Executive Summary: ICBD MCA

1.   Introduction

This research provides the key findings a market characterization analysis (MCA) of early-stage cleantech companies and the entrepreneurial ecosystem supporting cleantech in New York State (NYS). It informs an evaluation of the New York State Energy Research and Development Authority (NYSERDA) Innovation Capacity and Business Development (ICBD) program which aims to help entrepreneurs and companies develop business skills and capacities that will enable them to advance technologies to market more rapidly and with greater success rates.[1]

In the context of a broader entrepreneurial ecosystem, ICBD programs aim to encourage entrepreneurs to form successful cleantech companies, and to accelerate commercialization efforts, generate revenue, grow employment, and apply their clean technologies to achieve system-wide benefits. [2] ICBD directs most of its financial resources toward partner organizations, including six Incubators, two Proof of Concept Centers (POCCs) and one Entrepreneurs in Residence (EIR) program. These organizations then invest resources into a wide range of entrepreneurial, early-stage and growth cleantech companies in NYS.

The MCA research represents a snapshot of the current cleantech ecosystem in NYS in 2015 and 2016, describing the "market" for ICBD services (nascent and early stage cleantech companies) and characterizing NYSERDA's role in that ecosystem. The research included desktop research and a literature review; 68 interviews with a range of stakeholders; an online survey completed by 311 stakeholders (emphasizing ICBD participants); and an analysis of secondary data sources with quantitative metrics that help to characterize the entrepreneurial ecosystem . In the center of the ecosystem are the early-stage cleantech companies in NYS – the group of actors that ICBD programs mainly focus on serving. These companies are selected in the report if they are less than 20 years old, primarily focused on cleantech as their main line of business or the main market application of their technology, and have a significant operating presence in NYS.

2.   Overview of the NYS Cleantech Entrepreneurial Ecosystem
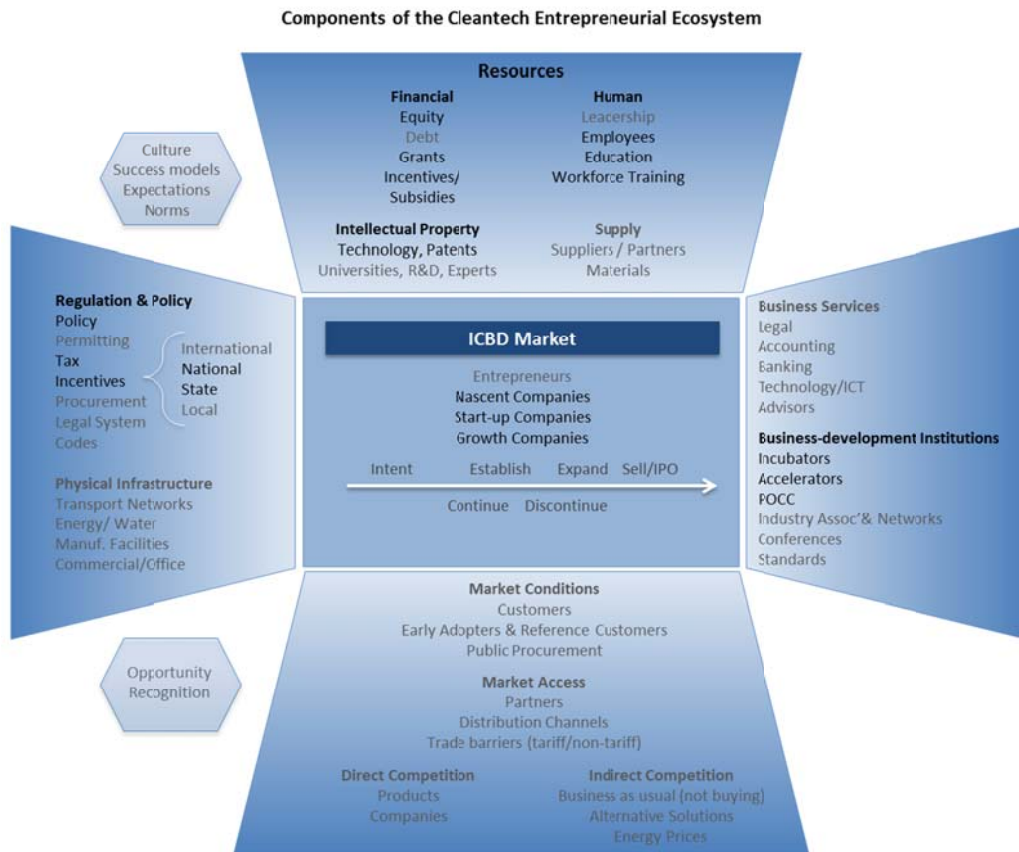
By combining data from eight different sources and conducting additional research and validation, at least 649 early-stage and 305 more mature cleantech companies in NYS were identified with a significant presence in NYS (Figure ES-1). Of the early-stage cleantech companies, 50% are in working in energy-related segments; and 53% participated in at least one NYSERDA program. Companies are concentrated in New York City, but other regions such as in western NYS and the capital region also have many active early-stage cleantech companies, many of which are proximate to large research universities and/or large companies. Figure ES-1 describes the elements that make up this ecosystem; black text identifies the key elements that are supported with quantitative data in this MCA, and gray text indicates elements that are described qualitatively.

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[1] NYSERDA, Jan. 2017, Clean Energy Fund Investment Plan: Innovation Capacity and Business Development Chapter. Accessed online Jan. 28, 2017 at: https://www.nyserda.ny.gov/-/media/Files/About/Clean-Energy-Fund/CEF-Innovation-Capacity-Business-Development.pdf.

[2] Entrepreneurial ecosystem is defined as "dynamic group of highly interconnected actors, resources, and a range of institutional and infrastructural supports that promote an innovation economy." Isenberg Daniel, May 25, 2011, "Introducing the Entrepreneurship Ecosystem: Four Defining Characteristics" Forbes Magazine, accessed September 25, 2015.

Figure ES- 1. Overview of Components (Factors and Resources) Comprising the Cleantech Entrepreneurial Ecosystem[3]

Components of the Cleantech Entrepreneurial Ecosystem

3.   Overview of the NYS Cleantech Entrepreneurial Ecosystem

3A. Population and Distribution of Early-Stage Cleantech Companies in NYS

By combining data from eight different sources and conducting additional research and validation, at least 649 early-stage and 305 more mature cleantech companies in NYS were identified with a significant presence in NYS (Figure ES-2). Of the early-stage cleantech companies, 50% are in working in energy-related segments; and 53% participated in at least one NYSERDA program.[4] Companies are concentrated in New York City, but other regions such as in western NYS and the capital region also have many active early-stage cleantech companies, many of which are proximate to large research universities and/or large companies.

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[4] NYSERDA programs included were: ICBD programs (incubators, POCCs or EIRs), a Program Opportunity Notice (PON), and/oor another research and development program as tracked in the NYSERDA R&D Metrics database.

Figure ES- 2. Number of NYS Early-Stage Cleantech Companies by Stage of Growth

NASCENT COMPANIES (<1 YEAR OLD)	START-UP COMPANIES (1-5 YEARS OLD)	GROWTH COMPANIES (6-20 YEARS OLD)	MATURE COMPANIES (>21 YEARS OLD)
10	241	398	305
649 early-stage cleantech companies incorporated between 1997 and 2016			**305**
954 cleantech companies identified (all stages)			
Source: Combined IEc dataset.[5]			

3B. Critical Resources Supporting NYS Cleantech Companies

The success of entrepreneurs and technological innovations relies in part on the surrounding conditions, and the ability to harness needed resources. The MCA focuses on four sets of resources critical to entrepreneurs and early-stage companies: financial resources, human resources, intellectual resources, and business-development resources targeted at this population of entrepreneurs and early stage companies.

Entrepreneurs and early-stage companies are accessing a wide range of **financial resources**, from grants to venture capital (VC) investments, sourced from within and outside of the state. An indicator of the ability of companies to attract such funding is the amount and number of VC investments made - some 44% of the 649 NYS early-stage cleantech companies identified had successfully attracted VC. The proportion of seed stage rounds went from zero in 2004 to over 50% of the deals in 2016, which is a positive indicator that investors are focusing on the potential of early-stage cleantech companies in NYS.

Intellectual property is being activity generated in NYS, by individual entrepreneurial teams, universities, and large companies. Between 2012 to 2014, NYS inventors registered some 927 cleantech patents, and NYS is ranked in the top three states nationally in total number of cleantech patents awarded, especially in electric vehicle/hybrid/fuel cell vehicles and solar technology.[6] The vast majority of patents appear to be filed by large established companies, followed by universities.[7] POCC participants – typically entrepreneurs or nascent companies at a very early stage in their development – are also active in filing patents. Of the 87 companies IEc surveyed participating in POCCs, 58% had either filed or already been awarded a patent based on the research conducted during their time with the POCC, and another 21% expected to file a patent in the future.

In terms of **human resources**, NYS is already a national leader in "clean jobs", with an estimated 85,198 "clean jobs" employed by around 7,500 business establishments state-wide.[8] However, some gaps in human resources emerged in the MCA research, and many felt this was a major barrier to growth.

NYS has a rich landscape of **business development resources** for early-stage companies, including at least 119 incubators, accelerators, EIR programs and POCCs. Some 19 of these programs focus on cleantech, and the other 100 programs are either open to any technology, or open to technology fields that overlap with cleantech. Within the landscape of existing BD resources, the ICBD programs fill a gap by serving geographic regions (in the northern and western parts of the state), and by offering programming

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[5] Sources were: the CEI Inventory Database (produced by Meister Consulting Group for NSYERDA in 2016); CBI Insights; Cleantech i3; EIR client data; lists of companies participating in five of the six NYSERDA-sponsored incubators (provided by incubator managers in July 2016); relevant companies that received R&D demonstration project funding from NYSERDA; contacts provided by NYSERDA for the IEc interviews; and relevant contacts suggested by Stage One participants of the IEc survey. We also checked each of these companies to verify that they were still in operation (such as an up-to-date website), and excluded several that appeared to be out of business.

[6] SRI International (2015) NYSERDA Clean Energy Technologies Innovation Metrics Report. Page 17, Data from 1790 Analytics (2015)

[7] Ibid. Page 18.

[8] The Clean Jobs Report of 2016 also found concentrations of clean jobs in the major urban areas of New York City, Long Island and the Lower Hudson Valley. BW Research Partnership and The Economic Advancement Research Institute. (May 2016). Clean Jobs New York Report.

specific to building cleantech companies, for example, by connecting companies to experienced mentors, testing facilities, and investors.

4.   Barriers and Drivers

Survey and interview respondents most often cited the following drivers as enabling cleantech in NYS: availability of financial resources (including state and national incentives), research & development (technology), and human capital. Respondents to the interviews and survey noted the following key barriers for early-stage cleantech companies in NYS, all of which can delay time to market for innovative technologies:

- Lack of access to sufficient financial resources. In particular, survey respondents and interviewees noted a lack of *pre-seed* funding, potentially filled by grants; and in *later-stage expansion capital*, as is needed to build a production facility. Financial resources were harder to access for companies distant from the financial hub of New York City, and/or for companies with capital-intensive "hardware" technologies. Even those able to access financial resources did so by combining multiple sources of capital, and spoke of the *significant time* it took to access these funds.

- Problematic state regulatory framework and policies, lack of tax incentives and subsidies, and high state tax rates all rated as significant barriers for respondents and interviewees.

- The challenge of attracting and retaining "serial entrepreneurs" to NYS and to cleantech to commercialize technologies and build sustainable businesses was often cited; and skill gaps were noted in process and production engineering.

- Risk-averse customers, especially in segments targeting utilities and large industrial facilities that can be reluctant to adopt new technologies.

- Challenges in Capturing and commercializing intellectual capital. For example, some interviewees noted the challenge of unlocking the innovative research developed in universities, where technology transfer offices can be slow. Additional barriers noted by interviewees included the need for faster and more cost effective testing and certification facilities, as well as help with filing and protecting patents.

These barriers appear to be more prevalent in non-urban locations, far from the central financial and population hub of New York City. Many of the barriers (and drivers) are interconnected. The drivers of having access to financial capital means that skilled engineers and other key staff can be hired. Supportive state policies help to attract investors, and so on. A holistic approach to policy supporting entrepreneurship and cleantech in the state is needed.

5.   NYSERDA's Role in the Ecosystem and ICBD Program Outcomes

Part of the scope of the MCA was to characterize the ICBD program's role in the NYS cleantech ecosystem, and identify areas of strength and potential areas for refined focus going forward. Stakeholders view NSYERDA as a reliable and valuable resource for early stage companies and entrepreneurs, especially as the availability of other resources fluctuates. NYSERDA's resources are especially important and highly valued in regions that are less rich in resources, such as those in the northern and western parts of the state.

NYSERDA has a considerable but not universal reach among early stage cleantech companies. According to interview and survey participants, ICBD incubators helped them to realize first sales more quickly and/or increased their sales volume. ICBD programs are well-received by nearly all who participate, in particular the services appreciated included: Mentoring/support; Feedback on business plan and/or strategy; Office space/lab space; Introductions to business contacts; and Participation in NYSERDA-sponsored networking.

A limiting factor for the NYS ecosystem is the ability to locate and then *access* resources, and the time and effort it is taking companies to do so. ICDB can (and already does) help connect entrepreneurs and companies to relevant resources, and could help to further extend these connections, connecting them to the right resources at the right time in their development.

6.   Conclusions and Recommendations for ICBD

The NYS cleantech ecosystem is vibrant, with many active early-stage companies commercializing cleantech innovations, and a rich array of resources is available to support the NYS entrepreneurial ecosystem. While there are many early-stage companies, they face significant hurdles in growing at the speed and scale that may be possible. Access to resources is uneven and can be time-consuming, which can impede company growth. For example, providers of business development services and equity funding tend to be concentrated in and around New York City, with other regions less well served. As a result, in regions such as Western New York and the Western Finger Lakes regions with strong potential generation of intellectual capital, are more heavily relying on ICBD programs.

The MCA analysis of the current entrepreneurial ecosystem in NYS provides some informal "actionable intelligence" for ICBD and NYSERDA that could help position programs to build on existing strengths of NYS's marketplace, and also address some of the key weak points in the entrepreneurial ecosystem.

6A. The ICBD program should continue to focus on growing the NYS cleantech market and ecosystem*.*

1. Support of incubators, POCCs, and EIR programs should continue, with a focus on regions with concentrations of resources, such as in and around major urban and university centers (Albany, Buffalo, New York City, Ithaca, Rochester, Stony Brook/Long Island, and Syracuse), and the regions where there are fewer resources but strong signs of entrepreneurial activity. Given that NYS is geographically very large and travel times are long, a focus on localized services is valuable, as is building up the local networks in each of these regions so that they can be self-sufficient in the longer term.

2. The success of ICBD client companies should continue to be promoted to key stakeholder groups that can help these companies succeed.

6B. The ICBD program could expand and/or complement its work by helping NYS cleantech companies connect to and access the resources they need to grow and succeed.

1. Expanding the EIR program by providing financial support to proven, serial entrepreneurs to come to NYS to commercialize technologies and build companies.

2. Providing seed grants to nascent companies (as is already planned). Grants, should be provided in a way that minimizes administrative burden, so as to enable entrepreneurs to dedicate more time to develop and commercialize their innovation.

3. Helping NYS early-stage cleantech companies to build and capture the value of intellectual capital resources, for example by providing more help with patenting, testing and certifying technologies, by adding capacity Testing Centers, and/or by creating including a "fast-track."

4. Building connections to potential suppliers, manufacturers, customers and clients in specific cleantech segments, helping cleantech companies to find the best "product/market fit" for their innovation, and connecting clients to large corporations, banks, and large purchasers/buyers that are supportive of cleantech innovations

5. Coordinating resources with other programs (both NYSERDA and other providers of business development services in the state); clarifying where possible funding amounts, deadlines, processes concur and where there are gaps; and optimizing administrative processes to speed up processes, and get resources to those that can make the best use of them.