i) outcomes achieved by Transportation Program participants, and ii) any areas where the Transportation Program is uniquely positioned to use its limited resources for greater impact.

To properly identify the extent of this segmented market, the most appropriate method for conducting the survey is a "snowball" survey technique that begins with actors directly connected to the Transportation Program and expands to include the companies and organizations operating in the same markets, but who

have not yet had contact with the Transportation Program.[8] While snowball surveys can have multiple rounds, IEc anticipates at least a two-stage survey; depending on the market actors identified, IEc will assess the extent to which the market described in those two stages coalesces around a "finite" market in New York State. That is, IEc will document the extent to which the organizations contacted concur about the key products, market actors, and trends when describing their markets or market segments, as well as the extent to which NYSERDA is already connected to key market actors identified through survey responses. If survey responses in Stages One and Two do not converge around certain major market parameters, IEc may conduct a third round of the snowball survey to further bound the markets in which the Transportation Program operates. The survey results will serve to refine and validate the market map developed under Task 2, and IEc anticipates that the final "market" will reflect a number of separate sub-markets with different areas of focus.

To support future impact evaluations - including six concurrent case study evaluations, described in a separate work plan – the survey will also include a limited number of questions on the program's desired outcomes and priorities (reflecting the logic model and any recent developments in the CEF). IEc will work with NYSERDA to identify key outcomes and priorities to include in the survey, and will use the survey instrument to provide relevant information on those metrics and related barriers.[9] This will allow a future impact evaluation to compare the results of the survey to historical program expenditures, to draw broader conclusions about NYSERDA's likely role in affecting change.

The proposed budget for the market characterization survey reflects the size, complexity, and diffuse nature of the transportation market, as well as the need to consider technologies supported by each of the three program areas (product development, demonstration, and deployment).

Stage One: Current and Past Program Participants

The Stage One survey consists of a mostly closed-ended questionnaire with a census of Transportation Program participants since 2010, which the IEc team estimates as about 200 companies and organizations.[10] Specifically, the IEc team will survey individuals representing companies and organizations that have participated in the Product Development, Product Demonstration, and/or Product Deployment components of the overall Transportation program. IEc will work with NYSERDA to define and identify program participants for inclusion in the survey.

The IEc team estimates that up to 25 percent of program participants may be difficult to locate because the original company went out of business, changed ownership, or moved to a new location. Therefore, the IEc team will conduct additional research (via Internet and telephone) to locate up to 50 of the 200 participants initially selected for the Phase One survey.[11] If the original company went out of business (or

[8] 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. For example, IEc would begin by surveying organizations known to Transportation Program staff, would ask those organizations to identify others with whom they interact, and would then survey those additional organizations.

[9] IEc already has access to the R&D Metrics Database, and has used the database to sort project outcomes into high-level categories (e.g., energy benefits, information dissemination, market animation).

[10] IEc will determine in conjunction with NYSERDA how, if at all, to address non-response from program participants. We propose using sensitivity analyses to demonstrate the potential impact of missing responses on our overall results. Depending on the nature and extent of non-response, we may also attempt to compensate for non-responses through information collected from other sources (e.g., program files, coordination with the clean energy inventory).

[11] Depending on the timing of this MCA and the inventory effort, IEc may be able to consult the clean energy inventory currently being developed by NYSERDA's Energy Analysis group. Note that NYSERDA's inventory effort may provide some data to identify potential survey respondents or characterize portions of NYSERDA's transportation market, but that effort focuses

a team disbanded) but the original contact can be located, the survey will be sent to the original contact. If the original company or team still exists but the original contact departed, the IEc team will attempt to find and survey a new representative at the original organization.

Stage Two: Non-Transportation Program Participants

Stage Two of the survey will be targeted to "non-Transportation Program" respondents (i.e., individuals in New York State's transportation market who have not been directly involved with NYSERDA Transportation Program initiatives). These respondents will be identified from open-ended ("write-in") responses in Stage One, using a "snowball" sampling design. The IEc team will make every reasonable effort to contact individuals representing these companies and organizations, including Internet searches to identify contact information if necessary. Prior to the Stage Two survey, IEc will again consult the clean energy inventory being developed by NYSERDA's Energy Analysis group for additional information about companies and organizations connected to Transportation program participants. At that time, IEc and NYSERDA will discuss whether any revisions to the survey instrument or target respondent list are necessary to align the two efforts and avoid duplication of effort. The preliminary results of the inventory effort may help to validate the key market actors in the transportation sub-markets identified through the survey responses.

Note that because the "non-Transportation Program" population is undefined at this stage, the IEc team will not be able to conduct statistical sampling or calculate the overall response rate for the Stage Two population. The IEc team expects that survey respondents will identify organizations *outside* of the Transportation Program that operate in markets upstream and downstream from program participants, which will help to illuminate connections between the development and deployment of products and services. IEc assumes that the Stage Two survey will be sent to at most 200 individuals.[12] In documenting the extent to which survey respondents are identifying the same set of organizations and technologies when describing their markets, IEc will assess whether the organizations identified in Stages One and Two constitute a reasonably complete characterization of the market.

In consultation with NYSERDA, IEc may increase the number of Stage Two surveys sent out or conduct a third round survey of companies and organizations identified by Stage Two respondents if survey responses continue to identify new major market actors, and/or if these responses feature multiple mentions of other (less major) market actors not yet included in the survey sample frame. The budget estimates in Table 2, later in this work plan, present a range of survey costs, depending on the size of the population surveyed and desired response rate. If preliminary survey results suggest that such a change is warranted, IEc will work with NYSERDA to revise the budget and schedule in this work plan. A Stage Three survey is not included in the budget for this work plan.

In total, survey participants will include:

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specifically on technology production, and not on services or adoption of technologies. We therefore anticipate that data collected under this inventory effort may refine and validate portions of the data collection in this MCA, but will not provide the specific information needed to identify program impacts and opportunities.

[12] This estimate is based on three key assumptions: (1) receipt of approximately 100 complete Stage One responses (a 50% response rate; see Table 1); (2) 12 contacts identified by each respondent, on average; and (3) 33% of identified contacts will be unique, accounting for overlap *in contacts identified by* Stage One respondents and/or overlap *with already-surveyed* Stage One respondents. Regarding the number of contacts likely to be provided by each respondent, we note that respondents have the opportunity to provide up to five contacts in each of three market segments in each of four questions (a total of 60 possible contacts), but may also select "N/A" for a given question, or may participate in fewer than three market segments.

1. Up to 200 key Transportation Program participants, representing a census or near-census of program participants since 2010 (Stage One);
2. Up to 200 companies and organizations identified by program participants as key actors in their markets (Stage Two);

Components of this task are detailed below.

- **Survey Instrument:** The IEc team has included draft versions of the survey instruments for Stage One and Stage Two as appendices to this work plan. These will be revised and presented again to NYSERDA for review pending any additional feedback from NYSERDA. The IEc team expects to have one or two conference calls with NYSERDA staff to collect input before finalizing the survey instruments.

  The survey will be designed to be completed in 15 minutes on average and to establish a baseline understanding of the companies and organizations operating within respondents' markets; to assess NYSERDA's past involvement with select transportation markets; to identify trends in the commercialization and adoption of technologies supported by NYSERDA in the past; and to identify opportunities for future NYSERDA involvement. The survey will ask respondents to self-select from a pre-populated list their own market(s), and, to minimize response burden, to identify up to three of those markets as "most important" to their operations. Respondents will be asked to identify up to three "major" actors (i.e., suppliers, customers, competitors, or business partners) in each of their three key markets. Finally, respondents will be asked to provide contact information for those companies and organizations. The IEc team will follow up by telephone with individuals who have not responded to the survey, to maximize survey response rate.

- **Survey testing:** The IEc team will pre-test both the Stage One and Stage Two surveys with up to five respondents. The testers will take the survey by email, and the IEc team will follow up by phone to debrief on their experience (e.g., length of time, wording, and comprehensibility). If needed, the IEc team will revise the surveys after testing.

- **Survey mode and administration:** The survey will be administered online and by phone by APPRISE. Prior to administering the survey, Apprise will send advance letters by email and/or postal mail to everyone in the sample frame. The IEc team has included a draft version of the advance letter as an appendix to this work plan; it will be finalized in conjunction with the survey instrument, based on NYSERDA's review. Recipients will be given two weeks from the time they receive the survey link to complete the online survey; those who do not complete the survey online will be called and invited to complete the survey by phone.

  The survey will use skip logic to ensure that questions are targeted appropriately for responding companies and organizations. To increase the likely response rate, the survey will ask for ranges of key variables (e.g., revenues, employment) rather than specific point estimates. This approach is expected to increase the response rate, as it will not require respondents to recall or look up company information, nor will it require respondents to divulge proprietary data. Although this will not provide the same level of specificity as a precise point estimate, it should

increase the response rate while still providing a clear indication of key metrics across companies. The survey results will be recorded in a database, coded and analyzed.

Additional information is presented in the survey planning form in Table 1. Information regarding the survey instrument may change as the IEc team works with NYSERDA to finalize the instrument.

Table 1. Survey Planning Form

	Element	Survey Description
1a. Target Population	Type	**Stage One contacts (census):** - Companies and organizations involved in transportation markets in New York State that have received funding from NYSERDA's Transportation Program since 2010 **Stage Two contacts (snowball sample):** - Individuals representing companies and organizations that did not participate in the program, identified by Stage One contacts
	Characteristics	Individuals and firms active in New York State's transportation market. (Individuals or firms that moved out of New York State after receiving services will also be included in the survey.)
	Time Frame	Transportation Program participants since 2010, plus everyone in the Stage Two group
	Total Number	Approx. 200 for Stage One; unknown for Stage Two (expect 200 Stage Two contacts)
	Contact info availability	The IEc team is not in possession of contact information, but expects to obtain email addresses for most (>75%) Stage One contacts from Transportation Program staff and Web searches. Contact information for Stage Two contacts will require either: a) Stage One contacts provide it, or b) independent Web search.
1b. Comparison Group	Type	None
	Characteristics	N/A
	Time Frame	N/A
	Total Number	N/A
	Contact info availability	N/A
	Notes	N/A
2. Sample	Sample Frame	Stage One: List of program participants compiled from Transportation Program records and APPRISE's research (e.g., tracking down current contact information for the survey population) Stage Two: Individuals representing companies and organizations identified by Stage One respondents
	Estimated Population Incidence (How confident are you in the sample frame data quality? Estimate the proportion of sample frame that you think is accurately characterized in terms of meeting the definition of the participant or non-participant group.)	Stage One: 90%; however, up to 25% of the contacts provided may require additional follow-up due to change in company status, company turnover, difficulty of locating original contact, etc. Stage Two: Unknown
	Type of Sampling:	Stage One: Census

	Element	Survey Description
	Census, simple random, stratified, proportionate to size, convenience	Stage Two: Snowball
	Target # of Completed Surveys	Stage One: 50 completed responses (The IEc team will attempt to conduct a full census; however, 50 completed surveys, or 25% of the population, seems more realistic given information about the target population.) Stage Two: 50 completed responses (25% of the 200 companies and organizations targeted).
	Precision Criteria *(Note: NYSERDA standard is 90/10 confidence interval. Indicate if you are proposing different criteria.)*	Stage One: Because the study is contacting the entire population in Stage One, precision criteria may not need to be calculated, depending on response rate. Stage Two: Because the non-participant population is undefined at this stage, precision criteria cannot be calculated.
3. Type of Survey	Mode	Online and phone (same instrument for both modes)
	Eligible Respondent *Note if the contact needs to be the original contact and/or the person on the survey contact list.*	Original contact from the relevant company or organization; if the original contact has moved on, the IEc team will attempt to survey a new representative at the same firm.
4. Approach	Number of instruments	Two instruments: one for Stage One respondents, and one for Stage Two respondents. The Stage Two instrument excludes questions related to NYSERDA funding.
	Length per instrument	15 minutes on average
	New or revised instrument?	New
	Number of open-ended survey questions	7 (write-ins for example products/services, most influential companies, suppliers, customers, competitors, partners, and contact info)
	Number of questions with "other/specify" option	7
	Timing of administration	Q1-Q2 2016
5. APPRISE Role	Contact info	APPRISE will piece together contact information from multiple sources provided by NYSERDA transportation program managers. APPRISE may also need to conduct Web research to identify contact info for Stage Two contacts, and up to 25% of Stage One contacts.
	Sample frame research	N/A
	Sample plan/selection	Sampling will not be used; APPRISE will attempt to survey all 200 contacts identified through Stage One responses.
	Survey instrument	IEc will develop the survey instrument.
	Online programming (if applicable)	APPRISE will program the online survey.
	Database development (for phone surveys only; online surveys automatically generate data files)	IEc and APPRISE
	Survey testing	APPRISE will run a test with 10 respondents (five respondents each in Stage One and Stage Two), and will follow up by phone to debrief their experience with the survey. APPRISE will then share any recommended changes with IEc. IEc will update the survey instrument as needed.
	Survey testing type: general (length, wording, comprehensibility) or	Cognitive

	Element	Survey Description
	cognitive (more involved pre-test that includes de-briefing testers on survey questions)	
	Survey testing mode (online with verbal follow up, or verbal only)	Online with verbal follow up
	Implementation	APPRISE to run administration
	Key Data Items *For online survey, indicate required fields.* *For phone surveys, identify any data fields that must be completed for response to be useful.*	All fields will be required except fields asking for contact information
	Response coding (for open-ended questions)	IEc will conduct all coding
	Preliminary data analysis	IEc will conduct all analysis

Task 4. Targeted Market Characterization Reviews for Key Supported Technologies

In addition to conducting a broad market survey that includes the full range of transportation technologies supported by NYSERDA, IEc will also conduct a targeted review of two key supported technologies/strategies. Discussions between IEc and NYSERDA have identified transportation demand management and electric vehicles for this review. The addendum to this work plan discusses the evaluation questions and indicators selected for these reviews following completion of the survey in December 2016.

This effort will enable IEc to address more detailed questions about the markets for supported technologies/strategies, including barriers to increased commercial sales and/or market adoption and opportunities for increased NYSERDA activity. IEc will conduct expert interviews to answer outstanding questions about the characteristics of the market for the targeted technologies, products, and services. Experts will assist IEc in validating information collected under Task 3, by identifying existing research and data for review (e.g., datasets from the Texas Transportation Institute or the Volpe National Transportation Systems Center) and industry groups and conferences that include key market actors. IEc intends to interview the experts consulted under Task 2, and may also work with these individuals to identify other industry experts familiar with New York State transportation market segments. For this effort, IEc will develop formal interview guides, which will be refined in collaboration with NYSERDA.

Following the expert interviews, IEc will review existing research and data on the selected transportation market segments and any additional program documentation on relevant projects. IEc will work with the industry experts and NYSERDA staff to identify data and documentation for review. As applicable for each selected technology/strategy, IEc will conduct quantitative analyses of existing data on transportation markets in New York State over time and in New York State as compared to other states, and will make use of publicly available data or data to which NYSERDA already has access (e.g., data from CBInsights and I3) wherever possible.

Concurrently with the MCA, IEc is also planning to develop six detailed case studies on technologies previously supported by the Transportation Program, as detailed in a separate work plan. These case studies may be able to inform the targeted market characterization reviews for supported technologies, depending on the technologies selected; IEc will draw on data collected for the case studies as part of this task as appropriate.

Outputs of this research will address Question 3 (potentially relevant organizations that have not yet connected with NYSERDA), Question 4 (trends in commercialization of and market demand for supported technologies/strategies), and Question 5 (opportunities to increase market adoption of supported technologies/strategies).

The December 2016 Addendum to this work plan provides additional detail on the focus of these reviews, based on discussions with NYSERDA evaluation and program staff and preliminary analysis of the survey results.

Task 5. Analysis

Task 5 compiles and analyzes the data from Tasks 2, 3, and 4 to answer the questions in this work plan. This task will also address critical gaps, inconsistencies, and areas that will affect the market impact evaluation to be undertaken at a later date. IEc will analyze the survey data in Access or Excel, generate summary statistics for each question, and summarize the results in tables and graphs. IEc will also compile findings from expert interviews that informed the targeted market reviews, information collected for the concurrent Transportation Program case studies, and existing industry data and research highlighted by the expert interviews, and will analyze this information in the context of the broader market data collected through the survey.

The results of the analysis will be primarily qualitative, bringing together information from the survey and other data collection methods. However, the analysis will also include key descriptive statistics to inform potential future focus areas for the program. In addition, we will provide quantitative metrics where possible regarding market size and trends in the adoption of program-supported technologies, as well as any other activity that the Transportation Program can use to measure progress against its goals (i.e., in the context of a later impact evaluation).

Sub-tasks include:

- Identify suites of relevant technologies and connected companies and organizations that constitute market segments of the transportation industry in New York State, and assess areas of overlap between these market segments;
- Determine recent and/or potential future growth trends for these technology market segments in New York State, key barriers to technology commercialization and adoption, and opportunities for NYSERDA involvement;
- Pinpoint data gaps and estimate the degree to which these gaps affect the results and will affect subsequent market impact evaluations; and
- Create a template to report results from the survey, and generate graphs, tables and other visualizations of the data.

Task 6. Final Report

Task 6 synthesizes the findings from the previous tasks into a final report. The IEc team will develop a draft and final report with findings that span the program and industry background research, survey, and detailed technology characterizations. The report will present and discuss survey findings, using tables and graphics as appropriate. The report will clearly connect survey results to the evaluation questions listed in the Evaluation Scope section above. The final report will include an executive summary, a description of the research conducted, methods used, results, and limitations, as well as annexes with details on the findings.

The budget for this work plan assumes up to two (2) rounds of revisions based on comments from Transportation Program managers and evaluation staff.

Sub-tasks include:

- Write and edit the report, executive summary, and annexes;
- Send to NYSERDA for review;
- Revise the report based on NYSERDA's feedback; and
- Complete the report.

Anticipated Challenges and Limitations

IEc anticipates certain challenges in carrying out the tasks in this work plan. Challenges and possible mitigating factors include:

- **Although the MCA is meant to be a baseline study, the Transportation Program has already been active for several years.** To account for this challenge, future market impact assessments should report changes from the time the MCA is conducted (early 2016) through the date of subsequent research efforts, and qualify the findings accordingly. In addition, although the program has been active for several years, the present is an ideal time to capture a baseline for tracking progress under the CEF.
- **Multiple markets are served by the Transportation Program.** The Transportation Program has focused both on the deployment of technologies for use in New York State and the development of products and services within New York State for commercial sales more broadly. Similarly, the Transportation Program also serves companies and organizations in a variety of transportation-related sectors with diverse technologies and different market trajectories; the program has supported technologies ranging from efficiency improvements for refrigerated freight transport to support services for the New York City subway. As a consequence, assessing outcomes for the program overall is challenging. To partly mitigate this challenge, the survey will ask participants to indicate when their company was founded, the type of technology or service their company provides, and the estimated market size. The IEc team will analyze the survey results both in aggregate and by category, and will report any discernible differences in performance that might be explained by these firm- or sector-specific variables. IEc will also conduct an in-depth investigation of two supported technologies/strategies, which will help to illuminate the nuances of the program's role in market adoption.
- **Survey responses may be incomplete:** The IEc team will exclude surveys that have incomplete responses to key questions. To encourage higher completion rates, the IEc team will ask mostly close-ended questions and use skip logic to bypass questions that are not relevant for particular respondents.

Technology outcome questions will be placed at the end of the survey, as these types of questions are more likely to result in non-response.

December 2016 MCA Work Plan Addendum: Targeted Market Reviews

In conjunction with NYSERDA program and evaluation staff in December 2016, IEc selected two transportation technologies/strategies for the targeted market reviews: transportation demand management (TDM), and light/medium duty electric vehicles (EVs). Tables 4 and 5 summarize the evaluation questions and associated methods to be employed in each of these reviews. The discussion that follows is intended to supplement the discussion of Task 4 in the work plan, which was developed prior to selecting the focus technologies/strategies.

Table 4. Evaluation Objectives and Main Research Questions – TDM

Objective	Evaluation Questions	Data Sources & Analytic Methods
Assess the market potential for TDM in New York State.	What conditions are necessary and sufficient for TDM, and where can these conditions be found in New York State?	• Literature review • Interviews with key stakeholders or industry experts • Geospatial analysis using publicly available data
	What are the most significant barriers to increased use of TDM?	• Literature review • Interviews with key stakeholders or industry experts
Identify key market actors that should be engaged in TDM projects.	Which market actors need to be involved for successful TDM?	
	What types of market actors are already working on or interested in TDM in New York State?	• Analysis of MCA survey data and, as applicable, data from NYSERDA's Clean Energy Inventory and Innovation Capacity and Business Development (ICBD) survey

Table 5. Evaluation Objectives and Main Research Questions – EVs

Objective	Evaluation Questions	Data Sources & Analytic Methods
Assess gaps in the market for EVs in New York State.	To what extent are consumers aware of the value proposition of EVs?	• Literature review • Interviews with key stakeholders or industry experts
	What are the most significant barriers to increasing EV adoption, including both technical and economic barriers?	
Identify key market actors that should be engaged to increase EV adoption.	What consumer awareness programs exist to encourage growth in understanding?	
	What types of market actors are already working on or interested in EVs in New York State?	• Analysis of MCA survey data and, as applicable, data from NYSERDA's Clean Energy Inventory and Innovation Capacity and Business Development (ICBD) survey

Tasks

For purposes of this Addendum, the tasks required to carry out these reviews are as follows:

- Task 4a – Review of secondary data sources
- Task 4b – Additional expert interviews
- Task 4c – Analysis
- Task 4d – Presentation of results
- Task 4e – Draft report
- Task 4f – Final report

The following sections describe each of these tasks in additional detail.

Tasks 4a and 4b: To characterize the markets for TDM and EVs, IEc will begin by conducting a review of secondary data sources (e.g., published literature, publicly available data sets) and interviews with key stakeholders or industry experts (up to three for each review). IEc has already conducted several relevant interviews for the recent Buffalo Niagara Medical Campus and EV supply equipment case studies, which were developed under a separate work plan. IEc will share those interview guides with NYSERDA to determine whether IEc should follow up with the interviewees for additional information. For any new interviews conducted, IEc will develop and refine interview guides in collaboration with NYSERDA in advance of the calls.

For TDM, the objective of this background research will be to understand the most important conditions for successful workplace or municipal TDM. For EVs, the objective will be to identify existing consumer awareness programs, research on consumer opinions of EVs in New York State, and research on technical and economic barriers to adoption.

Task 4c: Analytic methods are discussed separately for each review.

<u>Transportation Demand Management</u>

To assess the market potential for TDM in New York State, IEc will conduct geospatial analysis of publicly available data to identify "priority" areas for TDM. This analysis will focus on Core Based Statistical Areas (Metropolitan and Micropolitan Statistical Areas), which are defined by the Office of Management and Budget (OMB) as geographic areas anchored by an urban center of at least 10,000 people plus adjacent counties that are socioeconomically tied to the urban center by commuting. IEc will assess these areas according to the criteria identified in Tasks 4a and 4b, which may include but are not limited to:

- High population density[13]
- Large populations known to benefit from TDM (e.g., low-income, elderly residents)[14]

[13] Likely source: U.S. Census Bureau American Community Survey

[14] Likely source: U.S. Census Bureau American Community Survey

- High levels of public safety, represented by crime rates[15]
- One or more large employers and/or universities[16]
- Widespread public transit coverage[17]
- Existing car-sharing and/or bike-sharing services[18]

IEc will then produce maps of "priority" areas for TDM that meet most, if not all, of the criteria evaluated. Although this analysis will not yield a formal, detailed assessment of market potential (i.e., the likely size of the market for TDM), IEc will describe factors influencing market potential quantitatively whenever possible.

To identify key market actors for TDM initiatives, IEc will combine the results of the literature review and interviews (Tasks 4a and 4b) with assessments of the survey data collected for this MCA and data from two other recent NYSERDA surveys: the Clean Energy Inventory and the ICBD market characterization. These assessments will allow IEc to identify broad categories of organizations that need to be involved in TDM initiatives, as well as specific organizations working on or interested in TDM in New York State.

Electric Vehicles

IEc's characterization of the market for EVs in New York State will first focus on identifying gaps, particularly those related to consumer awareness and technical/economic barriers (e.g., infrastructure cost, technical capabilities of EV charging stations). Based on the literature review and interviews conducted under Tasks 4a and 4b, IEc will compile both quantitative and qualitative data on consumers' current level of awareness in New York State and the most significant barriers to increasing EV adoption. IEc will provide examples of existing consumer awareness programs and will discuss how consumer awareness in New York State compares to other states, in the context of state-level EV adoption. These analyses will rely on publicly available information on state programs and the results of surveys conducted by Essense and Edelman Intelligence in 2016 in collaboration with NYSERDA. IEc will compare results from the two surveys and discuss which indicators NYSERDA should include in subsequent surveys to assess changes from the 2016 baseline.

To identify key market actors, IEc will combine the results of the literature review and interviews with assessments of the survey data collected for this MCA and data from two other recent NYSERDA surveys: the Clean Energy Inventory and the ICBD market characterization. These assessments will allow IEc to identify organizations that are already working on or interested in EVs and public outreach in New York State. IEc will also discuss overlap between this list of organizations and the organizations known to have existing consumer awareness programs.

Task 4d: Following conclusion of Task 4c for each review, IEc will present the results of the review to NYSERDA program and evaluation staff over webinar. The purpose of this presentation will be to solicit

[15] Likely source: New York State Division of Criminal Justice Services (http://www.criminaljustice.ny.gov/crimnet/ojsa/stats.htm)

[16] Likely source: Internet search for "largest employers" in geographic area

[17] Likely source: Federal Transit Administration (https://www.transit.dot.gov/ntd/ntd-data)

[18] Likely search: Internet search for car-sharing and bike-sharing services in geographic area

feedback from NYSERDA prior to drafting the summary report. IEc will revise the analysis as necessary following receipt of final comments from NYSERDA for each review; for budgeting purposes, IEc assumes that comments will be limited to clarifications and elaborations of the analysis conducted under Task 4c, rather than requests for significant additional data collection.

Task 4e: Following receipt of NYSERDA's final comments on each presentation, IEc will develop a draft report summarizing the findings of the targeted market review. These summary reports will be integrated into the larger MCA report (Task 6), as separate volumes.

Task 4f: IEc will revise each summary report based on one round of feedback from NYSERDA.

Program Outputs/Outcomes and Indicators

Tables 7 and 8 present the outputs, outcomes, and indicators to be evaluated in each review, in the context of the Transportation Program's overall reporting requirements. Green shaded indicators are those that NYSERDA is required to report to DPS. The final report will include baseline values for all listed indicators as an additional column in these tables. IEc may update the information in the data source column as necessary.

Table 7. Outputs, Outcomes, and Indicators – TDM

Outputs/Outcomes	Indicators	Data Source	Report to DPS?
Employers proactively offer TDM opportunities	# of employer TDM programs	IEc to provide information based on definition of TDM programs determined by NYSERDA and NYSDOT	To be determined; investment plan not yet filed
People shift commuting modes away from single occupancy vehicles (SOVs)	Commuter mode split (% using SOV)	NYSDOT	
New car/bike sharing programs launch	# of metro areas with car or bike sharing	IEc to provide information through literature review and stakeholder interviews	
People participate in ride matching programs	# of people signed up for NYS ride matching programs	NYSDOT	
More people use car/bike sharing programs	# of car/bike sharing program members in NYS	IEc to provide information through literature review and stakeholder interviews	
Development and demonstration of products for improved technical performance and business models for TDM programs	# of product development and demonstration projects initiated	NYSERDA	

Table 8. Outputs, Outcomes, and Indicators - EVs

Outputs/Outcomes	Indicators	Data Source	Report to DPS
Consumers receive rebates for ZEV's at the point of sale	# of rebates issued	Salesforce	Y
Consumers receive rebates for ZEV's at the point of sale	% of rebate recipients completing follow-up surveys	Salesforce via contractor	Y
Program marketed jointly with stakeholders	# of industry stakeholders engaged in consumer awareness programs	Reports and contractor calls	Y
Development and demonstration of products for improved technical performance, business models, innovative financing, and charging technologies	# of product development and demonstration projects initiated	Salesforce	Y
Development and demonstration of products for improved technical performance, business models, innovative financing, and charging technologies	# of product development and demonstration partners supported	Salesforce	Y
Utilities advised on approach and business models supporting EVs	# of meetings with utilities	NYSERDA	N
Case studies developed and "how to" materials	Case studies and how to materials completed	NYSERDA to provide information/links posted to web	N
Pilot consumer engagement programs initiated	# of pilot programs initiated	Salesforce	N
Coordination with other states and DOE on developing and possibly jointly funding EV awareness campaigns	Coordination with other states ongoing	NYSERDA	N
Car dealers and employers understand how to participate in EV market	Education with car dealers and employers in progress	NYSERDA	N
Charging station purchasing collaborative instituted paired with incentives	Charging station purchasing collaborative instituted paired with incentives	NYSERDA	N
Fast-charge stations funded and installed	# of charging stations installed in New York	NYSERDA to provide information from DOE	Y
Demonstration of models for aggregate EV purchases supported	# of aggregate charging station purchase participants	NYSERDA	Y
Standardized policies and programs with coordination between entities	Coordination with other entities ongoing	NYSERDA	N
Increased rate of EV sales	# of EVs registered in NY	NYSERDA to provide information from contractor tracking this through DMV	Y
Raised awareness of EVs	EV market share (EVs as a percentage of total number or registered vehicles in NY)	NYSERDA to provide information from contractor tracking this through DMV	Y
Bench-scale prototypes of economically viable technologies that enable smart charging	# of product development projects initiated related to smart-charging	Salesforce	Y

Outputs/Outcomes	Indicators	Data Source	Report to DPS
Beginning of in-service demonstrations of promising EV-enabling technologies	# of demonstration projects initiated	Salesforce	Y
New business models that monetize second-life battery uses and enable charging station financing	New business models	NYSERDA to provide qualitative information based on meetings and relationships	Y
New partnerships formed to encourage consumer awareness and local EV adoption	# of industry stakeholders engaged in consumer awareness programs	IEc to provide information through literature review and stakeholder interviews	Y
Aggregation pilots for EVs and EV charging stations begin engaging customers and facilitating initial bulk purchases	# of aggregate charging station purchase participants	NYSERDA	Y
Fast-charging station network expands to 30 locations statewide along major interstate corridors	# of charging stations installed in New York	NYSERDA to provide information from DOE	Y
Adoption encouraged for standardized policies and programs	Coordination with other entities ongoing	NYSERDA	N
Growth in EV registrations	# of EVs registered in NY	NYSERDA to provide information from contractor tracking this through DMV	Y
Revenue	$ of revenue from sales of commercialized products	Salesforce	Y
Products commercialized	# of products commercialized	Salesforce	Y
Replications from demonstrations	# of replication projects from demonstrations	Salesforce/R&D Demo Survey	Y
Introduction of new products and new utility programs that enable smart EV charging that benefits both EV drivers and utilities/grid operators	# of new products enabling smart charging	Salesforce	Y
Introduction of new products and new utility programs that enable smart EV charging that benefits both EV drivers and utilities/grid operators	# of new utility programs enabling smart charging	NYSERDA	Y
Growth in consumer awareness and experience with EVs, including growth in consumer understanding of the value proposition of EVs	Consumer awareness and experience with EVs	IEc to provide information through literature review and stakeholder interviews	Y
Reduction of installed cost of charging stations	Average installed cost of Level 2 charging station per port	Salesforce based on projects being funded	Y
Geographic availability of charging stations, especially DC fast charging stations that enable greater intercity EV travel	Geographic availability of charging stations, especially DC fast charging stations that enable greater intercity EV travel	NYSERDA to provide from DOE	Y
Municipalities adopt standard policies to support EV-friendly zoning, building codes, planning procedures, and permitting	Standard policies adopted	NYSERDA/Evaluation study	N