

2010 Report

of the Climate Change

Insurance Advisory Committee



Introduction

In April 2007 by Executive Order, Governor Martin O'Malley established the Maryland Commission on Climate Change [Executive Order No. 01.01.2007.07 (2007)]. The Commission was tasked with developing "a Plan of Action to address the drivers and causes of climate change, to prepare for the likely consequences and impacts of climate change to Maryland, and to establish firm benchmarks and timetables for implementing the Plan of Action." [Executive Order No. 01.01.2007.07 (2007) at p. 2] The Climate Action Plan was issued in August 2008 (http://www.mde.state.md.us/assets/document/Air/ClimateChange/Report_1.pdf).

Chapter 2 of the Plan is an assessment of the consequences that changes in the climate will have on the agricultural industry, forestry resources, fisheries resources, fresh water supply, aquatic and terrestrial ecosystems and human health. The assessment was conducted by the Scientific and Technical Working Group of the Commission on Climate Change and was based on literature review and model projections. One component of this assessment was a review of coastal vulnerability. (Climate Action Plan, *Comprehensive Assessment of Climate Change Impacts in Maryland*, p. 3)

...Maryland has experienced considerable shoreline erosion and deterioration of coastal wetlands which are a critical component of its bays and estuaries.

Sea-level rise is very likely to accelerate, inundating hundreds of square miles of wetlands and land...

Rains and winds from hurricanes are likely to increase, but changes in their frequency cannot now be predicted. The destructive potential of Atlantic tropical storms and hurricanes has increased since 1970 in association with warming sea surface temperatures. This trend is likely to continue as ocean waters warm. Whether Maryland will be confronted with more frequent or powerful storms depends on storm tracks that cannot yet be predicted. However, there is a greater likelihood that storms striking Maryland would be more powerful than those experienced during the 20th century and would be accompanied by higher storm surges—made worse because of higher mean sea level—and greater rainfall amounts. (Climate Action Plan, *Comprehensive Assessment of Climate Change Impacts in Maryland 2*, p. 3)

The Adaptation and Response Working Group of the Commission on Climate Change was responsible for developing a Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change. The strategy recommended that the Governor and General Assembly take legislative and policy actions to:

- Promote programs and policies aimed at the avoidance and/or reduction of impact to the existing-built environment, as well as to future growth and development in vulnerable coastal areas.

- Shift to sustainable economies and investments and avoid assumption of the financial risk of development and redevelopment in highly hazardous coastal areas.
- Enhance preparedness and planning efforts to protect human health, safety and welfare.
- Protect and restore Maryland's natural shoreline and its resources, including its tidal wetlands and marshes, vegetated buffers, and Bay Islands, that inherently shield Maryland's shoreline and interior. (Climate Action Plan, *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change*, p. 8)

The Plan states that:

Due to sea-level rise and a likely increase in the intensity of coastal storm events, climate change will significantly impact the financial status of insurers and reinsurers, their ability to pay future claims, and consequently, the availability and affordability of insurance to Maryland's households and businesses. Maryland must take steps to maintain the insurability of financial investments. (Climate Action Plan, *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change*, p. 15)

As a result, the Plan established an Insurance Advisory Committee to advise the Insurance Commissioner and the Governor of the "risks that climate change poses to the availability and affordability of insurance" to consumers and business in Maryland. The Committee was asked to assess:

- The adequacy of data availability to insurers to assess risks posed by climate change, including sea-level rise, and recommend steps to improve data where it is deficient.
- The degree to which adaptive options, such as zoning that recognizes risks of building in high-risk areas and improved building codes to protect against more severe weather and flooding, may mitigate insured losses due to climate change, and whether insurance rate structures could be constructed that provide incentives for early adaptive actions.
- Options to promote partnerships with policyholders for loss mitigation. (Climate Action Plan, *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change*, p. 15)

The Climate Action Plan provided that the Committee be composed of citizens, business owners, members of civic and conservation organizations, representatives from the insurance industry, and local and state government representatives. After consultation with the Department of Natural Resources, the Committee was established in September 2008. The members are as follows:

- Joe Abe, Maryland Department of Natural Resources
- Ron Bowen, Director, Anne Arundel County Department of Public Works
- Dick Franyo, Annapolis Boatyard Bar & Grill
- Brice Gamber, Coastal and Watershed Advisory Committee
- David Guignet, Maryland Department of the Environment

- Joy Hatchette, Maryland Insurance Administration
- Bill Holley, Fireman's Fund Insurance Company
- Kate Imparato, Selective Insurance Company
- Zoe Johnson, Maryland Department of Natural Resources
- Andrew Kreinik, Baltimore Real Estate Agent
- Andrew Layard, CERES
- Sharlene Leurig, CERES
- Stefan Mueller, Allianz/Sustainable Enterprise Management, LLC
- Carver Struve, Maryland Emergency Management Agency
- Dave Unnewehr, American Insurance Association
- Sue Veith, Coastal and Watershed Advisory Committee

Structure and Function of the Insurance Industry in Maryland

The Maryland Insurance Administration ("MIA") is the state agency charged with regulating the business of insurance in Maryland. Headed by the Insurance Commissioner, the MIA is responsible for monitoring insurer solvency and compliance, investigating consumer complaints, reviewing insurance rates and forms, licensing producers and insurance companies and educating consumers statewide on a multitude of insurance issues.

All insurers who issue, sell or deliver property insurance in the State of Maryland must file all policy forms with the MIA and obtain the Commissioner's prior approval before those forms can be utilized by the insurer.

The Insurance Reform Act of 1995 [HB 923, Competitive Rating, (1995)] authorized insurers to use rates for certain lines of property and casualty insurance without the prior approval of the Commissioner. Each authorized insurer and each rating organization designated by an insurer for the filing of rates must file with the Commissioner all rates and supplementary rate information as well as any changes to rates or supplementary rate information on or before the date they become effective. [See *Maryland Annotated Code, Insurance §11-307 (2003)*]. In accordance with ratemaking principles, rates may not be excessive, inadequate, or unfairly discriminatory. Under competitive rating, the Commissioner may only find a rate to be excessive if it is unreasonably high for the insurance provided *and* the Commissioner has issued a ruling that a reasonable degree of competition does not exist in the market to which the rate is applicable. [See *Maryland Annotated Code, Insurance §11-306 (2003)*].

States moved from prior approval of rates to competitive rating to allow insurers to react quickly to business cycles. When claims experience is favorable, it is anticipated that insurers will generally act to decrease rates and/or relax underwriting restrictions to increase their market share. When claims experience deteriorates, it is anticipated that insurers will generally act to increase rates and/or tighten their underwriting standards to accept less risk. Proponents of competitive rating maintain that competition between insurers prevents excessive rating even during a downturn in the business cycle because no insurer is willing to raise rates to the point where it will lose significant market share to one or more of its competitors. Moreover, competition

encourages insurers to accept more risks, making insurance widely available to consumers.

Section 19-107 of the Insurance Article sets forth the requirements when an insurer seeks to refuse to underwrite (issue) or renew certain types of insurance based solely on the geographic location of the risk [Maryland Annotated Code, Insurance §19-107 (2006)]. Specifically, §19-107 of the Insurance Article states:

(a) An insurer may not refuse to issue or renew a contract of motor vehicle insurance, property insurance, or casualty insurance solely because the subject of the risk or the applicant's or insured's address is located in a certain geographic area of the State unless:

(1) at least 60 days before the refusal, the insurer has filed with the Commissioner a written statement designating the geographic area; and

(2) the designation has an objective basis and is not arbitrary or unreasonable.

(b) A statement filed with the Commissioner under this section is a public record.

[Maryland Annotated Code, Insurance §19-107 (2006)]

Currently, under §19-107, a carrier who wishes to refuse to issue or renew a contract of property insurance solely on the basis of the geographic area where the property is located must file a written statement designating the geographic area with the Commissioner 60 days before the change is implemented and that designation must have an objective basis and cannot be arbitrary or unreasonable [Maryland Annotated Code, Insurance §19-107 (2006)]. Underwriting is the process by which a company decides whether it should issue a policy and, if so, on what terms. A filing under § 19-107 is not subject to the Commissioner's prior approval, but is made pursuant to Maryland's "file and use" system. This means that 60 days after providing its notice to the Commissioner, the carrier may begin implementing its geographic restrictions.

Availability and Affordability of Property Insurance in Maryland

As a part of the 2007 legislative session, the Maryland General Assembly enacted House Bill 1442 (Chapter 486) which required the establishment of a "Task Force on the Availability and Affordability of Property Insurance in Coastal Areas." The Task Force examined:

1. the availability and affordability of homeowner's insurance and other property insurance in coastal areas of the State, including the Eastern Shore and Southern Maryland, and whether there is sufficient competition within those areas;
2. the current number and types of insurers in the coastal markets, including admitted carriers, excess and surplus lines carriers, residual market mechanisms, captives, and the reinsurance market, and the types of products offered;
3. the competition and rate adequacy in the coastal markets for storm-related perils;

4. the impact of coastal markets on the availability and affordability of property insurance in noncoastal areas and the costs associated with spreading property insurance risks among homeowners across the entire State;
5. the regulatory framework within the State for the pricing and underwriting of property insurance, including the use of named storm deductibles;
6. the development and evolution of storm modeling and its use by the insurance industry in the assessment of potential losses from significant storms and the need for a regulatory framework in the use of storm modeling;
7. potential structural protections for properties in coastal areas that would result in the mitigation of storm damage in coastal areas and the extent to which such mitigation has had a beneficial impact on the availability and affordability of property insurance in other states;
8. the ability of the State to influence patterns of real estate development in coastal areas in a manner that minimizes future exposure of the State and Maryland residents to severe storm damage to property.
9. the effectiveness, cost, and long-term viability of alternative market mechanisms, such as limited coverage products, wind pools, the expansion of residual market mechanisms, and catastrophe funds that have been implemented or are being considered in other states or by the federal government;
10. initiatives adopted in other states to increase availability and affordability of property insurance in coastal areas; and
11. any other matter the Maryland Insurance Commissioner deems relevant to the availability and affordability of homeowner's insurance in coastal areas of the State.

As a result of its review and deliberations, the Task Force made the following recommendations:

1. Require any insurer that seeks to refuse to underwrite or renew a risk based solely on the fact that the risk is located in a certain geographic area to obtain the prior approval of the Insurance Commissioner. This recommendation would require legislation to amend the existing law, Section 19-107 of the Insurance Article.
2. Require any insurer that seeks to use catastrophe modeling as a basis for its rating and/or underwriting to have its catastrophe model reviewed and approved for use by the Insurance Commissioner. This recommendation would require legislation that would be supplemented by regulation.
3. Require any insurer that seeks to apply a mandatory and separate deductible for losses arising out of a hurricane or named storm in an amount greater than 5% to obtain the prior approval of the Insurance Commissioner. This recommendation would require legislation as the Insurance Article currently has no such restriction.
4. Require any insurer that seeks to apply a separate deductible for losses arising out of a hurricane or named storm to advise the insured of this separate deductible and its amount in the Annual Summary of Coverages and Exclusions as required by Section 19-205 of the Insurance Article. This recommendation will require amendment to the existing statute.

5. Require any insurer that seeks to apply a separate deductible for losses arising out of a hurricane or named storm to have common language that operates as a trigger for the application of the deductible. It is recommended that a hurricane or named storm deductible be triggered when the National Weather Service has issued a Hurricane or Named Storm warning for the State of Maryland and that it will be removed 24 hours after the National Weather Service has cancelled the Hurricane or Named Storm warning or watch. This recommendation will require legislation as the Insurance Article does not address this matter.
6. Require the development of a statewide building code that applies to all new construction and major renovations (equating to more than 50% of the property) with the requirement that residential dwellings meet the International Residential Code and commercial construction meet the International Building Code. This recommendation will require legislation.
7. Encourage mitigation efforts by requiring insurers to provide a discount on the policy premium for those insureds who undertake mitigation efforts to protect their properties in the event of a loss. Identifying the mitigation efforts that will entitle an insured to a discount and the amount of the discount will be established by the Insurance Commissioner in regulation. This recommendation will require legislation that can be supplemented by regulation.
8. Provide the Commissioner with the authority to take the necessary actions, with respect to submission of claims, grace period for payment of premiums, postponements of cancellations and nonrenewals, and other powers as needed to protect the citizens of the State when the Governor has declared a state of emergency. This recommendation will require legislation as the Insurance Article does not currently provides the Commissioner with this type of authority.
9. Request the Maryland Insurance Administration to study the desirability and feasibility of a State Catastrophe Fund.
(Report of the Task Force on the Availability and Affordability of Property Insurance in Coastal Areas, March 2008, pp. 5-8, <http://www.mdinsurance.state.md.us/sa/documents/TaskForce-PropertyInsuranceCoastalAreas-0308.pdf>).

The recommendations of the Task Force on the Availability and Affordability of Property Insurance in Coastal Areas were taken very seriously by the Insurance Administration, as well as the Maryland General Assembly. In response to the report, legislation was introduced to incorporate most recommendations into Maryland law. Chapters 95 and 540, Acts 2008 enacted sections 19-209 through 19-212 of Maryland Code Annotated, Insurance. Those sections of the Insurance Article implement recommendations 3 through 7, while Section 2, Chapter 63, Acts 2008 added Section 2-115 to Maryland Code Annotated, Insurance, codifying recommendation 8. With respect to the second recommendation, insurers must advise the MIA if they are using catastrophe models and have those models available to the MIA for review upon request. In addition, regulations have been adopted to support these recommendations.

<http://www.mdinsurance.state.md.us/sa/documents/2009ReportCompetitiveRatingfinalpl>

us01-07-10.pdf [See Maryland Regulations Code Title 31.01.02 (2009) and Maryland Regulations Code Title 31.08.12 (2010)]. As a result of the task force report and the subsequent legislation, Marylanders now benefit from greater consumer protection with respect to policies of property insurance underwritten in coastal areas.

In January 2010, the Maryland Insurance Administration issued its "2009 Report on the Effect of Competitive Rating on the Insurance Markets in Maryland" (http://www.mdinsurance.state.md.us/sa/documents/2009ReportCompetitiveRatingfinal_plus01-07-10.pdf). This report found that Maryland consumers continue to have a variety of choices with respect to insurers, products and price.

Specifically, the report found that during calendar year 2008, there were 117 companies actively providing homeowners insurance in Maryland. Of the 117 actively writing homeowners insurance, 44 are a part of the top ten insurer groups.

The market share for the top ten insurer groups increased between 2003 and 2008. In 2003, these top ten insurer groups accounted for about 80 percent of the homeowner's insurance market increasing to about 86 percent by 2008. Over this six year period, the market share for Allstate, Travelers, Liberty Mutual, and Fireman's Fund increased and the market share for Nationwide, Erie, USAA, Chubb, and Zurich has fluctuated somewhat, but have basically remained stable, while State Farm and the Joint Insurance Association's (JIA's) market share decreased. Using the market share for each of the top ten insurers for Maryland 2008, the Heinfindchl-Hirschman Index (HHI)¹ for Maryland is 1137, up from 1065 for 2003, suggesting a minimally concentrated market. (2009 Report of the Effect of Competitive Rating on the Insurance Markets in Maryland, p. 5)

The 2009 Report concluded that:

For homeowner's insurance, the small market share for the residual market is an indication of a competitive market. However, the unwillingness of some insurers to write homeowner's insurance in certain portions of the state may be a sign that this market could become concentrated.

The MIA will continue to monitor both markets for changes in market concentration, competitiveness and availability. (2009 Report of the Effect of Competitive Rating on the Insurance Markets, p. 7).

Climate Change and Insurance

In December 2005, the National Association of Insurance Commissioners (NAIC) held a public hearing to discuss the implications that climate change would have on insurers and insurance consumers. As a result of this hearing, the NAIC created the

¹This is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. The HHI takes into account the relative size and distribution of the firms in a market and approaches zero when a market consists of a large number of firms of relatively equal size. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases.

Climate Change and Global Warming Task Force, which was tasked with drafting a white paper that documented the impact of climate change on insurance consumers, insurers and insurance regulators. The White Paper was finalized in 2008 [The Potential Impact of Climate Change on Insurance Regulation, National Association of Insurance Commissioners (NAIC, 2008)].

The White Paper noted that to the extent that climate change impacts an insurer's solvency (for example, investments in real estate in a coastal area or new investment opportunities that become available as a result of changes in technology) insurers, regardless of line of business, should review their portfolios and make adjustments where necessary in light of the real estate risk and the investment opportunities [The Potential Impact of Climate Change on Insurance Regulation (NAIC, 2008), pp. 1-2]. The White Paper notes that property and casualty insurers and regulators should work together to understand the exposure to risks and methods that can be implemented to reduce those exposures (for example, loss mitigation and improving building codes.) Consumer education is a key component to these efforts.

Adequacy of Data and Tools

The NAIC White Paper also advises insurance regulators to "review studies made by or on behalf of the insurer using catastrophe modeling." [The Potential Impact of Climate Change on Insurance Regulation, National Association of Insurance Commissioners (NAIC, 2008), p. 2]. This admonition results from the insurance industry's acceptance of and reliance upon catastrophe models to manage their risk portfolios. Catastrophe models were developed to better measure, estimate or quantify risk. Many factors and data, including scientific, engineering and economic, are incorporated into the models. As such, insurers consider them to be integral to their operations. Some background on the evolution of catastrophe models follows.

From the late 1800s through the late 1900's, there were many advances in our ability to understand and measure the impact of naturally occurring events. The identification of fault lines helped to predict where earthquakes were likely to strike, while an analysis of hurricane landfalls and tornadic activity increased awareness of the conditions that facilitated frequency and severity of occurrence. The seismograph, Richter scale and Modified Mercalli Intensity scale emerged as the primary measures of earthquake zones and severity. The Saffir-Simpson scale categorized hurricane wind speed and storm surge on a scale from one to five and the Fujita-Pearson Tornado scale clocked wind speed and the type of damage that would result on a scale from F0 through F5. [Introduction to Emergency Management: Natural and Technological Hazards and Risk Assessment (Haddow and Bullock, 2006), pp. 24-27]. Classifying an event after its occurrence by applying one of these scales assisted the scientific community, property owners, government agencies and insurers in identifying the type of damage to expect; however, the scales could not predict how great the economic impact would be.

Insurance companies are primarily concerned with the level of economic damage caused by a peril contained in the policy. In its most basic form, insurance is the transfer of risk from the owner of property to the insurer in exchange for the payment of

premium. For hundreds of years, insurers have underwritten policies and assumed the risk of loss. To remain solvent, which risks to cover, where those risks are located and how much premium to charge are the fundamental questions for which insurers need answers. The principle challenge for any insurance company is to accurately identify, quantify and manage the risk being assumed. While actuarial principles were applied by the insurers, there have been instances, especially after catastrophic events such as Hurricane Andrew in 1992, when insurers underestimated the probability of a loss occurring, the level of damage caused and the amount of premium to charge for the risk assumed. As a result, a number of insurers were declared insolvent.

Catastrophe models were thus formed at the mathematical intersection of science and risk management in the late 1980's. According to Grossi in *An Introduction to Catastrophe Models and Insurance*:

Computer based models for measuring catastrophe loss potential were developed by linking scientific studies of natural hazard measurements and historical occurrences with advances in information technology and geographic information systems (GIS). The models provided estimates of catastrophe losses by overlaying the properties at risk with the potential natural hazard(s) sources in the geographic area. With the ability to store and manage vast amounts of spatially referenced information, GIS became an ideal environment for conducting easier and more cost-effective hazard and loss studies (An Introduction to Catastrophe Models and Insurance (Grossi, Kunreuther, and Windeler, 2005), p. 24].

Thus, by gathering historical scientific information related to natural disasters, utilizing computer and GIS technology to capture information regarding property located in a specific area and overlaying financial data, such as the amount of damage caused by the events, algorithms were devised. The models ultimately were validated based upon this past experience. As a result, the models were used to predict the future probability of an event's occurrence and the likely financial loss.

The models were not used widely, though, until the late 1990's. By that time, several natural disasters negatively impacted the insurance industry, including Hurricanes Hugo and the aforementioned Andrew in 1989 and 1992, respectively and the Northridge Earthquake in 1994. As a result, by 1996 rating agencies began requiring insurers to provide catastrophe loss information before assigning a grade [Task Force on the Availability and Affordability of Property Insurance in Coastal Areas (March 2008), p. 18]. The federal government also was interested in this technology for emergency planning and mitigation purposes. After studying the existing technology, the government funded the development of Hazards U. S., otherwise known as HAZUS, a publicly available catastrophe model.

There are generally four components to catastrophe models: hazard, inventory, vulnerability and loss. The hazard component may include tornadoes, hurricanes, flooding and earthquakes where the parameters being measured are wind speed, direction, storm surge and moment magnitude, among others. Inventory consists of all properties located in the specific area or region being evaluated. Vulnerability analysis

is conducted by overlaying the hazard and inventory components. This analysis considers not only the number and location of the buildings, but also the construction methodology utilized, the height and age of the buildings, as well as any insurance policy information that may exist to better calculate the likelihood of loss from a particular hazard exhibiting specific characteristics. Finally, the loss component is calculated based upon the direct costs of a catastrophe (the costs to repair or replace the building and/or its contents) and the indirect costs (business interruption and/or additional living expenses). While each model may differ in its calculations by weighting certain components more or less heavily, the ultimate goal is to calculate the probable maximum loss a particular event will cause to a region with a certain level of confidence.

For an insurance company, based on its regulatory capital and surplus requirements, there is only a certain level of risk that can be legally borne. The catastrophe models are used to determine the likelihood that this level could be exceeded. This figure is often referred to as the exceedance probability. By determining the probable maximum loss and the exceedance probability, catastrophe modeling provides insurers the information necessary to make better risk management decisions. Models complement traditional actuarial techniques that may fail to accurately capture low frequency/high severity catastrophe risks that have limited historical data or are dynamic in nature, which is the case for many climate change related risks. Once provided this information, insurers have a number of options to consider. They include refusing to underwrite risks located in certain areas, reducing the types or amount of coverage in the policies, charging higher premiums for the coverage provided, purchasing reinsurance for catastrophe events that cause damage in excess of a certain amount and/or securitizing the risk by issuing catastrophe bonds or other derivative products. In addition, insurers can also encourage their policy holders to undertake mitigation and/or hardening measures that would reduce both the probability of loss and the financial impact, in exchange for premium discounts or reduced deductibles. Given this, the insurance industry relies heavily on catastrophe models to determine which of the options, or combinations thereof to pursue not only to maintain solvency, but also to operate profitably. As such, policy holders, regulators, rating agencies, reinsurers, investment banks and investors also have an interest in how the catastrophe models have been developed and how they are being utilized by the insurers.

While the use of models has gained more wide spread acceptance within the insurance industry since their introduction in the late 1980's, there are still a number of concerns regarding the industry's reliance upon them. Like any other computer application, the result retrieved from the model can only be as good as the information that has been input. There are still uncertainties and unknowns with respect to the data entered into the hazard and inventory components. For example, there is a finite amount of historical information regarding the tracks of hurricanes making landfall within the US. Based on this limited information, it becomes clear that certain areas are more likely to be impacted by a hurricane than others. Additionally, depending on other factors, such as sea surface temperatures, topography of the land and wind speed, the frequency of occurrence, location and/or direction of a hurricane's path may vary from these historical norms. A model can be used to simulate various scenarios, such as if

wind speed is x , and the direction is y and sea surface temperatures are above z , then where will the hurricane likely make landfall? The possibilities are numerous. While the models can simulate where the hurricane will strike given a set of parameters, the model can never predict when.

In addition, if the ultimate goal is to determine the financial impact, how accurate is the data regarding the infrastructure and buildings that exist within the region being modeled? Information on the housing and commercial property stock can be gleaned from public sources, such as property sales and tax assessment records, but does that reflect the cost to actually repair or replace the structure (and its contents) in the event of a loss? This information may also be gleaned from data insurance companies obtain when underwriting risks; however, many insurers may not capture anything more than the square footage, number of stories, type of construction and age of the building, which may or may not be completely accurate or current. A property owner may modify the building without advising the insurer, or the insurance company representative may accidentally enter erroneous information into its system. In addition, it may also be difficult to determine whether any additions, changes or modifications were built to the prevailing codes. If incomplete information exists, the model will compensate by classifying the construction component based upon a "typical building" within the region. Any deviation between the actual building and a typical building will skew the output.

According to Grossi and Windeler:

Natural hazard, engineering and economic data are the foundation of catastrophe models. Limitations in data and assumptions about the model's parameters, in the hazard, inventory and vulnerability modules, affect a catastrophe model's loss estimates and the uncertainty associated with these estimates. [Grossi & Kunreuther *Catastrophe Modeling: A New Approach to Managing Risk, Sources, Nature and Impact of Uncertainties on Catastrophe Modeling* (Grossi & Windeler, 2005), p. 69].

Judgment calls, expert opinions, estimates and assumptions all play a part in the creation of catastrophe models. The more incomplete or unavailable the scientific, engineering or economic data is, the more uncertainty is introduced into the model by the developers substituting their judgments, opinions, estimates and assumptions. Therefore, the acquisition of accurate and complete data is imperative if the model is to maintain predictive value.

While the availability of data has increased substantially since catastrophe models were first introduced, modeling for catastrophes in an era of climate change simply adds another level of uncertainty to the equation. How quickly will sea levels rise? What impact will sea level rise have on sea surface temperatures? What effect will the combination of an increase in sea level and sea surface temperatures have on storm surge? Satellite technology, GIS mapping and better monitoring will assist in providing improved information to those developing and utilizing the models. The accuracy of models will depend on public and private sector investments, not only in the technical advancement of models themselves, but also in the availability, regional scope and reliability of underlying climate change impact data. Improvements are needed in

the collaborative dialogue between insurers and other stakeholders on the front-lines of adapting to climate risk and our nation's scientific community. Recent federal investments in the U.S. Global Change Research Program and the prototype Climate Services platform launched by NOAA exemplify the types of programs needed at the state level. Initiatives such as these should generate user-oriented scientific assessments of the effects and consequences of a changing climate, improve modeling of impacts and vulnerabilities and aid in prioritizing targeted loss-reduction mitigation measures.

Identifying and Evaluating Adaptive Options for Mitigating Losses

Adaptation to future climate impacts should be an integral part of housing improvement in order to mitigate losses. Insurers can enable individuals to understand the importance of investing in adaptation strategies by setting premiums at a level which reflects the underlying risk. While some progress is being made on designing and building new homes in a sustainable way, widespread adaptation of existing homes in areas subject to sea level rise and coastal storms is crucial to reducing the scale and scope of climate change impacts.

Adaptation is not "one-size fits all". This chapter will explore adaptation strategies in some detail, however, a comparison of options which examines the benefits, costs, feasibility and adaptive capacity should be completed in order to determine which strategies to implement and on what timeframe. The criteria described below would help ensure consistency in describing and evaluating adaptive options in the second phase of the CCIAC. The goal would be to create a table for decision-makers to view the efficacy of various options.

Proposed Framework for Evaluating Adaptive Options²

Benefits: This criterion addresses the extent to which the adaptation policy reduces vulnerability and provides other benefits. Essentially, this criterion compares vulnerability without adaptation and vulnerability with adaptation. This difference in vulnerability can be thought of as the primary benefit of the adaptation option. Ancillary- or co-benefits should explicitly be considered if the adaptation option provides benefits to other sectors or for other policy objectives. This criterion can indicate relative differences in effectiveness between multiple policy alternatives. For example, creating water markets to promote more accurate accounting of the real value of increasingly scarce water resources may not be as effective at reducing demand as incentivizing water efficiency measures (i.e., more benefits may be realized under the latter scenario). This criterion also includes the concept of flexibility, narrowly defined as a policy option that provides benefits (or can be adjusted to provide benefits) under different plausible climate scenarios. For example, building a dam exactly 15-foot-tall provides no flexibility should increasing precipitation require a 20-foot-tall dam, while

² These criteria are borrowed from Florida's Governor's Action Team on Energy and Climate Change and ADAPTING TO CLIMATE VARIABILITY AND CHANGE: A GUIDANCE MANUAL FOR DEVELOPMENT PLANNING (US AID, August 2007).

designing a 15-foot-tall dam to allow for relatively inexpensive incremental increases to its height increases its flexibility.

Costs (or Capital Intensity): This criterion concerns whether an adaptation is relatively expensive or inexpensive to implement. Typically, costs include the initial funds needed to implement an adaptation policy. However, costs over time, such as operation and maintenance, administration and staffing, expected frequency of reconstruction, and so forth should also be considered. An accounting of costs should include non-economic and nonquantifiable costs, as well as economic and quantifiable costs. For example, costs, such as a reduction in viable habitat for significant species or an increased impact on human health, should be considered alongside more traditional costs.

Feasibility: This criterion addresses whether the action can be implemented. Do the necessary legal, administrative, financial, technical, and other resources exist, and are they available for use on this policy option? This typically means adaptations that can be implemented under the current operational framework will be favored over adaptation options that require new authority, new technology, changes in people's preferences, or other significant changes in the operational context. Feasibility also includes the concept of a "window of opportunity." For instance, most planning decisions undergo a periodic review, such as, every 10 or 20 years. If one of these planning documents is up for reconsideration, then a window of opportunity exists that makes the adaptation option more feasible. Windows of opportunity can also be created when the political landscape is propitious or when response is required following a disaster. The three criteria listed above may be sufficient for use in ranking adaptation policy options. They will work best when applied to adaptation options designed to meet similar goals.

Adaptive Capacity (or Capacity): Adaptive capacity describes the ability of a human or natural system to cope with the consequences of climate change. Some systems can accommodate changes in climate without significant intervention while other systems cannot. For example, most hard infrastructure (e.g., roads, bridges, coastal buildings) cannot alter their alignment, elevation, or structural foundation to accommodate coastal erosion or increased flood risk. On the other hand, farmers have historically responded to natural climate change by modifying farming practices or planting different crops. Consequently, adaptive capacity is lower for hard infrastructure than for agriculture. Some policy options will increase adaptive capacity, such as developing emergency management plans, while other policy options may decrease adaptive capacity, such as developing infrastructure in a floodplain. Notably, increases or decreases in adaptive capacity are typically independent of future changes in climate: developing emergency management plans increases adaptive capacity under all plausible future climate conditions and developing infrastructure in a floodplain decreases adaptive capacity under all plausible future climate conditions.

Timing/Urgency: Some climate impacts are not expected to occur for many decades, while others are already being observed or are likely to become apparent within a few decades. For example, sea level is projected to rise slowly over the course of many decades, while the frequency and intensity of coastal storms and heavy precipitation events is already observable.

Timing/Preferred Implementation Plan: Some options can be implemented very quickly with widespread support. Others may require years of building support and planning, followed by years of construction, followed by years of operation and maintenance. In some instances, wait and see or a phased approach may work best.

Climate Adaptation Options Identified by the CCIAC

Adaptation strategies aimed at mitigating losses generally fall into three categories:

- Make the environment less hazardous by maintaining and enhancing natural protective features,
- Make structures more resistant to climate change hazards, and
- Manage the development and redevelopment of land with regard to climate change hazards.

Make the environment less hazardous by maintaining and enhancing natural protective features

Natural resource protection - Retain and expand forests, wetlands, and beaches to buffer storm surge and wave risks, retain floodwater, and lessen coastal erosion. This can be accomplished through various approaches, including regulations, financial incentives, and enforcement approaches in areas suitable for long-term survival.

Conservation Easements - Placing restrictions on a piece of property to protect the resources (natural or man-made) associated with the parcel, while prohibiting certain types of development (residential or commercial) from taking place on the land. This tool can be applied to maintain the natural protective features, to restrict development or redevelopment of hazardous areas, and/or to provide sufficient lands for wetland migration.

Make structures more resistant to climate change hazards – According to the Federal Alliance for Safe Homes (FLASH), for every \$1 invested in mitigation, between \$5 - \$7 is saved on future losses. The Institute for Business and Home Safety (IBHS) further supports this concept of mitigation in its “Code Plans” program for new construction. The program indicates that although the construction cost may increase from 3-10%, this increase is paid for due to less damage in the event of a disaster.

Building codes and construction standards - Establishment and enforcement of consistent ordinances, building codes, and construction standards. Strengthen standards and techniques relative to debris resistance, flood resistance, and wind resistance for new infrastructure and buildings in vulnerable coastal areas. Consider utilizing ISO tools such as the Building Code Effectiveness Grading Schedule (BCEGS).
Examples of specific options:

- *Base flood elevations and freeboard requirements* - Incorporate future conditions into BFE determinations; require an additional 2 or more feet of freeboard to accommodate sea level rise and increased storm surge.
- *Engineered foundations* - An engineered foundation system is one that has been specifically designed to be resilient and resistant to flooding. This can help maintain stability and limit structural damage if the building is exposed to severe flooding,

rapidly flowing water or waves. The system might include strengthened anchorage, improving resistance to erosion caused by flooding, and construction with impermeable materials. Engineered foundations are generally applied to new buildings, but may be added to existing structures that are at high risk of severe flooding.

- *Building envelope* - Continually review and improve building envelopes (entire exterior surface of building, including walls, windows, doors, and roofs) to ensure proper protection from wind, wind pressure, and wind-borne debris.
- *Reinforced cladding* - Reinforced cladding, the protective layer covering the exterior structure of a building, can limit structural damage in the event of flooding by resisting the pressure of water on the building and reducing damage from any flood-borne debris. This measure provides most benefit for buildings exposed to fast-flowing water or severe flooding.
- *Protection of external electrical and mechanical equipment* - Raising outside electrical and mechanical equipment (lighting, garden equipment, security systems, gas meter, etc.) above potential water levels can reduce or eliminate damage. Adapting a property in this way can be particularly cost-effective if carried out during the course of repair or renovation.

Drainage systems - Evaluate and update storm water management systems to cope with extreme precipitation events and larger volumes of water.

Wind-retrofitting - Facilities and private residences that are at risk from hurricane-force winds should use hurricane shutters, hurricane clips, tie downs, doorway reinforcements, and other wind-retrofit measures. These measures could be incorporated into hazard mitigation and/or emergency management strategies.

Manage the development and redevelopment of land with regard to climate change hazards

Overlay districts - Overlay districts are used to apply additional regulations to land uses beyond those that apply to the underlying districts. The creation of an Overlay District would create codes to minimize potential loss of life, destruction of property, and environmental damage inevitably resulting from storms, flooding, erosion and relative sea level rise. These requirements would take precedence over those of an underlying land use or zoning district.

Site design regulations and performance standards - Apply V-zone standards to structures built in "coastal A- zones" - These include performance requirements concerning resistance to flotation, collapse, and lateral movement; and prescriptive requirements concerning elevation, foundation type, engineering certification of design and construction, enclosures below the base flood elevation, and use of structural fill.

Setbacks and buffers - Increase coastal setback requirements to accommodate erosion, sea level rise and storm surge. This would typically apply to new development, but also may be imposed on non-conforming structures that are substantially damaged after a disaster where there is sufficient room on the lot for the structure to be rebuilt in a different location.

Incentive zoning - A tool that allows developers to exceed certain zoning restrictions, such as density or height, in return for providing additional protective measures or making additional concessions. Incentives may be offered for maintaining or enhancing the natural protective features of a site, for encouraging development to avoid hazardous areas, or for providing additional safety features such as safe rooms. While this is primarily a tool for new development, it is applicable for re-development as well.

Subdivision ordinances and zoning - Provide the option of concentrating development within a portion of a subdivision, thus leaving a portion of the land undeveloped. This may be used to preserve open space, to protect sensitive environmental features (including natural features such as wetlands and dunes that provide protection against natural hazards), or to avoid building in hazardous areas.

Capital expenditure policies and programs - Capital investments, such as roads, water supply, and wastewater collection and treatment systems, can substantially influence the location, timing, and intensity of development. Climate change projections should be incorporated into policies and programs about where, when, and how long to provide public services and infrastructure.

Outreach and Education

Education and information programs designed to inform the public about climate change impacts and what they can do about them can play a significant role in the success of implementing voluntary and regulatory adaptation strategies. Initiatives directed towards property owners and developers are important for building and maintaining support for new and existing strategies for reducing risk. Specific examples include:

- *Risk maps* - Provide online consumer access to maps of areas that are most vulnerable to sea level rise and those areas that may require a two-foot freeboard. Combine online maps with broad-based public awareness campaigns.
- *Sea level rise disclosure and advisory statement* - Inform prospective coastal property purchasers of the potential impacts of climate change to a particular property, including general information about risks associated with sea level rise, coastal storms, and shore erosion.
- *Flood insurance disclosure* - Educate the insured community about the need to purchase flood insurance and that homeowners' policies do not cover flood damage.

Promoting Partnerships and Using Rating-Based Incentives

Promoting partnerships and using incentives to modify behavior are vital to effective climate adaptation. Key steps include identifying key stakeholders to engage, using existing partnerships, building new alliances, developing incentives for stakeholders to adapt to climate change, and continuing Maryland's Coast-Smart Communities initiative, an important tool for engaging communities regarding climate adaptation issues and choices.

a) Key Stakeholders to Engage

How do you decide which stakeholders to involve? In identifying stakeholder affected by climate change, Robert Repetto³ identified three criteria for selecting organizations:

- “their operations, investments or missions that are vulnerable to climate change
- they are making or planning long-term fixed investments or long-running programs which will inevitably feel the effects of climate change; and
- they have the organizational capacity to forecast and plan.”

In addition to these, it is important to include organizations that:

- have the ability to shape the underlying causes of climate change and thus the magnitude and duration of climate change impacts;
- can communicate, motivate and lead effective change at all levels; and
- can develop breakthrough solutions through collaboration across diverse groups.

The following organizations fit the above criteria:

- Financial and insurance companies
- Federal and state insurance regulators
- Natural resource management and environmental protection agencies
- Nonprofit organizations (especially those that build collaborative partnerships across diverse interests)
- Communication media
- Disaster management agencies
- Energy, telecommunication and water utilities
- Public health and disease prevention agencies
- Local governments
- Transportation agencies and companies
- Regional planning organizations
- Economic development and trade organizations
- Construction and real estate industry and trade associations
- International, national and local building code organizations
- Energy resource development companies and trade associations

b) Use Existing Partnerships

There are a number of existing partnerships working on the insurance and climate adaptation, including:

³ Robert Repetto, “The Climate Crisis and Adaptation Myth”, Working Paper Number 13, Yale School of Forestry and Environmental Studies

Business for Innovative Climate and Energy Policy (BICEP) <http://www.ceres.org/bicep>
 Investor Network on Climate Risk <http://www.incr.com/>
 ICLEI – Local Governments for Sustainability <http://iclei.org/>
 Transition Towns <http://www.transitiontowns.org/>
 Global Climate Adaptation Partnership <http://www.climateadaptation.cc/>
 Coastal Climate Adaptation http://collaborate.csc.noaa.gov/climateadaptation/default.aspx?option=com_docman&task=doc_details&qid=389&Itemid=32

Maryland should identify how these and other groups might help build awareness, legitimacy and influence to overcome the many barriers to climate adaptation.

c) Build New Alliances

While tapping existing partnerships makes sense for a number of reasons, there are some significant advantages and reasons for building new alliances for adapting to climate change. Different groups often have varied capacities, perspectives, and stakeholder relationships that when combined can achieve results that could not be achieved independently.

Preparing Baltimore for Climate Change

Coastal communities around the world are taking climate adaptation seriously. Coastal urban areas can be particularly vulnerable because of investments, infrastructure and population density. Both London <http://www.london.gov.uk/climatechange/> and New York City http://www.nyc.gov/html/planyc2030/html/plan/climate_citywide.shtml, for instance, are taking significant steps toward climate adaptation. Maryland is already working with New York State on a number of regional issues. How might Baltimore build on their and other cities' experiences to tailor a strategy that fits its needs?

Engaging the Business Community

Increasingly, businesses and the investment community are calling for action on climate change because they are already experiencing threats to their own long-term prosperity. Importantly, the Securities and Exchange Commission recently ruled that publicly traded companies should warn investors of any serious risks that global warming might pose to their businesses. <http://www.nytimes.com/2010/01/28/business/28sec.html>

Building alliances between diverse interest groups requires a sharp vision of stakeholder interests and priorities and finding ways to meld these stakeholder perspectives into a win-win strategy. As described in more detail in chapter 8, the State is already pursuing a strategy to build Maryland's green economy. Climate adaptation needs to be folded into the green jobs movement to help realize near term needs, such as jobs and a restored economy, and longer-term needs such as sustainable, resilient communities. <http://www.governor.maryland.gov/pressreleases/100714.asp>

As described in Chapter 6, making the environment less hazardous by maintaining and enhancing natural protective features is an important part of Maryland's Climate Action Plan. Realizing this goal will likely involve building new alliances beyond traditional boundaries. Many conservation groups work to preserve, protect and create wetlands and forests primarily for water quality and habitat. Wetlands and forest also provide services to help mitigate flood risk, reduce urban heat buildup and pollution, and help sequester carbon dioxide. While there are several groups working on environmental markets to reduce pollution (via nutrient and carbon trading) or habitat protection and creation (wetlands banking), these efforts do not yet appear to capture the value of risk reduction related to flood mitigation. This may be a ripe area of potential collaboration among these diverse interests.

Working with Other States Leading in Climate Adaptation

Other states such as California <http://www.climatechange.ca.gov/adaptation/> and Florida are, like Maryland, leading climate adaptation efforts in the U.S. How can States build on each others strengths? Importantly, Maryland could use existing networks described previously to build new alliances that address our particular needs and challenges while sharing our tools and experience.

d) Incentives for Stakeholder to Implement Adaptive Options

Property Assessed Climate Action (PACA) Bonds

Local governments, businesses and citizens need access to financial resources and incentives to implement Maryland's Climate Action Plan, including energy efficiency upgrades, renewable energy system installations, and retrofits that reduce climate risks and build resiliency within communities and infrastructure. All of the above actions can also help stimulate a green economy, including green jobs, local circulation of money, increased savings by homeowners and businesses, and new markets and business opportunities.

In 2009, Maryland passed HB 1567, Clean Energy Loan Programs, that gives Maryland local jurisdictions the authority to develop and manage Property Assessed Clean Energy (PACE) funds. <http://mlis.state.md.us/2009rs/bills/hb/hb1567e.pdf>. PACE bonds (see insert box) provided by participating Maryland communities can help homeowners and business fund clean energy retrofits such as energy efficient windows and renewable energy systems such as solar systems or wind turbines.

Property Assessed Clean Energy ("PACE") Finance Defined (www.Pacenow.org):

A PACE bond or lien is a debt instrument where the proceeds are lent to commercial and residential property owners to finance energy retrofits (efficiency measures and small renewable energy systems) and who then repay their loans over 15-20 years via an annual assessment on their property tax bill. PACE bonds can be issued by municipal financing districts or finance companies and the proceeds can be used to retrofit both commercial and residential properties.

How PACE Finance works: The key innovations of PACE finance involve materially lengthening the repayment period for energy retrofit loans and structuring the loan repayments as annual property tax surcharges. These innovations result in large benefits to property owners (positive cash flow in the first year on energy retrofits), municipalities (no fiscal burden yet large job creation), existing mortgage holders (borrower cash flow improves and the property value increases), and to PACE bond holders/investors (virtually no risk on investment because the PACE lien is senior in right to mortgage debt).

Specific benefits are as follows:

Property owners benefit from large cash savings as efficiency savings exceed the annual financing cost: Instead of large required upfront payments by property owners for energy retrofits, the capital is lent to property owners and repaid over 15-20 years via an annual property tax surcharge. This long term repayment mechanism results in annual energy savings that greatly exceed the annual property tax cost, making PACE finance highly attractive to home and building owners.

States/Municipalities create jobs and have no added credit risk: States and municipalities benefit from immediate job creation and the fact that PACE finance creates no credit or fiscal burden as the entire liability resides directly with those property owners who opt in to receiving PACE loans.

Appeal to existing mortgage holders: PACE finance improves the cash flow of property owners (annual energy savings > annual tax surcharge cost) and increases the property's overall value all of which increase the creditworthiness of the existing mortgage.

PACE bond holders/investors benefit from a highly secure investment: PACE bonds have strong appeal to investors given that they are secured by long term tax liens that are senior in right to mortgage debt.

In a similar manner, property assessed bonds can cover upfront costs for climate adaptation measures such as strengthening roofs and making foundations and outside energy units flood resistant. These retrofit projects financed via Property Assessed Climate Action (PACA) Bonds would likely lower insurance premiums for property owners. In addition, the insurance industry might help finance and market these instruments.

It is recommended that property assessed bonds be expanded to include both mitigation and adaptation measures to reduce their greenhouse gas emissions and vulnerability to climate change impacts. These broader Property Assessed Climate Action (PACA) bonds would help fund energy efficiency upgrades, installation of renewable energy systems, and building the hazard resistance and resilience of buildings, landscapes and infrastructure.

Key Challenge

Fannie Mae and Freddie Mac have asserted that homeowners are in default of their mortgages if they finance energy improvements with PACE. The Pace Programs have the strong support of the Department of Energy and the White House, which issued its White House PACE Policy Framework on October 18, 2009. Currently the mortgage lending industry is trying to thwart PACE bonds even though the Obama Administration and many State governors are highly supportive.
http://latimesblogs.latimes.com/money_co/2010/07/fannie-freddie-freeze-pace-energyefficiency-retrofit-financing-programs.html#more

Efforts to Overcome Challenge:

Congressman Mike Thompson (D-CA) was joined by 29 other members of Congress in introducing legislation to protect clean energy initiatives that are important to homeowners in California and the rest of the country. The "PACE Assessment Protection Act of 2010" would order lenders to adopt standards that support Property Assessed Clean Energy (PACE) programs, rather than stymie green energy efforts:

"PACE programs are an important part of the push to create a green economy and reduce our reliance on foreign oil," said Congressman Thompson. "They create jobs, and are an exciting way for homeowners to reduce their energy bills while also reducing greenhouse gas emissions. This is especially important in California, which has already taken significant steps to ensure that PACE programs are available to 70% of Californians by the end of 2010. And our district has been a national leader in getting these programs up and running – lending institutions should not interfere with these great green energy programs."
<http://mikethompson.house.gov/PRArticle.aspx?NewsID=461>

National Flood Insurance Program (NFIP)'s Community Rating System

The National Flood Insurance Program's (NFIP) Community Rating System was implemented to recognize and reward communities that have floodplain management programs that exceed the minimum standards. The goal of the Community Rating System (CRS) is to 1) reduce flood losses, 2) facilitate accurate insurance ratings, and 3) promote the awareness of flood insurance. A community is awarded points based on 18 creditable activities that fall under these 4 categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparation.
<http://www.fema.gov/business/nfip/crs.shtm>

New York City, for instance, is exploring how to use CRS to promote climate adaptation modifications in buildings and community infrastructure to reduce risks and flood insurance premiums for those who voluntarily take preventative steps. As described below, Maryland is already developing and testing a Coast-Smart Scorecard that emulates some key aspects the CRS program, such as improved hazard mapping, engaging and educating stakeholders, and evaluating options for reducing risks in coastal communities.

e) Coast-Smart Communities Initiative

Maryland's *CoastSmart* Communities Initiative provides a comprehensive toolbox of sea level rise and coastal hazard adaptation planning resources to help local communities identify and implement strategies to protect life and property vulnerable to coastal hazards and climate change. Through the online resource center (<http://www.dnr.state.md.us/CoastSmart>), businesses, communities and local governments can access web-based planning tools, storm surge inundation and sea level rise maps, training programs, case studies, staff resources, and access to local grants.

Identifying and Overcoming Obstacles

"To say that the United States *can* adapt to climate change does not imply that the United States *will* adapt." - Robert Repetto, Senior Fellow, United Nations Foundation

Robert Repetto, in "The Climate Crisis and Adaptation Myth," makes a compelling case that while the United States is "rich in technology, economic resources, competent organizations and educated people, all of which combine to create a high capacity to adapt," it is becoming increasingly clear that it lacks the political will to act, particularly given the current economic recession. Repetto² identified a number of obstacles to climate adaptation:

- Uncertainty regarding future climate change at regional and local scales
- Uncertainty regarding the future frequency of extreme weather events
- Uncertainty regarding the ecological, economic and other impacts of climate change
- Lack of relevant data for planning and forecasting, and such data as are available are typically outdated and unrepresentative of future conditions.
- Institutional and human barriers:
 - The need to overcome or revise codes, rules and regulations that impede change
 - The lack of clear directions and mandates to take action
 - Political or ideological resistance to the need for responsiveness to climate change
 - The preoccupation with near-term challenges and priorities and the lingering perception that climate change is a concern only for sometime in the future
 - The inertia created by a business-as-usual assumption that future conditions will be more or less like those of the past.

Repetto, in assessing the U.S. position, suggests that at best the U.S. will likely be reactive, and not anticipatory or preventive, in its climate adaptation. Society will respond to after the effects of climate change are felt and the damage has been done. He also points to continuing "maladaptations," such as shoreline and floodplain real estate development in high risk areas, may erase any positive outcomes from preventative measures that are deployed.

Repetto⁴ summarizes here:

“Without national leadership and concerted efforts to remove these barriers and obstacles, adaptation to climate change is likely to continue to lag. It will be largely reactive rather than anticipatory and preventative, responding to damaging impacts once they have occurred.”

Maryland can also learn from the work of other states coping with climate adaptation. Lara Whitely Binder, Outreach Specialist with the University of Washington, identified the following obstacles:

- *Denial/Disbelief*. Climate change is not occurring.
- *The “so what?” problem of scale*. Mis-interpretation of the magnitude of the change (it’s only a couple of degrees...)
- *The “perfect information” problem*. There is too much uncertainty to take action; I’ll wait for better information.
- *Issue fatigue*. I have to deal with X, Y, and Z yesterday, and you want me to do this too?
- *The “after I’ve retired” problem*. The long-term nature of the problem is beyond the time horizon for many decision makers.
- *“In my back yard” syndrome*. Can you tell exactly me how climate change will affect my specific watershed, coastline, forest?
- *“My hands are tied” problem*:
 - Lack of internal and/or external support for acting on climate change.
 - Regulatory restrictions prohibiting the use of new information on climate change
 - Lack of staff/fiscal/technical resources for planning
- *Difficulties dealing with probabilistic information*. How do you start basing multi-million dollar decisions on probabilities with relatively large uncertainties?
- *The risk taking problem*. You don’t get punished for following existing guidelines.
- *The “no one’s asking” problem*. I am not hearing anyone from the public asking about climate change impacts in meetings, discussions, etc.

“Community Engagement and Addressing Barriers to Adaptation” by Lara Whitely Binder, Outreach Specialist, UW Climate Impacts Group at the Washington State Coastal Training Program Workshop, *Planning for Climate Change*. <http://www.nerrs.noaa.gov/CTPIndex.aspx?ID=455>

Additional obstacles to consider include:

- Individuals perceive the likelihood of impacts to be low enough that they contend it will not happen to them.

⁴ Robert Repetto, “The Climate Crisis and Adaptation Myth”, Working Paper Number 13, Yale School of Forestry and Environmental Studies (Repetto, from 2001-2008, was Professor in the Practice of Economics and Sustainable Development at the School of Forestry and Environmental Studies at Yale University)

- People are uninformed about the risks posed, and the strategies to combat the impacts
- People tend to be short-sighted and only focus on expected benefits of adaptation over the next couple of years, even though the average life expectancy of property is between 30-50 years. Up-front costs likely appear unattractive if the long term rewards from investing in a loss-reduction measure are not incorporated.
- Lack of political will (in all levels of government: local, state, federal) to move adaptation strategies forward
- Lack of funding mechanism to implement on the ground adaptation strategies
- Thoughts that providing insurance to areas most at risk will perpetuate further development in those areas.
- Using risk-based premiums to drive adaptation will take time, initially those in the highest risk areas will have highest cost policies.

Overcoming Obstacles

Maryland's Climate Action Plan provides a blueprint for overcoming most of the barriers described above. Overcoming these barriers requires a commitment to implement the actions identified over the long run.

Integrating Climate Adaptation Into Maryland's Green Economy Strategy

"We must transition from a carbon-based economy to a green, sustainable economy..."

—Governor Martin O'Malley testimony before the U.S. Senate Environment and Public Works Committee (EPW), September 2007.

In 2010, getting the economy back on track is top priority for Marylanders. To overcome the institutional and cultural obstacles listed above, climate change adaptation should be fully integrated into Maryland's strategy for building a green economy.⁵

A bold, simple vision that unites diverse interests, when supported by a plan, resources, and tangible results, can inspire Marylanders to meet the challenges of today and tomorrow. The observed and projected impacts of climate change provide ample reason for Maryland and the United States to shift toward a green, sustainable economy. A green economy will involve the greenhouse gas (GHG) mitigation efforts necessary to avoid the increasingly severe impacts associated with greater change and the adaptations required in responding to the current climate change commitment created by past and ongoing emissions.

While some fear climate change as inhibiting economic prosperity and development, more businesses recognize solutions to climate change may actually create significant economic opportunities while solving other societal problems. The

⁵ Maryland Climate Action Plan Appendix E, FBEI-8. Green Economic Development Initiative http://www.mde.state.md.us/assets/document/Air/ClimateChange/AppendixE_Adaptation_Response.pdf

Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (2007), Working Group II Report "Impacts, Adaptation and Vulnerability, Section 20 states "Sustainable development can reduce vulnerability to climate change by enhancing adaptive capacity and increasing resilience. At present, however, few plans for promoting sustainability have explicitly included either adapting to climate change impacts, or promoting adaptive capacity." Although green-collar jobs in the energy sectors are more widely recognized, adaptation responses to reduce climate change threats and promote sustainability also offer economic development opportunities.

Solutions to climate change can be smart, win-win strategies that simultaneously address multiple issues for diverse stakeholders. There are many adaptation strategies to reduce vulnerability to sea level rise and associated hazards. If they are carefully crafted, some adaptation opportunities can also contribute to climate change mitigation efforts and broader goals of environmental sustainability. To realize the promise of such strategies, a green economic development plan for Maryland is needed.

Fortunately, the benefits of creating a green, sustainable economy are substantial and widespread. They include a better quality of life, independence from imported fossil energy, thousands of green-collar jobs, lower operating and maintenance costs for homes and businesses, cleaner and more reliable and resilient power systems, a more dependable and healthy food system, better access and mobility, and significant environmental and health improvements, such as cleaner air and water, open space, pedestrian-friendly communities, and restored habitats.

To achieve the above goals, Maryland has initiated the development and execution of a green economic development plan. <http://www.governor.maryland.gov/pressreleases/100714.asp> . The intent is to catalyze a self-reinforcing green growth cycle across all sectors of Maryland's economy. In such a growth cycle, an increasing demand for green products and services sustains a thriving community of green businesses and industries which, in turn, create more jobs, healthy communities, and a cleaner environment. Central to this growth cycle are natural principles, such as turning waste into wealth, resource efficiency, optimizing stakeholder value, and life cycle thinking. Thus, Maryland will meet the challenges of climate change while helping the state shift toward a greener, leaner, more sustainable economy.

Conclusion

This report has identified numerous options available to the various stakeholders. At this juncture, the report needs to be shared with these stakeholders so that they may have the opportunity to comment and assist in choosing the options that are most beneficial for all Marylanders.