

## Chapter 13

# Stimulating a Low-Carbon Energy Economy in New York

### Introduction

Economic growth and responsible stewardship of the environment must coexist and must be designed to be complementary. The key is to invest in businesses and in environmental practices that simultaneously promote job growth while helping society mitigate and adapt to climate change. While some policy options discussed in this plan may impose costs on society in the near term, many provide economic benefit today and even greater benefit in the future.

Developing New York's clean energy economy<sup>1</sup> offers one of the most viable means of stimulating environmentally sustainable economic activity in New York in the 21<sup>st</sup> century. New York has a long history of progressive energy and environmental policy action, as discussed elsewhere in this Interim Report, and such early action is the foundation upon which the State's 80 by 50 planning process is being built. The State's leadership in clean energy provides many examples of the economic development and in-State job creation value of such investments (see Table 13-1 at the end of this chapter).

Much has been written about the potential growth of the burgeoning clean energy economy, and the competition for these emerging markets is global. President Obama has stated that "the nation that leads the clean energy economy will lead the global economy." China is aggressively pursuing dominance in the supply of new clean energy products,<sup>2</sup> and Germany is establishing itself as a leader in several efficiency industries.<sup>3</sup> In the U.S., the Pew Center on Global Climate Change<sup>4</sup> reports that the clean energy economy is emerging as a vital component of America's new economic landscape; many states are trying to revitalize their economies on the prospect of worldwide market expansion for clean energy products and services.

But not all regions will emerge as market leaders. The successful regions will be those which build on strategic assets, which make investments of adequate scale and duration, and which have broad business, political and public support for these ventures.

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<sup>1</sup> "Clean energy economy" in this section is the broad definition of all industries and sectors contributing to a low-carbon economy. This includes energy efficiency, renewable energy, low-carbon transportation technologies and systems, and lean manufacturing, similar to the definition used by the Pew Charitable Trusts in its report, *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*. June 2009.

<sup>2</sup> Center for American Progress. *Out of the Running: How Germany, Spain, and China are Seizing the Energy opportunity and why the United States Risks Getting Left Behind*, March 2010. See also: Breakthrough Institute and The Information Technology and Innovation Foundation, *Rising Tigers, Sleeping Giants: Asian Nations Set to Dominate the Clean Energy Race by Out-Investing the United States*. November 2009.

<sup>3</sup> The Economist. *The Green Machine: A Second Wind for Germany*. March 11, 2010.

<sup>4</sup> The Pew Charitable Trusts. *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*. June 2009.

New York is well positioned to compete in this economic race: New York has long been a leader in energy technology innovation and commercialization, with a well established world-class research infrastructure, and is home to a major financial and venture capital industry. New York has a superior higher education system, the natural resources necessary to power a low-carbon economy, and a productive and skilled labor force that can readily transition into new energy industries and markets.

This chapter first details New York’s significant clean energy assets and then describes the building blocks critical for nurturing our clean energy economy. Finally, this chapter presents strategies designed to promote long-term and sustained economic growth in New York related to clean energy technologies and innovations for the future low-carbon economy. These strategies can make New York a regional, national, and international hub of clean technology industry and innovation— with the goal of creating good jobs for New Yorkers.

*These strategies can make New York a regional, national and international hub of clean technology industry and innovation for the future low-carbon economy – with the goal of creating good jobs for New Yorkers.*

While other chapters of the Interim Report focus on policy options to reduce greenhouse gas emissions and to adapt to a changing climate, this chapter attempts to bridge climate policies with strategies to foster clean energy business growth and clean energy job creation. It does not attempt to measure the economy-wide impacts of climate policy, but work is underway to develop such analyses. (These economic assessments, including analysis of macroeconomic impacts of proposed policies, will be presented in the final Climate Action Plan and will require re-evaluation in progressively greater detail throughout policy development and implementation.)

## **New York Clean Energy Assets and Limitations**

### **New York Clean Energy Assets**

The unique regional differences in New York’s economy provide a wide variety of advantages for the state. Upstate New York has strengths in innovation and high-tech industry, value-added manufacturing, and large amounts of untapped renewable energy potential and natural resources. Both Rochester and Albany rank among the top ten most patents per capita across the U.S.<sup>5</sup> and the State ranks 2nd in total number of clean energy patents (see Figure 13-1).<sup>6</sup> New York City and downstate regions complement upstate assets with large investment and financial services, access to venture capital, and the country’s largest consumer market. The state routinely scores well in national rankings of innovative, knowledge-based economies in the country, such as in

<sup>5</sup>Greenberg, A.. *The Knowledge Economy: America’s Most Innovative Cities*. Forbes Magazine. May 24<sup>th</sup>, 2010. <http://www.forbes.com/2010/05/24/patents-funding-jobs-technology-innovative-cities.html>.

<sup>6</sup>Heslin, Rothenberg Farley & Mesiti, P.C. *CleanTech Patent Index*. 2009.

the Kauffman report, which ranks New York as 5th best prepared to transition into a new knowledge based economy.<sup>7</sup>

### *Types of Capital in New York State*

- **Human capital:** New York State boasts one of the most educated workforces in the country. Overall, 31% of New Yorkers have a bachelor's degree, and 14% hold a graduate degree. New York's workforce is the 4th most educated in the country, below only Massachusetts, Maryland, and Connecticut.<sup>8</sup> Human capital is the most valuable asset in an innovation, knowledge-based economy.
- **Financial capital:** Despite an ailing economy, New York City remains the global financial capital. The city is home to many Fortune-500 corporations and has one of the largest banking centers. This immense source of financial capital, if targeted correctly, will be pivotal in funding new technology and startup companies throughout the transition into a clean energy economy.
- **Natural capital:** New York State has vast assets in low-carbon natural resources that will help fuel the clean energy economy including wind, solar, hydro, and biofuels. According to the New York State Energy Plan, if fully developed, these renewable resources could meet nearly 40 percent of New York's projected primary energy needs in 2018<sup>9</sup>.
- **Manufacturing infrastructure:** New York State has an extensive manufacturing infrastructure (and associated labor force), particularly in the upstate region, that could be transitioned into new growth markets in clean energy.

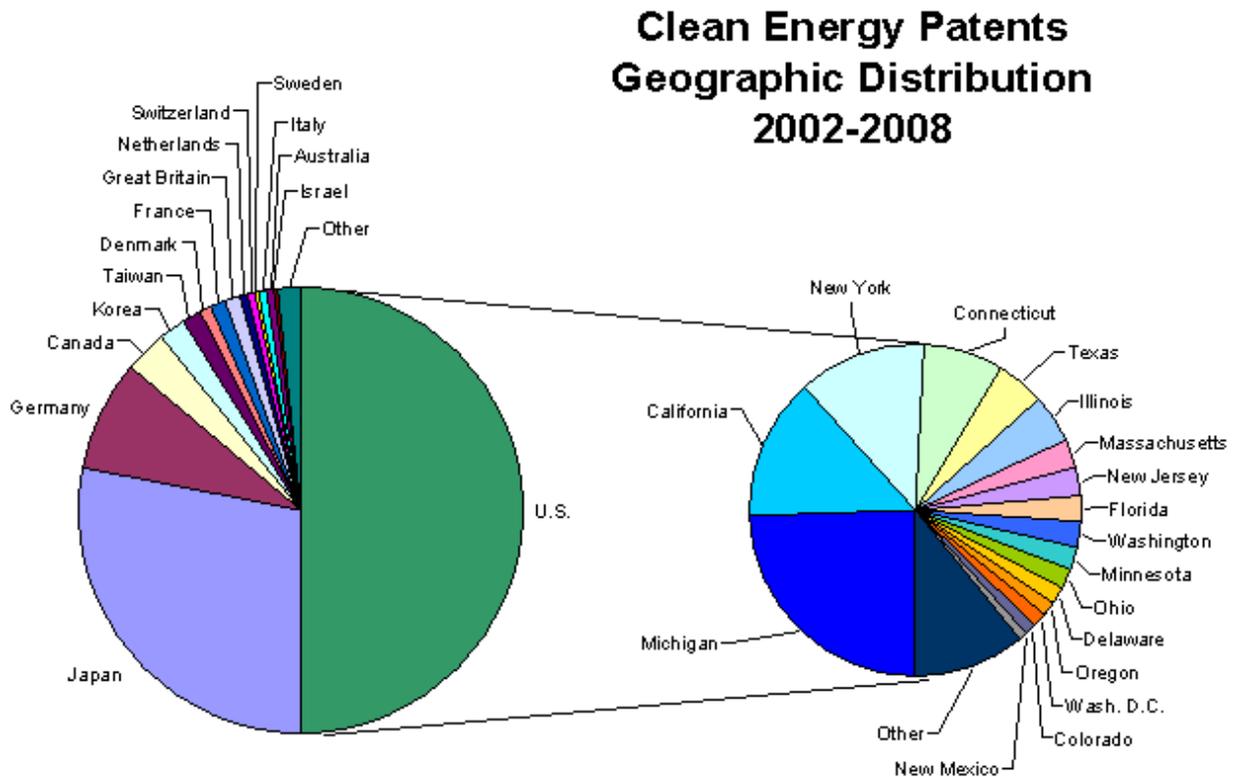
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<sup>7</sup> Atkinson and Andes, The 2008 State New Economy Index, Benchmarking Economic Transformation in the States, Kauffman Foundation. November 2008.

<sup>8</sup> The Brookings Institution Metropolitan Policy Program, The State of Metropolitan America. 2010.

<sup>9</sup> New York State Energy Planning Board, 2009 State Energy Plan. December 2009.

**Figure 13-1. Clean-Energy Patents: Geographic Distribution 2002–2008**



Source: Heslin, Rothenberg Farley & Mesiti, P.C.

***Academic and Research Institutions***

New York State is home to a large number of leading universities and research centers, including two Ivy League universities, seven members of the Association of American Universities, over 20 major research institutions, and a wide breadth of smaller colleges.<sup>10</sup> New York State ranks 2nd in the country in number of doctoral scientists and currently enrolled graduate students and 3rd in the country in the number of doctoral engineers.<sup>11</sup> These institutions play a critical role in the development of the state’s vital human capital assets, and we must ensure the state continues to have the employment opportunities necessary to retain this talent.

However, these academic and research institutions provide more than just an educated workforce: they conduct the initial research and development for new technologies that are commercialized in the private sector. Recently, five New York research laboratories were awarded multimillion-dollar Energy Frontier Research Centers grants by the U.S. Department of Energy. These research centers, at SUNY Stony Brook, Brookhaven National Laboratory, Columbia University, Cornell University, and General Electric Global Research, are working to

<sup>10</sup> New York State Energy Planning Board. 2009 State Energy Plan,. December 2009.

<sup>11</sup> New York City Investment Fund. Cleantech: A New Engine of Economic Growth for New York State. January 2007.

dramatically transform the new energy technologies available to the industry. The State helped fund these New York proposals in order to leverage the sizable federal funds.

New York universities have also entered the emerging field of nanotechnology, which promises advancement in clean energy technologies, including photovoltaics, battery storage, and other renewables. The College of Nanoscale Science and Engineering of the University at Albany is the first college in the world dedicated to the emerging disciplines of nanotechnology. The college's \$6 billion-dollar complex already employs 2,500 scientists and has attracted 250 industry sponsorships.<sup>12</sup> The above section highlights only a few examples of research and development being conducted at universities throughout the state.

### ***Training Institutions***

At the community college and local levels, New York State has recently developed an extensive network of clean energy training programs at 32 facilities across the State. These programs have conducted over 16,000 trainings of individuals in new energy efficiency and renewable energy markets and are poised to continue to develop the workforce needed for critical components of a low-carbon economy. [See Highlight Box]

### ***Industry and Private Enterprise***

Industry and private enterprise is the most important sector of the economy regarding job growth. Fortunately, the state currently has 67,000 employees in the management, scientific, and technical consulting services industry and 54,000 employees in the scientific research and development sector.<sup>13</sup> These industries pay average salaries of \$98,000 and \$64,000 respectively, both well above the state average.<sup>14</sup> Although these jobs are only a small portion of the innovation and clean energy economy, they are representative of the economic benefits involved in a transition to a low-carbon economy. Furthermore, these sectors will transition easily into the new economy and thus provide a strong base of human capital that can be expanded on. When coupled with growth in value-added manufacturing, the potential for economic growth and creation of jobs is dramatic.

Industries and private corporations throughout New York have already been successful in creating or attracting clean energy businesses and jobs. The sector already boasts 3,300 clean energy businesses employing over 34,000 people, making the State a national and international leader in the sector.<sup>15</sup> These businesses include large corporations and small startups alike. For example, General Electric recently opened its \$45 million Renewable Energy Global Headquarters in Schenectady, New York. Emphasizing smart growth principles, GE created 650 new jobs in the city, with the capacity for growth in the future. Another example of new economic development is Global Foundries' new semiconductor manufacturing facility in

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<sup>12</sup> College of Nanoscale Science and Engineering. University at Albany, <http://cnse.albany.edu/>

<sup>13</sup> U.S. Department of Commerce, Bureau of Economic Analysis – regional Economic Accounts. <http://www.bea.gov/regional/index.htm#gsp>

<sup>14</sup> United States Department of Labor, Bureau of Labor Statistics.

<sup>15</sup> The Pew Charitable Trusts, *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*, June 2009.

Saratoga County, currently the largest economic development project in the country.<sup>16</sup> This facility is expected to bring over a thousand jobs to the local economy.

Over the last decade, New York has lost 40 percent of its manufacturing jobs, well above the national average.<sup>17</sup> The transition to a clean energy economy could provide value-added manufacturing jobs to a region with a surplus of skilled workers with manufacturing experience and underutilized industrial sites, particularly in upstate New York. GE and Global Foundries are only examples of the many existing and potential economic development opportunities available to the state. Recognizing that other states have faced manufacturing job losses and will seek to lure manufacturing plants to their borders, the more quickly New York is able to form the culture of innovation that can create new energy businesses, the more likely that capital, talent, and other businesses will find New York an attractive place to locate.

### ***Public Institutions and Government***

Another set of assets New York has to help catalyze economic development through clean energy and climate policy are its public institutions and units of state and local government. These institutions can together bridge academic, private, and public research and development programs by streamlining government incentives and funding while fostering a culture of cooperation within the clean energy sector. An economic transition on the scale required for achievement of the 80 by 50 goal will require substantial and coordinated public planning and guidance.

### ***Specific Clean Energy Core Competencies in New York***

The New York Academy of Sciences recently conducted an assessment of areas of economic growth potential in New York.<sup>18</sup> It identified four economic growth areas and enabling technology core competencies in New York: advanced materials, biotechnology, information technology, and clean technology. The Academy further identified six areas within clean technology with the greatest economic promise for the state: photovoltaics, energy storage, fuel cells, bioenergy, smart electric grid, and integrated building technologies (Figure 13-2). These innovation assets align with the technologies needed for a low-carbon future.

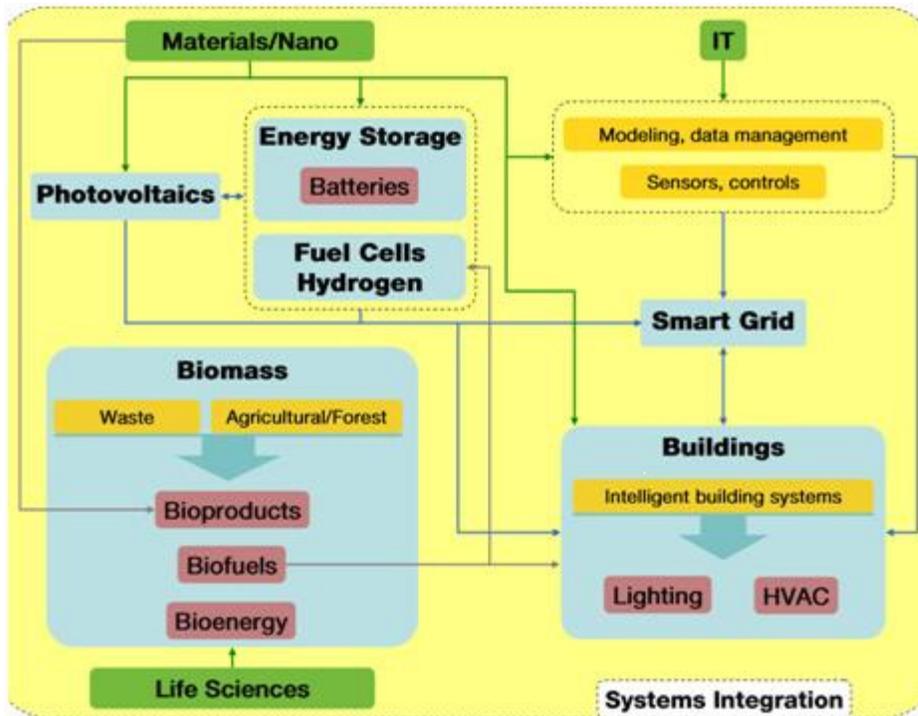
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<sup>16</sup> Saratoga Technology + Energy Park. <http://step.nyserda.org/index.html>.

<sup>17</sup> New York City Investment Fund. *Cleantech: A New Engine of Economic Growth for New York State*. January 2007.

<sup>18</sup> New York Academy of Sciences. *Innovation & Clean Technology in New York State: A New Economic Engine*. August 2010.

Figure 13-2. Clean Energy Innovation Assets in New York



Source: New York Academy of Sciences

## New York Clean Energy Limitations

### Social Capital and Integration Networking

While New York has significant assets, they are not fully integrated with each other and with the transition to a cleaner economy. As a result, developments in one sector of the economy can sometimes have difficulty translating into other areas. For instance, while New York leads the nation in research and development, only 4 percent of academic research in New York is funded from industry.<sup>19</sup> This is below the national average and demonstrates the potential for more university-industry collaboration. While New York is home to more than 20 major research institutions, and its universities place it 2<sup>nd</sup> among the states in attracting federal research and development (R&D) funding, these universities lag behind in incubating new companies.

The growth of an innovation economy requires many connections among many participants, much like a natural ecosystem. Key participants include university researchers, technology developers, sources of capital, entrepreneurs and executives, service providers, business advisors, and others with a stake in commercializing new energy technologies. Better networks in New York would accelerate technology commercialization by promoting the early formation of multifaceted teams to bring new technology to market and by reducing the time and costs involved in identifying and engaging suitable commercialization resources such as capital, key

<sup>19</sup>The Pew Charitable Trusts. The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America. June 2009.

personnel, complementary capabilities, and strategic partners. Some promising public and private sector activities are underway to address this gap.<sup>20</sup>

### **Venture Capital**

Despite the large financial industry in New York City, one of the problems arising from the lack of integration networking is inadequate venture capital investments. Venture capital is a critical component for an economic transition of this magnitude. These investments are necessary to move products and technologies from the research and development phase into demonstration and commercialization. As Figure 13-3 demonstrates, New York venture capital investments lag behind other traditional high-tech centers of innovation and entrepreneurial. If this pattern continues, New York will risk losing advances in research and development to startups in other parts of the country.

### **Regulatory and Tax Structure**

New York must ensure that its tax system, fee structure, and regulatory environment all encourage rather than discourage economic activity in targeted industries. The cost of doing business is a primary factor in firms' location decisions, and the entire range of State policies and laws can affect a business's costs— from fees to licensing requirements to property taxes to tax treatment of investment income. The State must undertake a comprehensive analysis of all impediments to clean energy job and business growth in order to identify barriers and suggest policy and statutory solutions.

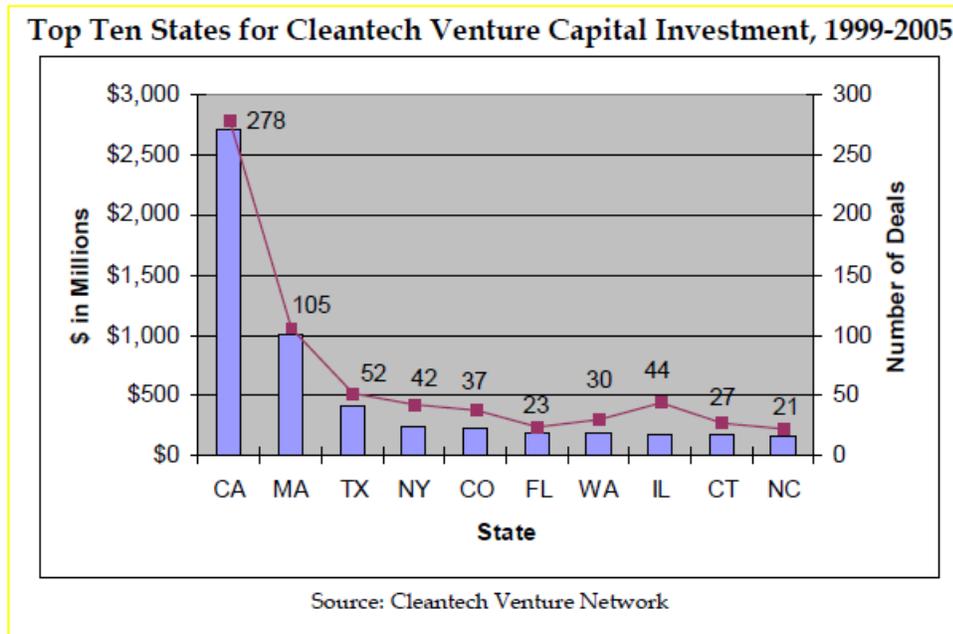
### **Legislative and Regulatory Uncertainty**

Uncertainty and risk associated with a developing economy can slow the generation of new companies, the entry of entrepreneurs into the market, and the flow of investor capital. The current legislative and regulatory uncertainty regarding climate policy, both at the federal and state levels, may be a barrier to entry or expansion for firms and individuals. Regulatory and legislative actors can help by building future certainty regarding laws, goals, and responsibilities throughout the state. This was a clear recommendation offered by a number of investors in the clean energy sector, convened as part of the Climate Action Plan process. New York State has the opportunity to obviate much of this concern by clearly integrating into all its policies the core values of wise use of energy and the in-state production of abundant clean energy.

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<sup>20</sup> See Upstate Venture Connect. [www.uvc.org](http://www.uvc.org)

**Figure 13-3. Venture Capital**



### Policy Options to Drive Clean-Energy Economic Growth in New York

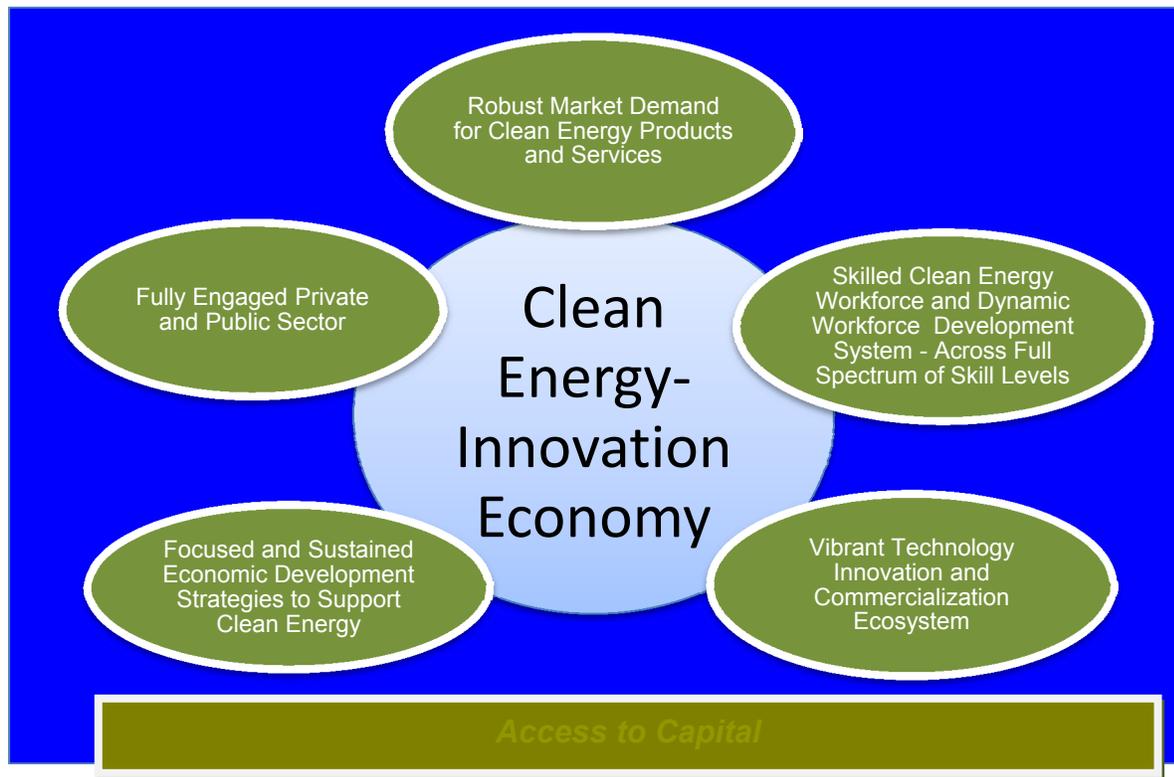
Figure 13-4 illustrates the major building blocks of an innovation-based clean energy economy:

- Robust market demand for clean energy products and services,
- Skilled clean energy workforce and dynamic workforce development system,
- Vibrant technology innovation and commercialization ecosystem,
- Focused and sustained economic development strategies to support clean energy,
- Fully engaged private and public sector.

Each of these elements is critical, along with the fundamental access to capital.

*A portfolio of policies strategically designed to support these critical elements would maximize economic development potential in New York and, if properly executed, would turn climate policy into an engine for economic growth.*

**Figure 13-4. Building Blocks of a Clean Energy-Innovation Economy**



### **Building Block #1: Creating Robust Market Demand for Clean Energy Products and Services**

Strong market demand must exist in order for companies to make investments in facilities, manufacturing, services infrastructure, and R&D. Demand can be created through a variety of policies at the international, national and state levels. Such policies include market-pull policies (e.g., the Renewable Portfolio Standard, or RPS), financial incentives/disincentives (e.g., a carbon tax), regulations and/or codes, procurement guidelines, and a variety of other mechanisms addressed through this Interim Report. Market demand is the foundation for advancing a clean energy economy.

The greenhouse gas mitigation policy options presented throughout this Interim Report would stimulate local demand for clean energy technologies and services (see Chapters 5 through 8) and thereby lay the foundation for a clean energy economy in New York. While policies that drive larger markets (i.e., national and regional policies) will mobilize more private capital and will do so more quickly, history has demonstrated that State policies can move markets in the clean energy arena and create local economic growth.<sup>21,22</sup> Just as we have seen several European nations surpass the U.S. in the commercial development of solar and biomass technologies

<sup>21</sup> New York Renewable Portfolio Standard Evaluation Report. March 31, 2009.

<sup>22</sup> Lawrence Berkeley National Laboratory. Renewable Portfolio Standard in the United States: A Status Report with Data Through 2007. April 2010.

because of public policy support and a motivated customer base, New York's climate policies have *the potential* to significantly stimulate the local clean energy economy.

It is important to note, however, that not all clean energy/climate policies will necessarily create local jobs. For example, a Renewable Portfolio Standard that is met through the acquisition of out-of-state renewable energy credits is not likely to directly create jobs in New York, although it will bolster overall demand for renewable energy products. Energy efficiency policies, on the other hand, have the dual benefit of not only being the most cost-effective greenhouse gas mitigation options but of also providing substantial local benefits in the form of installation and service jobs. This in part has been a strong driver behind policies such as the Green Jobs Green NY legislation. From the perspective of supporting new technology firms, Columbia University's Amar Bhidé has identified “venturesome consumption” as a key driver for value-creating innovation for venture-backed firms and notes that local markets enable the growth of new technology firms.<sup>23</sup>

One of the key issues for any state or region in designing such policies is the timing and level of financial incentive. Regions and states that move out ahead of other areas with more aggressive policies will capture the attention of investors and companies looking to grow in clean energy. On the other hand, the policy design must avoid over-incentivizing and creating markets that are not sustainable. Policymakers must carefully weigh the costs incurred by the consumer in subsidizing a low-carbon technology vs. the benefits in terms of stimulating local jobs, environmental protection, etc. In considering this for electric energy efficiency and renewable resource policies, the price suppression benefits should be factored into the analysis, given that investments in energy efficiency and renewable energy can have the effect of lowering the net cost of electricity to *all* consumers. [See Table 13-1]. All of these factors must be carefully considered in designing policies that stimulate market demand.

## **Building Block #2: Designing a Dynamic Workforce Development System**

A skilled workforce must exist in order for companies to grow and locate in the State. In an innovation-based economic model, a full spectrum of skill levels is needed— from the technician servicing customers’ repair and installation needs to the chief executive officer needed to attract investment and run a company. A dynamic workforce development system meeting the needs of a clean energy economy must take a long view to develop the human capital needed to prepare New York and capture the benefits of a clean economy. The K-16 system must educate New Yorkers in math and science, help them understand the need for environmental sustainability and alternatives to a carbon-based economy, and prepare them for entrepreneurship. The higher education system must continuously evolve to reflect the needs of the changing economy through curriculum modifications and through certifications or degree programs. Incumbent workers must have continuous access to education and training to upgrade their skills throughout their working career in order to meet the changing needs of their employers. Finally, nurturing the entire spectrum of skill levels will keep professionals living and working in New York while creating pathways out of poverty to raise the standard of living for our most vulnerable populations.

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<sup>23</sup> Bhidé, A. *The Venturesome Economy: How Innovation Sustains Prosperity in a More Connected World*. Princeton University Press. 2008.

Chapters 6 and 12 of the Interim Report identify a range of specific workforce development needs largely associated with requirements for installing and servicing new energy technologies and ensuring that we have skilled labor all along the supply chain. This Clean Energy Economy Chapter looks more broadly at the educational and workforce development needs over the long term and identifies ways to grow the human capital needed to move New York State toward a low-carbon future.

*The State must invest in a dynamic workforce development system that can position its workforce for jobs in growth markets.*

Because we cannot predict the technologies in future demand, we must develop the means to identify and respond to workforce development needs as they arise. Robust information sharing among the stakeholders involved in K-16 education, higher education, worker training, and industry<sup>24</sup> is necessary to create a workforce development system that is not only comprehensive along the entire spectrum of skill levels but is also dynamic enough to nimbly adjust curricula and trainings as technologies and employer needs evolve. This information-sharing must be incorporated into a continuous feedback loop among constituents— businesses, employees, and educators. As needs, technologies and gaps evolve, the workforce development system must be designed to also evolve.

Such a system includes three essential elements:

- **Labor market characterization:** Assessing, projecting, and monitoring market demand and describing the labor market characteristics of the state’s high-priority clean energy sectors, including staffing patterns, skill requirements, earnings, career ladder opportunities, occupational trends and labor supply, and demand assessment. Widespread deployment of new technologies is not possible without trained a installation and service workforce.
- **Program development:** Designing programs to meet supply and demand. Must identify needed skills and expertise, map gaps in available workforce skills, inventory, and design training programs/apprenticeships. Must meet needs of all participants (workers, employers) by addressing barriers to training and employment and engaging economically disadvantaged communities.
- **Coordination:** Full spectrum of training activities (public sector, private sector) to leverage resources, to market opportunities, and to establish certifications and standards. Note that “clean energy jobs are not unique to the clean energy industry, and require the same range of education, skills and earnings as jobs in other energy sectors and jobs in the construction and manufacturing industries.”<sup>25</sup>

These strategic elements are neither driven by the market nor sustainable in the market without public support, and a workforce with the requisite skills to properly analyze, design, install, and

<sup>24</sup> ARRA New York State Department of Labor grant for green-business survey.

<sup>25</sup> New York State Department of Labor. New York State’s Clean Energy Industry: Labor Market and Workforce Intelligence. May 2009.

maintain industrial and technological advances will not evolve as quickly as needed without public investment. Intervention will continue to be particularly vital for reaching traditionally underrepresented and economically disadvantaged communities and populations.

The past several years have seen a precipitous decline in federal support for state-administered workforce development programs. New York State has not supplemented the decreased federal dollars. To ensure adequacy of resources, policymakers will need to dedicate revenues for workforce development. Allocating a portion of Climate Action Plan public investments to workforce development can help ensure the ability of the workforce development system to change with the needs of employers and the labor force, particularly by supporting the critical incorporation of real-time labor market and workforce intelligence into program and curriculum development.

The methodological basis for public workforce investment strategy over the 2050 planning horizon is not likely to change from that of today. This includes addressing the following:

- Barriers and bottlenecks that prevent the market from producing the requisite workforce development activities necessary to achieve the goals of the Climate Action Plan;
- Breadth of services: K-16, continuing education for adults, continuous access (both availability and cost) for skills upgrades;
- Comprehensively cataloging job and training opportunities; existence of gaps will justify and help direct use of public funds;
- Evaluation, measurement, and verification of the benefits of public investment in workforce development to support the Climate Action Plan; must set clear, relevant, and achievable goals.

Key market barriers that must be addressed by a comprehensive public workforce investment strategy over the 2050 planning horizon are likely the same as we face today:

- **Matching outcomes to investments:** The objective of clean energy workforce development programs is to improve worker proficiency in knowledge, skills, and abilities required of the jobs to manufacture, install, operate, and maintain the technology advances in clean energy. These goals cannot be measured by simple metrics, such as job placement rates or wage increases, but must instead be measured by more difficult metrics that would assess participants' increased skills or knowledge. The positive productivity effects of workforce development investments are conclusively documented in the literature, and this remains critically important in valuing the effectiveness of workforce development programs.
- **Loss of income while participating in training:** For many individuals, the immediate need to work to cover basic needs far exceeds the delayed greater income potential from not working and participating in training. Therefore, public workforce development investments must include sufficient funding for needs-related payments to encourage individuals to participate in training.
- **Loss of business productivity while training employees:** Some worker skills can be acquired only through on-the-job training, which can be costly to the business through lost productivity of its existing staff. Support for incumbent worker training and on-the-job

training through compensation for lost productivity is an important component of a workforce development portfolio.

- Need for employment-related supports: Remediation of employment barriers, such as transportation, child care, costs of tuition and materials, will remain an integral part of successful workforce development investments targeted at entry-level positions.
- Need for training capacity: Training infrastructure includes curriculum development, school startup and accreditations, and worker certification. It also includes the cost to properly equip workers with the requisite tools necessary for the job. Public workforce investments must provide support for capacity building to advance skills proficiency in installation work, operation work, and maintenance work in the clean energy industry.
- Need for marketing and outreach: The need to publicize the availability of training programs is particularly relevant in economically disadvantaged communities. Public workforce investments should include sufficient funding to promote clean energy training initiatives and opportunities, focusing initially on low-income residential building performance and urban ecology.

### **Building Block #3. Catalyzing a Technology Innovation and Commercialization Ecosystem**

The challenges of 80 by 50 will not be solved with today's technology.<sup>26</sup> Experts across the globe are recommending substantial and sustained investment in energy and environmental technology R&D on top of new approaches to technology commercialization.<sup>27</sup> It is well documented that technology innovation is responsible for over half the U.S. annual GDP growth.<sup>28</sup> A full ecosystem comprised of inventors, entrepreneurs, financiers, and market experts will together spur creation of new clean energy companies that will take the necessary risks needed to produce new products and services. New York has the key ingredients for a robust job-creating energy-technology innovation system<sup>29</sup>. With greater alignment of policies, New York could reap substantial economic gains related to emerging clean energy growth markets.

New York has a long history of supporting innovation in energy technology—dating back to the days of Edison and the demonstration of the world's first electrical grid, the world's first electrically illuminated city, and one of the largest renewable energy-hydropower developments in the early 20th century. From an organizational standpoint, the New York State Legislature had the foresight in the 1970s to create an institution to focus exclusively on innovation in energy technology and, specifically low-carbon energy technology, through the creation of the New York State Energy Research and Development Authority (NYSERDA). But meeting a challenge

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<sup>26</sup> Edmonds, Jae and Gerry Stokes. *Launching a Technological Revolution in Climate Policy for the 21st Century: Meeting the Long-Term Challenge of Global Warming*. Edited by David Michel. Center for Transatlantic Relations. 2003.

<sup>27</sup> International Energy Agency. *Global Gaps in Clean Energy RD&D, 2010*. See also Bill Gates: *Gates Path to an Energy Revolution*. New York Times, August 24, 2010.

<sup>28</sup> Robert Sokolow, Nobel-Prize winning economist on innovation and growth economics. See also American Council on Economic Competitiveness.

<sup>29</sup> New York Academy of Sciences. *Innovation and Clean Technology in New York State*. 2010.

as transformative as 80 by 50 goes beyond a single organization's mission. Such a challenge will only be met through concerted and coordinated policy, program, procurement, and investment practices in all agencies of State government. And most importantly, such a challenge will only be met if we can unleash the creativity of private enterprise, where products will ultimately be introduced into markets.

The current global level of investment in energy technology innovation is nowhere near adequate to solve the energy-climate challenge, nor is it commensurate with the economic opportunities associated with new emerging growth markets.<sup>30</sup> However, there are signs of change. Large corporations are increasing their investments and partnerships in clean energy technology. Start-up companies are emerging with greater frequency in the clean energy business space. Venture capital investment in clean energy is at a record-high level nationally. And in the past few years, there has been a higher level of federal funding available for energy R&D relative to the past two decades.

The challenge to New York is to seize these economic opportunities, revitalizing and diversifying the State's economy— both by creating an environment that stimulates new high-growth start-ups and by encouraging continued investment in innovation and commercialization at larger, more established businesses that have the capital and human resources needed to make major improvements in technology.

Research and development is a critical component in an innovation system, but creating a vibrant technology innovation and commercialization ecosystem requires more than R&D. The State must actively promote innovation and entrepreneurship to bring the fruits of R&D investments to the market and to realize local economic benefits. The recommendations presented herein build on NYSERDA's three decades of experience in working with New York businesses to commercialize new energy technology and are supplemented with recommendations from stakeholders and several recent reports on actions needed to stimulate innovation in New York, including the Task Force on Diversifying the New York State Economy through Industry-Higher Education Partnerships (IHETF)<sup>31</sup>, the Public Policy Institute of the New York State Business Council,<sup>32</sup> Center for an Urban Future,<sup>33</sup> the New York City Investment Fund,<sup>34</sup> and several review papers by the New York Academy of Sciences.

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<sup>30</sup> United Nations Foundation, Scientific Research Society. *Confronting Climate Change*. February 2007.

<sup>31</sup> Task Force on Diversifying the New York State Economy through Industry-Higher Education Partnerships, Final Report. December 2009.

<sup>32</sup> Public Policy Institute. *Transcending the Hamster Cage: Unfettering New York's Static Innovation Economy*. January 2010.

<sup>33</sup> Center for Urban Future. *Building New York City's Innovation Economy*. September 2009.

<sup>34</sup> New York City Investment Fund. *Cleantech: A New Engine of Economic Growth for New York State*. January 2007.

The creation of new ventures, in particular high-growth ventures, is critical both to the State's climate strategy and to its economic development goals. Startup companies account for the bulk of job creation and economic growth. From 1980 to 2005, nearly all net job creation in the U.S. came from companies less than five years old.<sup>35</sup> Even though jobs are constantly being created and destroyed by businesses of all ages, high-growth startups compensate for job losses by firms that close, even during recession.<sup>36</sup>

*The State must actively promote innovation and commercialization and entrepreneurship to bring the fruits of R&D investments to the market and to realize local economic benefits.*

However the focus cannot be solely on directing State funding to capital for startup companies in the hopes of encouraging their formation and helping to sustain them through lean and dangerous early days. This strategy must be preceded by other policies that set the stage: For example, policies to enhance the entrepreneurial climate by providing entrepreneurial training and expanding access to technology are valuable strategies in their own right and often a necessary precursor for direct funding programs to be successful.<sup>37</sup> Examples of these corollary policies follow:

- To convert New York's research capacity to sustainable economic impact, the IHETF Final Report wisely calls for a statewide culture that emphasizes commercialization, and recommends a number of steps to foster this culture:
  - Changing practices at universities to emphasize entrepreneurship and technology commercialization;
  - Calling on industry to engage universities strategically and to sponsor relevant research,
  - Increased availability of capital for seed stage companies and the creation of support structures that help entrepreneurs start up and grow,
  - Adoption of an economic development policy that emphasizes business creation and talent retention, rather than industry attraction,
  - Networking universities and their industry counterparts together.
- The current State Energy Plan also calls for policies and programs in line with the IHETF Report that create an environment encouraging innovation at each stage of the clean energy product and business cycle: from research, development, and entrepreneurship through value-added manufacturing. Continuing development of policies that foster the innovation ecosystem for clean energy technologies and supporting public-private partnerships to lower

<sup>35</sup> Haltiwanger, Jarmin, and Miranda, Jobs Created From Business Startups in the United States, Kauffman Foundation, January 2009. [http://www.kauffman.org/uploadedFiles/BDS\\_Jobs\\_Created\\_011209b.pdf](http://www.kauffman.org/uploadedFiles/BDS_Jobs_Created_011209b.pdf)

<sup>36</sup> Horrell and Litan, After Inception: How Enduring is Job Creation by Startups?, Kauffman Foundation, July 2010. <http://www.kauffman.org/uploadedFiles/firm-formation-inception-8-2-10.pdf>

<sup>37</sup> Lerner, J., Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed and What to Do About It, Princeton University Press, 2009.

the risk of investing in new energy technologies, are essential elements of a prosperous low-carbon future.

- In addition to creating an environment conducive to high-growth startups in clean energy, State policies and programs must further capitalize on the tremendous assets associated with the many large corporate R&D centers in New York, such as GE, IBM, and General Motors, all of which are making major investments in clean energy technology and markets. From an economic development standpoint, one of the key challenges in working with multinational firms is that the economic activity and commercialization activity cannot be constrained to any one state—these are highly competitive global operations. One successful new public-private partnership model that appears to provide value for large clean energy businesses as well as small startups is the New York Battery and Energy Storage Technology Consortium (NY-BEST). Under this collaborative effort, interdisciplinary industry and academic teams have been established to advance energy storage technology, with the public funding going to expand access to university talent in New York State needed by the industrial partner. This effort at networking helps to retain the economic activity in New York by building linkages and, as an example, has proved to be successful in helping to expand GE’s battery business in New York State.
- Lastly, New York needs improved linkages between its technology and investment capital. The New York City Investment Fund, in its report *Cleantech: A New Engine of Economic Growth for New York State* suggests that the State could work with regional business organizations to establish periodic forums in which the venture community is exposed to technology developed at academic and industrial research facilities in New York.

Together, these and other measures applied to clean energy technologies can promote the innovation ecosystem with many connections among its participants— university researchers, technology developers, sources of capital, entrepreneurs and executives, service providers, business advisors, and others with a stake in commercializing new energy technologies. Such an ecosystem will accelerate technology commercialization by promoting the early formation of multifaceted teams to bring new technology to market and by reducing the time and costs involved in identifying and engaging suitable commercialization resources such as capital, key personnel, complementary capabilities, and strategic partners.

Looking beyond State policy, New York should advocate for national policies that play to New York’s strengths in energy innovation (see also Chapter 14). For example, the federal R&D tax credit has again expired. New York should consider pushing for an aggressive and permanent federal R&D tax credit, which would benefit many industrial energy R&D activities in the State. Of paramount importance, New York State should advocate for substantial and sustained federal investment in energy R&D, without which progress toward a low-carbon future will be extremely slow. New York should also continue to encourage the U.S. Department of Energy to embrace new models for energy technology innovation, including those that are far more decentralized than the energy research models of the past few decades. These models can help support regional energy innovation consortia that can accelerate the pace of energy technology development and commercialization.

## **Building Block #4. Focused and Sustained Economic Development Strategies that Support Clean Energy**

New York must embrace a model for economic development that builds on the state's strengths as a knowledge-based economy, with high-value-added manufacturing capabilities, recognizing that the state will struggle to compete in low-cost commoditized markets. The State's economic development policies should support the retention of jobs and the creation of new businesses and jobs in emerging high-growth markets, such as clean technology industries. The State's economic development policies must embrace the new emerging economy of the 21<sup>st</sup> century—an economy whose growth is based on innovation, knowledge, and entrepreneurship.

To position New York as a leader in the clean economy, the State should integrate into its core values the principles of wise use of energy and instate production of abundant clean energy. Codifying these values through a multi-generational commitment will help sway decision makers in commerce and investment to tie their futures to New York State. To build New York's prosperity in the emerging economy, policymakers should also link economic development strategy with nurturing and growing the clean economy.

Economic development strategies for the short term are very different from strategies for the long term. Decision makers today are called on to defend against poaching threats from other states and nations, to mitigate community upheavals from facility closures, and to sway multi-state businesses to consolidate operations in New York rather than in facilities elsewhere. Much of the work of economic developers in New York is to support and protect our existing commercial/industrial base.

Economic development strategies for the long term, however, are not tied to any specific business or immediate need but are focused on creating the culture and infrastructure needed to generate new economic activity: to grow the workforce through cutting-edge K-16 schools and workforce development programs, to grow innovation through R&D investments and support of entrepreneurs, to grow firms and businesses with technical assistance for expansion and for access to new markets, to grow investment by improving borrowers' access to capital, and to grow commerce through market generation.

Beginning immediately, the State should engage in the following activities:

- More strategically allocate monies made available each year for individual firm incentives to focus on high-growth areas such as clean energy. Relevant programs financed in New York State are administered by several agencies, including but not limited to Empire State Development, Department of Environmental Conservation, Department of State, Department of Labor, NYSERDA, and

*To build New York's prosperity in the emerging economy, policymakers should link New York's economic development strategy with nurturing and growing the clean energy economy.*

New York State Foundation for Science, Technology and Innovation (NYSTAR). Strategic allocation could be accomplished in part through the annual budgeting process.

- Engage in a robust marketing campaign targeted to high-growth green firms, both startup businesses and expanding manufacturers, and both home-grown and out-of-state firms. Catalog and exploit our competitive advantages, including but not limited to
  - Hydro resources (good for water-intensive activities like food processing and microprocessor fabrication facilities), multi-climate geography (test-bed for climate-based research);
  - Population/industrial center of massive eastern seaboard market;
  - Global financial center;
  - International connections (immigrant population, points-of-entry, United Nations, etc.);
  - Demographics (multilingual and highly educated populace, highly productive workforce);
  - Transportation infrastructure.
- Work more aggressively with existing New York scientists and researchers on commercialization of promising technologies. [See Building Block #3 above and Chapter 10 on RD&D needs].
- Change State procurement laws and practices both to strengthen New York State as a purchaser and to increase demand for products manufactured in New York [related to Building Block #1 above]. Specific actions could include the following:
  - Internalize true greenhouse gas costs of manufacture and transportation of purchased goods in order to preference those whose production is most aligned with the goals of the 80 by 50;
  - Work with the federal government to ensure that multilateral and bilateral agreements regarding energy and electricity procurement are aligned with climate change goals;
  - Consider revising the weighting on bids for RPS to increase the value of New York's economic benefits, giving greater priority for bids with relatively more New York-manufactured materials equipment and services with positive employment impacts;
  - Strengthen goals for State agency purchasing.<sup>38</sup>

The greater impact, however, will be structurally changing our economic infrastructure to align our education and workforce development systems, our regulatory framework, and our tax structure to encourage the growth and risk taking that will put New York on the top. Four critical long-term strategies to create the culture and infrastructure are identified below:

**Long-term strategy #1:** Align workforce training, K-12, and higher education with goals of clean energy.

- Develop entrepreneurship and ecology curricula; expand training in, and networks of, entrepreneurs (also noted in Building Block #3 above).

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<sup>38</sup> Current statements of goals are embodied in Executive Orders #4, #111, and #142.

- Increase the focus on STEM subjects (science, technology, engineering, and math).
- Incorporate the diversity of New York’s population in education and social programs.
- Adopt proposals developed in the IHETF and within the State University of New York’s (SUNY) “Power of SUNY” strategic plan.

**Long-term strategy #2:** Provide public clean energy R&D investments and encourage private investments in R&D, innovation, and commercialization (related to Building Block #3 above).

- Greater performance-based public support of university research centers, university-industry partnerships, technology “de-risking” through public-private partnerships, and improved transition to private ventures especially in emerging markets.
- Create a State Venture Capital Investment Fund.
- Allow SUNY to restructure, creating marquee university centers.
- Enact a bond act to finance clean technology upgrades in New York’s infrastructure.

**Long-term strategy #3:** Grow commerce through generating and nurturing the market for clean economy.

- Encourage networks of investors; facilitate relationship building and startup mentoring.
- Make New York State an early adopter of promising technologies.
- Bolster export assistance for New York manufacturers.
- Continuously upgrade transportation networks— air freight, rail cargo, and deep-water ports.

**Long-term strategy #4:** Create a tax and regulatory environment supportive of clean energy.

- Consumer behavior: encourage certain purchases (electric vehicles, Energy Star products, renewable energy fuels) and discourage certain purchases (high-GHG emitting fuels, old cars).
- Property-owner behavior: encourage green buildings (zoning, insurance benefits, and consumer taxes on non-green materials) and discourage high-risk or sprawl construction (zoning, higher fees to expand public services).
- Investor behavior: reward profit associated with green businesses, share risk through allowing tax write-offs of green-investment losses.
- Licensing/certification: make New York State the leader in defining certain niche areas of expertise in low-carbon clean energy markets (e.g., as has been done with the establishment of the Building Performance Institute in New York).

A state’s financing structure can create an environment where technology firms are born and grow and thrive in the private market without government intervention. While taxes and fees are often considered simply a source of revenue, how they are structured can have significant impacts on decision making and economic behavior. While a comprehensive analysis of the tax and regulatory systems is beyond the scope of this paper, a temporary commission composed of

both industry and State agencies should be created to study and propose reforms that would encourage business growth in New York's emerging clean energy economy.

**Long-term strategy #5:** As part of community revitalization, develop locations suitable for clean energy businesses.

### **Building Block #5: Encouraging Full Private and Public Sector Engagement**

Achieving a goal as transformational as 80 by 50 is possible only with the full and sustained commitment of all levels of the public and private sectors. Success of the Climate Action Plan and the requisite clean energy revolution<sup>39</sup> will ultimately depend on linkages and support from the federal government, the State government, businesses and corporations, academic institutions, not-for profits, and municipal governments— each of which plays an important role in the transformation to a clean energy economy. And without support from the public at large, policymakers in New York will struggle to advance and sustain the ambitious climate-energy policies presented herein. In the current fiscal environment, these climate-energy policies will be competing for resources with other important policy and near-term social needs.

To facilitate this full engagement, we must: (i) capitalize on the unique roles that each entity plays in our society, (ii) engage a broad spectrum of society, and (iii) ensure that each entity is fully aware of the challenge and empowered to act.

**Roles:** The public sector's role in establishing a policy framework to internalize the price of carbon and stimulate innovation will be absolutely critical. Other important public sector roles such as supporting a robust educational system, sponsoring research whose benefits are either too long-term or high-risk for any individual private entity, investing in existing and new low-carbon infrastructure, and leading by example will be vital to this transformation. Businesses must be willing to invest in opportunities that are climate friendly and reduce the energy requirements for delivering the goods and service that they provide. Given a supportive policy climate, many businesses appear poised to do this.<sup>39</sup> Private companies can advance a technology into a commercial product, although some government risk sharing will be needed in the early stages of development.

Substantial private capital will be needed to transform our energy system and make the necessary physical investments. New forms of public-private partnerships will be needed to mobilize the capital required to achieve this transformation. New financing models for consumers will be needed to increase access to capital for energy efficiency and renewable energy investments. New financing models for technology developers and project developers will be needed to bridge the "valley-of-death."<sup>40</sup> New forms of loan guarantees will be needed to mitigate risk associated with first-of-a-kind large-scale projects. Specific recommendations clarifying and illustrating the roles of the many different participants in the emerging clean energy economy are described throughout this Interim Report.

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<sup>39</sup> Jeff Immelt (General Electric) and John Doerr (Kleiner, Perkins, Caufield & Byers). Washington Post. August 3, 2009.

<sup>40</sup> Bloomberg New Energy Finance. Solutions to the Next Generation Clean Energy Project Financing Gap. June 21, 2010.

**Engaging a Broad Spectrum of Society:** To accelerate and sustain a transformational shift to a clean energy economy in New York, a broad spectrum of society will need to be engaged and benefits must accrue to a diverse cross-section of the population. Jobs must be available for all skill levels, from so-called green collar positions to corporate positions. Ensuring this kind of broad and inclusive engagement will require a range of policy mechanisms, from targeted workforce development initiatives to community-based approaches and mechanisms for establishing effective training-to-jobs networks/programs, such as the use of existing local groups and institutions as informational and organizational hubs. These types of community-based efforts can also help to ensure that green jobs programs and initiatives take into consideration and build upon New York State’s rich cultural and ethnic diversity.

*Realizing a transformation as significant as 80 by 50 will require the full and sustained engagement of the public and private sector—at all levels.*

**Table 13-1 Economic Impacts of Clean Energy Investments**

<b>Energy Efficiency: An Investment in our Economy and the Environment</b>
Energy efficiency investments have demonstrated a positive impact on the New York State economy. For the 11-year period from 1999 through 2009, New York’s System Benefits Charge program has demonstrated that for every dollar invested in energy efficiency, New York State realizes \$4.7 in statewide economic and environmental benefits. These benefits include the creation of 5,300 additional jobs in the New York economy. In addition, these energy efficiency investments have increased personal income by \$1.7 billion, and improved the overall New York economy by increasing the gross state product by \$2.4 billion. <sup>41</sup>
<b>Renewable Resources: Creating Local Jobs with Local Resources</b>
A recent evaluation of the State’s Renewable Portfolio Standard (RPS) program shows that investments in renewable energy technologies can provide positive economic benefits. This analysis concluded that the RPS program resulted in creation of approximately 22,670 total job-years, including approximately 6,490 direct job-years and 16,180 indirect job-years. <sup>42, 43</sup> For every incentive dollar paid to support the construction of the new renewable energy facilities, the State realized over \$6 of total economic benefit. In addition to the jobs created, the RPS program was also noted to reduce overall electricity costs for consumers, as well as result in economic benefit from reduced pollution that would have been otherwise emitted from fossil fuel power plants.

<sup>41</sup> NYSERDA. New York’s System Benefits Charge Programs Evaluation and Status Report, Quarterly Report to the Public Service Commission, Quarter Ending March 31, 2010. Final Report. May 2010.

<sup>42</sup> Three construction jobs that are in effect for one year are the equivalent of three job years. A single job that persists for three years also represents three job years.

<sup>43</sup> KEMA, Inc. and Regional Economic Development Research Group, Inc.. NYSERDA Main Tier RPS Economic Benefits Report. November 14, 2008.

### **Energy Efficiency and Renewable Energy: Reducing the Price of Electricity**

Analysis conducted for the 2009 State Energy Plan demonstrates that aggressive energy efficiency and renewable energy policies can result in reductions in electricity prices for New York energy consumers. When looking at energy efficiency, the State Energy Plan examined the impact to electricity prices if the current 15 by 15 policy goal was achieved. That analysis demonstrated that the net retail price of electricity paid by consumers is expected to be reduced by 0.4 to 0.9 cents per kilowatt hour, which would equal a total annual bill savings to ratepayers of \$600 million to \$1.4 billion in the year 2015. This analysis accounts for both the expected **increases** in annual customer bills to implement the program, as well as the expected **decreases** in annual customer bills due to the reduction in wholesale electricity prices due to the reduced need for electricity, and the reduced need for power generated by the most inefficient and expensive fossil fuel power plants and for importing electricity from outside New York.

The 2009 State Energy Plan also conducted a similar analysis to measure the effect on electricity prices of the 30 by 15 renewable energy policy goal. The renewable energy analysis demonstrated that the net retail price of electricity paid by consumers is expected to be reduced by 0.06 to 0.16 cents per kWh by 2018, which would equal a total annual bill savings to ratepayers of \$93 million to \$262 million. Like the energy efficiency analysis, this study accounts for both expected cost increases to implement the program, and the expected decreases in annual customer bills due to reduced electricity prices and the reduced need for electricity from fossil fuel power plants from imported electricity.

### **Energy Technology Development: An Investment in Economic Development**

It is well documented that investments in technology innovation lead to economic growth. Evaluation of the System Benefit Charge energy R&D portfolio has shown that for every one dollar co-invested with New York business partners in energy product development, Gross State Product has increased by over four dollars.<sup>44</sup>

### **Clean Energy Workforce Development: Positioning New Yorkers for Jobs in a Low-Carbon Economy**

New York State has been supporting energy efficiency and renewable energy workforce development and training initiatives for approximately 10 years, and has created a network of over 32 clean energy training facilities across the state. This includes the Center for Energy Efficiency and Building Science (CEEBS), headquartered at Hudson Valley Community College, an expansive network of 18 locations that develop and deliver workforce development building science training across the state. To date, over 5,150 students have been trained through CEEBS.

NYSERDA has also worked closely with groups such as the Building Performance Contractors Association, the New York State Builders Association, the US Green Building Council, the Association for Energy Engineers, and others to provide funding support for energy efficiency training to over 5,850 practitioners. Through this network, partners have provided training in solar water heating, small and large wind, geothermal, fuel cells, PV, and anaerobic digestion to 4,900 installers, designers, builders, and architects on renewable energy technologies.

Finally, NYSERDA is working with 25 new training partners to develop career pathways and other technical training initiatives that target low-income applicants with a priority to serve unemployed and underemployed individuals. Career pathway and technical training initiatives will train an additional 6,900 participants by June 2012.

<sup>44</sup> NYSERDA New York's Systems Benefits Charge Program Evaluation and Status Report, Final Report. March 2010.