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Turning Up the Heat on Cooling Down the Planet: Comparing the Climate Leadership Actions of Maryland and Massachusetts

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Executive Summary

Time is running out to tackle the problem of climate change. To avoid unacceptable and unmanageable impacts of climate change, Earth temperatures must flatten by mid-century and annual global greenhouse gas (GHG) emissions levels must be driven down to net zero by mid-century. This requires a series of direct and enabling actions of governments and stakeholders to reduce deposition of GHGs in the atmosphere, with parallel actions to adapt to climate disruptions that occur along the way. US states are critical to this effort as many are leading global emitters and solutions providers.

This report identifies key characteristics of governmental leadership required to implement climate solutions at scale, recognizes the critical importance of stakeholder consensus building, and conducts a detailed review and comparison of Maryland and Massachusetts actions with identification of shortfalls and leadership response needs. Leadership characteristics were determined based on expert review of global best practices and the actions of a cohort of leading states and nations.

The six characteristics for governmental climate change leadership include:

1. Targets and limits
2. Economic and environmental justice systems
3. Whole of government approach
4. Comprehensive policies and measures
5. Matching implementation mechanisms
6. Measurement and verification systems

Review of actions in each state indicate that Massachusetts and Maryland were on similar paths to advancement through 2016 but separated as Massachusetts sped up and Maryland slowed down, although Massachusetts also faces shortfalls. To close gaps, systematic responses are needed through a combination of swift executive and legislative actions. Maryland has the potential to re-establish itself as a national leader on climate change but must take immediate, comprehensive, and sustained new actions.

Key priorities for Maryland to address include:

- Establishment of economy-wide and sector-level emissions reductions targets and limits through 2050 for net-zero emissions with transitional targets and enabling actions.
- Elevation of economic and environmental justice goals within state goals and programs.
- Establishment of a whole of government approach and executive leadership for climate change mitigation and adaptation programs across a full suite of state agencies.
- Removal of policy barriers, such as the prohibition of action in the manufacturing and industrial sectors and anti-competitive renewable energy siting requirements.
- Updating, expansion, and integration of sector level policies and measures to be comprehensive.
- Recognition of the critical importance of stakeholder consensus building to develop state priorities, policies, and programs.
- Accelerated implementation of recommendations of the Maryland Commission on Climate Change to move past study to action, including increased transparency and public involvement.
- Establishment of public and private sector sources of funding to match climate change mitigation and adaptation programs at full program and market scales.
- Improved measurement systems, including application of social cost of carbon and other GHGs and full impact analysis of specific policies and programs.

Table 1 provides results of the detailed review of Maryland and Massachusetts actions with comparative ratings on a scale of 1 to 5, with 5 being the highest rating.

Table 1: Comparison of Maryland and Massachusetts Climate Leadership Characteristics*

	Massachusetts	Maryland
Targets and Limits		
GHGs Short Term (2030)	4	4
GHGs Long Term (2030-2050)	4	2
Sector Level	4	1
Agency Level	3	1
Vulnerability Reduction	3	2
Economic and Social Progress	3	2
Economic and Environmental Justice		
Definition and Metrics	3	2
Inclusion in Agency and Sector Goals	3	2
Inclusion in Policy and Program Planning	3	2
Inclusion in Impact Assessments	2	2
Inclusion in Program Implementation	3	1
Inclusion in Financing and Investment	2	2

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	Massachusetts	Maryland
Whole of Government		
Executive Office	4	2
Agency Requirements	4	2
Legislative Committees	4	2
Local and Federal Cooperation	4	3
Public Private Collaboration	3	2
Accountability Audits/Mandates	4	2
Policies and Measures		
Energy Supply (Heat and Power)	4	4
Residential, Commercial, Institutional	4	2
Industry and Manufacturing	4	2
Transportation	3	2
Agriculture and Forestry	2	2
Waste Management	3	2
Implementation Mechanisms		
Innovation Financing	3	2
Program Deployment Financing	3	2
Blended Finance and Leveraging	2	1
Program Staff Capacity Building	4	1
Program Implementation Tools	4	2
Macro Enabling Environment	4	2
Measurement and Verification		
GHG Inventory and Forecast	4	4
GHG Policy Impacts	3	3
Social Cost of Carbon (& Others)	3	1
Cost Benefit Analysis	4	4
Macroeconomic and Fiscal	3	3
Fairness and Equity	2	1

*Review of state actions is based on publicly available information and input from public and private parties involved in climate action planning and implementation in Maryland and Massachusetts.

Introduction

Greenhouse gas emissions must begin the drop to net zero levels through governmental and stakeholder actions starting now and continuing through 2050 to avoid unmanageable levels of climate change vulnerability.

One of the fundamental questions facing government leaders today is how long we can wait to tackle the problem of climate change. The answer – based on the most recent scientific assessments of the world's topmost intergovernmental science body – is that we cannot wait any longer.[1] For Earth temperatures to flatten by mid-century at levels that avoid unacceptable and unmanageable impacts of climate change, annual global greenhouse gas (GHG) emissions levels must be driven down to net zero by mid-century.[2] This requires a series of direct and enabling actions of governments and stakeholders to reduce deposition of GHGs in the atmosphere and must be combined with parallel actions to adapt to the inevitable warming and vulnerabilities from climate disruptions that occur along the way.

US states play a key role in this response. Many are among the largest economies and sources of emissions globally and state actions are critical to national level efforts. In terms of scale, if US states were nations, Maryland's economy would be ranked 39th (ahead of the United Arab Emirates and Norway), and Massachusetts would rank 21st (ahead of Sweden, Poland, and Taiwan).[3] In terms of GHG emissions, Maryland would rank 88th among global emitters (about the same as Chile) and Massachusetts ranking 80th (about the same as Hungary).[4] Because of their power, creativity, and conscience, US states have also played a critical role in reducing national trajectories of GHG emissions as leading providers of technology and management solutions (such those identified in US states climate action plans and local climate action plans).[5] State climate change leadership actions are consistent with historical trends by which states act as "laboratories of democracy"[6] and often lead national action and spur upward evolution of policy.[7] While this report focuses predominantly on climate change mitigation, US states also have led important developments in climate change adaptation, such as Maryland's focus on the vulnerability and protection of over 3,190 miles of coastline.[8]

An important part of this process has been the search for solutions that yield positive economic and environmental results. Evidence from US states' actions indicates strong potential for enacting climate mitigation actions and economic improvements at the same time. For instance, according to a 2017 study by the World Resources Institute, Maryland leads the nation in the decoupling of GHG emission reductions and economic development as part of a national trend. Forty-one out of 50 states have grown their economies while reducing emissions since 2005. Of these, Maryland leads, having reduced its energy-related CO2 emissions 37.6 percent between 2005−2017 — more than any other state — while growing its economy by 17.7 percent.[9] Macroeconomic assessments by the Center for Climate Strategies of specific, sector level US state policies and programs related to climate change reinforce these findings, including assessments of renewable energy policy in Maryland.[10]

To lead the fight against climate change, government jurisdictions must undertake a series of immediate, comprehensive, and sustained response actions to install and implement programs for the adoption of improved technologies and best practices — all of which take time and effort. For instance, the introduction of energy efficient automobiles, the development or retrofitting of energy efficient buildings, the development of transit systems, the siting and installation of renewable energy

facilities, and the restoration of degraded forest lands all may take several years of enabling action, development, investment, and ultimate implementation. Importantly, the policy development process supporting this transition requires political implementation agreements among diverse stakeholders that seriously address economic and equity issues in the process, and in turn requires in-depth planning, analysis, and bottom-up collaboration supported by unwavering leadership from government leaders. Given the time we have lost in this race to solutions at scale, any hesitance, delay or tardiness going forward threatens attainment of climate stabilization goals and brings irreversible consequences.

Unlike many traditional environmental challenges involving short lived pollutants, climate change cannot be solved through a "wait and react" strategy.[11] After GHGs are deposited in Earth's atmosphere, global temperatures rise in few years but GHGs do not cycle out for centuries. They will continue to drive unnaturally high levels of radiative forcing on Earth for very long periods with a series of cascading new vulnerabilities to human and natural systems.[12] If we wish to avoid such conditions, we must act in advance rather than test our tolerance of impacts with the option to act later. There is no turning back once GHGs enter the atmosphere.[13] This dilemma is like the proverbial frog in a pot of slowly warming water. Because it cannot detect gradual changes in temperature, it does not escape in time.

Increases in GHG concentrations in the atmosphere from human activities cause gradual, long-term warming of Earth that cannot be reversed for many decades or even centuries.

Methods

This report identifies and examines key characteristics of governmental leadership in executive and legislative branches required to implement climate change solutions at the scales and time frames needed to meet global climate stabilization and resilience needs. It then applies this framework through review and comparison of actions in two US states with a history of climate action — Maryland and Massachusetts — with recommendations for new leadership actions to remedy shortfalls.

In its first step, the report establishes six characteristics for governmental climate change leadership and six key subcomponents and metrics within each by which governmental institutions and leaders can be assessed and compared. These characteristics are established through review of best practices and governmental activity at the global, national, and subnational levels based on current understanding of global climate change needs and actions by cohorts of leading national and subnational jurisdictions. This includes US states and key localities involved in climate action planning as well as nations that are involved in the submission and further development of Nationally Determined Contributions (NDCs), or national climate actions plans, under the Paris Agreement — including the US.[14]

In its second step, the report examines a wide range of executive and legislative branch activities related to these characteristics and metrics of government leadership by Maryland and Massachusetts based on publicly available information and conferral with active participants in state climate action planning processes. These states were selected as two that have been historically active in climate change policy action across a full range of

leadership areas, but with potentially differing levels of engagement and plans for the future. Evaluation is focused primarily on climate mitigation but also includes limited review of climate change adaptation, for instance whether it is treated in a co-equal manner with mitigation. A rating scale of 1-5 is applied to metrics to reflect the degree of leadership action based on evidence from information review and expert interpretation by the Center for Climate Strategies (CCS).[15] A comparative evaluation of the states across metrics is then provided to support gap analysis of leadership actions and priorities for future action.

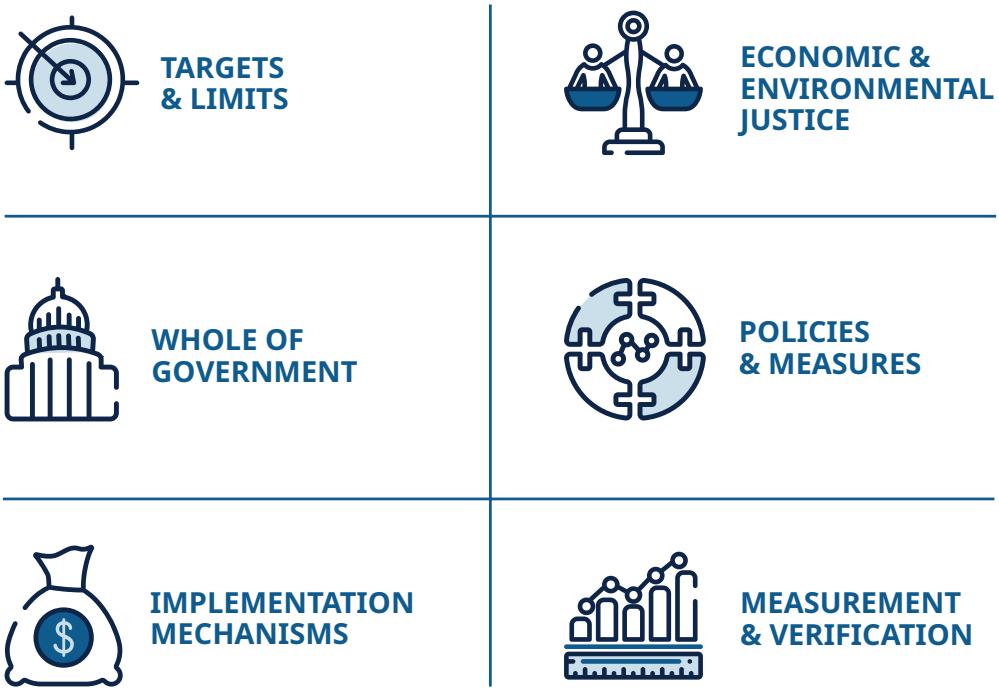
Findings 1: Leadership Characteristics

To establish leadership characteristics and subcomponent metrics at the global level, this report examined global best practices and climate policy and program actions at the national and state levels.

- Best practice and actions review included the Intergovernmental Panel on Climate Change (IPCC)[16] and the United Nations Framework Convention on Climate Change (UNFCCC)[17] including requirements of the Paris Agreement[18] and implementing activities by projects, programs, and partnerships of implementing agencies and independent organizations.[19] It also included a review of NDCs submitted by parties in key regions including leading countries in Africa, Asia, Europe, Central America, the Caribbean, the Middle East, the Pacific, North America, and South America.[20]
- At the subnational level, the review of leadership characteristics included a general review of climate action policy by proactive US states and localities as well as similar subnational jurisdictions outside the US, such as members of the Under 2 Coalition.[21] This included review of comprehensive climate action planning by 20 US states that have established such plans through initiatives led by CCS, and follow on initiatives designed to update, further develop, and implement these plans.[22] Reviews of US states' activities included identification of the architecture of executive and legislative branch actions at the aggregate and economy wide level as well as individual sectors (particularly high emitting and high vulnerability economic sectors).
- At the US national level, the review included Biden Executive Orders and the NDC of 2021. Executive Orders included Executive Order 13990 of January 20, 2021, "Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis"; Executive Order 14008 of January 27, 2021, "Tackling the Climate Crisis at Home and Abroad"; and "The United States' Nationally Determined Contribution, Reducing Greenhouse Gases in the United States: A 2030 Emissions Target." In addition, the review included recent US Congressional leadership directives in 2021 to form a select committee of jurisdiction on climate change as a priority as part of a whole of government approach.[23]

As a result, the following climate change governmental leadership characteristics were identified. These include formal actions on:

1. Targets and limits
2. Economic and environmental justice systems
3. Whole of government approach
4. Comprehensive policies and measures (P&Ms)
5. Matching implementation mechanisms
6. Measurement and verification systems



Each characteristic involves six subcomponents of action that ultimately lead to detailed implementation responses customized to local conditions and goal attainment.

TARGETS & LIMITS

Climate change solutions require a combination of measurable goals and objectives to succeed. As the adage goes, "if you aim at nothing you are sure to hit it."

Leading jurisdictions and best practices establish formal targets to guide and implement critical management decisions on climate change and their alignment with other priorities of government. These include short and long term[24] GHG emissions reduction targets and limits for decadal periods of 2030 through 2050 with periodic target years and cumulative tonnages of emissions over time.[25] For leading jurisdictions, these emissions reduction targets go beyond economy-wide jurisdiction boundaries and are applied at the sector and agency levels. Climate change adaptation and vulnerability reduction goals are also addressed with metric-based indicators and objectives for key sectors and systems focused on areas of exposure and vulnerability.

In addition, climate change targets by leading jurisdictions are aligned with high level goals for economic and social progress, such as performance metrics for employment, economic growth, and per capita income as well as distributional considerations (equity and justice) and the distribution of wealth across socio economic segments, such as for underserved and disadvantaged communities. This alignment of climate and economic goals is part of a deliberate process to decouple GHG

emissions from economic growth through policy development procedures that select and design mutually beneficial or "win-win" approaches and avoid economic, social, environmental tradeoffs.

ECONOMIC & ENVIRONMENTAL JUSTICE SYSTEMS

Underserved and disproportionately affected communities need protection from economic and environmental harm and full opportunity in the new prosperities of a clean and resilient economy.

Leading jurisdictions and best practices formalize broad scale programs to address the needs of underserved, disadvantaged, and disproportionately affected communities. This includes protection from potential harms from inaction or implementation of new policies and programs, as well as upside benefits of climate interventions, such as new spending on modernized economic systems. Specific areas of focus involve inclusion in: agency and sector goals, policy and program planning, impact assessments, program implementation, and financing and investment. The implementation of such programs is integrated with other areas of leadership, such as targets, P&Ms, implementation mechanisms, and measurement systems as well as through stand-alone programs.

WHOLE OF GOVERNMENT

Action by a full range of executive agencies and legislative bodies is required to address climate change, including sincere collaboration with diverse stakeholders and the public.

Leading jurisdictions and best practices involve a full range of agencies and institutions in comprehensive climate change response actions through the assignment of duties and decisions that incorporate climate change goals and metrics; they do not limit institutional participation to a short list of institutions. This process includes executive office oversight, agency requirements, legislative committees, local and federal government cooperation, public private collaboration (including diverse stakeholder participation in government decisions), and accountability audits and mandates.

COMPREHENSIVE POLICIES & MEASURES

Policies and measures are needed in all economic sectors and systems of human and natural activity to chart climate change action at levels needed for effective climate stabilization and resilience.

To reach climate change stabilization and resilience goals and targets, leading jurisdictions and best practices establish a comprehensive set of policies and measures across all economic sectors, agencies, and human and natural systems at a scales and time frames that enable full attainment.

This includes coverage of all emitting sectors and subsector areas that can provide emissions reductions through the adoption or enhancement of low emitting technologies and practices through specific programs. Parallel approaches to address vulnerability reduction are also needed. This combination or portfolio of program actions should be designed to measurably attain GHG reductions and other targets.

Actions critical to **climate stabilization and GHG reductions** include the following sectors:

Energy supply (heat and power) strategies and related policies and measures reduce the net GHG content of direct fuels and electricity through shifts to renewable energy sources, other low carbon sources such as nuclear power, and geologic storage of carbon captured through carbon dioxide waste streams.

Residential, commercial, institutional strategies reduce carbon dioxide through energy efficiency and conservation as well as on site renewable energy production associated with building design, equipment selection, building operations, and distributed generation (such as rooftop solar) as well as reducing GHGs through commercial process improvements (such as changes in refrigerant use).

Industry and manufacturing strategies include production-based energy efficiency and process efficiency improvements.

Transportation and land use strategies can be applied to land, marine, and aviation improvements in vehicle fuel efficiency, shifts to electrification, infrastructure design changes, transportation system and community design improvements.

Agriculture and forestry strategies include land protection and restoration to improve carbon storage, tree planting and regeneration, improved harvest methods to reduce energy use and carbon and methane loss, low input cultivation and growing methods to reduce energy inputs and increase carbons storage, feed efficiency for poultry and livestock to reduce methane emissions, locally grown produce to reduce embedded energy in food distribution, and other methods.

Waste management strategies include recycling, reuse, and source reduction of solid and liquid wastes, including energy recovery, composting, recyclable materials, and other methods.

Actions critical to **climate change adaptation and vulnerability reductions** include a wide range of human and natural systems and locations.

Human systems include a wide range of economic sectors that are sensitive to climate conditions and exposed to elevated levels of risk and vulnerability caused by changes in heat, precipitation, sea level rise, and possibly wind. In addition, climatic disruptions affect human communities at different scales (such as urban and rural) and social systems (such as access to health and welfare).

Natural systems include the effects of global warming on temperature, precipitation, sea level rise, and wind in specific geographic locations through effects on land, water, and air resources in the marine and terrestrial environment. In turn, these affect many types and communities of plants and animals that are part of natural and human ecosystems.

MATCHING IMPLEMENTATION MECHANISMS

Each policy and measure identified for climate change mitigation and adaptation must be accompanied by dedicated funding, authority, and capacity for its full implementation.

For each sector level and cross-cutting policies and measures, leading jurisdictions and best practices assign matching implementation mechanisms and commitments to enable full attainment. Broadly speaking, this includes use of financial and governance mechanisms to ensure adequate capacity and commitment to the actual implementation of policy. Financial mechanisms and commitments must address the need for early-stage development and innovation (technologies and practices) and later stage program deployment (technology adoption or infrastructure development).

Blended financial mechanisms are deployed to leverage private funds through public funding, public private partnerships, and investment mobilization procedures.[26] Governance systems must ensure adequate labor capacity (including key personnel), program implementation tools, and enabling environment needs, such as political stability and focus.

Implementation mechanisms for policies and measures include a menu of options for:

- Codes and standards (or regulations)
- Voluntary and negotiated agreements
- Funding assistance and financing
- Risk reduction and control mechanisms
- Pricing and tax mechanisms
- Market trading
- Technical assistance
- Information and education
- Reporting and disclosure
- Pilots and demos
- Research and development

These and other mechanism options may also be structured as hybrids and blends and they may transition over time, such as from voluntary to mandatory approaches.

MEASUREMENT & VERIFICATION SYSTEMS

Measurement and verification systems enable management of climate change programs and attainment of the multiple goals and priorities they serve.

To manage targets and implementation programs, leading jurisdictions "count what counts." Critical measures and systems include:

1. GHG baselines (historic and projected emissions and socioeconomic variables) for sectors and subsector activities
2. GHG impact analysis (before and after the fact), social cost of carbon (and other GHGs)
3. Social cost of carbon and other GHGs
4. Cost benefit analysis (to assess cost effectiveness and spending needs)
5. Macroeconomic analysis (to assess economic growth, employment, and income effects)
6. Fairness and equity evaluations (to assess disproportionate impacts and opportunities) related to economic and environmental justice

These are conducted in a manner that enables direct attribution of cause-and-effect relationships between specific sector level policies and programs and resultant impacts at a granular or "line item" level, in addition to aggregate impacts.

Findings 2: Maryland and Massachusetts Actions

The above framework of leadership characteristics and subcomponents was applied to Maryland and Massachusetts through review and comparison of specific actions. This included review of publicly available information from both states and other sources, such as documents related to governmental work group activities for policy research and development, state sponsored studies, final and proposed legislation, and state program implementation, and inputs from parties actively involved in climate action planning in each state.

The tables below summarize the review and comparison of Maryland and Massachusetts climate change actions across the six characteristics of leadership and six related subcomponents for each. Relative ratings are on a scale of 1-5, with 1 being the least favorable. A complete set of findings for Maryland and Massachusetts and their comparison is provided as an appendix.

TARGETS & LIMITS

Formal targets guide and implement critical management decisions on climate change and its alignment with other priorities of government.

- Through 2016 both states were on similar trajectories for target-setting and legislation. After that Massachusetts appeared to speed up while Maryland slowed down. While both states have set pre-2050 targets, Massachusetts has established 2050 targets and specified targets for each economic sector while Maryland has not.
- Massachusetts has more clearly aligned its targets with other high level state goals such as prosperity and equity.
- Massachusetts also has made greater progress on setting targets and sector level limits and standards to guide vulnerability reduction and the incorporation of economic and social progress.

	Massachusetts	Maryland
Targets and Limits		
GHGs Short Term (2030)	4	4
GHGs Long Term (2030-2050)	4	2
Sector Level	4	1
Agency Level	3	1
Vulnerability Reduction	3	2
Economic and Social Progress	3	2

ECONOMIC & ENVIRONMENTAL JUSTICE SYSTEMS

Formal and fully integrated programs address the needs of underserved, disadvantaged, and disproportionately affected communities.

- Both states acknowledge the important of equity and justice to avoid harm from action or inaction and to ensure inclusion. However, Massachusetts has done more to formalize such programs.
- Massachusetts has codified the definition of Environmental Justice in regulations, and has outlined specific criteria for review of impact on environmental justice populations in review of environmental impact assessments. Maryland has begun to require the use of data sets and mapping tools review and analyze the impact of current State and local laws, permits, actions, and policies on the issue of environmental justice and sustainable communities.
- Both states need to better determine the communities most harmed by climate impacts and then target funds to these communities.

WHOLE OF GOVERNMENT

A full range of agencies and institutions support comprehensive climate change response actions through assignment of duties, decisions, and climate change goals.

- Massachusetts has established a whole of government approach including a wide range of executive agencies under formal executive office oversight, while Maryland has included a narrower span with fewer requirements and executive oversight.
- While both states have a full working group structure to support mitigation and adaptation planning, Massachusetts has been more successful at moving past study processes into actual assignment of agency leadership roles and responsibilities. For instance, work group activities and legislative and executive branch decisions are better linked in Massachusetts.
- Massachusetts has established the Resilient MA Action Team (RMAT) to monitor and track the State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) implementation process, including state agency actions. Maryland has not established such oversight or guidance.

	Massachusetts	Maryland
Economic and Environmental Justice		
Definition and Metrics	3	2
Inclusion in Agency and Sector Goals	3	2
Inclusion in Policy and Program Planning	3	2
Inclusion in Impact Assessments	2	2
Inclusion in Program Implementation	3	1
Inclusion in Financing and Investment	2	2

	Massachusetts	Maryland
Whole of Government		
Executive Office	4	2
Agency Requirements	4	2
Legislative Committees	4	2
Local and Federal Cooperation	4	3
Public Private Collaboration	3	2
Accountability Audits/Mandates	4	2

COMPREHENSIVE POLICIES & MEASURES

Comprehensive policies and measures across all economic sectors, agencies, and human and natural systems support full attainment goals and targets.

- Both states have established a multi-sector framework for policies and measures with strong coverage of the power sector.
- Within this framework, Massachusetts has more clearly defined sector level programs and their ability to comply with state and sector level targets, including targets for adoption of energy efficient technologies. While Maryland has identified a wide range of such policies and measures, some are not specific or transparent enough to determine their ability to comply with targets, particularly in the long term.
- Neither state has fully developed their agriculture and forestry programs. For instance, Maryland is behind in forest and tree conservation actions that prevent or better manage tree removal and replacement.
- As noted in the Whole of Government review, while both states have a full working group structure to support mitigation and adaptation policy and program development, Massachusetts has been more successful at moving past study processes into actual adoption of policies and measures.

	Massachusetts	Maryland
Policies and Measures		
Energy Supply (Heat and Power)	4	4
Residential, Commercial, Institutional	4	2
Industry and Manufacturing	4	2
Transportation	3	2
Agriculture and Forestry	2	2
Waste Management	3	2

MATCHING IMPLEMENTATION MECHANISMS

Matching implementation mechanisms and commitments enable full attainment for all sector level and cross cutting policies and measures.

- Neither state has fully defined implementation programs for all necessary policies and measures to ensure full implementation at targeted levels. This is a critical gap facing both.
- Both states are behind in assessing and allocating funds to meet specific climate goals and program measures.
- Neither state has a consolidated state Green Bank or blended finance mechanism at present although have initiated other actions. Massachusetts appears to have a higher level or readiness for such a mechanism. The potential appears to exist in both states. Maryland, for instance, is home to three green bank structures: the state Maryland Clean Energy Center, the state Climate Access Fund, and the Montgomery County Green bank. While the Maryland governor has declined the 2015 recommendation of a working group to establish a single state-sponsored green bank, other institutions have begun to step in to fill the gaps, in response to insufficient state financing.
- Nonetheless, Massachusetts has more consistently identified governance mechanisms for each of the policies and measures and made a more concerted effort to do so as part of the policy and program development process whereas Maryland has more frequently established general policies and measures approaches without specified mechanisms.
- Massachusetts also has more consistently identified funding streams from public sources for its policies and measures from the outset of policy and program development, such as from state bonds. But it has not yet systematically developed blended finance to leverage private funding sources.
- While both states have a full working group structure to support mitigation and adaptation implementation, Massachusetts has been more successful at moving past study processes into actual adoption of mechanisms.

	Massachusetts	Maryland
Implementation Mechanisms		
Innovation Financing	3	2
Program Deployment Financing	3	2
Blended Finance (Public/Private) and Leveraging	2	1
Program Staff Capacity Building	4	1
Program Implementation Tools	4	2
Macro Enabling Environment	4	2

MEASUREMENT & VERIFICATION SYSTEMS

Counting what counts ensures effective management of climate change and related programs, goals, and targets.

- Both states have established GHG inventory and forecast (baseline) mechanisms to support before the fact and after the fact assessments of climate mitigation effectiveness.
- Massachusetts has formally adopted systems for measuring the social cost of carbon and other GHGs, while Maryland has not. However, the Maryland legislature has recently directed the Public Service Commission (PSC) to consider climate effects and GHG emissions in its planning and review processes.
- Massachusetts also has made a higher level of progress on measurement systems related to economic and environmental justice.
- Both states are behind in developing granular, line-item analysis of the GHG and socio-economic impacts of specific, sector level policies and measures, including the translation of policy to economic improvement investment need at a line-item level.

	Massachusetts	Maryland
Measurement and Verification		
GHG Inventory and Forecast	4	4
GHG Policy Impacts	3	3
Social Cost of Carbon (& Others)	3	1
Cost Benefit Analysis	4	4
Macroeconomic and Fiscal	3	3
Fairness and Equity	2	1

In addition to the evaluation and comparison of leadership characteristics in the tables above, Table 2 compares key related elements of the US NDC[27] with those of Maryland and Massachusetts actions for key variables such as targets, coverage of policies and measures, and equity and justice. The light blue shading indicates activity that is close to or fully consistent with the US NDC, the teal blue shading indicates partial progress, and the navy blue shading indicates low levels of progress or absence.

Table 2 portrays key elements of leadership characteristics and varying levels of progress by the US, Maryland, and Massachusetts, with Maryland showing the largest gaps. The status of actions is dynamic as state and national jurisdictions update programs and approaches. The US NDC is indicative of leading nations and reflects the global effort to resubmit NDCs with higher levels of ambition in 2021. Key areas of improvements for NDCs or their analog at the state level include greater transparency and granularity of baseline and impact measurements; explicit inclusion of equity and justice goals and objectives; establishment short and long term strategies that meet climate stabilization targets and are backed by mechanisms for governance and financing; assignment of responsibility to a full suite of government agencies; and stronger inclusion of stakeholders in governmental decisions, including special populations.

Table 2: Comparison of US NDC, Maryland, and Massachusetts Actions

United States	Massachusetts	Maryland
Targets		
26-28% emission below 2005 levels by 2025	25% reduction from 1990 levels by 2020	25% from 2006 by 2020
50-52% below 2005 by 2030	50% from 1990 levels by 2030	40% from 2006 levels by 2030
Net zero by 2050	75% by 2040; Net Zero by 2050	80-95% by 2050 (soft goal)
Electricity		
100% carbon free by 2035	40% RPS by 2030, 4000 MW offshore wind	50% RPS by 2030, 14.5% solar
Focus on generation, transmission, energy storage, carbon capture, nuclear	RGGI Participation, Pricing Mechanism Legislation, RPS Targets, Mass Save Program, coal plant retirements	RGGI Participation, RPS Targets, EmPower Program, focus on carbon capture and nuclear energy
Support RD&D and commercialization	Mass Clean Energy Center ($27.4M budget)	MD Clean Energy Center ($800,000 budget)
Transportation		
LDV emissions and efficiency standards	CAFE Standards, Federal RFS; sector emissions sub limits in process	CAFE Standards, Federal RFS
Zero emission vehicle incentives	Incentives for EV procurement; required deployment goals in process	No longer available as of 2020
Charging infrastructure	Incentives and state-led programs for deployment of charging infrastructure	Incentives for EV charging equipment
Reductions in VMT through transit, rail, biking and pedestrian improvements	Planned Implementation of TCI-P, EEA Planning grants, $220M for walking and cycling infrastructure, Commission on the Future of Transportation Report Recommendations	Smart Growth Program focused on reducing VMT and fossil fuel consumption through land use planning and development around public transportation hubs, however transit funding has been reduced in recent budget cycles
Maritime and Aviation decarbonization	No Action	No Action

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United States	Massachusetts	Maryland
Buildings		
Energy efficiency heating and cooking programs	Mass Save rebates for programmable thermostats, electric heating, and cooling; PACE financing	BeSMART energy efficiency loans, EmPower efficiency programs (utility-specific), low programmatic funding, state enabling of PACE financing
Heat pumps and induction stoves	Centralized rebates for electric heat pumps and high efficiency gas systems	Efficiency programs/incentives are varied between utilities.
Modern energy codes	Adoption of CA appliance standards	Federal appliance standards
High performance buildings	IECC codes; municipal buildings LEED silver & 25% EUI reduction by 2030, stretch goals adopted in 250 municipalities	IECC codes; municipal buildings LEED silver; 10% reduction in energy use in municipal buildings by 2029
Industry		
Carbon capture and hydrogen	N/A	Member of Midwest Regional Carbon Sequestration Partnership, CARES (proposed) has significant focus on CCS
Renewable, nuclear, and waste generation	Emissions sub limits for 1) commercial and industrial heating and cooling, 2) industrial processes and 3) natural gas distribution and service	No manufacturing sector criteria in GGRA
Market development for zero carbon industrial goods	N/A	N/A
Agriculture/Lands		
Scaling of smart agricultural practices (cover crops, rotational grazing, nutrient management, manure management, etc.)	Healthy Soils Program and ACRE program to support smart agricultural processes	Healthy soils program provides research, education, and assistance
Reforestation, forest protection and management	Forest Resource Management Plan Mandate, minor reforestation programs	68,530 acres of reforestation by 2030; 7.25M trees planted. Lack of continued improvements to Forest Conservation Act
Land restoration	Wetlands restoration programs, MA State Hazard Mitigation and Climate Adaptation Plan	Significant land conservation and restoration programs

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United States	Massachusetts	Maryland
Agriculture/Lands (continued)		
Blue carbon	Blue Carbon Calculator, wetlands restoration	Study/review by MCCC
Coastal resilience projects	Coastal Resilience Grant Program, StormSmart Coasts, Climate Adaptation Plans, significant public funding allocations for implementation of projects.	Coastal Resiliency Assessments. Resiliency Authorities, Coast Smart Construction Program and Living Shoreline Protection Act
GHGs		
Phase down use of HFCs	HFC specific regulations	HFC specific regulations
Plugging leaks from natural gas wells and mines	Methane emissions control regulations, declining emissions limits for operators; regulations for control of natural gas leakages	Methane emissions control regulations, leak monitoring and reduction plans; more stringent analysis and mitigation of methane leaks required
Equity and Environmental Justice		
Development of environmental justice council	EEA Environmental Justice Task Force & Interagency Environmental Justice Working Group	Commission on Environmental Justice and Sustainable Communities (CEJSC) recently strengthened but does not have legislative authority
Definition and codification of environmental justice populations	Statutory definitions for environmental justice principles and populations, with updates required every	No formal definition of environmental justice or sustainable communities; establishment of environmental justice principles by CEJSC
Science based tools and resources for identification of environmental justice populations and review of project impacts	Environmental justice reporting and analysis requirements, EJ public website and interactive maps, annual EJ reports, information repositories, training programs and priority for investments and directs agencies to incorporate environmental justice principles	Requires CEJSC to use data sets and mapping tools to review and analyze the impact of current State and local laws, permits, actions, and policies on the issue of EJ communities, including cumulative impact, effects, and exposure
Specific funding programs for historically marginalized populations to advance environmental justice and reduce persistent health disparities	Massachusetts Clean Energy Center (MassCEC) $12 million in new annual funding for clean energy workforce development for minority and women owned small businesses, environmental justice communities, and fossil fuel workers	SEIF Strategic Energy Investment Fund (SEIF) provides $7.0 million in funding for access to capital for small, minority, women, and veteran-owned businesses in the clean energy industry, subject to specified conditions, including an annual reporting requirement; program needs to be aligned with GGRA goals

Conclusions

Over the past decade, Maryland has approached climate change incrementally and without sufficient binding actions. This process has involved creation of study groups and policy research but not corresponding actions. In contrast, Massachusetts shifted gears in about 2016 and began a more comprehensive and action-based rescripting of state government progress around climate change. Maryland has fallen behind its neighbors on renewable energy siting and expansion despite similar resource potential, and the state enacted rules to prohibit manufacturing and industry from coverage of climate change policy actions despite evidence that economic growth and emissions reductions can occur simultaneously. Massachusetts has adopted a more proactive stance for these sectors and embraced opportunities for their growth based on a low carbon future.

To re-establish itself as a national leader as it responds to the repercussions of a warming climate, Maryland must undertake immediate and sustained new actions. Done properly, this can improve state climate leadership and economic development in the state by creating new jobs, improving infrastructure, and increasing investment in underserved communities. Other states have already positioned themselves as leaders and better serve their communities. The leadership characteristics and metrics in this report along with the detailed reviews of actions provide a framework by which new actions can be targeted and sustained.

Key priorities for Maryland to address include:

- Establishment of economy-wide and sector-level emissions reductions targets through 2050 for net-zero emissions with transitional five-year targets and enabling actions.
- Elevation of economic and environmental justice goals within state goals and programs.
- Establishment of a whole of government approach and executive leadership to oversee the climate change mitigation and adaptation programs across a full suite of state agencies.
- Removal of policy barriers, such as the prohibition of action in the manufacturing and industrial sectors and anti-competitive renewable energy siting requirements.
- Updating, expansion, and integration of sector level policies and measures to be comprehensive.
- Recognition of the critical importance of stakeholder consensus building to develop state priorities, policies, and programs.
- Accelerated implementation of recommendations of the Maryland Commission on Climate Change to move past study to action, including increased transparency and direct public and stakeholder involvement in governmental decisions.
- Establishment of public and private sector sources of funding to match climate change mitigation and adaptation programs at full program and market scales, including public investment in the state's existing Green Banks and mechanisms to leverage private capital.
- Improved measurement systems, including application of social cost of carbon and other GHGs and detailed, granular impact analysis of specific sector level policies and measures, including macroeconomic investment needs and options.

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Rex Hazelton also contributed to this report. He is an energy, environment and transportation professional with over a decade of experience in energy regulation, project finance, strategic communications and project management. Mr. Hazelton holds B.A. degrees in Political Science and Journalism from Lehigh University, and will be graduating from Johns Hopkins University in 2022 with a M.S. in Energy Policy and Climate.

Endnotes

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