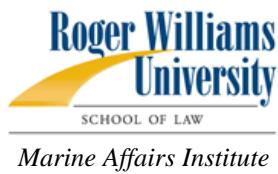




**AN OVERVIEW OF ONLINE RESOURCES FOR CLIMATE ADAPTATION POLICIES RELATING TO NEW
ENGLAND REGIONAL, STATE AND LOCAL MUNICIPALITIES**

Nels Schnobrich

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I. INTRODUCTION

This report represents an overview of adaptation strategies and policies that are being implemented to address sea level rise due to climate change in the coastal states of New England. This report will examine some of the varying ideas and actions throughout the region regarding coastal municipal adaptation strategies. This report will focus on the online resources specified in the *Municipal Responses to a Changing Climate in the Coastal Zone of the Northeast and Bay of Fundy*, a project by the Gulf of Maine Council on the Marine Environment/US Association of Delegates to the Gulf of Maine Council on the Marine Environment, Northeast Regional Ocean Council, Roger Williams University School of Law, StormSmart Coast Network, and Clean Air-Cool Planet, funded by NOAA's Climate and Societal Interactions Program (CSI). It is intended to be a starting off point for further research during the spring of 2012.

II. ADAPTATION RESOURCES AVAILABLE ONLINE

The following will examine the current holdings that several online databases compiled regarding adaptation strategies that municipalities and other organizations have taken to combat sea level rise and other climate change consequences that impact the built, natural and social environments. The online sources analyzed are a small representation of the field of adaptation data, and were chosen as reasonable starting points for a general search of climate adaptation policy, and due to their current usage among users in the New England coastal states. This research will be expanded upon during the spring semester of 2012. For a more comprehensive list of what is available on these sites, consult Appendix A.

A. NOAA-COASTAL CLIMATE ADAPTATION STRATEGY DATABASE

NOAA, as part of its continuing leadership in the climate adaptation field, created a Coastal Climate Adaptation Database to better facilitate data exchange for adaptation information.¹ The site

¹ NOAA-COASTAL CLIMATE ADAPTATION (last visited Nov. 8, 2011),
<http://collaborate.csc.noaa.gov/climateadaptation/default.aspx>.

provides ten categorical search links to more efficiently facilitate a user's progress. For the purposes of this report, the information provided in each link contains overlap, meaning a search on one link acquires data that can be found in many of the other search fields.² Three search fields of most significance to this report are the case studies and strategies, adaptation and action plans, and policies and legislation links, respectively.³

1. CASE STUDIES AND STRATEGIES

The data found in the various case studies and strategies presented here seem to share a mutual understanding that climate change and sea level rise affects all levels of built infrastructure including transportation,⁴ public and private land,⁵ and the natural ecosystems that they are associated with.⁶ Adopting adaptation efforts into city comprehensive or general development plans is a recommendation found throughout this database.⁷

2. ADAPTATION AND ACTION PLANS

Focusing on the development of comprehensive adaptation and climate action plans is an important step in strategizing climate change adaptation for states and municipalities.⁸ A common theme of many of the available action plans on the CSC website is the emphasis of both the mitigation of greenhouse gas emissions and the adaptation of built infrastructure for the changing climate.⁹ One study available on the CSC website, from the Pew Center for Global Climate Change, found that thirty-six states have completed comprehensive climate action plans, or are in the process of revising or

² See [id.](#)

³ [Id.](#)

⁴ JUDY GATES, MAINE DEPT. OF TRANSP. ENVTL. OFFICE, CLIMATE CHANGE AND TRANSPORTATION IN MAINE 2 (2009) available at <http://collaborate.csc.noaa.gov/climateadaptation/Lists/Resources/AllItems.aspx> (click on "Climate Change and Transportation in Maine" link, click on word document).

⁵ See JAMES G. TITUS, ROLLING EASMENTS 2 (Climate Ready Estuaries 2011) available at <http://www.epa.gov/cre/downloads/rollingeasementsprimer.pdf>.

⁶ [Id.](#) at 1.

⁷ See CITY OF PINOLE, CA, GENERAL PLAN CH 12.0-1 (2010) available at http://www.ci.pinole.ca.us/planning/docs/City_of_Pinole_General_Plan_12.2010-Chapter12.pdf.

⁸ See BROWN UNIVERSITY CENTER FOR ENVIRONMENTAL STUDIES, SUMMARY: PRELIMINARY ASSESSMENTS OF RHODE ISLAND'S VULNERABILITY TO CLIMATE CHANGE AND IT'S OPTIONS FOR ADAPTATION ACTION 7 (2010) available at <http://envstudies.brown.edu/Summary-RIClimateChangeAdaptation.pdf>.

⁹ See [id.](#) at 6.

developing one as of January 2011.¹⁰ According to information available on the CSC website, municipalities should emphasize adaptation strategies for impacts that cannot be slowed by mitigating the effects of sea level rise, like coastal development restrictions through rolling easements,¹¹ and prohibiting development that does not take into account a two-foot, one hundred year flood plain.¹² Another study available on the CSC website, Maine has proposed a possible strategy to prohibit any development that may be severely damaged by the intensity of a one-hundred year storm event or a two foot rise in the sea level, recognizing that both strategies have equal significance.¹³ Maine has recognized for the past ten years that allowing significant development on coastal sand dune systems will not only adversely affect the natural ecosystem but will also create a hazard for the built structures themselves, and has restricted this type of development accordingly.¹⁴

3. LEGISLATION AND POLICY

This section emphasizes that some adaptation strategies found on the CSC website that can be more effective if they are implemented through policy and legislation, like municipal by-laws that enforce restrictions on coastal zone development, and occasionally by court decisions restricting property rights.¹⁵ Coastal set-back requirements for coastal properties have also been identified as effective tools on the state legislative level, most notably in Hawaii where the state requires a forty foot setback and recognizes that a twenty foot set-back is an emergency situation requiring immediate action to protect the existing infrastructure.¹⁶ State or local legislation can also offer incentives for certain development practices if the property owner is proactive in implementing these ideas into his or her

¹⁰ PEW CENTER ON GLOBAL CLIMATE CHANGE, *supra* note 1, at 8.

¹¹ TITUS, *supra* note 13, at 1.

¹² Every year, one hundred year storm events can be calculated as having a one in one hundred probability of happening, which put in these terms, showcases how frequent these events may actually occur, necessitating the need for regulation. LAND USE LAW CENTER, *supra* note 18, at 14.

¹³ Id.

¹⁴ Id.

¹⁵ WOODS HOLE SEA GRANT et al., MODEL BY-LAW FOR EFFECTIVELY MANAGING COASTAL DEVELOPMENT 2 (2009) available at http://www.capecodcommission.org/resources/bylaws/Coastal_Floodplain_Bylaw_Dec2009.pdf.

¹⁶ DENNIS HWANG & MAXINE BURKETT, SHORELINE IMPACTS, SET-BACK POLICY & SEA LEVEL RISE 5 (Univ. of Haw. Sea Grant 2009) available at

http://www.pacificdisaster.net/pdnadmin/data/original/ICAP_2009_shorelineimpacts_setbkpolicy.pdf.

design structures.¹⁷ Another case study available on the CSC website, the City of Hull, MA has proposed to offer permit reduction fees for new coastal development if the proposed construction is elevated a minimum of two feet above the highest federal or state requirements for flood zones levels.¹⁸ Concurrently, the State of Maine has enacted Chapter 355-Coastal Sand Dune Rules that accomplish both ecosystem protection and hazard mitigation by restricting or even prohibiting development near coastal dune systems that are susceptible to extreme weather events.¹⁹ This legislation allows sand dunes to migrate naturally seaward or landward and also prevents possible economic losses by developers who would have wanted to develop those areas.²⁰ The reports NOAA has made available on the CSC website could provide a comprehensive starting point for any public or private adaptation stakeholder, regardless if their respective region or city is not specifically represented.

B. NATIONAL RESOURCES CANADA-REGIONAL ADAPTATION COLLABORATIVE (RAC)

This website gives an overview of adaptation projects that the Atlantic Climate Adaptation Solutions Association (ACASA) has undertaken to assess coastal and inland vulnerability to climate impacts, particularly ground water intrusion by sea level rise,²¹ and infrastructure vulnerability in the coastal Provinces of Canada.²² Each project webpage provides goals and performance objectives for various projects ACASA has created, notably a municipal tool kit,²³ case studies regarding municipal adaptation capacity,²⁴ and vulnerability assessments for the built infrastructure of the coastal regions.²⁵

¹⁷ See generally, CITY OF HULL, MA CONSERVATION DEP'T, PROPOSED PERMIT FEE REDUCTION FOR ABOVE FREEBOARD SEA LEVEL DEVELOPMENT available at http://stormsmartcoasts.org/uploaded_docs/HullPermitCreditFreeboard.pdf.

Freeboard means elevating a buildings lowest level, including basement, above predicted flood levels by an additional height.

¹⁸ Id.

¹⁹ ME. REV. STAT. tit. 38, § 355 (2006).

²⁰ Id.

²¹ ATLANTIC CLIMATE ADAPTATION SOLUTIONS ASSOCIATION (last visited Nov. 8, 2011), <http://atlanticadaptation.ca/program>.

²² Overview of Themes, ATLANTIC CLIMATE ADAPTATION SOLUTIONS ASSOCIATION (last visited Nov. 8, 2011), <http://atlanticadaptation.ca/node/67>.

²³ See ATLANTIC CLIMATE ADAPTATIONS SOLUTIONS ASSOCIATION, COMMUNITY VULNERABILITY ASSESSMENT FOR PRINCE EDWARD ISLAND (last visited Nov. 8, 2011), <http://atlanticadaptation.ca/pei-community-assessment>.

²⁴ ATLANTIC CLIMATE ADAPTATION SOLUTIONS ASSOCIATION, MUNICIPAL PREPAREDNESS FOR CLIMATE CHANGE IN NOVA SCOTIA: EVALUATING MUNICIPAL CAPACITY TO RESPOND TO CLIMATE CHANGE THROUGH ADAPTATION (last visited Nov. 8, 2011), <http://atlanticadaptation.ca/node/198>.

The website is incomplete with regard to its resources archives, though one resource was present that represented a superseding policy recommendation over the prior Flood Hazard Area Land Use Management Guideline of 2004.²⁶ The report emphasized guidelines for municipalities to regulate subdivision approval processes for coastal development and to implement land use management plans²⁷ that take into consideration the variability of local tide conditions, shoreline orientation and other factors that change allowances for local storm surge and wave effects.²⁸ Additionally, the municipal toolkit resource produced by Prince Edward Island Environment, Energy and Forestry, is being used to assess four communities vulnerabilities regarding coastal hazards, flooding, drinking water threats and winter hazards with the findings being showcased in various city public forums.²⁹ As of this report, the website has advised users that resource documents will be uploaded when accumulated, though many resource links remain empty.³⁰

C. ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA

ICLEI-Local Governments for Sustainability USA is a database that advocates for the mitigation of greenhouse gases and energy efficiency standards as the first step in climate adaptation for municipalities.³¹ ICLEI-Local Governments for Sustainability USA has created a well-connected association of 550 cities in the US.³² This organization is the largest network of adaptation minded municipal stakeholders in the world.³³ ICLEI also provides guidance on a regional level with projected climate data, case studies about regional success stories and tool kits to assist new member cities with

²⁵ ATLANTIC CLIMATE ADAPTATION SOLUTIONS ASSOCIATION, AN EVALUATION OF SOCIAL VULNERABILITIES AND SOCIAL ASSETS AT RISK TO CLIMATE CHANGE IMPACTS IN THREE NOVA SCOTIA ACAS COMMUNITIES (last visited Nov. 8, 2011), <http://atlanticadaptation.ca/node/199>.

²⁶ B.C. MINISTRY OF ENVT, CLIMATE CHANGE ADAPTATION GUIDELINES FOR SEA DIKES AND COASTAL FLOOD HAZARD LAND USE: GUIDELINES FOR MANAGEMENT OF COASTAL FLOOD HAZARD LAND USE 1 (2011) *available at* http://atlanticadaptation.ca/sites/discoveryspace.upei.ca.acasa/files/BC%20coastal_flooded_land_guidelines%202011.pdf.

²⁷ Id.

²⁸ Id. at 3.3.7.

²⁹ ATLANTIC CLIMATE ADAPTATION SOLUTIONS ASSOCIATION, *supra* note 42.

³⁰ *Policy and Planning*, ATLANTIC CLIMATE ADAPTATION SOLUTIONS ASSOCIATION (last visited Nov. 8, 2011), <http://atlanticadaptation.ca/node/52>.

³¹ ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA (last visited Nov. 8, 2011), <http://www.icleiusa.org/about-iclei>.

³² ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY, *supra* note 51.

³³ Id.

starting their adaptation planning. The USA chapter of ICLEI is based in Boston, MA, with ICLEI workers stationed throughout the US.³⁴ They act as an overall coordinator for stakeholders who want to have as much data at their disposal as possible. They do not focus on the New England Region specifically but their overall goals are succinct with what should be done about climate adaptation strategies for the region.³⁵ ICLEI is co-sponsoring the Rio+20 Conference as part of its continuing effort to grow the adaptation network throughout the world.³⁶ The following synopsis will focus on four resource areas that the website emphasizes for community stakeholder as starting points in providing climate change adaptation responses, though most of the reports emphasized by each section could be used to provide holdings in any of the four resource areas. This section will then discuss one of the tools available for climate change adaptation, available on the ICLEI website.

1. CLIMATE MITIGATION GUIDANCE

The first example of information available on the ICLEI website this report will explore is climate mitigation guidance. These examples can provide municipalities with success stories on how to create climate mitigation strategies, even if new and lucrative funding sources are not immediately available. Greenhouse gas reduction is a common policy choice when attempting to facilitate climate mitigation in urban areas.³⁷ One example available on the ICLEI website is building infrastructure of New York City. Building infrastructure, as opposed to the transportation infrastructure, accounts for seventy-five percent of the greenhouse gas production and eighty-five percent of the water usage throughout the city.³⁸ New York City, as part of their NYC Green Codes Task Force, is advocating requirements in its city building codes that mandates all public buildings, new and existing, to follow the

³⁴ See id.

³⁵ Though their U.S.A. headquarter is located in New England, ICLEI's overall goal is to connect all sectors of the U.S. to create a well networked association of cities. See id.

³⁶ Rio +20 is the United Nations Convention on Sustainable Development Conference. Held in Rio de Janeiro, Brazil from June 4-6, 2012 and gathering community mayors from around the world, its focus is to promote a stronger green economy and build an institutional framework for sustainable development. See Id., available at <http://www.icleiusa.org/news/iclei-world-congress-2012/> (click on the Training & Events tab).

³⁷ U.S GREEN BUILDING COUNCIL, NEW YORK CITY GREEN CODES TASK FORCE, EXECUTIVE SUMMARY 1 (2010) available at http://www.urbangreencouncil.org/greencodes/greencodestaskforce_exsummary_final.pdf.

³⁸ Id.

new standards set and also requires a ninety percent compliance rate to the existing building codes throughout the city.³⁹ Greening the City Building Code requirements, rather than advocating LEED Certification for the private sector, has been recognized by New York City as a more efficient route in implementing climate mitigation practices.⁴⁰ Another example available on the ICLEI website is from across the country, in Sonoma County, CA, where the city created an Energy Independence Program (SCEIP) which gives renovation funding through tax-lien loans of up to ten percent of the property value to implement energy efficiency, water conservation and renewable energy upgrades into new construction and development.⁴¹ Repayment for the loan is through their respective property tax bill over several years at a fixed seven percent interest rate,⁴² however, through certain tax exempt bonds those interest rate could decrease to one or two percent.⁴³ Funding resources to provide administrative support for climate mitigation can be an issue for local municipalities with a limited tax base, especially when there is opposition to any increase in taxes, such as a tax increase on trash disposal that charges waste disposal operators for the amount of trash received.⁴⁴ Another example available on the ICLEI website comes from Boulder, CO, where the city is using a trash tax to fund a two year study on permanent funding for climate mitigation, and became the first municipality in the country to put a carbon tax on its residents' energy consumption.⁴⁵ The tax creates an annual budget of almost \$1,000,000 a year for reduction of greenhouse gas emissions in the city, with households and businesses paying an average of \$1.33 and \$3.80 per month respectively.⁴⁶ The resulting tax increases from

³⁹ See id. at 11.

⁴⁰ LEED is the Leadership in Energy and Environmental Design standard created by Federal Government as a broad environmental sustainability standard. Id. at 1-2.

⁴¹ CALIFORNIA PUBLIC UTILITY COMMISSION, LOCAL GOVERNMENT ENERGY EFFICIENCY: SONOMA COUNTY ENERGY INDEPENDENCE PROGRAM-SCEIP 1 available at <http://www.icleiusa.org/action-center/learn-from-others/SCEIP.pdf>.

⁴² Id.

⁴³ Id. at 3.

⁴⁴ CAROLYN BROUILLARD & SARAH VAN PELT, A COMMUNITY TAKES CHARGE: BOULDER'S CLIMATE TAX 3-4 (2007) available at <http://www.icleiusa.org/action-center/learn-from-others/> (select search field "Midwest Region", scroll results and click on "A Community Takes Charge: Boulder's Carbon Tax" hyperlink).

⁴⁵ Id. at 1.

⁴⁶ Id. at 11.

strategies previously discussed above can also increase city revenue over time to help facilitate implementation of new strategies that were not fiscally viable in the past.

2. CLIMATE ADAPTATION GUIDANCE

The second section of the ICLEI website this report will examine is its climate adaptation guidance. Local governments looking to tailor climate adaptation for their municipalities sometimes require an extreme weather event to galvanize their citizens into approval for taking on new adaptation challenges.⁴⁷ ICLEI's Climate Resilient Communities Program (CRC) has been at the forefront of providing guidance for municipalities in their efforts to better adapt to the consequences of climate change by assisting cities like Keene, NH in structuring their formal adaptation and resiliency planning process.⁴⁸ As a result of joining the CRC, Keene formed a preparedness team to assess its vulnerable sectors,⁴⁹ and ultimately identified that adaptation of the built infrastructure to increased flooding from higher precipitation events was of most concern to the city.⁵⁰ The preparedness team identified that the current one hundred year flood plain estimate would need to be updated if their adaptation efforts were going to be effective,⁵¹ and they have now undertaken what few municipalities of its size have done; implement these strategies into their comprehensive development plans.⁵² Another example, Burlington, VT has attempted to adapt to climate change by implementing a voluntary but recommended green purchasing initiative for public and private buyers that emphasizes buying recycled and refurbished goods over new products.⁵³ Though it is not a requirement like a tax or city zoning law, this type of climate action can help municipalities adapt to climate change by providing leadership in reducing the city's environmental footprint while also attract new businesses that have climate adaptation as a core

⁴⁷ See ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, CASE STUDY: KEENE, NEW HAMPSHIRE LEADING ON CLIMATE PREPAREDNESS 1 (2010), available at http://www.icleiusa.org/action-center/learn-from-others/ICLEI_case%20study_Keene_adaptation.pdf.

⁴⁸ Id.

⁴⁹ Id.

⁵⁰ See id. at 2.

⁵¹ See id.

⁵² Id. at 4.

⁵³ CITY OF BURLINGTON, VT, ENVIRONMENTALLY PREFERABLE PURCHASE POLICY § 1.0 (2009) available at <http://www.icleiusa.org/action-center/learn-from-others/EPP%20policy%20ADOPTED.pdf>.

part of their business structure.⁵⁴ Municipalities have identified that a coordinated effort between stakeholders that share natural and built infrastructure could be an effective way to spread cost and loss, minimizing the effects of climate adaptation for both.⁵⁵

3. RENEWABLE ENERGY GUIDANCE

The third section of the ICLEI website that this report will examine is its renewable energy guidance. The renewable energy field can be an attractive and popular strategy for climate adaptation but can require some modeling of how the new practices will interact with a city's existing environments.⁵⁶ The ICLEI website examines the city of Chester, MA, where an advanced city approach and has formed model by-laws for the city to minimize any negative effects that new wind generation systems may have on the natural environment.⁵⁷ The city requires a special use permit in order to receive approval to incorporate this infrastructure into the existing city comprehensive plan.⁵⁸ Along with requiring that the wind development project conforms to local regulations, the city mandates that the project complies with all state regulated adaptation requirements, including storm water runoff control, noise laws, and wetland buffer requirements.⁵⁹ Also available on the ICLEI website, Shutesbury, MA, has been very proactive in its drive to become energy independent, especially for the small size of the community.⁶⁰ In 2002, the city created an Energy Committee to study the feasibility of bringing renewable energy to a town where only two percent of the budget was mandated for energy projects.⁶¹ Despite its limited budget, the city installed a two kW solar panel electric grid on the elementary school

⁵⁴ See *id.*

⁵⁵ See generally., PAUL KIRSHEN, EXPLORATORY, PRELIMINARY, TENTATIVE ADAPTATION TO RISING SEA LEVELS IN MYSTIC AND GROTON LONG POINT (Battelle Memorial Institute 2010), available at <http://www.icleiusa.org/action-center/planning/Modeling%20Adaptation%20Actions%20for%20Groton.pdf>. Groton and Mystic both sit on the Thames River floodplain as well as the Long Island Sound. This area is highly developed by old infrastructure that is valuable to the areas economic viability but could be updated and adapted as part of a hazard resiliency initiative.

⁵⁶ See TOWN OF CHESTER, MASS., WIND ENERGY CONVERSION FACILITIES BYLAWS § 5.6.1 (2007) available at <http://www.icleiusa.org/action-center/tools/municipal-clean-energy-toolkit/Chesterwindenergyconversionfacilitiesbylawfinal.pdf>.

⁵⁷ See *id.*

⁵⁸ *Id.* at § 5.6.4 (2007).

⁵⁹ See *id.* at § 5.6.4(c)1-4 (2007).

⁶⁰ ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, AN INNOVATIVE APPROACH TO RENEWABLE ENERGY AND ENERGY EFFICIENT PROJECTS IN SHUTESBURY, MASSACHUSETTS 1 available at http://www.icleiusa.org/action-center/learn-from-others/small-communities-toolkit/CaseStudy_ShutesburyMA.pdf.

⁶¹ *Id.*

that provides not only clean energy and cost savings but an educational tool for the city's children and citizens.⁶² By providing a working example of how the costs of traditional fossil fuel energy consumption can be deterred and perhaps even eliminated, municipalities can show real time savings to its citizenry to better advocate for the implementation of these strategies while opposition for these strategies focus only on the high upfront costs as their opposition rationale.⁶³ The success of these particular projects was a result of transparency to the city citizens regarding the real cost benefits, not only economically but environmentally, and these success stories can provide guidance for other small cities to undertake renewable energy projects.⁶⁴

4. ENERGY EFFICIENCY GUIDANCE

The last section of the ICLEI website this report will focus on is its energy efficiency guidance. Energy consumption has been identified as a large producer of greenhouse gas emissions, which is one of the leading causes of accelerated climate change and its consequences.⁶⁵ Mitigating energy consumption by implementing efficient energy use strategies can be a popular mitigation strategy because it offers both cost savings to a city but also helps to reduce the amount of greenhouse gases emitted into the environment.⁶⁶ Energy efficient buildings, LEED-based certification⁶⁷ and clean diesel vehicle programs⁶⁸ are just a few examples of how municipalities can become energy efficient. One case study the ICLEI site examines is Springfield, MA, which participated in the EPA's Northeast Clean School Bus initiative in an attempt to reduce its carbon footprint while also becoming more efficient in

⁶² *Id.* at 2.

⁶³ *See id.*

⁶⁴ *See id.* at 3.

⁶⁵ See CITY OF DURHAM & DURHAM COUNTY, N.C., GREENHOUSE GAS AND CRITERIA AIR POLLUTANT EMISSIONS INVENTORY AND LOCAL ACTION PLAN FOR EMISSION REDUCTION 9 (2007), available at http://www.icleiusa.org/action-center/learn-from-others/action-plans-inventories/Durham_ghg_lap_full_report.pdf.

⁶⁶ *See id.* at 10.

⁶⁷ ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, ENERGY EFFICIENCY AND SUSTAINABLE DESIGN IN EPPING, NEW HAMPSHIRE 1 available at http://www.icleiusa.org/action-center/learn-from-others/small-communities-toolkit/CaseStudy_EppingNH.pdf.

⁶⁸ ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, CASE STUDY: THE SUCCESSFUL INSTALLATION OF DIESEL OXIDATION CATALYSTS IN SPRINGFIELD, MASSACHUSETTS 1 available at <http://www.icleiusa.org/action-center/learn-from-others/case-studies/springfield%20case%20study.pdf>.

its consumption of energy by using bio-diesel as its main fuel source.⁶⁹ The project required the city to retrofit forty of its buses with diesel oxidation catalysts, which act as filters to reduce particulate matter in the exhaust while also allowing the buses to run on more environmentally efficient fuel.⁷⁰ Transportation infrastructure is not the only part of a municipal infrastructure system that has been recognized as a possibility for becoming more efficient in its operation. Additionally, because the building infrastructure can be the largest consumer of energy for a municipality, cities like Epping, NH have undertaken to review and identify ways to make their new and existing buildings run more efficiently.⁷¹ The city formed a LEED based system of rating points awarded for each building's respective energy efficiency and/or renewable energy footprint.⁷² The system delegates a point standard for each building based on its square footage, and the building owner must fulfill these points by implementing energy efficient practices and environmentally friendly techniques that reduce the buildings environmental footprint.⁷³ As a result of this policy, developers are required to meet this point standard in order to gain the required permits to construct the requisite developments.⁷⁴

Larger cities and even county-wide institutions have become more energy efficient by using greenhouse gas mitigation as a catalyst for this end result.⁷⁵ The ICLEI website examines Durham, N.C. and Durham County, where an elaborate greenhouse gas emissions and criteria inventory for all governmental buildings has been created in order to identify where more efficient energy usage is required.⁷⁶ The city has found that payback periods for initial capital investments are four to seven years while the benefits accrue well beyond this payback period, and this type of residual pay back is how the city can justify an upfront cost to its constituents.⁷⁷ ICLEI has taken an energy based approach to

⁶⁹ Id.

⁷⁰ See id.

⁷¹ ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, *supra* note 82.

⁷² Id.

⁷³ See id. at 2-3.

⁷⁴ Id.

⁷⁵ CITY OF DURHAM & DURHAM COUNTY, N.C., *supra* note 80.

⁷⁶ See id.

⁷⁷ See id. at 14.

climate adaptation, and has been able to market these benefits to almost 800 municipalities throughout the country.⁷⁸ The examples that their website has provided only reinforces how their CRC program can help any size municipality with its climate adaptation needs.

5. USEFUL TOOL AVAILABLE ON THE ICLEI WEBSITE

One tool of specific significance is ICLEI's Adaptation Database and Planning Tool (ADAPT).⁷⁹ ADAPT is a powerful, online tool that guides local government users through ICLEI's Five Milestones of Adaptation planning process.⁸⁰ ADAPT walks any municipal stakeholders or governmental official through the process of assessing their vulnerabilities, setting resiliency goals, and developing strategies that integrate into existing hazard and comprehensive planning efforts.⁸¹ Cities hoping to take advantage of this tool can gain access by becoming a part of the Climate Resilient Communities Program.⁸² The program was officially created in 2010 and offers local governments a well-connected source for tools and resources that are essential in building their resilience to climate adaptation consequences.⁸³ Under the program, local governments are advised to follow ICLEI's Five Milestones for Climate Adaptation, as their introductory planning and implementation guideline.⁸⁴ To become a member, local governments are required to pay dues based on the population of the region, county or city they are applying under.⁸⁵

D. CAKE-CLIMATE ADAPTATION KNOWLEDGE EXCHANGE

EcoAdapt's Climate Adaptation Knowledge Exchange (CAKE) focuses on both environmental and governmental adaptation strategies in its database exchange as a means to reach effective climate

⁷⁸ ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, *supra* note 51.

⁷⁹ See ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA (last visited Oct. 19, 2011), <http://www.icleiusa.org/tools/adapt>.

⁸⁰ These Milestones represent what ICLEI has identified as the most effective step by step process for municipalities to coordinate their adaptation efforts, based on several pilot cities that served as living laboratories to test different policy needs.

⁸¹ *Id.*

⁸² See ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA (last visited Oct. 19, 2011), http://www.icleiusa.org/programs/climate/Climate_Adaptation/climate-resilient-communities-program.

⁸³ *See id.*

⁸⁴ The five steps process recommended is conduct a climate resiliency study, set preparedness goals, develop a climate preparedness plan, publish and implement climate preparedness plan, and monitor and reevaluate resiliency. Following these pre-set goals helps to build a standard review process to better evaluate how these goals work in a case by case basis. *See Id.*

⁸⁵ See ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, *supra* note 154.

adaptation ends.⁸⁶ The following section of this report section will briefly summarize some environmental adaptation studies that are located in its database and library resources and will describe some governmental adaptation strategies that have been used throughout this report.

1. ENVIRONMENTAL ADAPTATION

Environmental adaptation is an important function for overall climate adaptation and is the emphasis for CAKE's knowledge exchange, as demonstrated by the numerous ecological studies and strategies that are found in its case study database.⁸⁷ Climate action plans for coral reef sustainability, effective watershed adaptation and forest management practices are all present within the pages of its case study database.⁸⁸ Some studies, particularly studies from Hawaii, which depend on the balance of ecosystems and the built environment, showcase how environmentally conscious adaptation can have a cross over effect in helping the built community adapt to climate change.⁸⁹ As part of the Hawaii Coastal Zone Management Program (HCZMP) and State Revised Statutes, the state created an Ocean Resource Management Program (ORMP) as part of the statewide development plan to ensure their natural ecosystems are managed in a sustainable way.⁹⁰ The state also created a Climate Adaptation Working Group to facilitate and implement the strategies recommended by the ORMP.⁹¹ Some of the strategies suggested for ecological sustainability are reducing coastal erosion,⁹² and preparing hazard mitigation plans for the ecosystems and environments that depend on their continued health.⁹³ The state emphasizes that natural resource need to be analyzed as a commodity, not just as a resource, and that a statewide regulatory practice could be preferred over leaving regulation to local governmental

⁸⁶ CLIMATE ADAPATATION KNOWLEDGE EXCHANGE (last visited Nov.9, 2011), <http://www.cakex.org/>.

⁸⁷ Case Studies, CLIMATE ADAPTATION KNOWLEDGE EXCHANGE (last visited Nov. 9, 2011), <http://www.cakex.org/case-studies/all?showmap=0>.

⁸⁸ See id.

⁸⁹ STATE OF HAW. OFFICE OF PLANNING, HAWAII OCEAN RESOURCE MANAGEMENT PLAN 1 (2006) available at http://www.cakex.org/sites/default/files/Hawaii_ORMP_2006.pdf.

⁹⁰ See id.

⁹¹ HAW. OCEAN RESOURCE MANAGEMENT PLAN WORKING GRP., CLIMATE CHANGE ADAPTATION FRAMEWORK 4-6 (2009) available at http://hawaii.gov/dbedt/czmrmp/reports/climate_change_adaptation_framework_final.pdf.

⁹² See id. at 24.

⁹³ See id.

stakeholders.⁹⁴ For future stakeholders, the examples of ecological adaptation policies presented on the CAKE website could be synthesized to foster decision-making regarding the built environmental systems that share resources with the ecosystems they are built upon.

2. BUILT ENVIRONMENT ADAPTATION

Because of the impacts that climate change has on the built environment, studies found on the CAKE website focus on a needs-based approach for helping municipalities adapt the built environment to climate change.⁹⁵ Some studies present in this section that relate to municipal adaptation strategies have been constructed by regional and state organizations,⁹⁶ while some larger municipalities with larger resources have taken a local approach to presenting their adaptation findings.⁹⁷ The state of Maine has several adaptation case studies present in the CAKE database,⁹⁸ highlighted by Maine Sea Grant⁹⁹ and the State Department of Environmental Protection (MEDEP).¹⁰⁰ The MEDEP report available on the CAKE website found that with funding sources becoming more and more exacerbated, existing regulations and programs should be emphasized for adaptation strategies so as to not pass the cost onto future generations by mandating new and currently unfunded programs.¹⁰¹ Additionally, the EPA Climate Ready Estuaries Program has several documents uploaded on the CAKE website, several of which describe recent success stories,¹⁰² and some also provide a yearly progress report of the entire

⁹⁴ STATE OF HAW. OFFICE OF PLANNING, *supra* note 97, at 2.

⁹⁵ BAMBURGER, *supra* note 5, at 3.

⁹⁶ HAW. OCEAN RESOURCE MANAGEMENT PLAN WORKING GRP., *supra* note 99; see also SOUTHERN ME. REGIONAL PLANNING COMMISSION, COASTAL HAZARDS RESILIENCY TOOLS PROJECT available at <http://www.smrpc.org/CoastalHazardResiliencyToolsProject/Coastal.htm>.

⁹⁷ See generally, S.F. BAY CONSERVATION AND DEVELOPMENT COMMISSION, LIVING WITH THE RISING BAY: VULNERABILITY AND ADAPTATION IN SAN FRANCISCO BAY AND ON ITS SHORELINES (2011) available at <http://www.bcdc.ca.gov/BPA/LivingWithRisingBay.pdf>. The commission was formed as a branch of the State government but its main objective is to provide recommendations for amendments to the San Francisco Bay Plan.

⁹⁸ See CLIMATE ADAPTATION KNOWLEDGE EXCHANGE, *supra* note 95.

⁹⁹ See generally, ME. SEA GRANT, CLIMATE VARIABILITY AND COASTAL COMMUNITY RESILIENCE: DEVELOPING AND TESTING A NATIONAL MODEL OF STATE-BASED OUTREACH (2010) available at http://www.seagrant.umaine.edu/files/pdf-global/10SARPtech_final.pdf. This report is a result of the author's assessment of how to effectively educate both coastal property owners and municipal decision makers regarding effective adaptation strategies.

¹⁰⁰ See generally ME. DEPARTMENT OF ENVIRONMENTAL PROTECTION, ADAPTING PEOPLE AND NATURE TO MAINE'S CHANGING CLIMATE: CHARTING MAINE'S COURSE (2009) available at http://www.maine.gov/dep/oc/adapt/Report_final.pdf.

¹⁰¹ See *id.*

¹⁰² Ready, 4 CLIMATE READY ESTUARIES, Summer 2010 available at <http://www.epa.gov/cre/downloads/100709Ready4FINAL-tagged.pdf>.

program.¹⁰³ The website also provides some legislative data, most notably a link to the R.I. Coastal Resource Management Council's Redbook.¹⁰⁴ The Redbook is the comprehensive coastal planning regulations for all coastal zone development in Rhode Island.¹⁰⁵ It involves regulating all resources related to the coastal areas including, but not limited to, natural, commercial, industrial and aesthetic assets that have recognized value in the present and future development of Rhode Island.¹⁰⁶ The CAKE website also provides links to visual data, like a five part video series prepared by the Southern Maine Regional Planning Commission regarding the adaptation efforts of several Maine coastal municipalities.¹⁰⁷ The comprehensive data that CAKE has provided can be looked at to cover almost all the needs of a particular coastal stake holder or decision maker, but deeper analysis to whether the proposed strategies and progress reports have been successful may need to be performed to expand on the overview of this report.

E. GEORGETOWN CLIMATE CENTER

The Georgetown Climate Center is based out of the Georgetown University School of Law and serves as a leading resource for state and federal policy related to climate change.¹⁰⁸ The Climate Center focuses on federal, state and transportation adaptation efficiency policy recommendations.¹⁰⁹ The following section of this report will group the federal and state adaptation strategies together and then briefly describe their work through adapting the transportation infrastructure to climate change.

1. ADAPTATION

¹⁰³ See generally, U.S. ENVTL PROTECTION AGENCY, CLIMATE READY ESTUARIES PROGRESS REPORT (2009) available at <http://www.cakex.org/sites/default/files/2009-CRE-Progress-Report.pdf>. The report summarizes what was accomplished from the previous year's objectives and then makes recommendations on how to further their goals for the coming year.

¹⁰⁴ See CLIMATE ADAPTATION KNOWLEDGE EXCHANGE, *supra* note 95.

¹⁰⁵ See generally JOANNE MOORE & JEFF WILLIS, R.I. COASTAL ZONE MGMT. PROGRAM, REDBOOK (Joanne Moore et al. eds., 1st ed. 1996) available at <http://www.crmc.ri.gov/regulations/RICRMP.pdf>. The Redbook is also statutorily based through R.I General Laws.

¹⁰⁶ R.I. GEN. LAWS § 46-23-1(2) (2011).

¹⁰⁷ SOUTHERN ME. REGIONAL PLANNING COMMISSION, COASTAL HAZARDS RESILIENCY TOOLS PROJECT available at <http://www.smrpc.org/CoastalHazardResiliencyToolsProject/Coastal.htm>.

¹⁰⁸ See GEORGETOWN CLIMATE CENTER (last visited Nov. 9, 2011), <http://www.georgetownclimate.org>.

¹⁰⁹ See *id.*

The Georgetown website provides a resource of state-based and local adaptation plans, though not all states are represented on the website.¹¹⁰ This section will focus on the several New England States and municipalities that are represented on this database. Keene, NH, and its ICLEI sponsored Climate Resilience Communities case study regarding adaptation planning efforts previously discussed in this report, was found listed on the Georgetown website.¹¹¹ Additionally, a report by the City of Groton, CT, and a link to the City's February 2011 Final Report on Climate Adaptation, is available on the Georgetown website.¹¹² The report is a result of a two year project created by the City Council to charge the City Climate Task force with forming recommendations for making the city more resilient to climate change.¹¹³ Additionally, Massachusetts is represented on the Georgetown website with a report by the state Office of Energy and Environmental Affairs, regarding the state Climate Change Adaptation Plan, a resource for the state legislature.¹¹⁴ The report's findings advocate policies that use the best available science and technology and use cross-cutting strategies that help both state and local governments share data and planning strategies.¹¹⁵ Because not all U.S. states are represented on the Georgetown website, it is unclear whether the incompleteness of the database is a result of a particular state not having a state adaptation plan, or whether the information is not yet available on the still-developing website.

2. TRANSPORTATION EFFICIENCY AND ADAPTATION

¹¹⁰ See *Adaptation, State and Local Adaptation Plans*, GEORGETOWN CLIMATE CENTER (last visited Nov. 9, 2011), <http://www.georgetownclimate.org/adaptation/state-and-local-plans>.

¹¹¹ See generally KEENE, N.H., ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY, ADAPTING TO CLIMATE CHANGE: PLANNING A CLIMATE RESILIENT COMMUNITY (2007), available at http://www.ci.keene.nh.us/sites/default/files/Keene%20Report_ICLEI_FINAL_v2_1.pdf. Keene's efforts are principally based on mitigating green house gas emissions and inefficient energy consumption, as they are not a coastal city that must be concerned with adaptation to sea level rise, but merely flooding from extreme weather events.

¹¹² TOWN OF GROTON, TASK FORCE ON CLIMATE CHANGE AND SUSTAINABLE COMMUNITY FINAL REPORT 1(2011) available at <http://www.town.groton.ct.us/uploads/TaskForceClimateChangeSustainableCommunityReport.pdf>.

¹¹³ *Id.*

¹¹⁴ See generally CLIMATE CHANGE ADAPTATION ADVISORY COMM., THE COMMONWEALTH OF MASS. EXEC. OFFICE OF ENERGY AND ENVTL AFFAIRS, MASS. CLIMATE CHANGE ADAPTATION PLAN (2011) available at <http://www.mass.gov/eea/docs/eea/energy/ccaa/eea-climate-adaptation-report.pdf>. The advisory committee was appointed by the Governor as a result of passing the Global Warming Solutions Act of 2008. The committee is charged with updating the State adaptation plan and presenting those findings to the Legislature.

¹¹⁵ See *id.* at 25-28.

The transportation link found on the Georgetown website provides an overview of projects that have been initiated regarding adaptation of state and national transportation infrastructure.¹¹⁶ The website focuses on the Transportation and Climate Initiative of the Northeast and Mid-Atlantic States (TCI) project.¹¹⁷ The project is a collaboration comprised of twelve Northeast and Mid-Atlantic jurisdictions that seek to develop the clean energy economy and reduce greenhouse gas emissions in the transportation sector.¹¹⁸ The Georgetown website provides overviews of several projects provided by the TCI, notably a Regional Electric Vehicle Network and Sustainable Communities Activities regarding expansion of mass transportation facilities.¹¹⁹ These projects are facilitated by the Georgetown Climate Center in conjunction with TCI to expand the recommendations of the TCI Strategic Work Plan, released in 2010.¹²⁰ The TCI Strategic Work Plan's mission is to reduce greenhouse gas emissions, minimize the transportation sector's reliance on high-carbon fuels, promote sustainable growth, address the challenges of vehicle-miles traveled, and help build the clean energy economy.¹²¹ This initiative's efforts compliment and support other initiatives already under way, including state and regional Climate Action Plans and statewide statutory greenhouse gas emission reduction targets in each TCI member state.¹²² The resources that Georgetown Climate Center provides coincide with the issues that the Mid-Atlantic and Northeast Region face in regard to the climate adaptation, but differ from other databases in that they do not provide any natural ecosystem-based adaptation strategies.

F. WASHINGTON STATE UNIVERSITY-CLIMATE IMPACTS GROUP

¹¹⁶ See GEORGTOWN CLIMATE CENTER, TRANSPORTATION AND CLIMATE INITIATIVE OF THE NORTHEAST AND MID-ATLANTIC STATES (last visited Nov. 9, 2011), <http://www.georgetownclimate.org/state-action/transportation-and-climate-initiative>.

¹¹⁷ See id.

¹¹⁸ Id.

¹¹⁹ Id.

¹²⁰ See generally TRANSPORTATION AND CLIMATE INITIATIVE, STRATEGIC WORKPLAN FOR THE TRANSPORTATION AND CLIMATE INITIATIVE: AN AGENDA FOR ACTION (2010) available at

<http://www.georgetownclimate.org/sites/default/files/TCI-workplan%281%29.PDF>. The Georgetown Climate Center acts only in an advisory position and is not an official voting member of the TCI organization.

¹²¹ Id. at 2.

¹²² Id.

The University of Washington, as part of its Joint Institute for the Study of the Atmosphere and Ocean, created the Climate Impacts Group forecasting and planning tools website as a resource for state, regional and local adaptation efforts.¹²³ The website provides a user-based case study and media library for adaptation minded stakeholders who wish to increase their knowledge regarding climate adaptation issues.¹²⁴ For this report, the data provided will be summarized by adaptation efforts focusing on municipal adaptation strategies.

1. ECONOMIC-BASED ADAPTATION STRATEGIES

On the University of Washington website, a section is devoted to the economic incentives that can coincide with adaptation planning. In January 2011, the Pew Center for Global Climate Change released a comprehensive overview of the issues presented by climate change.¹²⁵ Found on several of the databases in this report, the document consists of sections focusing on federal, state and local action, as well as Technology and Business based solutions for climate adaptation.¹²⁶ Focusing on local municipal responses, the Pew report advocates that municipalities should embrace and emphasize a positive approach towards climate adaptation by working with local utility providers to create incentives for providers to obtain more energy through renewable energy resources.¹²⁷ A positive approach will help to promote and develop smart growth techniques in cities' development plans by making high density, mixed use and transit-oriented development a more attractive way to distribute energy requirements.¹²⁸ The Pew report also emphasizes that greenhouse gas emission reductions can serve as both a climate mitigation source, and as a source for reducing costs for municipalities in their energy consumption, thereby freeing up more resources to further their adaptation goals.¹²⁹ Another resource found on the University of Washington website emphasizes an innovative approach of looking to the

¹²³ UNIV. OF WASH., CLIMATE IMPACTS GROUP (Last visited Nov. 9, 2011), <http://cses.washington.edu/cig/cases>.

¹²⁴ Id.

¹²⁵ See PEW CENTER ON GLOBAL CLIMATE CHANGE, *supra* note 1.

¹²⁶ See id.

¹²⁷ This report separates itself into distinct sections. As a result, the text before the cited pages in this and proceeding footnotes refer to the page number in the listed section alone. Id. at Local Action 2-3.

¹²⁸ Id. at Local Action 2.

¹²⁹ Id. at Local Action 3.

private business sector, notably the insurance underwriter industry, for guidance on what practices best reduce costs of climate change impacts.¹³⁰ The findings located in that report advocate that modern-design, engineering based building code requirements reduced home damages by forty-two percent during extreme weather events, based on the size of claims submitted to the insurance companies.¹³¹ As a result of extreme weather events, flooding risk for coastal and inland properties are also of concern for urban regions, emphasized by a report by the Center for Clean Air Policy.¹³² Because of climate change and sea level rise, one hundred year extreme flooding and precipitation events may become fifty or ten year events, exacerbating already flood prone areas and creating public health risks from combined sewage overflows from storm water infiltration.¹³³ Advocating the positive side of adaptation efforts, instead of showcasing the risks and disaster consequences resulting from inaction, represents how the University of Washington website structures its data exchange towards advocacy and policy opportunities that facilitate learning from what other successes have occurred throughout the Northwest and the United States.

G. STORMSMART COASTS ADAPTATION TOOL

In 2006, recognizing the need to provide technical assistance to Massachusetts communities, the state applied for a grant from NOAA to receive a coastal management fellow.¹³⁴ The StormSmart Coast Network and Adaptation Tool was created in conjunction with the Massachusetts Office of Coastal Zone Management and the state's Coastal Hazards Commission in 2007.¹³⁵ Wes Shaw was chosen to lead phase one of what is now StormSmart Coasts and helped to launch the StormSmart Coast Network

¹³⁰ FRANCES G. SUSSMAN & J. RANDELL FREED, ADAPTING TO CLIMATE CHANGE: A BUSINESS APPROACH 23-24 (2008) available at <http://www.pewclimate.org/docUploads/Business-Adaptation.pdf>.

¹³¹ See *id.* at 24.

¹³² ASHLEY LOWE, JOSH FOSTER & STEVE WINKELMAN, ASK THE CLIMATE QUESTION: ADAPTING TO CLIMATE CHANGE IMPACTS IN URBAN REGIONS 11(Center for Clean Air Policy 2009) available at http://www.ccap.org/docs/resources/674/Urban_Climate_Adaptation-FINAL_CCAP%206-9-09.pdf.

¹³³ See *id.*

¹³⁴ Local Strategies for Addressing Climate Change, COASTAL SERVICES, Feb. 2009, at 4-5 available at <http://www.csc.noaa.gov/magazine/climatechangestrategies.pdf>.

¹³⁵ *Id.*

website in 2008.¹³⁶ This tool was created to assist US coastal municipality decision makers in their efforts to address their unique coastal zone adaptation issues.¹³⁷ Currently, there are eleven coastal states that are either full member participants or are engaging in the process so as to help their respective coastal municipalities' access state specific data and planning recommendations.¹³⁸ In the New England region, both Rhode Island and Massachusetts are full member participants with Connecticut, New Hampshire and Maine joining the program in the near future.¹³⁹ Each full participant state has its own specific website with interactive tools to help any coastal municipal stakeholder track and project possible consequences from incoming storm fronts and naturally expanding sea levels.¹⁴⁰ Some of the interactive resources the StormSmart Coasts network provides are real time hurricane tracking, an iCAT Damage Estimator, and various beach and surf webcams placed on pre-selected beaches in each respective participating state.¹⁴¹ The user friendly applications that this web based tool provides is a showcase of what 21st century technology can provide by a click of a button, but more seasoned municipal planners and stake holders may need more training to understand what types of advantages this program provides.

III. CONCLUSION

The websites briefly discussed in this report, and the large amount of data present on their respective databases, could provide any adaptation stakeholder from the small city to the large metropolis with adequate information on how to start their particular adaptation strategies. Stakeholders should understand that no one policy or strategy fits every situation, and area-specific data for each stakeholder's needs should be compiled and assessed before implementation of these strategies is commenced.

¹³⁶ See id.

¹³⁷ STORMSMART COASTS (last visited Oct. 19, 2011), <http://stormsmartcoasts.org/>.

¹³⁸ Id.

¹³⁹ Id.

¹⁴⁰ STORMSMART COASTS RHODE ISLAND (last updated Oct. 18, 2011), <http://ri.stormsmart.org/tools/>, see also STORMSMART COASTS MASSACHUSETTS (last updated Oct. 18, 2011), <http://ma.stormsmart.org/tools/>.

¹⁴¹ See id.

Appendix A: Online Website Database References on Climate Change Adaptation Efforts

List of resources available on existing internet databases (November 30, 2011)

Marine Affairs Institute, Roger Williams University School of Law

Contractor for: Researching and Documenting Climate Change Best Practices/Innovative Municipal Adaptation Approaches

1. ICLEI-Local Governments for Sustainability USA (<http://www.iclei.org/>)

A. Green Building Construction for Energy Adaptation and Capital Improvement

- This document outlines how New York City has created a green code standard that does not mandate LEED certification as the baseline, but wants to emphasize raising the baseline green building standards for private building construction in the city. U.S GREEN BUILDING COUNCIL, NEW YORK CITY GREEN CODES TASK FORCE, EXECUTIVE SUMMARY (2010) *available at http://www.urbangreencouncil.org/greencodes/greencodestaskforce_exsummary_final.pdf.*
- This report outlines a twelve city case study on stormwater management. U.S E.P.A, GREEN INFRASTRUCTURE CASE STUDIES: MUNICIPAL POLICES FOR MANAGING STORMWATER WITH GREEN INFRASTRUCTURE (2010) *available at http://www.icleiusa.org/action-center/learn-from-others/EPA_gi_case_studies_2010.pdf.*

B. Learning from Others

- This outlines a tax incentive program that allows existing homeowners to receive tax breaks for providing renewable energy and energy efficient practices in updating their existing home improvement plans. CALIFORNIA PUBLIC UTILITY COMMISSION, LOCAL GOVERNMENT ENERGY EFFICIENCY: SONOMA COUNTY ENERGY INDEPENDENCE PROGRAM-SCEIP *available at <http://www.icleiusa.org/action-center/learn-from-others/SCEIP.pdf>.*
- This report is an overview of one of the pilot cities for ICLEI's Climate Resilient Communities Program. ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, CASE STUDY: KEENE, NEW HAMPSHIRE LEADING ON CLIMATE PREPARDNESS (2010), *available at http://www.icleiusa.org/action-center/learn-from-others/ICLEI_case%20study_Keene_adaptation.pdf.*
- In 2006, Boulder, CO passed the nation's first *Climate Action Plan Tax*, marking the first time that a municipal government will impose an energy tax on its citizens to directly combat global warming and fund adaptation strategies for the city. CAROLYN BROUILLARD & SARAH VAN PELT, A COMMUNITY TAKES CHARGE: BOULDER'S CLIMATE TAX (2007) *available at http://www.icleiusa.org/action-center/learn-from-others/A%20Community%20Takes%20Charge_Boulders%20Carbon%20Tax.pdf.*
- This bylaw was enacted to accommodate distributed generation, wind energy conversion facilities in appropriate locations while minimizing adversely effects the facilities have on the built, social and environmental systems. The laws give the City Planning Board and Zoning Appeals board to review proposed facilities so they are kept in compliance with the City's existing by-laws. TOWN OF CHESTER, MASS., WIND ENERGY CONVERSION FACILITIES BYLAWS § 5.6 (2007) *available at <http://www.icleiusa.org/action-center/tools/municipal-clean-energy-toolkit/Chesterwindenergyconversionfacilitiesbylawfinal.pdf>.*

C. Small Communities Tool Kit

- The city was effective in implementing energy efficient practices into their development activities through providing cost savings data to the community, fostering citizen engagement and providing grant funding through state renewable energy funds. ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, AN INNOVATIVE APPROACH TO RENEWABLE ENERGY AND ENERGY EFFICIENT PROJECTS IN SHUTESBERRY, MASS. available at http://www.icleiusa.org/action-center/learn-from-others/small-communities-toolkit/CaseStudy_ShutesburyMA.pdf.
- This case study outlines Epping, NH's green building credit system they implemented to encourage sustainable and green updating to existing buildings in the city. ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, ENERGY EFFICIENCY AND SUSTAINABLE DESIGN IN EPPING, NEW HAMPSHIRE available at http://www.icleiusa.org/action-center/learn-from-others/small-communities-toolkit/CaseStudy_EppingNH.pdf.
- This power point presentation was created to emphasize what policies the two cities in CT are implementing to combat sea level rise and its effects on the cities respective coastal infrastructures. PAUL KIRSHEN, EXPLORATORY, PRELIMINARY, TENTATIVE ADAPTATION TO RISING SEA LEVELS IN MYSTIC AND GROTON LONG POINT (Battelle Memorial Institute 2010), available at <http://www.icleiusa.org/action-center/planning/Modeling%20Adaptation%20Actions%20for%20Groton.pdf>
- Homer, Alaska prepared a *Climate Action Plan*, linked to the case study, as part of the Climate Resilient Communities Program. The plan focuses on three priorities for the cities adaptation efforts as Protecting Existing Infrastructure, undertake Emergency preparedness measures and adopt policies that incorporate effective adaptation planning for future development of the city infrastructure. Their main focus is to reduce their greenhouse gas footprint with green building requirements and incentives ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABLE USA, CASE STUDY: HOMER, ALASKA'S CLIMATE CHANGE ADAPTATION PROGRESS DESPITE UNCERTAINTIES available at http://www.icleiusa.org/action-center/learn-from-others/ICLEI_case%20study_Homer_adaptation.pdf.

D. Affecting Policy

- Durham, North Carolina recognized that in order to facilitate a greenhouse gas adaptation plan for reducing emissions, it would need a comprehensive plan that identified what systems were the largest contributors. This report identifies which sectors of the government provide the greatest incentives, both economically and environmentally, to provide the most cost beneficial reductions of greenhouse gas emissions. CITY OF DURHAM & DURHAM COUNTY, N.C., GREENHOUSE GAS AND CRITERIA AIR POLLUTANT EMISSIONS INVENTORY AND LOCAL ACTION PLAN FOR EMISSION REDUCTION (2007), available at http://www.icleiusa.org/action-center/learn-from-others/action-plans-inventories/Durham_ghg_lap_full_report.pdf.
- This policy was designed to encourage the city municipal departments in Burlington, VT, to buy environmentally recycled and friendly products for their day to day administrative capacities. The policy is explicit in stating the policy does not preempt any violation of any state, federal or municipal code in compliance with this policy. CITY OF BURLINGTON, VT, ENVIRONMENTALLY PREFERABLE PURCHASE POLICY (2009) available at <http://www.icleiusa.org/action-center/learn-from-others/EPP%20policy%20ADOPTED.pdf>.
- As part of the Northeast Clean School Bus Initiative, this case study outlines the success that Springfield, Massachusetts, had with funding and implementing their school buses with Diesel Oxidation Catalysts filters that reduce the output of carbon monoxide, particulate matter, and hydro carbons from its diesel buses. The city was part of a region wide program and many cities have similar cases studies posted on this website. ICLEI-LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, CASE STUDY: THE

SUCCESSFUL INSTALLATION OF DIESEL OXIDATION CATALYSTS IN SPRINGFIELD, MASS. available at <http://www.icleiusa.org/action-center/learn-from-others/case-studies/springfield%20case%20study.pdf>.

2. CAKE-Climate Adaptation Knowledge Exchange (<http://www.cakex.org/>)

- This is a comprehensive development and adaptation strategy plan for all the islands of Hawaii, to help mitigate the effects of coastal erosion and the consequences stemming from extreme weather events. Because of the unique history of interaction between its citizens and the ocean ecosystem, the plan focuses on preserving their state's coastal dependency and sustainable use of the ocean resources. STATE OF HAWAII OFFICE OF PLANNING, HAWAII OCEAN RESOURCE MANAGEMENT PLAN (2006) available at http://www.cakex.org/sites/default/files/Hawaii_ORMP_2006.pdf.
- An assessment of the procedural recommendations and steps that the State Office of Planning has identified as the most efficient process for developing adaptation strategies for the state. It provides a six step process highlighted by the need to conduct vulnerability and risk assessments so to better allocate resources in a timely manner. HAWAII OCEAN RESOURCE MANAGEMENT PLAN WORKING GROUP, CLIMATE CHANGE ADAPTATION FRAMEWORK (2009) available at http://hawaii.gov/dbedt/czm/ormp/reports/climate_change_adaptation_framework_final.pdf.
- This report is part of an eight part document that assesses Connecticut's ability to deal with climate change adaptation consequences in its built, natural and social environments. The report focuses on how the built infrastructure is vulnerable to the impacts of climate change and how the State can minimize the negative consequences associated with it. CONN. DEPT. OF ENVTL PROTECTION, FACING OUR FUTURE: INFRASTRUCTURE ADAPTING TO CONNECTICUT'S CHANGING CLIMATE (2009) available at <http://www.ct.gov/dep/lib/dep/air/climatechange/adaptation/090320facingourfuture.pdf>.
- The report was a collaboration of the Maine and Oregon Sea Grant Programs to assess how climate change and coastal hazards are affecting the coastal regions of both states. The findings of the report are guided toward giving recommendations for development for both coastal property owners and municipal elected officials. MAINE SEA GRANT, CLIMATE VARIABILITY AND COASTAL COMMUNITY RESILIENCE: DEVELOPING AND TESTING A NATIONAL MODEL OF STATE-BASED OUTREACH (2010) available at http://www.seagrant.umaine.edu/files/pdf-global/10SARPtech_final.pdf.
- This report was submitted to the Joint Committee on Natural Resources of the 124th Maine Legislature to provide recommendations for the citizens and businesses of the state on how to implement adaptation strategies to counter act the effects of climate change. MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION, ADAPTING PEOPLE AND NATURE TO MAINE'S CHANGING CLIMATE: CHARTING MAINE'S COURSE (2009) available at http://www.maine.gov/dep/oc/adapt/Report_final.pdf.
- The report was prepared to identify informational needs for future vulnerability assessment for the Bay area. The report describes near-term and long-term strategies to address climate change impacts and provides recommendations and findings to be incorporated into the San Francisco Bay Plan. SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION, LIVING WITH THE RISING BAY: VULNERABILITY AND ADAPTATION IN SAN FRANCISCO BAY AND ON ITS SHORELINES (2011) available at <http://www.bcdc.ca.gov/BPA/LivingWithRisingBay.pdf>.
- It provides economic and capital development strategies for Cape Cod Municipalities that would like to address climate adaptation yet still provide meaningful growth for the local economy. CAPE COD COMMISSION, COASTAL USE TEMPLATES FOR ECONOMIC DEVELOPMENT PHASE 1 (2011), available at

http://www.capecodcommission.org/resources/economicdevelopment/CEDS_CoastalUseTemplatesRept.pdf.

- The Climate Ready Estuaries program provides an overview of the programs accomplishments as of 2009. It includes an assessment of the work of partner organizations of the National Estuaries Program, detailing some of the challenges that have been encountered, the next steps that should be taken. U.S. ENVTL PROTECTION AGENCY, CLIMATE READY ESTUARIES 2009 PROGRESS REPORT available at <http://www.cakex.org/sites/default/files/2009-CRE-Progress-Report.pdf>.
- This is the fourth edition of the U.S. EPA Climate Ready Estuaries Newsletter, which is released to provide updates as to the status of yearly grant funding provided by the National Estuary Program of the U.S. EPA to various state and local municipal stakeholders. *Ready, 4 CLIMATE READY ESTUARIES*, Summer 2010 available at <http://www.epa.gov/cre/downloads/100709Ready4FINAL-tagged.pdf>.
- This is a link to the RI Coastal Resources Management Council's regulations for coastal zone areas. It provides the guidelines that all coastal cities must follow when regulating coastal activity related to sea level rise and environmental sustainability. JOANNE MOORE & JEFF WILLIS, RI COASTAL ZONE MGMT. PROGRAM, REDBOOK (Joanne Moore et al. eds., 1st ed. 1996) available at <http://www.crmc.ri.gov/regulations/RICRMP.pdf>.
- The Coastal Hazards Municipality Adaptation Planning tool kit created by the Southern Maine Regional Planning Commission. The tool kit provides local stakeholders with model coastal zoning statutes, power point presentations on municipal strategies, and a 5-part video series on Maine municipal responses to sea level rise. SOUTHERN MAINE REGIONAL PLANNING COMMISSION, COASTAL HAZARDS RESILIENCY TOOLS PROJECT available at <http://www.smrpc.org/CoastalHazardResiliencyToolsProject/Coastal.htm>.
- In 2010, the author sent out a general questionnaire to state and local government officials to assess their most prevalent adaptation resource needs so as to better facilitate what are the barriers that municipal stakeholders face regarding economic and social needs in implementing climate adaptation strategies into their respective planning processes. LEAH BAMBERGER, PREPARING FOR THE CHANGING CLIMATE: A NORTHEAST-FOCUSED NEEDS ASSESSMENT 27 (Jennifer Andrews et al. eds., Clean Air-Cool Plant 2011) available at http://www.cleanair-coolplanet.org/climate_preparedness/NortheastAssessment2011.pdf.
- This program was piloted in Massachusetts in 2008 and has become one of the most user friendly, online guidance tools for municipal stakeholders attempting to minimize the impacts of sea level rise on their respective cities. STORMSMART COASTS (last visited Oct. 19, 2011), <http://stormsmartcoasts.org/>.
- This is an overview of how N.H. has prepared its small, but vulnerable coastal region for the impacts associated with climate change and rising sea levels. CHRIS KEELEY, THE NOAA ROADMAP TOOL IN CONTEXT: CLIMATE PREPAREDNESS IN COASTAL NEW HAMPSHIRE (David Keeley et al. eds., Clean Air-Cool Planet 2011) available at <http://www.cake.org/virtual-library/noaa-roadmap-tool-context-climate-preparedness-coastal-new-hampshire> (click on "NOAA Roadmap Tool in Context_CA-CP_2011" PDF link).

3. CSC sites, New England (<http://collaborate.csc.noaa.gov/climateadaptation/default.aspx>)

A. Adaptation/Action Plans

- Massachusetts Climate Change Adaptation Report <http://www.mass.gov/eea/air-water-climate-change/climate-change/climate-change-adaptation-report.html>
- Keene, New Hampshire Climate Adaptation Action Plan Summary Report http://cbtadaptation.squarespace.com/storage/KeeneSummary_ICLEI_FINAL2.pdf

- Emerging Climate Change Impacts on Freshwater Resources: A Perspective on Transformed Watersheds (New England Included) <http://www.rff.org/rff/documents/RFF-Rpt-Adaptation-Covich.pdf>
- Summary: Preliminary Assessment of Rhode Island's Vulnerability to Climate Change and its Options for Adaptation Action <http://envstudies.brown.edu/Summary-RIClimateChangeAdaptation.pdf>
- People and Nature Adapting to Changing Climate: Charting Maine's Course <http://www.maine.gov/dep/oc/adapt/>
- An Adaptation Portfolio for the United States Coastal and Marine Environment (not region specific) <http://www.rff.org/News/Features/Pages/Helping-Coastal-and-Marine-Environments-Adapt-to-Climate-Change.aspx>
- The New Hampshire Climate Action Plan: A Plan for New Hampshire's Energy, Environmental and Economic Development Future http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/documents/nhcap_final.pdf
- Buzzards Bay Action Plan: Planning for a Shifting Shoreline and Coastal Storms <http://www.buzzardsbay.org/newccmp/newccmp-shorelines.pdf>
- Stormy Seas: Land Trusts Navigate the Uncertainties Surrounding Climate Change (not region specific) <http://www.landtrustalliance.org/policy/emerging-issues/climate-change/stormy-seas%20LTA%20article%202009.pdf>
- Climate Ready Estuaries 2010 Progress Report (not region specific) <http://www.epa.gov/climatereadyestuaries/downloads/2010-CRE-Progress-Report.pdf>
- Adaptation Planning for the National Estuary Program: Elements of an Adaptation Plan (not region specific) <http://www.epa.gov/cre/downloads/CRAAdaptationPlanning-Final.pdf>
- Northeast and Mid-Atlantic Low Carbon Fuel Standards (Northeast) http://www.nj.gov/globalwarming/pdf/lcfs_governors-mou.pdf

B. Case Studies/ Strategies

- Keene, New Hampshire Climate Adaptation Action Plan Summary Report http://cbtadaptation.squarespace.com/storage/KeeneSummary_ICLEI_FINAL2.pdf.
- Prince Edward Island and Climate Change: A Strategy for Reducing the Impacts of Global Warming (Canada) http://www.gov.pe.ca/photos/original/env_globalstr.pdf
- Emerging Climate Change Impacts on Freshwater Resources: A Perspective on Transformed Watersheds <http://www.rff.org/rff/documents/RFF-Rpt-Adaptation-Covich.pdf>
- Urban Planning for Climate Change (not region specific) http://www.lincolninst.edu/pubs/1310_Urban-Planning-for-Climate-Change
- Summary: Preliminary Assessment of Rhode Island's Vulnerability to Climate Change and its Options for Adaptation Action <http://envstudies.brown.edu/Summary-RIClimateChangeAdaptation.pdf>
- Climate Ready: Ontario's Adaptation Strategy and Action Plan (Ontario, Canada) http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_085423.pdf
- The Role of Coastal Zone Management Programs in Adaptation to Climate Change: Final Report of the CSO Climate Change Work Group (not region specific) <http://www.coastalstates.org/wp-content/uploads/2010/07/CSO-2008-Climate-Change-Report2.pdf>
- Case Study: Keene, New Hampshire Leading on Climate Preparedness http://www.icleiusa.org/action-center/learn-from-others/ICLEI_case%20study_Keene_adaptation.pdf

- Paying the Premium: Insurance as a Risk Management Tool for Climate Change (not region specific) http://pdf.wri.org/working_papers/paying_the_premium.pdf
- Climate Ready Estuaries 2009 Progress Report (not region specific)
<http://www.epa.gov/cre/downloads/2009-CRE-Progress-Report.pdf>
- The Oyster River Culvert Analysis Project: Final Technical Report (NH)
http://www.prep.unh.edu/resources/pdf/oyster_river_culvert-prep-10.pdf
- Climate Change and Transportation in Maine
(<http://collaborate.csc.noaa.gov/climateadaptation/Lists/Resources/DispForm.aspx?ID=459&Source=http%3A%2Fcollaborate.csc.noaa.gov%2Fclimateadaptation%2FLists%2FResources%2FCase%2520StudiesStrategies.aspx&ContentTypeId=0x010300039D262E3B99C846B963A88630C05E27>)
- Climate Ready Estuaries 2010 Progress Report (not region specific)
<http://www.epa.gov/climatereadyestuaries/downloads/2010-CRE-Progress-Report.pdf>
- Adapting to Climate Change: The Public Policy Response – Public Infrastructure (not region specific) <http://www.rff.org/News/Features/Pages/Climate-Threats-to-Infrastructure.aspx>
- Integrating Climate Change into the Transportation Planning Process (not region specific)
<http://www.fhwa.dot.gov/hep/climatechange/climatechange.pdf>
- Local Strategies for Addressing Climate Change, Volume 2 (not region specific)
<http://www.csc.noaa.gov/magazine/climatechangestrategiesVol2.pdf>
- Climate-Smart Conservation (not region specific) <http://www.nwf.org/Global-Warming/Climate-Smart-Conservation.aspx>
- The Value of Green Infrastructure for Urban Climate Adaptation (not region specific)
http://www.ccap.org/docs/resources/989/Green_Infrastructure_FINAL.pdf
- Lessons Learned on Local Climate Adaptation from the Urban Leaders Adaptation Initiative (not region specific)
http://www.ccap.org/docs/resources/988/Urban_Leaders_Lessons_Learned_FINAL.pdf
- Using Freeboard to Elevate Structures above Predicted Floodwaters (not region specific)
(<http://ma.stormsmart.org/before/regs/using-freeboard-to-elevate-structures-above-predicted-floodwaters/>)
- Shoreline Management: Alternatives to Hardening the Shore (not region specific)
(<http://coastalmanagement.noaa.gov/shoreline.html>)
- Climate Change: Case Studies, NOAA Office of Ocean and Coastal Resource Management (not region specific) http://coastalmanagement.noaa.gov/issues/climate_casestudies.html
- Summary of Coastal Program Initiatives that Address Sea Level Rise as a Result of Global Climate Change (not region specific) http://seagrant.gso.uri.edu/z_downloads/coast_haz_slr.pdf
- Rolling Easements (not region specific)
<http://www.epa.gov/cre/downloads/rollingeasementsprimer.pdf>
- Climate Change and the Economy: Expected Impacts and Their Implications (not region specific) <http://www.bipartisanpolicy.org/library/report/climate-change-and-economy-expected-impacts-and-their-implications>
- Resource Management in a Changing and Uncertain Climate (not region specific)
<http://www.esajournals.org/doi/abs/10.1890/070146?journalCode=ftron>
- Facing Our Future: Adapting to Connecticut's Changing Climate
http://www.ct.gov/dep/cwp/view.asp?a=2684&q=436600&depNav_GID=1619#Sections
- Ecological Impacts of Climate Change (Northeast included) <http://dels-old.nas.edu/climatechange/ecological-impacts.shtml>
- Smart Growth for Coastal and Waterfront Communities (not region specific)
<http://coastalsmartgrowth.noaa.gov/report.html>

- The Faces of Climate Change Adaptation: The Need for Proactive Protection of the Nation's Coasts (not region specific) <http://coastalstates.org.seedevelopmentprogress.com/wp-content/uploads/2010/07/CSO-White-Paper-on-Climate-Change-Adaptation-May-2010.pdf>
- Conserving Coastal Wetlands for Sea Level Rise Adaptation (not region specific) <http://csc.noaa.gov/digitalcoast/wetlands/>
- Local Land Use Response to Sea Level Rise (not region specific) http://www.csc.noaa.gov/digitalcoast/inundation/_pdf/Pace_Final_Report.pdf
- Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies (not region specific) <http://dare.uvu.vu.nl/bitstream/1871/10440/1/f1.pdf>
- Climate Change and Conservation: A Primer for Assessing Impacts and Advancing Ecosystem-based Adaptation in the Nature Conservancy (not region specific) <http://conserveonline.org/worksheets/climateadaptation/documents/a-primer-for-assessing-impacts>

4. Georgetown Climate Center

- Adaptation Clearinghouse (<http://www.georgetownclimate.org/adaptation/clearinghouse>)

5. Regional Adaptation Collaborative (RAC) <http://adaptation.nrcan.gc.ca/collab/abosuje.php>

- This project will ultimately provide case studies that evaluate municipal planning capacity to respond proactively in several ACAS project communities. There have not been any updates provided as to how these studies have been compiled. *See* Atlantic Climate Adaptation Solutions Association, Municipal Preparedness for Climate Change in Nova Scotia: Evaluating Municipal Capacity to Respond to Climate Change through Adaptation (last visited Nov. 8, 2011), <http://atlanticadaptation.ca/node/198>.
- This project identifies the social and built infrastructure that is most at risk due to sea level rise and climate change and emphasizes the negative implications that are associated with this issue if no action is taken to protect them in the future. *See* Atlantic Climate Adaptation Solutions Association, An Evaluation of Social Vulnerabilities and Social Assets at Risk to Climate Change Impacts in Three Nova Scotia ACAS Communities (last visited Nov. 8, 2011), <http://atlanticadaptation.ca/node/199>.
- This document is meant to supersede the related section of existing “Flood Hazard Area Land Use Management Guidelines of 2004”, which was previously prepared by the B.C. Ministry of Environment. The document provides guidelines to assist local government officials and land use managers in implementing land use management plans and subdivision approval decisions for land exposed to sea level rise. B.C. MINISTRY OF ENVIRONMENT, CLIMATE CHANGE ADAPTATION GUIDELINES FOR SEA DIKES AND COASTAL FLOOD HAZARD LAND USE: GUIDELINES FOR MANAGEMENT OF COASTAL FLOOD HAZARD LAND USE (2011) available at http://atlanticadaptation.ca/sites/discoveryspace.upei.ca.acasa/files/BC%20coastal_flooded_land_guidelines%202011.pdf.
- This project provides a tool kit for municipalities focusing on implementing three steps, getting started, climate change issues and final report. At this time, the PEI Environment, Energy and Forestry Ministries are working with municipalities on identifying their vulnerable areas and identifying the best strategies to combat these effects. *See* Atlantic Climate Adaptation Solutions Association, Community Vulnerability Assessment for Prince Edward Island (last visited Nov. 8, 2011), <http://atlanticadaptation.ca/pei-community-assessment>.