

A Roadmap for Advancing the Green Economy in Rhode Island

February 9, 2010
Version 1.0 - A Working Draft

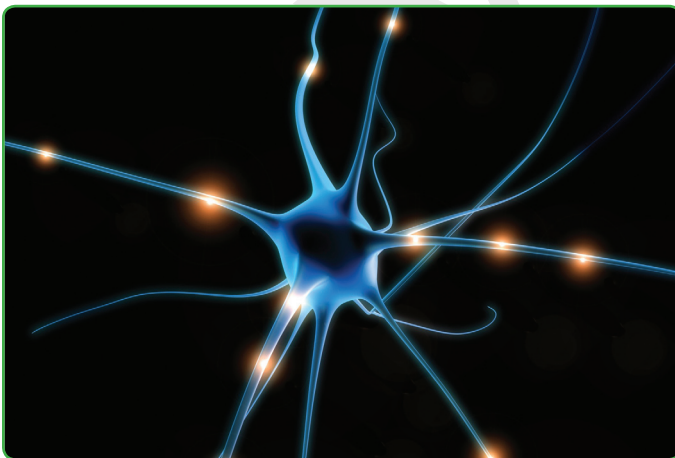
Advanced Manufacturing



Energy Efficiency



Innovation



Wind Power



Advancing the Green Economy

I. Introduction / Executive Summary

The green economy is a new opportunity for Rhode Island that can increase the number and diversity of jobs and raise wages. Education and training must be aligned to support job opportunities at all levels. Advancing the green economy will bring collateral benefits like waste and energy use reduction and energy price stabilization. Ultimately, advancing the green economy will require efforts with all kinds of companies: nurturing new, entrepreneurial efforts; helping existing companies grow and convert to green practices; and attracting existing or new ventures from outside the state.

As a result of the work done through the Rhode Island Economic Development Corporation's June 2009 *Green Economy Roundtable* and the subsequent Roadmap development processes, RIEDC has identified acceleration initiatives for advancing the green economy:

- » Make green products and green the advanced manufacturing process
- » Build or retrofit high performing/energy efficient buildings and infrastructure
- » Integrate the elements of innovation: research, development and then business application in the marketplace, resulting in business growth and adoption
- » Build the hub of a local supply chain for onshore and offshore wind power for the Northeast and Middle Atlantic states

Following the roundtable, RIEDC assembled key leaders to develop the roadmap for the critical green economy initiatives that were identified in June. The content for the roadmap is based on the outcomes of seven small workshops — one for each initiative, an additional workshop for wind and two workshops on workforce development — held in late 2009 and early 2010.

Policy, originally defined as an initiative, has now been identified as a building block that will tie the acceleration initiatives together.

Green policy, workforce training and education, behavior change, capital, and business growth and adoption were determined to be the five building blocks that will drive all the acceleration initiatives. In order for the four accelerator initiatives to succeed, the building blocks must provide a strong foundation. Strong building blocks will yield: aligned policy to redirect resources; up-to-date, innovative workforce training and education programs; increased behavior change of citizens; more available capital; and accelerated business growth and adoption. Further, it would create a strong competitive advantage for green business attraction and retention in Rhode Island.

Roadmap Outcomes

Meta Projects - Phase One, Begin Now

1. Develop a comprehensive state energy strategy
2. Organize access to capital for green companies
3. Create life-long learners on green career pathways

Acceleration Initiatives

Advanced Manufacturing

Phase One

1. Create advanced manufacturing metrics

Phase Two

2. Develop a center of excellence in advanced green manufacturing
3. Sell “manufacturing” in Rhode Island as advanced and becoming greener

Energy Efficiency

Phase One

1. Audit, baseline and target improvements for all state buildings
2. Create a direct financial incentive for the private sector
3. Create a dedicated communications program for energy efficiency

Phase Two

4. Statewide revision of building code to produce high performing buildings
5. Develop energy efficiency degree programs

Innovation

Phase One

1. Establish meaningful, accurate metrics for innovation
2. Create a statewide Small Business Innovation Research (SBIR) liaison

Phase Two

3. Create a mechanism to monitor business opportunities created by state and federal entities
4. Examine adding an arts component to the science, technology, engineering and math curriculum (from STEM to STEAM)

Wind Power

Phase One

1. Make Quonset a wind power supply chain hub/district
2. Install at least 100 MW of onshore wind power capacity

Phase Two

3. Amend the renewable portfolio standard
4. Demonstration projects/learning laboratory
5. Create a dedicated wind power R&D fund

The Advancing the Green Economy process will move from concepts in the roadmap to implementation through the formation of a statewide voice for the green economy — the Rhode Island Green Economy Network (RIGEN). RIGEN will work to foster collaboration, mobilize and aggregate resources, and drive implementation.

II. Acknowledgements

Building the strategic roadmap that aims to accelerate Rhode Island's green economy was truly a collaborative effort. At the RIEDC, we believe that collaboration is the key to any successful economic development strategy.

The seamless collaboration generated at RIEDC's June 2009 Green Economy Roundtable sparked genuine excitement about the future of Rhode Island's green economy. RIEDC would like to extend its gratitude to the stakeholders who participated in this important event. Some 120 participants worked together at this event to identify "acceleration initiatives" for Rhode Island's green economy. The group determined the four key initiatives to advance the green economy in Rhode Island. This would become the framework for this roadmap.

To follow up this effort, RIEDC assembled key leaders to develop the roadmap for the critical green-economy initiatives that were identified in June. The content for this roadmap is based on workshops held in the fall of 2009.

RIEDC wishes to acknowledge those who participated and spearheaded these workshops. These workshops proved invaluable to the roadmap which will marshal these initiatives and introduce a roll-out timeline to ensure short- and long-term economic growth.

Special thanks go to Governor Carcieri, Speaker Murphy and Senate President Paiva Weed for hosting the Green Economy Roundtable in June as well as the forum held in February 2010, and for their continued support as RIEDC guided the development of this roadmap.

Special recognition goes to Fred Hashway and J. Michael Saul, Co-Chairs of Rhode Island's Green Economy Initiatives and Jennifer Paolino, Manager of Rhode Island's Green Economy Initiatives.

Green Economy Roadmap, Fall 2009

Initiative "Quarterbacks"

Advanced Manufacturing

Michael Gravier, Ph. D., Bryant University
Leslie Taito, Rhode Island Manufacturing Extension Service

Energy Efficiency

S. Bradley Moran, Ph. D., University of Rhode Island
John Tuccillo, American Power Conversion

Innovation

Steve Lane, Ximedica
Christine Smith, Science and Technology Advisory Council

Wind Power

Mark Higgins, Ph. D., University of Rhode Island
Eric Offenberger, rTerra

Workshop Participants

Bob Chew	Alteris Renewables
Kleo Taliadouros	Ameresco
Mark Kravatz	Aperion Institute
Jed Greenberg	Aperion Institute
Mark DeMoranville, Ed.D	Aperion Institute
Dan Mendelsohn	Applied Science Associates, Inc.
Dave Durfee	Bay Computer Associates, Inc.

Chris Powell
Kathleen Shannon
Ray Dipasquale
Robin Smith
David Marquis
Jim Glover
Paul Rich
Mike Sullivan
Nancy Olson
Sandra Powell
Len Polizzotto
John Muggeridge
David Speser
Pedzi Makumbe
Larry Gemma
Nancy J. Olson
Janet Raymond
Jim Shaffer
Scott Wolf
Fred Unger
Rick Hodges
Cheryl Merchant
Al Durand
Linda Soderberg
John Jacobson
Robert Victor
Michael Cardente
Chuck Norden
Fred Santaniello
Steve Kitchen
Chris Benzak
Matt Auten
Karen Pare
Geoff Grove
Janet Raymond
Glenn Bachman
Alf Carroll
Keith Hartley
Brendan McNally
Paul Harden
Chris Cannata
Katharine Flynn
Betsy Loucks
David Bogen
Vin Graziano
Terry Feeley
Mark T. Sandvigen
Blake Henderson
Chris Long
Marie Ganim
Beth Cotter
John Farley
William McGowan
Shoguru Osada
Tom Dziki
Marion Gold
Garry Bozylinsky
Raymond Wright
Robert Cerio
Connie McGreavy
Rich Corcoran
Julian Alssid

Brown University
Brown University
CCRI
CCRI
Chemart Company
City of Providence
Deepwater Wind
DEM
Department of Labor and Training
Department of Labor and Training
Draper Lab
Fidelity Investments
Foresight Science and Technology
Gard Global
Gem Plumbing
Governor's Workforce Board RI
Greater Providence Chamber of Commerce
Groove-Pin Corporation
Grow Smart Rhode Island
Heartwood Group, Inc.
Hodges Badge Company
Hope Global
IBEW
Job Corps
JTJ Investments
Kahn, Litwin, Renza & Co., Ltd.
Lockheed Martin
National Grid
New England Institute for Technology
New England Institute of Technology
Newport Biodiesel
Office of Lieutenant Governor Roberts
Phil Pare and Sons Inc
Pilgrim Screw
Providence Chamber
Raven Consulting
Raytheon
Rhode Island Precision
RI-CIE
RIEDC
RIEDC
RIEDC
RIEDC
RISD
RISE Engineering
Rite Solutions
SAIC
SGE / Northeast Engineers
State of Rhode Island
State of Rhode Island
State of Rhode Island
Tec-RI
Telecommunication Workers Union
Toray Plastics
United Natural Foods
URI
URI
URI
URI Energy Center
USGBC
Viessmann Engineering
Workforce Strategy

Additional recognition to:

Roadmaps Advisory Board: Melissa Chambers, Julian Dash, Jon Duffy, Katharine Flynn, Marion Gold, Christopher Long and Meghan Wims

Facilitators and Authors: Robert Leaver and John Speck of New Commons

Senior Editor: Meghan Hinds

RIEDC's Research Team: Tim Cole, Irena Nedeljkovic and Sara-Beth Sidla

Green Economy Roundtable Participants, Summer 2009

Alexander Pichs
 Alan Shoer
 Rob Stolzman
 Bob Chew
 Kleo Taliadouros
 Andy Tolley
 John Tuccillo
 Lawrence R. Kunkel
 Brad Hyson
 Tim Burns
 Stephen Maiorisi
 Clyde Briant
 Ray Fogarty
 Greg Mancini
 Gerry Lavallee
 David Cicilline
 Scott Avedisian
 Jeffrey Weiss
 Steve Crolius
 Grover Fugate
 Mike Tikoian
 Jeffrey C. Flath
 Rich O'Meara
 John Kokot
 Jim Lanard
 Paul Rich
 Chris Wissemann
 Mike Sullivan
 Joe Haskett
 John Chrupcala
 Jon Duffy
 Matt Grigsby
 Deming Sherman
 Craig Swanson
 Sam Krasnow
 John Guerin
 Christopher Rein
 Bruce DiGennaro
 Fred Szufnarowski
 Thurston Hartford
 Noah Fulmer
 Carol Grant
 Phyl Speser
 Larry Gemma
 Frank Caprio
 Zaid Ashai
 Chris Long
 Laurie White
 Annie Johnson
 Scott Wolf
 David Milner
 Fred Unger
 Jeff Grybowski
 Dominique Browning
 Allen Durand
 Mike Mernick
 John Jacobson
 Elizabeth Roberts
 Roger Durand
 James White

AAER, Inc.
 Alder Pollock & Sheehan
 Alder Pollock & Sheehan
 Alteris Renewables
 Ameresco
 American Ecotech
 American Power Conversion
 American Strategic Holdings
 Aperion Institute
 BioProcessH2O, LLC
 Brown University
 Brown University
 Bryant University
 BuildRI
 CB Richard Ellis
 Mayor, City of Providence
 Mayor, City of Warwick
 Clean Energy Venture Group
 Clinton Climate Initiative
 Coastal Resources Management Council
 Coastal Resources Management Council
 Cooley Group
 Core Composites
 Crowne Plaza Hotel
 Deepwater Wind
 Deepwater Wind
 Deepwater Wind
 RI DEM
 Distill Studio
 Draka Cableteq
 Duffy & Shanley
 Ecolect
 Edwards Angell Palmer & Dodge
 Environmental Business Council of RI
 Environment Northeast
 EOS Ventures
 ESS Group, Inc.
 The Essex Partnership
 The Essex Partnership
 ETM Green
 Farm Fresh RI
 First Wind
 Foresight Science and Technology
 GEM Plumbing & Heating
 Rhode Island General Treasurer
 Good Energies
 Governor's Office
 Greater Providence Chamber of Commerce
 GreenHarmony, LLC
 Grow Smart RI
 Hastings Funds
 Heartwood Group
 Hinckley, Allen, Snyder
 House & Garden Magazine
 The IBEW
 ICF International
 JTJ Investments
 Rhode Island Lieutenant Governor
 Lifespan
 Local 57 Operating Engineers

Barbara Fields
 Raymond Marshall
 Mike Ryan
 Frank Conti
 Steven Kitchen
 Christopher Benzak
 Keith Stokes
 Susan Coakley
 Paul Cussen
 Kenneth Cavanagh
 Larry Chretien
 Michael McMahon
 David Martirano
 Gary Gump
 Steve King
 Michael Sabitoni
 Laurence Ehrhardt
 Andy Dzykewicz
 Sarah Kite
 Lou Mazzucchelli
 Stephen D. Galowitz
 Fred Hashway
 Bill Parsons
 Mike Saul
 Julian Dash
 Jenn Paolino
 Katharine Flynn
 Leslie Taito
 David Bogen
 Peter Hocking
 Vin Graziano
 Jim Lavoie
 John Chung
 Jonathan Stone
 Richard Schartner
 Nancy Langrall
 Blake Henderson
 Peggie Sharpe
 Thorne Sparkma
 Christine Smith
 Fausto Anguilla
 Beth Cotter
 Marie Ganim
 Jack Leyden
 Kevin Flynn
 Clay Rockefeller
 John Rupp
 Shigeru Osada
 Ed DaSilva
 Tom Dziki
 David Farmer
 Brad Moran
 Marion Gold
 Kenneth Payne
 Connie McGreavy
 Rich Corcoran
 Joe Caldeira
 Paul Richard
 Sharon Conard Wells
 Jackson Robinson
 Glenn Almquist
 Andrew Cortes

Local Initiatives Support Corporation
 Narragansett Bay Commission
 National Grid
 NEPTCO
 New England Institute of Technology
 Newport Biodiesel
 Newport County Chamber of Commerce
 Northeast Energy Efficiency Partnerships
 Northern States Metals
 Parkinson Technologies, Inc.
 Peoples Power & Light
 Placeholder Partners
 Point Judith Capital
 Portsmouth Econ. Dev. Committee
 Quonset Development Corporation
 RI Building Trades
 RI House of Representatives
 RI Office of Energy Resources
 RI Resource Recovery Corporation
 Ridgewood Capital
 Ridgewood Power
 RIEDC
 RIEDC
 RIEDC
 RIEDC
 RIEDC
 RIEDC
 RIMES
 RISD
 RISD
 RISE
 Rite Solutions
 Roger Williams Law School
 Save the Bay
 Schartner's Farm
 Senator Jack Reed's Office
 SGE
 Slater Technology Fund
 STAC
 State of Rhode Island
 State of Rhode Island
 State of Rhode Island
 State of Rhode Island
 RI Dept. of Administration
 The Steelyard
 Textron/RIPTA
 Toray Plastics
 TPI Composites
 United Natural Foods, Inc.
 URI Graduate School of Oceanography
 URI Graduate School of Oceanography
 URI Energy Center
 URI/RIEDC
 US Green Building Council RI
 Viessmann Manufacturing
 Vision 3 Architects
 Warner Babcock Institute
 West Elmwood Housing
 Winslow Management
 Woodard & Curran
 Youthbuild RI

III. “Meta” Projects

Meta projects are projects that have emerged from two or more acceleration initiatives. Rather than having the initiatives duplicate their efforts, the individual projects have been combined into meta projects. Meta projects will have work teams that include representatives from all appropriate initiatives.

Develop a Comprehensive State Energy Strategy

Rhode Island is faced with energy and environmental challenges that impact all facets of its citizens’ lives and stifle the general welfare. The conditions include high energy costs, reliance on imported fuels, aging energy infrastructure and a high unemployment rate.

In order to address the needs of the market and further advance the economy, Rhode Island should adopt a comprehensive energy strategy that takes into account today’s environmental challenges, the economic climate and ratepayer affordability. In order to achieve this, the plan must consider energy conservation, efficiency, renewable generation and overall reliability. The process for drafting the plan should be a collaboration of stakeholders, including the executive and legislative branches of government, state agencies, business and labor organizations, academic institutions and other interested parties.

The elements of the strategy^{*1}, its assessments and issue briefs should form the basis of policy and program recommendations for the Rhode Island Comprehensive State Energy Strategy: 2010 - 2020.

The state plan should include, but not be limited to:

1) The long-range energy policy objectives and strategies appropriate to increase energy supply, reduce energy demand and stabilize price should consider factors that include:

- » Diversity of the energy portfolio
- » Public health and security
- » Affordability to ratepayers
- » The economic competitiveness of the state
- » The state’s natural resources
- » The reduction of greenhouse gases
- » Energy conservation and efficiency
- » Renewable energy
- » The reliability of electric and natural gas systems
- » Existing energy policies and objectives
- » Existing infrastructure assets and essential improvements
- » Existing private and public capital programs

2) In addition, the state energy strategy should include:

- » The supply requirements and demand forecasts for electricity, natural gas, coal and petroleum products
- » Assessments of existing electric generation, transmission and distribution systems, fuel transmission facilities, delivery and storage systems, and energy transport systems to meet supply requirements
- » Projected energy process over the forecast periods
- » Assessments of the costs, benefits, uncertainties, market potential and opportunities for promoting sustainable alternatives to traditional energy resources
- » Assessment of the environmental, health and economic impacts associated with electricity production
- » Assessment of the state’s environmental policies and programs which impact the state’s development and implementation of energy policies and programs
- » An inventory of greenhouse gas emissions and strategies for facilitating and accelerating the use of low carbon energy sources and/or carbon mitigation measures
- » Assessments of the costs, benefits and uncertainties of traditional and alternative measures required to meet system demands over the forecast periods
- » State energy policies and programs intended to support economic development, including those intended to advance the green economy
- » Comparison of energy prices for various customer classes provided by electric and natural gas utilities of the state with those in other states to determine business competitiveness
- » The role of environmental justice considerations in energy-related decisions
- » Recommendations for administrative and legislative actions to implement policies and objectives set forth in the energy strategy

Organize Access to Capital for Green Companies

Context and Conditions

Rhode Island sees new economic opportunities based on green ideas, practices and businesses. To fuel the growth of these opportunities, or any of Rhode Island’s economic opportunities, capital will be vital.

Overall, capital access in RI is fragmented, and significant gaps exist along the capital spectrum (i.e., from seed / early stage to bank debt). Further, no logical continuum of funding exists to move a venture from business idea into production and then business sustainability. Even when the various existing funds are laid out as a continuum, there are gaps, especially in equity and mezzanine funding.

* See Notes, page 20

Existing state managed finance programs and funds are too limited to accelerate growth in business and more directly the green economy. Government-backed capital programs and funds need to be: (1) organized to better address gaps; (2) aligned for better leverage; (3) more agile and (4) increased. Creating a separate dedicated government-backed green capital fund would be counter-productive at this time because there is not enough money to “fully fund” both a regular fund and a green fund.

Projects within the Meta Project

The capital meta project will begin by focusing primarily on government-backed programs and funds. It will aim to achieve five objectives. One, provide broadly based coherent and aligned funds and programs along the capital spectrum. Two, increase the amount of government-backed funds. Three, develop agile practices to direct capital on the continuum to green ideas and businesses for the four green accelerators: advance manufacturing, energy efficiency, innovation and wind. Four, determine the feasibility of establishing self-sustaining capital funds comprised of both state and federal funding aimed at investments in growth companies in the green economy providing services or making products.

Create a Menu of Government-Backed Funds/Increase Fund Limits

Pieces of this menu already exist and will be organized. The chart below lists the type of fund and the current and proposed funding limits.

Fund	Type of Funding	Current Level	Proposed Level
Industrial Recreation Bond Authority	Loan Guarantee	\$20 mil.	\$80 mil.
Small Business Loan Fund Corp.	Loan	\$13 mil.	\$18 mil.
Renewable Energy Fund	Grant / Loan	\$2.5 mil.	\$5 mil.
Regional Greenhouse Gas Initiative	TBD	\$7 mil.	Estimated ² \$8.5 mil. in 2010
Innovation Tax Credit	Tax Credit	\$1 mil.	\$1 mil.
National Grid Fund	Varied	\$46 mil.	\$46 mil.
Slater Technology Fund	Equity	\$2 mil.	\$3 mil.

As part of assembling the menu and increasing the fund limits, each fund would maintain its own control. But it would be advantageous for all such funds to co-locate so collaboration on deals would occur.

With Government-Backed Funds, Use Agile Practices to Grow Green Business

To accelerate the growth of green economy, the current government-funded or backed programs need more agility. For example the Renewable Energy Fund (REF) only funds electricity production projects but could be expanded to allow investments, loans and grants across the spectrum of renewable energy production. Rhode Island should invest in companies that can create permanent green jobs as well as temporary construction jobs associated with renewable energy projects. Agility practices can also target the funds to companies with jobs coded green by the North American Industry Classification System (NAICS). In exchange for the agility, recipients of the funds would be accountable for meeting measured growth requirements, e.g., number of jobs added or increases in wages.

Review the Renewable Energy Fund for Scope and Use

Ratepayers fund the REF through a small percentage surcharge on their electricity use. This rate, 0.3 mills per kWh, is substantially lower than competitive states like Massachusetts and Connecticut (0.5 and 1.0, respectively). Because funds are generated only from electricity, the REF only supports renewable energy projects that produce electricity. Thus, projects that use solar thermal, geothermal and other non-electric technologies cannot receive REF funds. This project should review the mill rate and review similar charges for natural gas consumption currently used for “demand-side management” programs. A larger, more broadly defined REF could support a wider range of renewable projects, spurring action and driving the market.

Study the Feasibility of a Self-Sustaining Green Innovation Fund

The Slater Technology Fund has driven important innovations in the state. But it no longer matches the scale of similar funds. The state should pursue an innovative, multi-lateral funding approach that matches government investment with private investment to build the new fund to a scale that can support more robust spending in green-based research, development and innovation - the actual selling in the market of a green based product. While the state will need to invest the initial capital, this fund would become self-sustaining by taking ownership positions in the companies the fund helps create. As created companies buy out the fund’s position, that money - and matching money from the state - would sustain and grow the fund to support increased commercialization and innovation.

Articulate the Full Continuum of Green Capital

This project focuses on developing coherence for all public and private sources of capital to ensure that they “target” green companies and green products. To be on the continuum, the fund can be fully green-targeted or feature agile practices that “favor” green like the government-backed funds. It will serve companies from start-up through growing and then expanding as a company.

Sources of capital on the continuum will include: Equity, term debt, mezzanine debt, guarantee authority, tax benefits and venture funds. The eventual dollar amount of the respective funds on the continuum should be based on a thorough analysis of actual market opportunities and demand.

Create Life-Long Learners on a Green Career Pathway

Context and Conditions

Maximizing the opportunities in the green economy requires an able workforce, a workforce that is not yet in place, nor are all of the required jobs and skills known. This meta project will prepare the green workforce by focusing on two outcomes — life-long learning and a career pathway³. The pathway will be industry driven and delivered by a collaborative composed of training providers and others. Life-long learning will be woven throughout the pathway so workers/learners can be ready to take advantage of new opportunities in the nascent green industry where many of the skills and jobs are yet to be known.

This roadmap seeks to advance four green economy acceleration initiatives:

- » Advanced manufacturing: creating green products and greening the manufacturing process
- » Energy efficiency: building or retrofitting buildings to be high performing
- » Innovation: completing the continuum from research to development and ultimately business application in the marketplace
- » Wind power: building a local supply chain for offshore and onshore wind

There are many other potential green economy workforce development areas to address but that will be done in subsequent phases. The definition of the green economy for Rhode Island, at least during the first phase of the Roadmap building process, will focus on the above four business and job areas.

The goal is to develop flexible life-long learners — K to 12 through adult. The career pathway will include entry-level skills, middle skills, and advanced skills. It will include credit and non-credit offerings, certificates, two-year degrees, four-year degrees and advance degrees. It will include technical and managerial/finance skills. The curriculum would draw from science, technology, engineering, math, design and innovation.

Even though it is impossible yet to project where the jobs will be and when will they come, the players in the green economy can't stop thinking about this emergent sector or stop assembling capability for what will come next with the greening of the economy. Rhode Island is home to an emerging greener economy and will continue to move

further into it. Rhode Island has to be ready with the skills and workers ready to work.

Projects within the Meta-Project Know the Demand for Skills

Whether the project involves: utility-scale offshore wind; a large network of small, distributed systems; energy efficient new construction or building retrofits; or new, green manufacturing processes, a full understanding of the range and demand for skills is still not known. In fact, skills gap assessments will be an ongoing process.

The green career pathway will be competency-based with multiple entry and professional levels. The pathway will be shaped by guiding principles such as resilience. It will include technical, operational and managerial skills. A pathway map would include jobs, professional levels, capabilities required and pay levels, as well as the training and education required. Further, for each level and skill type, the pathway will determine current skills that need to be upgraded to be applied to green jobs, e.g., welders and divers. The pathway will determine the first set of priority green skills gaps to close based on skills gap studies from the Apeiron Institute, New England Institute of Technology's Green Technology Consortium funded by the Rhode Island Governor's Workforce Board and, potentially, others.

The pathways map should determine, if viable, the clusters of universal skill sets that are embedded in all or some of the four green economy accelerators. In effect, are there skills that apply to multiple jobs? It will project the new types of green jobs - the green jobs that don't yet exist - that will be created and required, at what levels, and when. It will also determine what skills must be added when existing jobs are "greened."

Beyond the technical, operation and managerial jobs and even the specific skills associated with these types of jobs, there will be a renewed emphasis on skills and methods of learning that may not be universally practiced now. For example, workers should learn to be resilient in the face of disruptive new energy technologies. They should develop skills such as critical thinking, innovation and whole systems thinking as these will become more critical to every kind of work, regardless of where one is on the career pathway. It then needs to be determined where these skills fit in the jobs and work of tomorrow.

Additionally, a bridge is missing to connect current and future innovators to what is going on in the green economy such as jobs, training for jobs, and other professionals.

Ready the Supply of Training and Education

Rhode Island needs to continue to polish and embed green principles into existing training programs and those to be freshly created.

The state should also determine what training needs are immediate. For example, with wind power the state and

the wider local renewable energy network must address this critical gap in capability by instituting aggressive worker training (or re-training) programs to produce qualified welders, electronic technicians, quality control technicians and, for the offshore projects, divers.

An inventory and a “lattice” of current training programs and gaps in offerings should be developed as well as trainers based on a profile of who the best trainers are. The programs and trainers included will be based on the ability to produce outcomes. Rhode Island will also determine what training and education is best offered in what form: blended learning, distant learning, hands-on, classroom, internships or online.

Use an Agile Delivery System Operating as a Collaborative

As the green economy of Rhode Island expands, the demand for education and training will expand beyond what anyone one provider could deliver. Even a hub-and-spoke model would likely suffer from a bottleneck in the hub. Rather, an agile network could quickly develop the requisite curricula and, if necessary, create new places for learning, rapidly responding to the growing need for education and training.

Membership in the collaborative is based on two criteria: agility in design and delivery, and the ability to deliver outcomes defined as certificates/degrees produced, jobs created or people placed in a job, and starting salary levels. To be agile, a collaborative of all providers would form to organize and deliver training and education, including flex models and co-location. The providers would include colleges, not-for-profits, commercial vendors and universities. It would include the informal networks convening around wind and energy efficiency. Each provider would offer the network its top capabilities - what it delivers best. The network would operate with a healthy, competitive spirit.

Create a Green Workforce Research and Innovation Lab

The green economy is a new opportunity. Yes, it relies on some existing skills and jobs. At the same time there many unknown elements to the skills/job/work mix. The lab would perform two functions. First, undertake continuous research about green industry growth and diversification, and the jobs and skill that will be demanded. For example, hold forums on 21st century building materials and what the use of such materials requires in terms of education. Secondly, vet fresh green training and education approaches for applicability.

The lab could be virtual, organized as a network, and not necessarily in one building. It would examine and vet for feasibility ideas such as:

Creating a fresh dialogue with the public schools: The lab will determine best ways to foster green economy thinking and workforce preparation in public schools, including at what levels and when.

Creating holding tanks for workers while the jobs are created: Public service employment has historically been used as a temporary “holding tank” measure while an economy rebounds and jobs are created. The state could possibly save many millions of dollars by reducing energy consumption in the buildings it owns or leases. Could freshly trained workers be hired as a public service workers (like the old Comprehensive Employment and Training Act (CETA) program) to assess energy efficiency of state buildings?

Develop Green Internships

Young people need exposure to exploratory “unknown” job opportunities in the green economy and opportunities that contribute to further understanding of possibilities for jobs and training. Internships in advanced green manufacturers let young workers experience how clean these factories are and the level of knowledge and technology required to make things today.

Fellowships

Offer fellowships for undergraduates and graduate students so they can learn green research.

Educate Regulators

Building inspectors, code enforcers, fire marshals - anyone that regulates the building of buildings or infrastructure - will have to be educated about the use and safety of green technology.

Projects for Further Consideration

These potential projects developed at the roadmap workshops will not be approached at this time. However, they merit inclusion in this document in hope that they will inspire discussion that will help shape these projects when they are addressed.

Level the Playing Field

Workshop participants felt strongly that the state’s incentive structure is biased toward recruitment of out-of-state businesses, and that this would serve to discourage local Rhode Island businesses from investing in the green economy. However, this project would require a wide-ranging review of incentives as well as policy recommendations that cover the entire Rhode Island economy. Because this project goes far beyond the intended scope of this Roadmap, only state policy makers can take up this clear call for action.

“Green” the Knowledge District

This project sought to build the Knowledge District on a green infrastructure and include in the buildings as many green technologies as possible. However, those development plans already have an active stakeholder group, and RIGEN may not be the most effective group to advance this agenda.

Green “Economic Gardening”

Economic Gardening is a new approach within economic development, focusing exclusively on home growing companies. It is an inside-out economic development strategy often executed as a partner with business attraction - the outside in strategy.

In RI, green economic gardening will have two applications: accelerating existing high growth companies and starting new entrepreneurial companies. High-growth potential companies are defined as having at least \$1 million annual revenue. For high growth companies, Economic Gardening mobilizes market intelligence and best practices, connects growth companies together and fosters a culture of entrepreneurship to help these companies grow rapidly to scale. For new entrepreneurs, Economic Gardening will map the resources of existing business development services and mount a public campaign as a call for entrepreneurs to step up and start green companies.

However, too many questions remain unanswered to commit to a major project that implements this approach. Rather, RIGEN members should continue to monitor this emerging approach and its applicability to Rhode Island.

IV. Initiative-Specific Action Plans

Advanced Manufacturing Goals

1. Provide guidance on indicators for sustainable manufacturing, developing and promoting standards that help manufacturers use existing indicators to improve environmental performance.
2. Identify promising sustainable manufacturing policies that allow manufacturers and their suppliers and customers to innovate products and processes to improve sustainability, developing and promoting a set of best practices.
3. Build a common vision for sustainable manufacturing that unites manufacturers, suppliers, customers and communities, developing and promoting shared metrics and significant milestones.
4. Develop a common definition and a scoreboard.
5. Create a partnership between manufacturing and academia to increase learning and workforce development.

Key Metrics for Five-Year Targets

Any measure of growth in advanced manufacturing must rely on quantifiable performance measures that distinguish advanced from traditional manufacturing. At present, no such data set is available. This roadmap includes a project dedicated to resolving this issue.

Innovation should be measured in several ways, all of which are tied to education. The number of engineering graduates as well as those with specific training in green or advanced manufacturing should be tracked, and the number of “capstone” projects, representing the culmination of an engineering education, that reach some level of implementation should be tracked, with both metrics sharing a target of continuous increase. Finally, while there are isolated public school programs that address skills needed for advanced manufacturing, there is no systemic curriculum. The alignment of state standards for K-12 education with economic growth sectors should be tracked with a target of 50 percent of middle schools offering hands-on curricula in manufacturing engineering.



Thermoform packaging from Nelipak in Norway.

Immediate and Emerging External Conditions

Policy

Manufacturing businesses seeking to grow the green economy in Rhode Island face many challenges. The current tax policy creates a general disincentive to growth, and energy policies discourage the use or installation of alternative energy generation, making up-front costs high and the return far in the future. In addition, our native workforce lacks adequate training in advanced manufacturing to make rapid growth feasible without importing labor.

Rather than attracting new manufacturing operations, companies are leaving the state in search of better conditions, hurting the state's tax base. This, in turn, is creating some level of unrest in the taxpayer community.

Workforce Training / Education

In brief, the green economy lacks two crucial aspects of workforce training and education: the educational process and the workforce.

In a Rhode Island Manufacturing Extension Services (RIMES) and Rhode Island Manufacturers Association sponsored study of critical skills in Rhode Island manufacturing, problems with the education process are exposed, as survey results indicate that 45 percent of manufacturers report finding entry level workers is getting more difficult.

Only 15 percent of entry-level workers are adequately prepared for entry-level jobs. Almost a third of entry-level jobs require skills at operating complex machinery (often computer controlled), preparing packaging and documentation for transportation, and assembling increasingly complex products.

The increasingly aging manufacturing workforce adds to the perception by local manufacturing executives that most Rhode Islanders (and Americans) think of manufacturing as “very last century” - heavy machines shaping steel and iron in loud, unsafe conditions; a non-creative industry of tedious assembly and pencil-pushing. Of course, nothing could be further from the truth. The manufacturing community does not adequately communicate about the current state of advanced manufacturing or the creative opportunities available within the sector.

With regard to the training of the existing workforce, two-thirds of surveyed managers stated that finding qualified workers was getting harder. Sixty percent of manufacturers have plans to expand within the next five years, but lack of skilled workers is a critical obstacle to expanding jobs in Rhode Island. The greatest needs for skilled workers are for machine operators/machinists, technical sales, engineers, and computer numerical control (CNC) machine setup. Workers need training to upgrade their skills with computers, technical knowledge and advanced machinery in order to compete for well-paid jobs and bolster the value add for Rhode Island manufacturers.

Behavior Change

In general, the manufacturing community lacks capabilities to adequately communicate best practices and innovative improvements to processes.

In several other sectors, industry and academia have developed consortia to promote technology transfer from university to company, to develop a network for moving students into the workforce and to promote best practices. The Rhode Island manufacturing sector lacks such an effort.

Also, the region’s manufacturing sector lacks a clearly stated, overarching goal as it enjoyed in the 1960 when space exploration served that purpose. Eliminating our dependence on fossil fuels could provide such a goal, but there is no consensus within the sector or the government to promote it as such.

Capital

Capital availability for traditional and advanced manufacturing can be described in two words: “not there.”

Both banks and investment groups demonstrate a perceived bias against investing in traditional manufacturing, resulting in a lack of capital across the continuum.

And this lack of capital exists despite the many new opportunities emerging in both the “greening of manufacturing” and the “manufacturing of green.”

Business Growth/Adoption

Adoption of green practices should already be occurring rapidly. While increasing industrial efficiency makes good environmental sense, it can also dramatically improve profitability. In fact, for low-margin companies like biotech firms, lowering expenses is vastly more profitable than increasing sales⁴.

The powerful profit-generating power of reducing resource use by manufacturing has the potential to equal or better the best periods of industrial growth in our nation’s history and put Rhode Island back on the map in terms of competitive advantage relative to other states and industrial clusters on the global economy.

But this is not happening, prompting the question: why?

Existing Rhode Island manufacturers lack access to many of the tax stabilization and other incentives offered to out-of-state companies, creating an uneven playing field. As stated above, the sector lacks an umbrella organization to act as a clearinghouse for growth and adoption.

The state, in general, lacks easily built-on commercial sites, and the sector badly lacks investment capital, especially for more advanced projects where the institutional awareness may not yet be fully developed.

However, some high-quality or high-value manufacturing has returned to the United States, despite higher costs. In advanced manufacturing areas such as biomedical, medical devices, green energy components and high-tech devices, Rhode Island could again enjoy a robust manufacturing sector with high-paying jobs.

Projects

Phase 1

Policy

Create an Advanced Manufacturing Dashboard

The advanced manufacturing sector offers the promise for rapid growth. Sadly, the traditional manufacturing sector faces continued challenges. To accurately assess the status of Rhode Island’s advanced manufacturing sector, the metrics must rely on data that exclude traditional manufacturers. With economic metrics such as GDP contribution or job creation, declines in the much larger traditional sector would more than nullify early gains in advanced manufacturing. Sustainability metrics such as waste reduction and energy efficiency must be indexed to GDP so they, too, require separate data sets.

This project seeks to create a methodology to separate advanced manufacturers from the traditional sector, acquire relevant data from those manufacturers, compile the metrics and publish the results. The dashboard should include these metrics as well as other yet to be determined.

Phase 2

Behavior Change

Develop a Center of Excellence in Advanced Green Manufacturing

Centers of excellence represent a major commitment on the part of the sponsoring institution to a specific field of research. The University of Rhode Island (URI) hosts separate centers of excellence in undersea technology and explosives detection, mitigation, response and characterization. As the state's public university as well as a leading engineering school, URI is in a unique position to host this center of excellence in advanced manufacturing, potentially in partnership with RIMES and/or other institutions.

Workforce Training and Education

Sell "Manufacturing" in Rhode Island as Advanced and Becoming Greener

The general public's perception of the Rhode Island manufacturing sector does not match the reality. The sector must communicate its value to the state's economy and the creative opportunities it offers potential workers, especially those in K-to-12 and coming out of college. In addition to a marketing campaign, the sector should work with the state to create a Manufacturing Day where schools can visit advanced manufacturers and companies can hold job/career fairs.

Energy Efficiency

Goals

1. Each year, bring 4 percent of all residential, commercial and public buildings into compliance with broadly accepted energy efficiency guidelines (ASHRAE 90.1-20073) and support Rhode Island State Building Commission's commitment to achieve compliance in 90 percent of new and renovated building space by 2017⁵.
2. Deliver prioritized, locally available skill sets to support a larger energy efficiency sector by training or retraining existing workers for all aspects of energy efficiency service sectors, building design, construction and maintenance.

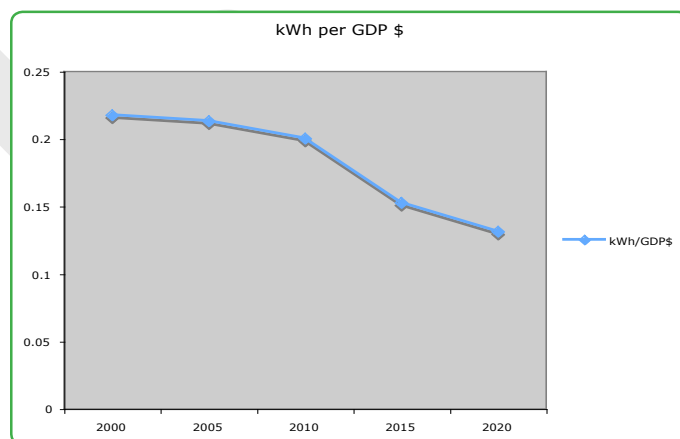
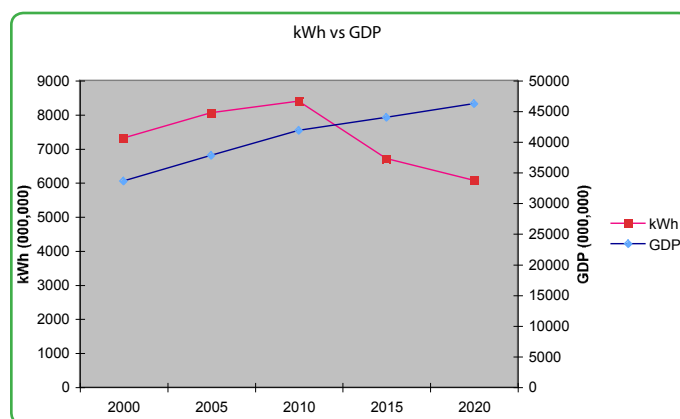
Key Metrics for Five-Year Targets

On the issue of energy efficiency metrics, for the phrase "energy efficiency" to have meaning, it must have a definition. Indeed, developing such a definition has proved difficult, with various, competing standards in the marketplace.

For this work, focusing on the economic development potential of energy efficiency, the metric requires a consistently measurable energy input and a directly associated economic output. Given available data, the metric used here will focus only on electricity used for commercial purposes divided by gross domestic product kilowatts per hour/Gross Domestic Product (GDP)).

This metric creates a framework in which energy consumption can decrease while GDP grows. Also, this metric allows the easy calculation of the related metrics of total costs and/or total emissions. These three interrelated factors - energy consumed, cost of energy and CO₂ emitted - represent the core target definitions. The inclusion of GDP intentionally links these energy efficiency metrics to economic development, which is the true focus of this roadmap.

To advance the green economy, any reductions in consumption must support continued economic growth.

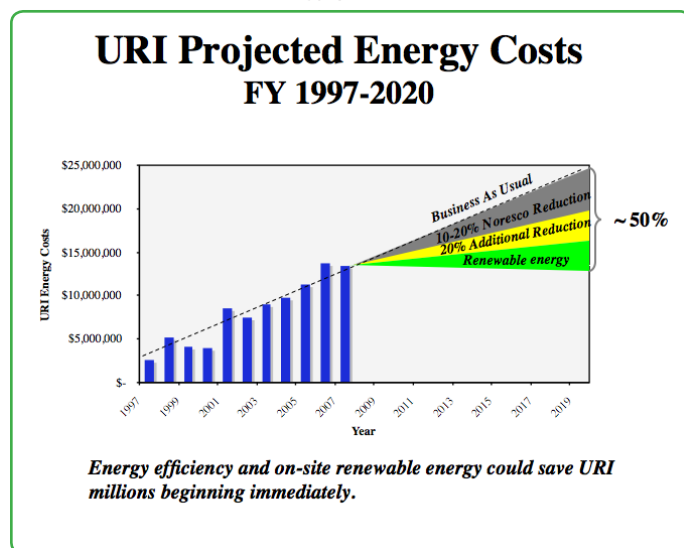


Thus, the upper graph shows a decrease in energy consumed and an increase in GDP. Combining those data sets into the metric defined above, the resulting graph (lower) shows continuous decrease in the number of kilowatts required to produce a dollar of GDP⁶.

Separately, development of the energy efficiency sector itself should be measured by the number of jobs in the sector, focusing on the "trades services" areas such as energy efficiency assessment and implementation. Special weight should be given to those certified to meet the emerging energy efficiency standards. Baseline and target TBD⁷.

Policy improvements should be measured through the speed with which incentive money is delivered to an end user, with a target of continuous rapid improvement.

To be sure, the total energy efficiency sector will ultimately include all energy used for all purposes, including commercial and residential electricity, heating/cooling, water heating and cooling, water/sewer use and even humidity controls. With limited resources and a strong sense of urgency, focusing RIGEN's work exclusively on the electricity consumption of commercial, industrial and government sectors will yield the fastest returns, including direct cash savings in a short time frame. The chart below shows the University of Rhode Island's projected cost saving from current and additional energy efficiency programs as well as on-site renewable energy production.



Immediate and Emerging External Conditions

Policy

Currently, National Grid handles the majority of energy efficiency incentives, as they are the sole source for the legislatively enacted demand-side management program that provides 2.0 mils per kWh of electricity delivered and a charge of up to \$ 0.15 per deca therm of natural gas.

Specifically, the money spent goes against broadly defined goals and National Grid solely determines its distribution. These programs and the agreements that require them do not require use of the in-state workforce nor can the state set priorities for spending.

Workforce Training and Education

Rhode Island lacks an organized, dedicated education and training system to develop workers focused on the energy efficiency sector. Yet students show a strong interest in energy efficiency studies (engineering through installation). If trends continue, Rhode Island stands to lose both young people and trained energy efficiency workers.

In general, market trends continue toward support of energy efficiency in the workplace. In the corporate and

governmental sectors, more organizations have created the role of chief environmental officer or chief sustainability officer and, among other duties, tasked them with accelerating the pace of improvement in energy efficiency.

Capital

The state's choice of tax incentives as a method of spurring market growth in energy efficiency may be restrictive in that it limits the opportunity for improvement to those organizations that both realize a substantial profit and corresponding tax obligation and have the liquidity to "front end load" an energy efficiency investment.

On the private side, National Grid, which is not directly linked to other "green" economic development initiative, represents Rhode Island's primary source for energy efficiency funds. A general lack of capital constrains efforts to establish and grow the energy efficiency opportunities.

Some funding has become available for educational programs. Given the general market support for energy efficiency and the green economy, additional funding may become available in the near future.

Behavior Change and Business Growth/Adoption

A general lack of education about the possibilities and realities of energy efficiency hinders the growth of business adoption.

Too often, "energy efficiency" conjures images of added pink insulation or similar "passive energy management" approaches and the years required to achieve positive ROI. Financial institutions see little value in additional up-front spending on more costly, energy efficient materials and components, even though this allows for a significantly lower cost of operation for, potentially, decades.

In reality, "active energy management" techniques currently used by large electricity consumers, such as data centers, can generate strong ROI in a matter of months. In particular, simple and relatively inexpensive lighting and HVAC improvements generate immediate and substantial cost savings⁸.

The current regulatory structure also hinders growth, but mostly from a lack of awareness about the goals, methods and benefits of energy efficiency and an inability to rapidly adapt regulations to emerging techniques, materials and technologies.

Ultimately, even the best-designed facilities require trained operators, but lack of awareness, education and training again limits effectiveness. Where other states and nations deliver dedicated energy efficiency curricula, Rhode Island delivers energy efficiency as part of the broader sustainability program.

However, several emerging factors offer hope. Engineers, architects and contractors have begun to seriously consider energy efficiency in their work. In some cases, the marketplace is leading government in innovation. In particular,

the “Energy Service Company” approach pioneered by Sun Edison allows for energy efficiency conversions with little or no up-front costs for facility owners. The U.S. Department of Energy is currently developing a national Data Center Certified Energy Practitioner program based on work from private industry partnerships⁹.

Projects

Phase 1

Policy

Audit, Baseline and Targeted Improvements for All State Buildings

While current legislation requires new and existing public buildings to meet energy efficiency goals, this only applies when buildings are either built or undergo major renovation. Thus, inefficient buildings that the state owns or leases may not see energy efficiency improvements for many years. This project seeks to identify and prioritize all owned and leased public buildings for a process of low- to no-cost energy efficiency improvements. The process involves auditing existing energy use, setting a baseline for measurement. Then each building can select targeted improvements that require only behavioral change, component upgrades or minimal physical improvements. As stated above, these types of low- to no-cost improvements have produced immediate and substantial cost savings in pilot projects. Ultimately, this project could result in a set of guidelines for energy efficiency improvement that can be applied voluntarily in all commercial buildings. Success will demonstrate the state’s commitment to energy efficiency and, to some extent, drive the market. The requirement for state buildings could be accomplished by executive order, as opposed to legislation.

Capital

Create a Direct Financial Incentive for the Private Sector

Compared to other investments, energy efficiency investments associated with new construction and major retrofit require a longer horizon to achieve a positive ROI. That is, money spent today on energy efficient materials and components will generate a slow, continuous return, eventually paying for the entire cost of the improvements. By developing a direct incentive in the form of a grant, tax credit or other incentive, the state can substantially accelerate ROI for these kinds of long-term improvements, spurring implementation and driving the market¹⁰.

Business Growth and Adoption

Create a Dedicated Communications Program for Energy Efficiency

Several existing and emerging Rhode Island programs include some type of energy efficiency work within their charters. These programs relate broadly to either building research capacity or creating economic growth opportunities. This project seeks to review and assess each program’s

specific capabilities and produce a concise guide to help public and private entities find and utilize existing resources best suited to their growth plans. National Grid could potentially play a major role in this project.

Phase 2

Policy

Statewide Revision of Building Code to Produce High Performing Buildings

This project builds a partnership of federal, state and local government agencies, as well as private and educational entities to seek funding for and develop a plan to co-create a new regulatory structure to maximize energy efficiency. Code officials would receive education in energy efficiency theory and practice. Then these officials, in partnership with other stakeholders, would develop definitions for various types of high-performing buildings, using the U.S. EPA Energy Star for Buildings as a starting point. Simplifying and modernizing these codes will spur adoption and implementation of energy efficiency, driving the market.

Workforce Development and Training

Develop Energy Efficiency Degree Programs

To meet the goal of increasing energy efficiency compliance in Rhode Island buildings by 4 percent annually, Rhode Island must rapidly increase the available skill sets that serve the green economy. In addition to the overall workforce development meta project, the energy efficiency sector requires at least two specific degree programs to develop engineers, architects, contractors and building managers with high levels of training in specific areas. This project seeks to develop a Bachelors program (BS) in Energy Efficiency and a Masters program (MS) in Energy Management. This project may also address the creation of a two-year Certified Energy Practitioner program. Success in developing these cutting-edge programs will provide the green sector with needed skill sets and position Rhode Island as a leader in this area.

Innovation

Goals

1. The R&D players - universities, hospitals, government and businesses - will become an innovation ecosystem where research, development and practical business application work together. This network commercializes discoveries by connecting solutions from the research community with opportunities in the market.
2. Rhode Island will use innovative technologies to accelerate growth in five categories of the green economy: clean energy; energy efficiency; environmentally friendly production; conservation and pollution mitigation; and training and support, with emphasis on the convergence of the wind, manufacturing and energy efficiency sectors.

Key Metrics for Five-Year Targets

Like the nation, Rhode Island must now compete in a new economy where innovation and knowledge are the primary drivers of economic growth. Innovation is a critical component of future prosperity, but it is difficult if not impossible to understand how it affects current economic conditions without a dynamic statistical system and tools to measure it. However, no such tools exist.

Other states have recently undertaken the task of developing these tools, and the federal government has put in place initiatives to help the public and private sector quantify innovation. In addition to providing data, these activities also serve to increase public awareness of innovation's role in increasing wealth and strengthening our competitive position in the world.

This chapter includes a project to address these issues, as does the advanced manufacturing chapter. In all likelihood, these two projects will join together as they share many of the same metrics. Putting in place a framework of definitions and indicators to measure innovation as it happens will help us better identify policies that foster and support it.



Aptera concept car from Aptera Motors in California.

Immediate and Emerging External Conditions

Policy

The need to innovate is clear. According to the Council on Competitiveness, "Innovation is the single most important factor in determining America's success through the 21st Century. It will drive productivity, standard of living and leadership in the global economy."

Over the past few years, Rhode Island has set in motion several initiatives to advance high-wage, high-growth industries. The Rhode Island Science and Technology Advisory Council (STAC), a coalition of business, academic and government leaders, was created in 2006. STAC is committed to strengthening Rhode Island's research platform, attracting and retaining entrepreneurs, and facilitating

collaborative innovation and public/private partnerships. STAC programs have included the creation of the Research Alliance and the competitive, merit-based Collaborative Research Award Program. STAC has also launched the Innovation Tax Credit and handled oversight of the URI Commission on Research and Innovation. Other state-supported initiatives include the Slater Technology Fund, which provides seed capital to promising innovative companies, and the Rhode Island Center for Innovation and Entrepreneurship, which helps launch academic research ventures.

Historically, U.S. investment in R&D has led all other nations except Japan. But leading indicators show a diminishing lead or no lead at all. Importantly for Rhode Island, a substantial portion of U.S. R&D occurs in the defense sector, where commercialization rates are very low. Thus the United States and, to an even greater extent Rhode Island, puts R&D investments into a sector that returns a relatively low rate of economic benefit. If commercialization rate in defense R&D were to rise, the defense cluster could provide a powerful catalyst to the economy.

Economic issues that involve national defense require national policies to guide them. Unfortunately, the United States is the only developed nation without a national innovation strategy.

Workforce Training & Education

Talent is a primary component of the 21st century innovation economy. As the United States transitions to a knowledge-based innovation economy, existing and new industries place a rising premium on skilled workers. New high-value, high-paying jobs in industries that did not even exist a generation ago demand highly educated and skilled workers. As the economy continues to advance, the demand for talent will continue to grow.

Serious questions arise as to whether Rhode Island will have an adequate supply of workers for these positions and if those workers will be trained and ready. For those workers entering the marketplace, completing some form of higher education will be critical to building a solid, sustainable career path. According to the U.S. Department of Labor, two-thirds of the estimated 18 million new jobs created in the next 10 years will be in occupations that require some advanced education (four-year college degree, a two-year degree from a community college or specialized training from a certificate or apprentice program)¹¹.

These jobs are unlike the jobs of the past. Strengthening K-16 math and science education will help prepare workers for the new and replacement job openings in the coming decades. These new jobs, however, also demand a new support system for lifelong job training. The workforce development system of job matching and retraining served the old economy; the new economy requires workers engaged in life-long learning that continually upgrade their skills.

Skilled workers with a capacity for innovation will increase Rhode Island's ability to compete effectively for new and higher paying jobs. Innovative workers not only have the knowledge base to meet the demands of employers, they also possess the assets to transform ideas, insights and inventions into new processes, products and services.

Behavior Change

Rhode Island's small size and high density work to its advantage in developing an "innovation mindset." The regional innovation networks appear to enjoy higher-than-average camaraderie and unity of purpose. Thus, the potential exists to produce rapid improvements against specific metrics. Also, the potential exists to attract innovators from nearby markets and to deliver products and services to those markets. This creates a sense of activity and progress, catalyzing more improvement.

Much of this activity exists only in tightly defined sectors, particularly the information technology sector, that tap into RIEDC's support, developing institutions to support workers and celebrate successes. Virtually all other potential growth sectors could benefit from such support.

To some extent, success depends on a positive attitude, and rankings and benchmarks have an impact on public perception. But this raises questions of the accuracy and appropriateness of these benchmarks. Specifically, is it just happenstance that it should be our neighbor, or must Rhode Island rank competitively with Massachusetts, an innovation leader in the United States, in order to see itself as a success?

Capital

In the Northeast in general and Rhode Island in particular, the capital continuum shows substantial gaps. This is most evident in the high-risk innovation sector, where many intellectual property-rich companies are not competitive for conventional funding. Many traditional capital institutions lack a fundamental understanding of the innovation sector and cannot be relied upon to drive the market. They often pass up what would have been highly lucrative opportunities. Perhaps emblematic of this lack of understanding is the fact that one of the most popular web properties of 2009 - Facebook - was a "New England idea" that could not find angel or venture funding in the region. Instead, the company was lured to Silicon Valley where it is highly successful.

In addition, private equity funding is in short supply, hitting a historic five-year bottom in 2009, declining 68 percent to \$95.8 billion from \$300 billion in 2008¹².

Business Growth/Adoption

Rhode Island enjoys a number of factors that benefit growth of the innovation sector. Hard assets include large public and private universities that host post-graduate research, a range of hospitals that engage in research and teaching, and a location within the Northeast U.S. innova-

tion corridor. Soft assets include an inviting lifestyle, a high level of unity among certain sectors, and a recent history of collaborations across research institutions and businesses. Universities and companies are beginning to recognize their co-dependence when it comes to achieving above-average success. Because of its small geographic size, Rhode Island is well positioned to take advantage of strategic partnerships to accomplish goals that would be too large for individual agencies to take on alone.

Some emerging national trends are leaving Rhode Island behind. Many states have developed innovation strategies and addressed infrastructure deficiencies to speed innovation. In many respects, Rhode Island has begun to make investments, but the pace of progress does not match that of leading states, especially those nearby. Furthermore, while there are bridge building and technology-transfer entities within the state, they are currently underutilized.

Projects

Phase 1

Policy

Establish Meaningful, Accurate Metrics for Innovation

As stated above, there is a critical need to establish innovation metrics that are both accurate and relevant. Other roadmap initiatives include projects that create or refine metrics, and this project should coordinate its work with theirs.

In recent years, many other entities have created or refined the definition and measurement of innovation, and this project should not "reinvent the wheel." Rather, this project will review this recent work, then adapt or refine the metrics to reflect the Rhode Island innovation sector. This will include identifying organizations and/or activities that impact the sector and capturing the relevant data sets. Ultimately, the project seeks to integrate these metrics into an index of indicators that accurately reflects the trends in the Rhode Island innovation sector.

Create a Statewide Small Business Innovation Research (SBIR) Liaison

The federal SBIR programs deliver important funding to drive innovation activities. Many states enjoy some type of coordinated program, including developing relationships with program officers in Washington, DC. At a minimum, this project seeks to develop a position that coordinates SBIR resources, helping Rhode Island businesses increase their levels of success in submitting proposals that ultimately receive funding¹³.

Phase 2

Business growth and adoption

Create a Mechanism to Monitor Business Opportunities Created by State and Federal Government Entities

When governments institute new regulations and laws, they often create business opportunities. By creating a mechanism to monitor these federal actions, Rhode Island would position itself to be first to market with products and services that meet these new requirements. Depending on the quality, quantity and rarity of the information gathered, licensing of this data to external entities could generate income to support the effort but to some extent would diminish the competitive advantage for local companies¹⁴.

Workforce Training and Education

From STEM to STEAM

For some time, educators have expressed the desire to expand science, technology, engineering and math (STEM) to include an arts component (STEAM). The idea grows from anecdotal information about the relationship between “creativity” and “innovation,” which might best be thought of as two facets of the same jewel.

This approach is by no means a broadly accepted one, but it is often the innovators themselves who argue most strongly for this approach. Regardless of the broader acceptance of this thinking, the arts and the “creative sector” play an important role in Rhode Island.

This project, in coordination with the larger workforce development and education meta project, would review available studies, sponsor and monitor programs in Rhode Island, and formulate recommendations¹⁵.

Wind Power

Goals

1. Fulfill state renewable energy commitment (20 percent of electricity by 2020) with locally produced renewables, at the same time maximizing our opportunities to build a smart grid.
2. Be the hub of the onshore and offshore wind-energy supply chain by attracting and developing the targeted suppliers in it.
3. Develop a strong awareness in the general public, the business community and throughout all levels of government about the long-term benefits of energy self-sufficiency.

Key Metrics for Five-Year Targets

Economic gains should be measured by growing employees in the wind power workforce by 30 percent per year¹⁶.

The “Current Commitments” Metric

In three years, these current commitments will be either complete or on schedule:

- » Block Island wind farm delivering projected megawatt hours
- » Special Area Management Plan (SAMP) final and registered
- » State meeting its Renewable Portfolio Standards (RPS) requirements.



A utility-scale wind turbine blade being assembled in China.

Immediate and Emerging External Conditions

Policy

Rhode Island has started down the road of developing its renewable energy capability, but many key challenges remain.

The state has developed an energy review team that secured and will administer \$58 million in American Reinvestment and Recovery Act (ARRA) money dedicated to energy projects. The legislature has created a residential tax credit, and the Rhode Island Economic Development Corporation (RIEDC) oversees the state’s Renewable Energy Fund, which funded \$1.2 million in projects in 2009. The fund received \$4.7 million in total requests¹⁷, and while not every project would have or should have been funded, many worthy project suffered from a lack of available funds.

In addition, the state has committed to a Renewable Portfolio Standard (RPS) with ambitious but achievable goals. However, the RPS only requires use of renewable energy and it can come from anywhere in the New England power pool¹⁸. This legally binding declaration does not provide an incentive for in-state production. By contrast, Massachusetts has an RPS but also has developed a “feed-in tariff” to spur the locally-produced solar energy market.

Rhode Island has no statewide guidance and requirements to address the siting and zoning of wind power installations. In addition, high-capacity onshore facilities have redundant permitting with the state's Department of Environmental Management (DEM), the local municipality and the Coastal Resources Management Council (CRMC) all potentially requiring approval.

In contrast, California passed a law in 2001 that allows conditional-use permits and requires municipalities to create appropriate laws for small wind installations. Our neighbor and competitor Massachusetts encourages cities and towns to pass a customized version of a model ordinance created by the state. Vermont has enabled net metering, created a feed-in tariff, relaxed height restrictions statewide for renewable energy installations, issued guidelines defining small wind power as a "public good"¹⁹, and even issued guidance on dealing with local regulations²⁰.

Workforce Training and Education

In general, Rhode Island is not prepared to supply the workforce for the proposed offshore wind projects or a robust wind power sector. Absent any new contracts, Rhode Island already sees a deficit in even the most basic workers for these projects.

Long term, the state lacks electrical and other engineering expertise needed to manage and maintain large-scale projects or a large, distributed network of small energy producers. Further, the complex skill sets required for wind power component R & D and manufacturing do not exist in the scale required.

Finally, municipalities have a tendency to focus on the short-term additional costs of wind power and lack sufficient understanding of the societal benefits of local renewable energy production (energy self-sufficiency). In addition, several Rhode Island municipalities have entered into long-term energy agreements, further complicating the scenario.

Behavior Change

In general, the public strongly supports efforts for energy self-sufficiency. Financing exists for renewable installations, but the overwhelming demand for limited funds means that the majority of end users are not receiving funds in scale. Significant stimulus money exists now and for a short time, but some in the professional community feel the state lacks a sufficient sense of urgency.

As renewable energy production grows locally and globally, it has attracted additional investment, and this use is inspiring more creativity by producing more efficient designs. The question looming on the horizon is: What happens when the stimulus money runs out?

Business Growth and Adoption

While Rhode Island made a good early start with the Portsmouth Abbey project, several factors are converging

to inhibit adoption in Rhode Island. First, the state lacks a predictable and robust set of incentives. Second, the state has a cumbersome, expensive permitting bureaucracy. Third, little private capital exists for these projects. Fourth, the RPS has no requirement - and potential incentive - for in-state renewable energy production. These factors coupled with the poor economic climate bring the projected ROI for these projects below the necessary financial threshold to spur action.

However, several emerging factors give Rhode Island the opportunity to take a competitive advantage. The offshore projects present supply chain opportunities, and ARRA funds make many new options viable. The addition of feed-in tariffs, in use in competitive states, could generate substantial momentum for wind power.

Capital

Federal tax credits and grants are stimulating and initiating corporate investment, but they are not enough. State grants and loans are reaching those who already know why renewable energy conversion is a good idea. However, only a small portion of the business community is aware of these funds. Ironically, increased awareness would deplete these funds at an even faster rate than at present.

The current incentives available and the way in which they impact overall project financing combined with the risks and unknowns of renewable energy often make it difficult for commercial financing (traditional bank lending) to become available. An overall lack of available capital in the general marketplace further complicates the situation.

It is not yet clear whether federal tax incentives that are set to expire will be extended. Capital support for renewable energy conversion projects will remain a rapidly changing sector, making concepts like a wind turbine tax incentives a reasonable proposition.

Projects

Phase 1

Behavior Change

Make Quonset a Wind Power Supply Chain Hub/District

Commercial development at Quonset Business Park, while substantial, could expand at a faster rate. Its strategic location with the best water depth on the East Coast would position a wind power hub to service both offshore and onshore demands. This project would partner with Quonset to develop a vision, priority land uses, infrastructure improvements and a partnership operating structure. By engaging the neighboring communities, Quonset can build "community capital" to better integrate with existing uses. A business-to-business marketing campaign to promote the wind power hub will attract organic start-ups, big company conversions, mid-market companies and relocations. High-quality amenities to serve the worker community should also be included.

A portion of this project involves assessing Rhode Island's competitive position in the wind supply chain. To effectively capture substantial market share in the wind energy supply chain, Rhode Island must first determine and articulate which elements of the supply chain offer the greatest promise. The state will likely not wish to approach all main elements — from raw materials to operations and maintenance — on equal footing. The state will be better positioned to approach certain companies based on local capabilities.

Business Growth and Adoption

Install 100MW of Onshore Wind Power Capacity

Rhode Island can easily site, approve and install substantial onshore wind power capacity in the next few years, provided that two objectives are reached. First, the RPS amendment project must increase the size and scope of the Renewable Energy Fund as well as the demand for in-state renewable power generation. Second, the state must create a consistent regulatory environment in all municipalities. The “Massachusetts model” — where the state creates a model ordinance that municipalities then customize and adopt - could work well in Rhode Island. This project, in coordination with the statewide regulation project in the Energy Efficiency section, seeks to create such a model ordinance and submit it to the legislature for adoption.

Phase 2

Policy

Amend the Renewable Portfolio Standard²¹

Current RPS legislation requires National Grid to acquire some of the electricity they sell in Rhode Island from renewable sources, usually through purchase of Renewable Energy Credits (RECs) or, less often, through direct payment to the state's Renewable Energy Fund in the form of an Alternative Compliance Payment (ACP). However, the RPS includes no requirement that RECs be acquired from Rhode Island-based projects. In practice, approximately 95 percent of RECs are purchased out of state. Amending the RPS to require that compliance come from RECs acquired from in-state production or ACPs paid to the REF

will ensure that Rhode Island projects receive funding and support. These requirements should be phased in over time (i.e., five years) and require a minimum of 35 percent of these RECs be from Rhode Island projects. Success in this project will speed the pace of change, keep Rhode Island on a par with Massachusetts in terms of structural incentives and lay a solid foundation for growth in the next few years.

Behavior Change

Demonstration Projects/Learning Laboratory

Rhode Island should set the East Coast standard for developing offshore wind power. Much the same way the New England Institute of Technology's onshore turbine delivers only modest amounts of electricity but also delivers an enduring leadership message about the institution, the state should vigorously pursue similar demonstration and learning projects. The Block Island offshore project and the Quonset wind power hub could be used this way to promote offshore capabilities. They could serve as a learning environment for future workers and, potentially, future clients for the Rhode Island offshore wind sector. The state should inventory all existing assets and planned projects to see which offer a defined additional value (physical presence, learning opportunity, etc.). Similarly, the Rhode Island Special Area Management Plan (SAMP) process is an innovative approach to science-based ocean mapping and community engagement that could be promoted as a model.

Business Growth /Adoption

Create a Dedicated Wind Power R&D Fund

To fulfill its commitment to become a wind power supply chain hub for the eastern United States, Rhode Island must begin investing in the research and development that will produce the next generation of wind power technology. This project seeks to create a fund of roughly \$1 million to fund requests from higher education and research-oriented companies to engage in research specifically targeting wind power technology and components. Potentially, this could involve a partnership between REF, STAC and others.

V. Implementation

Rhode Island Green Economy Network - RIGEN

RIGEN, as a statewide or even regional network, will accelerate the growth of the green economy. It will begin this effort by using Version 1.0 of Advancing the Green Economy Roadmap as its strategic plan. RIGEN will coordinate and bring coherence to the implementation effort. The interim leadership and management will be RIEDC. RIGEN will operate as an informal network and not be a separate not-for-profit organization for now. To jump start implementation of the Roadmap, RIGEN will invite other players to participate who are owners of projects.

Beginning Now

To start, RIGEN will have four roles:

1. Ensure the greening of current RIEDC programs
2. Manage implementation of phase I of the Roadmap
3. Convene a green economy forum twice per year
4. Facilitate communication and collaboration among key advisors to Advancing the Green Economy

Green the Current RIEDC Programs

Through Every Company Counts, provide energy efficiency programs for small businesses. Coordinate the formation of the offshore wind supply chain and the SAMP approval process. Work with STAC to develop green innovation practices. Green the SBLFC capital program managed by RIEDC. Work with RI Manufacturing Extension Services (RIMES) to green advance manufacturing.

Manage Implementation of Phase I of the Roadmap

RIEDC will serve as the project manager of Roadmap implementation. Specifically: It will ensure every Phase I priority project on the Roadmap has an owner and a work-group driving it to success. Phase I begins implementation in 2010. RIGEN will foster collaboration and coordination among the priority projects, both online and in person. It will adjust sequence and timing of projects based on changing conditions. Finally, RIGEN will report publicly on progress against goals.

Convene a Green Economy Forum

In building the Roadmap, there has been clear value for bringing key players in the green economy together to build relationships, encourage deals being made, share ideas, and tap the “collective genius” of those assembled. The Forum will include the voice and influence of RI stakeholder groups: academia/research, business, community / civic, government, et al. RIGEN will convene the Green Economy Forum twice per year.

Facilitate Communication and Collaboration among Key RIGEN Advisors

In building the Roadmap, many effective thinkers and doers provided major contributions to the building of it. These include the four accelerator initiative quarterbacks and many initiative workshop participants. This group of advisors will form and meet several times a year. Their job is to hold up a mirror for RIGEN to use in assessing progress on Roadmap implementation process. Advisors provide critique and support.

The Future

The market will determine if there is a need for additional leadership and management capacity beyond what has been presented in Section V of the Roadmap. The network may stay informal or become a formal separate not for profit organization.

In creating the Roadmap, it has been evident that there is additional value to be created, for growing the green economy, by developing and coordinating additional capabilities such as:

- » Formalizing relationship building and dealing making among key green economy players
- » Scanning the external environment of constantly changing conditions and analyze their impact - adverse or affirming - on the green economy of RI and the region
- » Formally, tapping into the collective genius of the thinkers and practitioners shaping the green economy
- » Identifying advanced practices and tools that are essential to delivering long-term green results
- » Developing additional projects when circumstances warrant them
- » Advocating to public and private organizations
- » Serving as a thought leader to stimulate new ideas and business practices
- » Increasing the credibility of the green economy as a real source of more and diverse jobs and wages
- » Mapping and monitoring all planned and active projects targeting the green economy

Notes

1. NY State Energy Plan served as a guide to this provisional set of strategy criteria. <http://www.nysenergyplan.com/presentations/FinalScope2.pdf>
2. Fund grows based on sale of credits.
3. The concept and practice of using career pathways is drawn from: Career Pathways: Aligning Public Resources to Support Individual and Regional Economic Advancement in the Knowledge Economy. Davis Jenkins. Workforce Strategy Center. 2006.
4. In the table below, profit margins for a sampling of industries are displayed. Simple math returns the numbers in the column to the right that indicate how much revenues would have to increase to equal a 5 percent reduction in expenses. Low margin companies benefit more from improved efficiency. Taking biotechnology as an example, if expenses consume 98 percent of revenues, the profits that would accrue from reducing expenses to 93.1 percent of revenues (a 5 percent reduction) would otherwise require almost 2.5 times more in sales to equal.

Reducing the energy and materials inputs required producing the right amount and kind of output. Improving efficiencies of transportation and other business services are the primary means of reducing business operational costs and improving ROA and ROI. Powerful innovations must happen in order to achieve improved business efficiency. The United Kingdom, Denmark, Germany and other countries have discovered that market based initiatives provide a better motivating force for innovation than compliance or "command and control" based policies which are limited by the vision set forth in the letter of the law.

Industry	Profit Margin	Expenses 5% lower equals revenue increase of...
Semiconductors	12.7%	34.4%
Clothing Mfgs	5.3%	89.3%
Biotechnology	2%	245%

Source: www.p360.org/dsg.aspx?Data_Set_Group_Id=498

5. ASHRAE updates the 90.1 code every two years. Rhode Island should commit to meeting updated standards.
6. While charts are for conceptual use only, they are based on actual data and conservative projections. Given the economic conditions and job losses in late 2008 and 2009, 2010 GDP represents a 10 percent decline from actual 2008 GDP of \$46.5 billion. 2015 and 2020 figures project a 1 percent annual increase. Electricity consumption data is total for Rhode Island, not the industrial/commercial component separately. 2010 figure projects the 2000-2007 average rate of increase. Annual decreases of 4 percent

until 2015 and the 2 percent until 2020 produce those figures.

7. Beyond the defined kW h/GDP metric, RIGEN may address other energy efficiency definitions and metrics as part of similar projects defined in the innovation and manufacturing roadmaps.

8. Green Grid partnered with U.S. EPA to reduce one of its largest energy costs - electricity at its data centers. "Minor tweaks" at just one facility produced an immediate 20 percent reduction, representing \$15,000 annual savings.

<http://earth911.com/blog/2009/11/24/energy-improvements-save-epa-15k/>

9. www1.eere.energy.gov/industry/datacenters/dc_cep.html

10. New construction and major retrofits completed today will remain in service for decades, even a century. Thus failure to make meaningful changes today will require even more costly upgrades during the building's service life.

11. Bureau of Labor Statistics <http://www.bls.gov/oco/oco2003.htm> (Table 1)

12. Source: PRNewswire, U.S. Private Equity Fund-Raising Plummets 68% in 2009; Worst Year and First Sub-\$100 Billion Year Since 2003, January 2010. <http://dowjones.mediaroom.com/index.php?s=43&item=337>

13. Suggested owner - Rhode Island Center for Innovation and Entrepreneurship (RICIE)

14. Suggested owner - Rhode Island Economic Development Corporation (RIEDC)

15. Suggested owner - Better x Design

16. Current RI wind power employment: 653 workers in three turbine manufacturers. Data for engineers, installers and other workers in existing wind projects is not available at this time.

17. Forty REF applications represented \$30.2 million in total project value and 61 MW installed capacity. Seventeen funded projects represent \$4.2 million in total project value and 16 MW installed capacity. Twelve of the 17 projects requested funds for feasibility studies, so value and capacity are estimated.

18. www.answers.com/topic/iso-new-england, www.iso-ne.com, www.iso-ne.com/portal/jsp/Impmap/Index.jsp

19. www.pewclimate.org/node/6558, publicservice.vermont.gov/Lamoille/glossary-legal.htm#cpg, http://publicservice.vermont.gov/energy/ee_renewables.html,

20. Anecdotally, those policies are said to reduce homeowner installation costs by about \$10,000.

21. In fact, Rhode Island has enacted a "Renewable Energy Standard" (RES), which is equivalent to the more commonly enacted "Renewable Portfolio Standard," the terminology used for this roadmap.