IAC Policy Recommendations August 22 2019

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Policy Summaries

Buildings

Policy #1: **Set Mandatory Emissions Reduction Limits on Building Sector Statewide by 2020**
The Commonwealth should begin the stakeholder process of setting mandatory emissions reduction limits no later than about 2020 for 2030 and beyond. These potential regulations may include (but are not limited to): incentivizing early retirement of inefficient HVAC to convert to clean heating and cooling, aligning the energy efficiency goals with the GWSA, maximizing the Alternative Portfolio Standard (APS), maximizing energy efficiency, phasing out fuel oil and natural gas, and more.
Criteria highlights: This policy builds off existing work, so is feasible and has political viability. There are large GHG reductions. There will be social benefits, particularly around fossil fuel reduction and associated public health. There are also workforce opportunities.
Policy #2: **Make the Building Code 2050-Compliant**
Because each building placed in service today is expected to be in service in 2050, and because building system costs are best minimized (and capitalized) at construction, the Commonwealth should, by about 2020 and no later than the adoption of the 2021 International Codes, comprehensively revise and update the Massachusetts State Building Code to require all new construction and major renovations to meet 2050-compliant building envelope standards in addition to supporting greater adoption of distributed energy resources and energy resiliency, including: storage; renewables for electricity and thermal energy; zero-emission vehicle (ZEV) charging; resilience/adaptation; and district heating and cooling.
Criteria highlights: While not addressing legacy buildings, codes level the playing field regarding social equity; healthier buildings are less expensive to operate and resilient.
Policy #3: **Require Expanded, Detailed Building Performance and Emissions Reporting, Benchmarking, and Improvements**
The Commonwealth should work quickly to address the systemic lack of accurate information regarding building system performance and related building service emissions in Massachusetts. This can be achieved through actions that include, but are not limited to, setting mandatory building energy performance reporting requirements, requiring building energy efficiency scorecards at point of listing for sale, lease, or rental, funding building operator training and workforce opportunities on maintaining building performance, and incentivizing green leases and other financing options.
Criteria highlights: GHG reductions could be significant. Boston and other cities are already pursuing this, and there are job creation/retraining opportunities.
Policy #4: **Require a Cross-Sectional Focus**
Livable 2050-compliant buildings are connected to, and dependent on, a design ecosystem that includes local zoning; local, regional, and state transportation planning; our energy supply systems; public health considerations; resilience, and more. As we work to decarbonize our building sector as required by the GWSA, the Commonwealth should actively maintain a dynamic, cross-sector, "integrative design" approach that looks for and leverages win-win options that achieve or advance multiple goals simultaneously wherever possible, including maintaining connections to: an interconnected regulatory landscape, local levers, resiliency, mobility and smart growth, waste, and equity.
Criteria highlights: This strategy allows for better integration across programs and laws (including the GWSA and GCA), which should increase the effectiveness and uptake of other efforts and should make the other policies more achievable and likely less costly.

Electricity

Policy #1: **Promote consistent GHG accounting methods within MA and among New England states**

Consistent, principled, and transparent emissions accounting is critical to achieving the GWSA's goals, particularly regarding the electricity sector. The issue is important both within the Commonwealth (for cities and towns with their own climate goals, for municipal aggregation, for municipal light plants) and regionally (in the context of large state clean energy procurements and as other states increase their focus on detailed emissions accounting in order to meet their own goals), and in each area we expect that importance to grow dramatically over the 2020s. As a result, the state should work to establish – in the early 2020s – consistent GHG accounting methods within MA and among New England states.
Criteria highlights: This is a feasible recommendation and has the potential to increase consistency and accountability while lowering costs associated with GHG accounting.
Policy #2: **Conduct a strategic review and alignment of the RPS, APS, CES, and CPS regarding the participation in each of biomass, landfill gas, and MSW "waste-to-energy" electricity generators**
Initial analysis indicates that in order to achieve GWSA-required levels of 2050 statewide emissions, ultra-low per megawatt-hour emissions will be required for the Commonwealth's entire electricity sector. Based on either potentially out-of-date life-cycle emissions estimates, or for other reasons altogether (e.g., to facilitate in-state waste disposal), however, several state energy programs currently include and incentivize electricity generation with substantial smokestack emissions that are likely not 2050-compliant. In order to ensure scarce ratepayer funds are spent wisely in pursuit of cost-effective GWSA-implementation, the state should review and revise, as necessary to ensure they are consistent with the Commonwealth's 2050 goals, the qualification and participation of biomass, landfill gas, and MSW "waste-to-energy" electricity generators in the RPS, APS, CES, and CPS and other clean energy incentive programs.
Criteria highlights: This will improve long term GHG gains; should be beneficial to social equity and public health by addressing particulate emitters, esp. in EJ Communities.
Policy #3: **Conduct a strategic assessment of the role of Municipal Light Plants (MLPs) in meeting the state's GWSA obligations**
The state's municipal utilities are generally exempt from major clean energy programs designed to ensure the state achieves its 2050 GWSA goals, and some municipal utilities have asserted that the state may not regulate them at all pursuant to the GWSA. Given that MLPs deliver about 12% of the electricity consumed in Massachusetts, the state should assess whether it can meet its GWSA mandate without the participation of MLPs.
Criteria highlights: This strategy is likely to be beneficial towards emissions reductions and it should be technically feasible to achieve.
Policy #4: **Ensure the state's Electricity Distribution Company (EDC)-maintained and operated electricity distribution system is transformed as needed to actively support and further statewide deep decarbonization efforts**
A thriving two-way electric distribution system that supports a wide variety of low-cost distributed energy resources and actively responsive demand is likely critical to the state's deep decarbonization efforts which will rely on ultra-low emissions electricity to allow widespread fuel-switching. While the Commonwealth's distribution system and distribution utilities are already successfully supporting the state's initial emissions reduction efforts (e.g., interconnecting and operating over 2,500MW of solar PV), substantial changes in that system are likely needed in order to support deep decarbonization and to do so at least-cost while ensuring reliability. The state must take active steps to ensure that the Commonwealth's electricity distribution system and its operators are designed and incentivized to actively support and further statewide deep decarbonization efforts, particularly around supporting distributed energy resources, load shifting and flexible demand, and EDC business models to be 2050-compliant.
Criteria highlights: This strategy should improve GHG reductions, social equity, and public health, as well as build a more resilient and adaptive grid (likely with job creations)
Policy #5: **Ensure the New England electricity system's markets and planning processes are transformed as needed to actively support and further statewide deep decarbonization efforts.**

Massachusetts participates in, and depends on, a regionally-managed electricity system (transmission grid, capacity markets, and market-based system dispatch) for the generation and delivery of its bulk electricity supply. Status quo market operations, however, are not supportive of MA's deep decarbonization efforts and without a change – likely involving substantial market re-design – many stakeholders are concerned that the regional energy markets may collapse in the next decade as state-procured clean and renewable resources are brought online. Massachusetts can and should lead the region to ensure that the regional electricity system is stable, cost-effective, and 2050 compliant.
Criteria highlights: This should have benefits across the board, but for this policy, without leadership pushing the regional markets in this direction, it's possible that benefits from other policies may be stunted.

Land use and Nature Based Solutions

Policy #1: **Avoid conversion of forests – especially resilient, interior forests – to other land uses**
We have clear, spatially explicit data in Massachusetts that identifies forests that are carbon storage and sequestration powerhouses, as well as those that are most likely to survive climate change and remain carbon-rich in the future; prevention is always better than after-the-fact restoration or mitigation. Harvard Forest predicts a ~ 20% loss of carbon storage over the next 50 years if we continue current trends of forest land conversion and management. Through protecting forest blocks, helping communities and private landowners preserve their lands, streamlining protection funding, providing incentives and tax credits, and technical assistance offerings, MA can help preserve this carbon storage.
Criteria highlights: In addition to the carbon benefits, there are public health and resiliency benefits.
Policy #2: **Invest in the restoration, maintenance, migration, and protection of blue carbon systems (salt marshes and eelgrass beds) through funding, strengthening coastal wetland protection, and enabling salt marsh migration with land conservation and/or limited development/land use in the coastal zone**
Salt Marsh degradation and eelgrass meadow loss has been occurring, notably since the 1980s in some of Massachusetts greatest systems like Plum Island and Cape Cod Natural Seashore. These systems provide fish nurseries, wave attenuation, and high rates of carbon sequestration--even more efficiently than forests—but degradation, nutrient pollution, and loss creates mud flats releasing centuries worth of stored carbon into the atmosphere, further exasperating our greenhouse gas emissions, global warming and climate change. Protecting, restoring, and maintaining our blue carbon systems is critical for not only shoreline protection from sea level rise and storm surge but also preventing a mass emission of greenhouse gases stored in these systems for centuries.
Criteria highlights: Inaction could lead to significant release of stored CO2; there are coastal resilience benefits and potential benefit to commercial fish industry.
Policy #3: **Continue, and greatly expand, urban tree planting and stewardship programs, such as Greening the Gateway Cities, ReGreen Springfield, and tree planting efforts within metro Boston**
To set ourselves up to meet future Global Warming Solutions Act targets (2030, 2040, 2050, etc), we need to plant trees now in places where they will significantly reduce energy usage and store carbon in future decades. Investing in tree-planting in urban communities benefits some of the most vulnerable residents of the Commonwealth who now currently lack tree canopy, and in small ways, begins to correct a history of environmental injustice. Community benefits include shade (and reduced cooling costs), windbreaks

(and reduced heating costs), reduced stormwater runoff and flood risk, job opportunities for local residents, better respiratory health, and better quality of life from having access to green space.
Criteria highlights: There are energy reductions from trees near homes, job creation opportunities in EJ communities, and public health benefits.
Policy #4: **Make the value of forest carbon visible and quantifiable in state policies**
As we recognize the cost of carbon in more and more sectors (e.g. electricity, heat, transportation), we should recognize that carbon stored by nature also has value. Every ton of carbon emitted from land use conversion is a ton of carbon Massachusetts must remove from the atmosphere. We need to set a precedent that forest carbon has value, and then increase that value until it matches the societal cost of carbon, achieve through actions such as revising MEPA land use conversion policies, "no net loss of forest" policies, local by-laws for tree retention and planting, creating a mitigation fund/"carbon banking", requiring "ecologically equivalent" compensation for forest disruption, and requiring GHG impact reporting for MEPA projects.
Criteria highlights: In addition to the general GHG and public health benefits associated with forest preservation, there would likely be a revenue generation as part of it.
Policy #5: **Improve Forest Management**
Strategies that help improve the health and carbon sequestration abilities of forests should be pursued to ensure that MA helps actively improves the management of forests. These strategies include pursuing compensation for landowners and developers for restoration efforts, promoting sustainable use of wood, requiring use of local wood, the smart growth tree retention law, considering adaptive management and other approaches to sequester carbon, assist forest managers relating to the Forest Cutting Practices Art, invest in landscape carbon measures to track the impact of improved forest management over time.
Criteria highlights: This would have significant GHG benefits, as well as potential job creation and resilience benefits.
Policy #6: **Increase the carbon sequestration potential of soils**
Both above and below-ground uses of land can aid in the sequestration of carbon; soil carbon and appropriate soil management techniques can significantly increase the carbon capture of land. MA has recently released a Healthy Soils Action Plan which outlines several key strategies to achieve health, carbon-capturing soils. The Commonwealth should pursue those strategies with an eye towards carbon sequestration potential, including providing incentives for best practices and finding other mechanisms to achieve compliance.
Criteria highlights: This has carbon capture potential as well as adaption and resilience benefits.
Policy #7: **Reward municipalities that use Smart Growth and other climate-friendly actions**
The Commonwealth has several programs already in place, including the Municipal Vulnerability Program (MVP), the Green Communities program, and the Housing Choice Initiative, that could better integrate nature-based solution and GHG mitigation strategies into their activities. Proposed legislation would Establish the Communities for a Sustainable Climate Program for municipalities (like the Green Communities Program), which provides technical assistance and funding to communities that opt in and adopt carbon-friendly local policies and practices. Through funding, technical assistance, creation of a Green Infrastructure Fund, and better certifications and oversight into what constitutes a "nature-based" solution, the state can ensure existing efforts are magnifying their opportunities for impact
Criteria highlights: These programs work with communities throughout the state, allowing for distribution of benefits across the commonwealth. By bringing GHG mitigation to a program focused on resilience, both objectives are achieved.

Transportation

Policy #1: **Reduce GHGs from vehicles**
This policy aims to dramatically reduce emissions across vehicle types, and includes: protecting and expanding vehicle efficiency standards; expanding incentives and programs for low-carbon vehicles , including rail, bus, and heavy duty vehicles); expanding grid-smart EV charging infrastructure; incentivizing the retirement of inefficient vehicles; exploring new hydrogen and fuel-cell technology; and assessing the adoption of a Clean Fuel Standard.
Criteria highlights: EVs have air pollution and public health benefits, particularly for heavy-duty. In general, these strategies are building on existing efforts and should be politically and technically feasible.
Policy #2: **Invest in mass transit and promote alternatives to driving**
This policy aims to increase the number of Massachusetts residents who routinely use alternatives to driving, including public transit, and includes: increasing funding for the MBTA and RTAs; this policy promotes building more Complete Streets; incentivizing active transportation options such as biking or scooters, working with employers to reduce commuting emissions e.g. telecommuting, or van/carpools, and promoting more non-work related shared rides. Larger investments to improve public transit and high-speed rail, including access to it, will be necessary.
Criteria highlights: Several strategies increase access to viable transportation options, improving social equity. Most of these are very viable, building off existing efforts.
Policy #3: **Price transportation externalities**
Our transportation system is burdened by market distortions, including the unpriced emission of pollution, the underpriced use of public infrastructure, particularly during periods of high traffic, and the subsidized use of public land for parking. Policies that more accurately price the use of valuable roads and bridges can incentivize lower GHG choices and use proceeds to invest in lower GHG choices and equity efforts to achieve lower GHG transportation across socioeconomic classes. Strategies to help achieve this include the Transportation Climate Initiative (TCI) and) Regional/State/Federal and economy-wide carbon pricing, as well as; roadway pricing changes; pay-by-the-mile auto insurance; reduced or eliminated parking subsidies; and TNC (i.e. Uber, Lyft) regulations.
Criteria highlights: These options raise money which can be re-invested to promote social equity and expansion of low-carbon alternatives and are effective means of achieving the behavior change necessary for substantial mode shift.
Policy #4: **Integrate transportation and land use planning**
The root of transportation emissions is moving people from point A to point B. Integrated, long term planning offers a suite of opportunities to decrease the distance between key locations and to increase convenient access to transit. Strategies include: expanding the housing choice initiative to prioritize; housing near public transit, making master plans for transit oriented development enforceable, reevaluating and eliminating parking requirements; and instituting transportation demand management policy to increase mobility needs as population and density grow.
Criteria highlights: These strategies would increase access to improve social equity, and building long-term GHG reductions scenarios that would be less likely to back-slide.

Policy Details

Buildings

IAC Buildings Work Group Policy Recommendations

Policy #1: Mandatory Building Emissions Reduction Limits

Policy Name: *Set Mandatory Emissions Reduction Limits on Building Sector Statewide by 2020.*

Summary:
Consistent with the state's ongoing obligation under the GWSA to ensure steadily declining, volumetric reductions in statewide emissions, including those in the building sector [New England Power Generators Association, Inc. v. Department of Environmental Protection, No. SJC-12477 (Sept. 4, 2018).], The Commonwealth should begin the stakeholder process of setting mandatory emissions reduction limits no later than about 2020 for 2030 and beyond, in order to achieve 2030 and 2050 thresholds. There are a range of potential regulations and complementary programs available for doing so, including:

- Offering incentives for the early retirement of inefficient HVAC systems and conversion to clean heating and cooling systems;
- Aligning EE goals/next 3 year plan with GWSA—Mass Save (2050 compliant)
- Maximizing the APS
    - Higher renewable thermal requirements for electric utilities; thresholds that incline more quickly, potentially through a carve-out mechanism for the renewable thermal technologies (EDCs in the APS that best allow us to comply with GWSA);
    - Setting requirements for gas utilities to demonstrate rigorous compliance with the Alternative Portfolio Standard (APS), also using renewable thermal technologies that best enable compliance with GWSA
    - Setting a mandatory threshold for the percentage of heating and cooling statewide that will come from renewable or clean electric sources (e.g. 30%) by 2030;* with increasingly stringent thresholds out to 100%, or as high as possible, by 2050;
- Maximizing Energy Efficiency
    - Leverage next 3-year Energy Efficiency Plan, and all subsequent plans, and Mass Save programs to require alignment of cost-effectiveness thresholds with GWSA 2030 and 2050 mandates
    - Incentives or requirements for whole building efficiency approach in new construction and existing
    - Incentives or requirements to accelerate EE standards, programs, and financing;
- Setting requirements to phase out fuel oil #2 and #6, and gas after a certain date [include in modeling];
- Other renewable thermal actions already recommended by the State's Department of Energy Resources (DOER).*

*MassDOER, *Commonwealth Accelerated Renewable Thermal Strategy* (Jan. 2014) at 2 ("With aggressive support for RT technologies and business-as-usual rates of conversion to natural gas, the state may serve a maximum of 32% of thermal loads with RT (up to 15,000 MWth of capacity)."

Evaluation Criteria & Implementation Notes	
GHG reductions	Beneficial – will lower statewide GHG emissions
Technical feasibility	Very feasible, many already exist (if imposing emissions limit, at some point it'll be the envelope, it'll be harder, especially "cost effectively", though cost-effectiveness and pricing of carbon should be reformed. Technically feasible – economically viable alternatives to fossil heating/bldg. services exist
Political feasibility	Feasible if clear market signals are sent early
Energy diversity	Beneficial – will lower building loads, de-stressing energy system and likely involves more use of DERs, adding diversity
Social equity	*Look at fuel oil closely here, lots of oil in EJ communities.* Beneficial – will result in energy-bill-lowering retrofit of low-income homes
Public Health	Beneficial – will result in better indoor air quality
State influence	Fully within jurisdiction

Leakage	Little impact but likely beneficial – will reduce load which will reduce pot. for leakage
Adaptation & resilience	Beneficial: will make all homes/buildings more resilient
Cost	Cost savings also to come, over the lifetime, if we exploit district heating and cooling and microgrid opportunities. Beneficial – current buildings can be deep energy retrofit while providing lower monthly bills to occupants
Revenue generation	No impact
Jobs	Workforce opportunities, end to end view of buildings value, retraining

Go/No-Go decision: Given above, should this stay on the short list for consideration/modeling? YES

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?** Job creation benefits Modeling how these things come out

Policy #2: Building Codes

Policy Name: Make the Building Code 2050-Compliant

Summary:
Because each building placed in service today is expected to be in service in 2050, and because building system costs are best minimized (and capitalized) at construction, the Commonwealth should, by about 2020 and no later than the adoption of the 2021 International Codes, comprehensively revise and update the Massachusetts State Building Code to require all new construction and major renovations to meet 2050-compliant building envelope standards in addition to supporting greater adoption of distributed energy resources and energy resiliency, including: storage; renewables for electricity and thermal energy; zero-emission vehicle (ZEV) charging; resilience/adaptive; and district heating and cooling.

A number of ultra-low energy intensity, 2050-compliant codes are already in use across the U.S. and Europe (e.g., Living Building Challenge, PHIUS+ 2015) that provide ready examples in whole or in part. All of these standards account for good building practices to improve public health through proper ventilation and air exchange, etc.* Some of these standards extend beyond the building footprint to take into account holistic benefits, such as the WELL standard which aims to improve health and human experience through design** or SITES, which is integrates landscape, ecosystems, and resilience. ***

* https://blog.passivehouse-international.org/eight-passive-house-myths-busted/

** https://www.wellcertified.com/

*** http://www.sustainablesites.org/certification-guide

Evaluation Criteria & Implementation Notes

GHG reductions	Yes – from better new construction and major renovation Some (85% is existing….). Beneficial – will lower statewide GHG emissions
Technical feasibility	100% technically feasible
Political feasibility	Feasible if clear market signals are sent early
Energy diversity	Can integrate many different kinds of clean energy and optimizes EE, Beneficial – will lower building loads, de-stressing energy system and likely involves more use of DERs, adding diversity
Social equity	*Improve equitable outcomes for all, positive for social equity (without code, leaves people behind)* *Potential for job creation,* Beneficial
Public Health	Very beneficial
State influence	Fully within jurisdiction
Leakage	Little impact but likely beneficial – will reduce load which will reduce pot. for leakage
Adaptation & resilience	Beneficial: more resilient homes/buildings
Cost	Affordable housing reviewed in Boston, around 3% upfront cost for ZNE. USGBC-MA report due out imminently, Beneficial – construction is least-cost time to, ensure 2050 compliance
Revenue generation	Cost savings over lifetime of buildings, and new trades jobs

Go/No-Go decision: Given above, should this stay on the short list for consideration/modeling? YES

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?** Looked at cumulative emissions reductions Timing of roll out makes a difference

Policy #3: Building-level Performance and Emissions Reporting

Policy Name: Require Expanded, Detailed Building Performance and Emissions Reporting, Benchmarking, and Improvements.

Summary:
The Commonwealth should work quickly to address the systemic lack of accurate information regarding building system performance and related building service emissions in Massachusetts. Strategies may include:

- Imposing, by 2020, mandatory building energy performance reporting requirements on all buildings of 20,000 square feet or greater throughout the Commonwealth, ratcheting down to smaller building footprints closer to 2030 and beyond.
    - Boston's Building Energy Reporting and Disclosure Ordinance (BERDO) and Cambridge's Building Energy Use and Disclosure Ordinance (BEUDO) provide ready examples of successful mandatory

energy reporting and disclosure frameworks the state can emulate. Any new requirements should be structured to coordinate with, and not duplicate or obviate, existing reporting requirements. South Portland Maine demonstrates how a benchmarking ordinance can work in smaller communities.
    - Impose an ACP mechanism to collect payments if buildings fail to report, make improvements, or meet thresholds of decreasing benchmarks, which can help fund improvements, particularly for low-income, EJ, historical buildings, small business, and non-profit communities.
- Exploring the feasibility of requiring building energy efficiency scorecards at the point of listing for sale, lease, or rental to cover all building sizes and types by 2030, embedding these into the MLS and enumerating the climate, economic, and public health benefits, among others, of efficiency.
- Providing utility and State funding for building operator training and other workforce opportunities; routine commissioning; occupant-focused behavioral change programs; energy management systems, smart lighting, and other smart controls; demand response programs; and technology transfer.
- Incentivizing green leases and other financing and incentive tools for both owners and tenants e.g. passthrough clauses, operational clauses, and sustainable purchasing.

Evaluation Criteria & Implementation Notes	
GHG reductions	Beneficial – reporting only will facilitate GHG reductions; if mandatory, would drive reductions
Technical feasibility	Technically feasible – City of Boston and other examples exist
Political feasibility	Feasible if clear market signal is sent early and incentives are included
Energy diversity	Beneficial – will lower building loads, de-stressing energy system and likely involves more use of DERs, adding diversity
Social equity	Beneficial
Public Health	Beneficial
State influence	Fully within jurisdiction
Leakage	Little impact but likely beneficial – will reduce load which will reduce pot. for leakage
Adaptation & resilience	Beneficial: more resilient homes/buildings
Cost	Technically, with disclosure and improvements, cost savings should result long-term
Revenue generation	Yes, if ACP mechanism activated. Job development.

Go/No-Go decision: Given above, should this stay on the short list for consideration/modeling? YES

Modeling considerations of policy			
Inputs	**Linking Constructs**	**Outputs**	**Outcomes**
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #4: Cross-Sectional Focus

Policy Name: Require a Cross-Sectional Focus

Summary: Our lives revolve around our homes and the buildings in which we work. Livable 2050-compliant buildings are connected to, and dependent on, a design ecosystem that includes local zoning; local, regional, and state transportation planning; our energy supply systems; resilience; public health considerations; and more. As we work to decarbonize our building sector as required by the GWSA, the Commonwealth should actively maintain a dynamic, cross-sector, "integrative design" approach that looks for and leverages win-win options that achieve or advance multiple goals simultaneously wherever possible. These include:

Strategies:

- **An interconnected regulatory landscape**: Explicit alignment between other environmental regulations and statutes and the mandated GWSA requirements, including the 3-year Energy Efficiency Plans, which are governed under the Green Communities Act, and the Board of Building Regulations and Standards (BBRS), which governs the State Building Code.
- **Local levers**: State funding and technical assistance programs that enable, accelerate, and incentivize climate-smart zoning, permitting, and inspectional processes; net zero planning; and financing mechanisms such as the HEAT loan, collective purchasing, and performance contracting.
    - Could this be modeled? State $ invested (GHG inventory, guidelines for standard data sources)
- **Resiliency**: Nature-based solutions (e.g. eco-roofs), preparedness, and smart growth coupled with energy resilient infrastructure and systems, including renewable-fueled microgrids, district heating and cooling systems, and storage.
- **Mobility and Smart Growth**: Buildings that serve as 2-way conduits for the transportation system of the future, including V2X,* lower parking requirements, Transportation Demand Management (TDM) strategies for workplace employees, and connections to transit and bike/ped infrastructure.
- **Waste**: Building level requirements in the municipal, residential, and commercial/industrial sectors for waste reduction, diversion, and clean waste-to energy production.
- **Equity**: All of the programs and strategies suggested within these recommendations should provide adequate incentives and support for affordable housing and low- and moderate-income residents to comply with any mandates and fully participate in all benefits and opportunities.

* V2X means generally vehicle-to-everything, and can include the grid, other vehicles, the built environment, and more. See, e.g., https://www.zdnet.com/article/what-is-v2x-communication-creating-connectivity-for-theautonomous-car-era/

Evaluation Criteria & Implementation Notes	
GHG reductions	yes
Technical feasibility	yes
Political feasibility	Business cases can easily be made
Energy diversity	yes
Social equity	*yes*
Public Health	yes
State influence	In many cases
Leakage	
Adaptation & resilience	yes
Cost	Should reduce overall
Revenue generation	

Go/No-Go decision: Given above, should this stay on the short list for consideration/modeling?

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Electricity

IAC Electricity Work Group Policy Recommendations

Policy #1: Promote Consistent GHG Accounting

Policy Name: Promote consistent GHG accounting methods within MA and among New England states.

Summary: Consistent, principled, and transparent emissions accounting is critical to achieving the GWSA's goals, particularly regarding the electricity sector. The issue is important both within the Commonwealth (for cities and towns with their own climate goals, for municipal aggregation, for municipal light plants) and regionally (in the context of large state clean energy procurements and as other states increase their focus on detailed emissions accounting in order to meet their own goals), and in each area we expect that importance to grow dramatically over the 2020s. As a result, the state should work to establish – in the early 2020s – consistent GHG accounting methods within MA and among New England states.

Strategies: We recommend that EEA and DEP immediately begin work to:

- Develop a recommended GHG accounting framework for use within MA by cities and towns that is consistent with the state's GHG Inventory and governing framework; and
- Actively work towards, and where possible affirmatively incentivize, the adoption by all New England states of a uniform method of greenhouse gas (GHG) emissions accounting consistent with that currently used by the Commonwealth.
    - Such methodology should reflect best-available information and practices for UN IPCC compliant emissions accounting, and should result in the amendment of the Commonwealth's methodology as needed to so conform.
    - EEA and DEP could initiate intra-state work on this perhaps as part of regional efforts around TCI.

Evaluation Criteria & Implementation Notes	
GHG reductions	Will ensure claimed GHG reductions across state and region are valid.
Technical feasibility	100% technically feasible; best-practices accounting structures already exist
Political feasibility	No major barrier – other state systems are generally less developed than MA's
Energy diversity	Will aid in (a) tracking and (b) understanding what to procure to ensure diversity
Social equity	No direct impact
Public Health	No direct impact
State influence	Internal is within state jurisdiction; external is issue for executive leadership in region
Leakage	Will help to minimize
Adaptation & resilience	No direct impact
Cost	Low
Revenue generation	None; has potential to make clean energy procurements more efficient/less costly

Jobs	No direct impact

Go/No-Go decision: Given Eval. above, should this stay on the short list for consideration/modeling? N/A (we assume the modeling will already be internally consistent).

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #2: Conduct Strategic Program Review & Alignment re: Emitting Generation

Policy Name: Conduct a strategic review and alignment of the RPS, APS, CES, and CPS regarding the participation in each of biomass, landfill gas, and MSW "waste-to-energy" electricity generators.

Summary: Initial analysis by the Commonwealth and by others indicates that in order to achieve GWSA-required levels of 2050 statewide emissions, ultra-low per megawatt-hour emissions will be required for the Commonwealth's entire electricity sector. Based on either potentially out-of-date life-cycle emissions estimates, or for other reasons altogether (e.g., to facilitate in-state waste disposal), however, several state energy programs currently include and incentivize electricity generation with substantial smokestack emissions that are likely not 2050-compliant. In order to ensure scarce ratepayer funds are spent wisely in pursuit of cost-effective GWSA-implementation, the state should review and revise, as necessary to ensure they are consistent with the Commonwealth's 2050 goals, the qualification and participation of biomass, landfill gas, and MSW "waste-to-energy" electricity generators in the RPS, APS, CES, and CPS and other clean energy incentive programs.

Strategies: We recommend that EEA and DEP

- Comprehensively review and analyze the ability of the state to meet GWSA-required emissions limits in 2050 while maintaining the current inclusion in those programs of biomass (particularly woody biomass), landfill gas, and municipal solid waste "waste-to-energy" and
- Propose no later than 2022, legislation and regulation based there on - as needed - to maintain or remove biomass, landfill gas, and MSW "waste-to-energy" to/from the RPS, APS, CES, and CPS in order to ensure Massachusetts will meet its GWSA obligations.
- Establish an internal interdisciplinary task force (electricity, emissions, solid waste) to develop a GWSA-compliant MSW plan for 2050.

Evaluation Criteria & Implementation Notes

GHG reductions	Beneficial: likely to increase GHG emissions reductions
Technical feasibility	100% technically feasible
Political feasibility	Fully within EEA and DEP jurisdiction to study and propose changes
Energy diversity	Minimal impact - may lead to slightly less energy diversity but small overall system impact due to relatively low MWh production from sources under review
Social equity	Beneficial: review sources include high volume particulate emitters in EJ communities
Public Health	Beneficial: review sources include high volume particulate emitters in EJ communities
State influence	Fully within EEA and DEP jurisdiction to study and propose changes
Leakage	No direct impact – source reduction would be offset by declining load (initially) and by on-going large procurements of non-emitting sources (sustained)

Adaptation & resilience	No direct impact
Cost	Low consumer cost; expected cost impact on privately owned review sources
Revenue generation	No direct impact
Jobs	Minimal impact – may lead to small localized job loss around few certain facilities

Go/No-Go decision: Given Eval. above, should this stay on the short list for consideration/modeling? Yes – modeling scenarios should include these sources and track their emissions through 2050; modeling should explore scenarios where these resources continue business-as-usual vs. with operating restrictions (including potentially, full shut-down by 2050).

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #3: Conduct Strategic Assessment of Municipal Light Plants

Policy Name: Conduct a strategic assessment of the role of MLPs in meeting the state's GWSA obligations.

Summary: The state's municipal utilities are generally exempt from major clean energy programs designed to ensure the state achieves its 2050 GWSA goals, and some municipal utilities have asserted that the state may not regulate them at all pursuant to the GWSA. Given that MLPs deliver about 12% of the electricity consumed in Massachusetts, the state should assess whether it can meet its GWSA mandate without the participation of MLPs.

Strategies: We recommend that EEA and DEP:

- Comprehensively review and analyze the ability of the state to meet GWSA-required emissions limits in 2050 without the participation of the MLPs in any mandatory clean energy or emissions program; and
- Propose no later than 2022, legislation and regulation based there on - as needed - to add MLPs to the RPS, APS, CES, and CPS and other clean energy programs in order to ensure Massachusetts will meet its GWSA obligations.

Evaluation Criteria & Implementation Notes

GHG reductions	Beneficial: likely to increase GHG emissions reductions
Technical feasibility	100% technically feasible
Political feasibility	Fully within EEA and DEP jurisdiction to study and propose changes
Energy diversity	Minimal impact - may lead to slightly less energy diversity but small overall system impact due to relatively low MWh production from sources under review
Social equity	Beneficial: review sources include high volume particulate emitters in EJ communities
Public Health	Beneficial: review sources include high volume particulate emitters in EJ communities
State influence	Fully within EEA and DEP jurisdiction to study and propose changes
Leakage	No direct impact – source reduction would be offset by declining load (initially) and by on-going large procurements of non-emitting sources (sustained)
Adaptation & resilience	No direct impact
Cost	Low consumer cost; expected cost impact on privately owned review sources

Revenue generation	No direct impact
Jobs	Minimal impact – may lead to small localized job loss around few certain facilities

Go/No-Go decision: Given Eval. above, should this stay on the short list for consideration/modeling? Yes – modeling scenarios should include scenarios where the MLPs are not participating in the state's decarbonization efforts, continuing business-as-usual practices; and scenarios where MLPs do participate in existing state programs (or in their own programs that have the same outcome trajectories as otherwise mandatory state programs).

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #4: Ensure the Electricity Distribution System Is 2050-Compliant

Policy Name: Ensure the state's EDC-maintained and operated electricity distribution system are transformed as needed to actively support and further statewide deep decarbonization efforts.

Summary: A thriving two-way electric distribution system that supports a wide variety of low-cost distributed energy resources and actively responsive demand is likely critical to the state's deep decarbonization efforts which will rely on ultra-low emissions electricity to allow widespread fuel-switching. While the Commonwealth's distribution system and distribution utilities are already successfully supporting the state's initial emissions reduction efforts (e.g., interconnecting and operating over 2,500MW of solar PV), substantial changes in that system are likely needed in order to support deep decarbonization and to do so at least-cost while ensuring reliability. The state must take active steps to ensure that the Commonwealth's electricity distribution system and its operators are designed and incentivized to actively support and further statewide deep decarbonization efforts.

Strategies: We recommend that EEA and its agencies, in one or more studies followed by one or more regulatory proceedings to:

- Maximize the ability of distributed energy resources (DERs) to contribute to cost-effective electricity generation, resilience and emissions reductions. Relevant studies and regulatory proceedings include:
  - DPU proscribing required hosting capacity analysis (that meet the most current Interstate Renewable Energy Council guidelines) from each EDC based on best-available DER integration information and practice; and
  - DPU conducting total value analysis (consistent with the methodology and approach in the Interstate Renewable Energy Council guidelines for Calculating the Benefits and Costs of Distributed Solar Generation) of DERs to include PV, demand response, and battery storage as well as clean micro-grids; and
  - DPU developing and issuing a comprehensive statewide plan to maximize emissions reductions, at least-cost to businesses and families, from the integration and use of DERs and clean micro-grids on the distribution grid.
- Maximize the ability of distribution customers and EDCs to provide and maximize the effectiveness of flexible and responsive demand, including to minimize costs and emissions associated with likely shifting peak load profiles. Relevant studies and regulatory proceedings include:
  - DPU and DOER developing, with the input and participation of the state's EDCs and other retail energy suppliers, a comprehensive statewide plan based on best-available information and practice regarding responsive and controllable load and peak demand reduction. Such a plan should consider, but not be limited to, deployment of time-of-use, or time-blocked, rates together with "smart grid" and consumer tools (e.g., real-time price and system information for customers, active demand management technologies, on-site storage, etc.) to access and respond to them

- Transform the EDC business model as necessary to create and support a 2050-compliant distribution system. Relevant studies and regulatory proceedings include:
    - DOER, the AGO, and DPU developing, with broad stakeholder participation and input:
        - A consensus regulatory framework for EDCs that is forward looking and outcomes-based and that will allow and incent EDCs to operate as distributed platform system operators (maintaining system reliability while integrating distributed energy resources and third-party technology and enabling two-way flows of electricity and information) and as active supporters (particularly with respect to their customers) of the state's decarbonization efforts; together with
        - An efficient and fair rate design that aids and helps to enable distribution system customers in making cost-effective decisions regarding their own usage and patterns of usage cause for the system.
    - DOER, the AGO and DPU allowing EDCs to establish budgets for demonstration, testing, and integration of new technologies and processes to determine their value for broader deployment; and
    - Consideration of the interaction between, and possible combination of EDCs and LDCs to ensure all distribution companies are appropriately authorized and incentivized to, and fairly remunerated for, actively supporting the state's deep decarbonization transition.

Evaluation Criteria & Implementation Notes	
GHG reductions	Beneficial: likely to increase GHG emissions reductions
Technical feasibility	100% technically feasible
Political feasibility	Fully within EEA jurisdiction to study and propose changes
Energy diversity	Beneficial: likely to increase energy diversity
Social equity	Beneficial: likely to increase local assets and local control
Public Health	Beneficial: likely to decrease non-GHG particulate pollution
State influence	Fully within EEA jurisdiction to study and propose changes
Leakage	No direct impact
Adaptation & resilience	Beneficial: DERs and clean micro-grids will make energy system more resilient and better able to adapt
Cost	Beneficial: recommended changes should each result in cost-savings and gains in efficiency
Revenue generation	No direct impact
Jobs	Beneficial: increased DER deployment will create local jobs (example: in-state solar jobs created to-date)
Go/No-Go decision: Given Eval. above, should this stay on the short list for consideration/modeling? Yes	

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #5: Ensure the Regional Electricity System Is 2050-Compliant

Policy Name: Ensure the New England electricity system's markets and planning processes are transformed as needed to actively support and further statewide deep decarbonization efforts.

Summary: Massachusetts participates in, and depends on, a regionally-managed electricity system (transmission grid, capacity markets, and market-based system dispatch) for the generation and delivery of its bulk electricity supply. In 2016, system stakeholders (members of the New England Power Pool) including the Attorney General's Office collectively identified a critical need to transform that regional system (planning and market structures) to fully integrate and support state decarbonization goals, particularly those of MA and CT which represent over 70% of regional consumption. Without such change – likely involving substantial market re-design – many stakeholders are concerned that the regional energy markets may collapse in the next decade as state-procured clean and renewable resources are brought online. The independent regional system operator has made clear that it will not change its market design to support decarbonization without the express direction, participation, and ultimate approval of the New England states. Massachusetts can and should lead the region to ensure such market redesign occurs in order to ensure the stability and future cost-effectiveness of the regional electricity system.

Strategies: We recommend that:

- EEA strongly, actively, and immediately lead on this issue.
- EEA should convene and coordinate relevant MA state agencies and actors (particularly the DPU and the AGO) together with counterpart New England state executive actors to build the necessary consensus to give strong direction to the regional system operator.

Evaluation Criteria & Implementation Notes	
GHG reductions	Beneficial: likely to increase/directly facilitate GHG emissions reductions
Technical feasibility	100% technically feasible – several viable market-design proposals currently exist.
Political feasibility	Possible – potentially necessary – but requires strong leadership
Energy diversity	Beneficial: likely to increase energy diversity (esp. existing nuclear and hydro)
Social equity	No direct impact (in the long run should lower system costs thus consumer costs)
Public Health	Beneficial: likely to decrease non-GHG particulate pollution by hastening transition to ultra-clean electricity generation
State influence	Indirect but strong – MA is effectively the 50% regional electricity customer
Leakage	Beneficial: likely to reduce
Adaptation & resilience	No direct impact
Cost	Beneficial: recommended changes should each result in cost-savings and gains in efficiency
Revenue generation	No direct impact
Jobs	Beneficial: facilitate new clean industry (especially offshore wind)

Go/No-Go decision: Given Eval. above, should this stay on the short list for consideration/modeling? Potentially – relevant if modeling includes cost assessments; we expect a thriving regional clean energy market to procure future required capacity additions more cheaply than state-only incremental long-term contracting.

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes

What does the policy do?	How do the program inputs achieve the program outputs?	What are the policy's goals?	How do those goals fit into the 2050 Roadmap?

Land use and Nature Based Solutions

IAC Land-use and Nature Based Solutions Work Group Policy Recommendations

Policy #1: Avoid Forest Conversion

Policy Name: Avoid conversion of forests – especially resilient, interior forests – to other land uses.

Summary: Prevention is always better than after-the-fact restoration or mitigation. Though data are constantly improving, we already have clear, spatially explicit data in Massachusetts, identifying forests that are carbon storage and sequestration powerhouses, as well as those that are most likely to survive climate change and remain carbon-rich in the future. Permanent conversion to other land uses impacts significant acreage, with fragmentation and edge effects impacting even more (see Mass Audubon's Losing Ground reports). Harvard Forest predicts a ~ 20% loss of carbon storage over the next 50 years if we continue current trends of forest land conversion and management.

Strategies:

1. Protect forest blocks, especially those that are large or interconnected, with the most carbon stored and the best ability to be resilient.
    a. Increase funding for EEA, DFW, and DCR land conservation programs, including raising the annual cap on the Conservation Land Tax Credit. Look for opportunities to leverage federal programs and private capital.
    b. Increase the weight given to carbon stock and/or sequestration in deciding which lands state agencies conserve
2. Allocate funding (e.g. use part of a Green Infrastructure Fund from a price on carbon) to help communities exercise their right of first refusal for Chapter 61 land.
3. Streamline and integrate state grant funding, ecosystem services payments, and tax incentives to make it easier to fund land protection using more than one source of funds.
    a. For a parcel of land that includes more than one land use (e.g. farm and forest), this is particularly important as funding sources like the Agricultural Preservation Restriction and forest conservation restriction funding sources may need to be combined with a single landowner on a single parcel.
4. Maintain/expand estate planning workshops and other technical assistance that reduces the barriers to landowners with conservation intent formalizing and acting on that intent.

Evaluation Criteria & Implementation Notes	
GHG reductions	We have this, more trees = less HVAC (cooling from forest)
Technical feasibility	Yes!
Political feasibility	Waxes and wanes, appetite of administration, land values, communities embracing, loss of community revenue on land conversion. Will it be managed? Reserve? Other activities. Always land protection happening, growing movement on carbon on land as part of the solution (right now is high). Local political, municipalities
Energy diversity	
Social equity	*Not a large concern, if succeed, could be beneficial. Offsets as an optics issue that the carbon sink would be better, offsets are replacing pollution in EJ communities. Parks: last small amount of forest is important not to convert—in urban/suburban*

Public Health	Water quality, air quality benefits
State influence	Regulatory approach? Cluster sub-division (zoning reform)
Leakage	
Adaptation & resilience	Huge benefits
Cost	Costs money, $$,
Revenue generation	ROI study, generate tourism revenue (TPL Study), ecosystem services, measurable, have good factsheets
Additionality	
Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?	

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #2: Blue Carbon Systems

Policy Name: Invest in the restoration, maintenance, migration, and protection of blue carbon systems (salt marshes and eelgrass beds) through funding, strengthening coastal wetland protection, and enabling salt marsh migration with land conservation and/or limited development/land use in the coastal zone.

Summary: Salt Marsh degradation and eelgrass meadow loss has been occurring, notably since the 1980s in some of Massachusetts greatest systems like Plum Island and Cape Cod Natural Seashore.[1] These systems provide fish nurseries, wave attenuation, and high rates of carbon sequestration, even more efficiently than forests[2],[3]. Degradation and loss creates mud flats releasing centuries worth of stored carbon into the atmosphere, further exasperating our greenhouse gas emissions, global warming and climate change. Blue Carbon systems degrade as a result of trampling and over-grazing from invasive crabs, from stormwater runoff and nutrient loading, and sea level rise.[4] Protecting, restoring, and maintaining our blue carbon systems is critical for not only shoreline protection from sea level rise and storm surge but also preventing a mass emission of greenhouse gases stored in

[1] National Park Service Salt Marsh Dieback Cape Cod National Seashore http://nbnerr.org/wp-content/uploads/2018/09/Overview_of_salt_marsh_losses_on_Cape_Cod_with_special_emphasis_on_crab-driven_vegetation_losses__consequences_S._Smith.pdf

[2] ESTIMATES OF CARBON SEQUESTRATION IN TIDAL COASTAL WETLANDS ALONG THE US EAST COAST 1 Charpentier, M, 2 Wigand C, and 3 Hyman, J. 1 Raytheon, 27 Tarzwell Drive, Narragansett, RI 02882. 2 US EPA NHEERL, Atlantic Ecology Division, 27 Tarzwell Drive, Narragansett, RI. 3 University of Rhode Island, Kingston, RI 02881.

[3] Drake, Katherine & Halifax, Holly & Adamowicz, Susan & Craft, Christopher. (2015). Carbon Sequestration in Tidal Salt Marshes of the Northeast United States. Environmental management. 56. 10.1007/s00267-015-0568-z.

[4] Bertness, MD, Holdred, C., Altieri, AH. Substrate mediates consumer control of salt marsh cordgrass on Cape Cod, New England. Ecology. 2009. Aug: 90 (8): 2108-17

these systems for centuries. Their protection also aid in closing the gap in achieving greenhouse gas reductions where clean energy, energy efficiency, and retrofits in the built environment can not, in a cost effective manner.

Strategies:

1) Protect all remaining blue carbon systems and consider strengthening the mitigation requirements for inland wetlands:

   -Strengthen the Massachusetts Wetland Protections Act and municipal local wetland bylaws for greater protective buffers and barriers around coastal wetlands. Eliminate development/ land use in the coastal zone to enable salt marsh migration. Use the BioMapII Coastal Adaptation Data to identify and prioritize no development and areas in greatest need for conservation for salt marsh migration.

   - Work with municipal coastal managers on creating boating, recreation, and commercial use of bays and harbors that create protective barriers for eelgrass beds. Invest in restoration of eelgrass beds where significant loss has occurred.[5]

   Prevent any further infilling or other conversion of salt marshes and eelgrass beds.
   Recognize that current compensatory mitigation requirements for conversion of wetlands do not adequately account for greenhouse gases, and revise them to reflect best-available science.

2) Provide additional funding for the Division of Ecological Restoration and Office of Coastal Zone Management, directed towards restoration projects that secure existing blue carbon stocks, manage invasive species, and improve the ability of blue carbon systems to sequester carbon. (show a $12:$1 ROI)

3) Leverage municipal MS4 permit requirements under the Clean Water required under the Clean Water Act as a mechanism to implement green infrastructure and natural runoff infiltration strategies to reduce non-point source pollution and nutrient loading to blue carbon assets. Assist municipalities in reducing upstream pollution from nitrogen and sediment that can degrade blue carbon systems by providing the a cost-benefit tool for green infrastructure vs. gray infrastructure, funding for green infrastructure with a goal of regional/watershed collaboration, and education on operation and maintenance of green infrastructure for municipal public works staff to enable operationalizing green infrastructure strategies.

Evaluation Criteria & Implementation Notes	
GHG reductions	More effective carbon sequestration than forests, protection of blue carbon prevents significant GHG emissions of centuries' stored carbon in salt marsh system.
Technical feasibility	Pilot salt marsh restoration projects on Cape Cod, Plum Island, and Narragansett bay.
Political feasibility	Lots of communities already doing this, soon to be mudflats, carbon storage in them, how to continue to enable growth and vitality of these regions, thin layer deposition being attempted, their protection is critical to keep carbon out of the atmosphere
Energy diversity	Carbon sequestration close the gap in GHG reduction strategies where traditional measures do not enable goals.
Social equity	*Green Economy Reduces environmental risks and ecological scarcities to improve the well-being and social equity of all – UN Environment Program*
Public Health	Promote water quality with filtering runoff and excel nutrients.
State influence	Yes, there are pollution standards
Leakage	

[5] Massachusetts Coastal Zone Management and Woods Hold Group Eelgrass Inventory data from 1995-2017. https://www.mass.gov/guides/eelgrass-mapping-project

Adaptation & resilience	Wave attenuation, help with coastal storms
Cost	
Revenue generation	Fish nurseries, important for commercial fish industry.
Additionality	

Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #3: Urban Trees

Policy Name: Continue, and greatly expand, urban tree planting and stewardship programs, such as Greening the Gateway Cities, ReGreen Springfield, and tree planting efforts within metro Boston.

Summary: To set ourselves up to meet future Global Warming Solutions Act targets (2030, 2040, 2050, etc), we need to plant trees now in places where they will significantly reduce energy usage and store carbon in future decades. Investing in tree-planting in urban communities benefits some of the most vulnerable residents of the Commonwealth who now currently lack tree canopy, and in small ways, begins to correct a history of environmental injustice. Community benefits include shade (and reduced cooling costs), windbreaks (and reduced heating costs), reduced stormwater runoff and flood risk, job opportunities for local residents, better respiratory health, and better quality of life from having access to green space.
Another idea: enabling legislation around urban trees, Some communities with tree bi-laws to get a permit to cut down a tree
Model bi-law for tree retention—in 2015 ABT program, lots of good ideas in there (linking to MVP program)
Green communities includes tree planting ordinance. Tree planting team

Evaluation Criteria & Implementation Notes

GHG reductions	Yes- Energy reductions, carbon capture, greening the gateway cities, Stantec study
Technical feasibility	Yes! Though hard to implement, not net loss
Political feasibility	Right of way issues, challenging to work with MassDOT/right of way, right of way planning, public agency collaboration
Energy diversity	
Job	Creates them, WFD, youth summer employment
Social equity	*WFD program for these jobs, water,* *Yes- Greening the Gateway study*
Public Health	*Yes- Greening the Gateway study*
State influence	
Leakage	
Adaptation & resilience	Co-benefits,
Cost	Over $600/tree, retention strategies, maintenance costs for street trees

Revenue generation	Potential from fines with different
Additionality	

Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?

Modeling considerations of policy			
Inputs	**Linking Constructs**	**Outputs**	**Outcomes**
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #4: Value Forest Carbon

Policy Name: Make the value of forest carbon visible and quantifiable in state policies.

Summary: As we recognize the cost of carbon in more and more sectors (e.g. electricity, heat, transportation), we should recognize that carbon stored by nature also has value. Forest carbon already has a price in the California and voluntary carbon offset markets, though Massachusetts' small parcel sizes and strong forest protections make it hard to access these existing markets. Every ton of carbon emitted from land use conversion is a ton of carbon Massachusetts must remove from the atmosphere. We need to set a precedent that forest carbon has value, and then increase that value until it matches the societal cost of carbon per ton (vastly underestimated by a US interagency group in 2016 at ~$42 per ton of carbon dioxide (~$11 per ton C) , and likely closer to $220 per ton CO2 (~$60 per ton C) or higher, as estimated by a group of Stanford economists in 2015).

- Follow Maryland's lead (but tailor to the needs of Massachusetts) with a "No Net Loss of Forest Carbon") policy, potentially set at 50% of MA (or the carbon equivalent) as called for by the Wildlands and Woodlands vision. This could build on the existing No Net Loss Policy related to state conservation lands, which requires ecologically equivalent mitigation when protected land is developed.
- Create a mitigation fund ("carbon banking," similar to existing water banking programs) for large-scale development projects, and allow developers to either directly compensate for loss of forest carbon (tree planting, paying for forest or coastal wetland restoration, protecting equivalent carbon stocks and sequestration capacity elsewhere, e.g.) or pay into the fund.
- Require "ecologically equivalent" compensatory mitigation for disturbances to large, intact forests that accounts for fragmentation and edge effects, and the loss of future carbon sequestration.
- Use the discretion within the current MEPA Greenhouse Gas Policy for projects over 50 acres, and explore updating MEPA requirements to lower the acreage threshold to 10 acres. Consider making greenhouse gas impact reporting and actions to partially offset impacts required (not at the Secretary's discretion) for all MEPA projects.

Enabling legislation for municipalities, the carbon communities program. Mitigation fees, water banking, local money, community could have a dedicated fund, stays local, keep $ in community, consider the safety, when trees come down, turn into mulch (then city doesn't need to spend, wood waste), wood-chipper to help go around
Help ID The data gaps

Evaluation Criteria & Implementation Notes	
GHG reductions	High, similar to land protection it's always cheaper and more effective to prevent loss (in this case of forest carbon) than to make up for it later
Technical feasibility	Feasible
Political feasibility	Could be a challenge since this is making costs formerly borne by the state/communities visible to individuals/businesses/communities
Energy diversity	

Social equity	
Public Health	
State influence	
Leakage	
Adaptation & resilience	
Cost	
Revenue generation	Would generate revenue (unless it kept all the trees!)
Additionality	
Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?	

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #5: Forest Management

Policy Name: Improve forest management.

Summary: Strategies that help improve the health and carbon sequestration abilities of forests should be pursued to ensure that MA helps actively improves the management of forests.
Strategies:

1) Provide additional rebates or other form of ecosystem service payment to landowners and developers who manage or restore lands in ways that store more carbon on the land and in usable products over the medium term(e.g. new Chapter 61 incentive program, Family Forest Carbon Program, or others), using a fixed rate for different land classes or for different management practices to decrease the bureaucratic load.
2) Promote sustainable and local uses of wood for construction and thermal energy.
3) Enforce and consider expanding procurement policies that require use of local wood. Looking only at forest carbon without considering what carbon is in the wood and if the wood is substituting for building or energy materials gives you only part of the picture. Some data exist on this, through New England Forestry Foundation and existing state-funded studies. DOER has wood product reports.
4) Establish that cutting plans every year will be used to establish regs into the future
5) Consider carbon sequestration and climate change adaptation in state-funded forest management plans and outreach materials, and in the type of forest management promoted to private landowners and implemented on public lands
6) Practice adaptive management, considering the impact of insect and disease outbreaks, fires, and storms in creating young forest and shrubland and reducing the annual acreage goal accordingly.
    a. Measure changes in type and volume of harvest statewide using cutting plans from the Forest Cutting Practices Act. Consider making this reported from the bottom-up, rather than top-down: provide an easily accessible, user-friendly tool to aid forest managers in quantifying their carbon loss, and for management plans that include re-planting, quantify the carbon benefits of that. Create a state-wide database that is evaluated every five years to determine net carbon emissions/capture through forest management practices.

7. Invest in cutting-edge landscape carbon measures (LiDAR, others) to allow for tracking the impacts of improved forest management over time.	
Evaluation Criteria & Implementation Notes	
GHG reductions	
Technical feasibility	
Political feasibility	Political. What forest practices to employ, extracting and keeping in the woods
Energy diversity	
Social equity	
Public Health	
State influence	
Leakage	
Adaptation & resilience	
Cost	
Revenue generation	
Additionality	
Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?	

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #6: Soil Carbon

Policy Name: Increase the carbon sequestration potential of soils

Both above and below-ground uses of land can aid in the sequestration of carbon; soil carbon and appropriate soil management techniques can significantly increase the carbon capture of land. MA has recently released a Healthy Soils Action Plan which outlines several key strategies to achieve health, carbon-capturing soils. The Commonwealth should pursue those strategies with an eye towards carbon sequestration potential, including providing incentives for best practices and finding other mechanisms to achieve compliance.

Summary:

1) Provide incentives and training for use of cover crops, biochar, low-till methods, and other means of increasing soil carbon.
2) Work with state Natural Resources Conservation Service (NRCS) office and officials to adjust cost share amounts and find other was to implement the USDA Building Blocks for Climate Smart Agriculture and Forestry (see report from May 2016).
3) Consider additional policies in the ReThink Soil roadmap published by The Nature Conservancy. IAC subcommittee members generally lack agricultural expertise and suggest looking to this document as an outside source.
4) Map organic soils that have a disproportionately high ability to store soil carbon and provide preferential or additional funding to improve soil management in these places.

Note: the Northeast Organic Farming Association of Massachusetts (esp. Marty Dagoberto) or Regenerative Design Solutions (esp. Jim Newman or Keith) would help with this given their lead work on the Healthy Soils Action Plan.

Evaluation Criteria & Implementation Notes	
GHG reductions	
Technical feasibility	
Political feasibility	
Energy diversity	
Social equity	
Public Health	
State influence	Do more here, Soils Teams
Leakage	
Adaptation & resilience	
Cost	
Revenue generation	
Additionality	

Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #7: Municipal Actions

Policy Name: Reward municipalities that use Smart Growth and other climate-friendly actions

Summary:
The Commonwealth has several programs already in place, including the Municipal Vulnerability Program (MVP), the Green Communities program, and the Housing Choice Initiative, that could better integrate nature-based solution and GHG mitigation strategies into their activities.
Strategies:

1) Provide implementation funding for priority actions identified by communities through the Municipal Vulnerability Program, favoring nature-based solutions.
2) Tighten certification requirements relating to the promotion and use of nature-based solutions.
3) Provide rebates at the municipal level or from a Green Infrastructure Fund for municipalities that adopt sustainable development ordinances or tree-planting and open space preservation policies, e.g.:
    a. Retaining trees on building sites
    b. Requiring planting of trees of equal carbon value when trees are removed (e.g. see GreenDOT tree replanting policy)
    c. Natural Resource Protection zoning

d. Updates and improvements to zoning, incl. mixed-use and infill/redevelopment zoning
e. Low Impact Development regulations.

4) Create programs that compensate lower income rural communities for conserving land and/or improving forest and farmland management, thereby offsetting carbon emissions from other communities. Consider allowing communities to invest in greening environmental justice communities.
5) Mainstream and incentivize nature-based solutions for infrastructure, or hybrid gray-green solutions.
   a. Consider the co-benefits of nature-based solutions when reviewing and funding projects for erosion control, stormwater storage, water quality, and other needs.
   b. Add green infrastructure projects to those eligible for loans from the Clean Water Revolving Loan Fund using the "sponsorship" model from Ohio and other states.
   c. Develop a calculator that synthesizes ecosystem and economic data into a spatial decision support tool to help communities evaluate nature-based solutions.
   d. Assist municipalities in reforming local ordinances and by-laws to enable the use of nature-based solutions, and in building and stewarding nature-based solutions projects.
   e. Encourage planning and building of nature-based solutions at the scale of ecosystems rather than municipalities.
6) Provide technical assistance and/or case studies to demonstrate avoided costs, e.g.:
   a. Reduced land clearing and grading, less extensive pipes and transmission lines, and less paving when compact development is used versus traditional development; avoids both building and maintenance costs
   b. Lower cost to comply with stormwater (MS4) permits by using natural bioretention for stormwater
   c. Lower energy costs from tree retention

Evaluation Criteria & Implementation Notes

GHG reductions	These can be high-level estimates of expected outcomes.
Technical feasibility	Additional modeling and analysis will refine them.
Political feasibility	
Energy diversity	
Social equity	
Public Health	
State influence	
Leakage	
Adaptation & resilience	
Cost	
Revenue generation	
Additionality	

Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?

Modeling considerations of policy

Inputs	Linking Constructs	Outputs	Outcomes
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Transportation

IAC Transportation Work Group Policy Recommendations

Policy #1: Reduce GHGs from vehicles

Policy Name: Reduce GHGs from vehicles.

Summary: Dramatically reduce emissions across vehicle types.
Strategies:

Protect and expand federal (And state!) vehicle emission and fuel economy standards- Ford, Honda, and BMW have officially announced they will continue to design and build to the 35 mpg standard.

- Baker administration work with allies in Congress and the administration
- Groups advocating in DC to demonstrate business support to retain standards
- NRDC and others suing EPA
- Work with California to establish strong LEV and ZEV standards post-2025.

Expand Incentives and Programs for EV, ZEV and Hybrid Vehicle transition

China is rapidly adopting EVs (see - status summary)

- **Heavy- and Medium-duty vehicles:** Almost all of Massachusetts freight transport, valued at $350m, moves by heavy duty, on-road vehicles. California's HVIP program provides up to $120,000 for transit buses in disadvantaged communities in addition to other incentives for electric trucks. This has an enormous impact on the payback periods for heavy duty electrification. New York also has an HVIP program. Electric vehicles/technology is now suitable and cost effective for many fleets: urban delivery, transit buses and shuttles, and refuse collection vehicles.
- Require that **existing fleets & vehicles be rebuilt with hybrid or EV technology.** Several American companies developing hybrids and electrification rebuild ventures (eg. Hybrid XL,in Mass, and EDI, based in CA)
- **Incentivize electrification of commuter rail trains and RTAs, state and municipal fleets, and school bus fleets.** Several bills currently under consideration on Beacon Hill propose electrification. Electric buses are price competitive but require significant upfront investment in vehicles and charging infrastructure. Many of the factors affecting the initial Mass pilot for school buses have been corrected in the last few years. Electric Buses Running in DC are cost competitive. Several other major US cities are moving to electric transit bus fleets, including New York City and Los Angeles which have committed to electrifying 100% of municipal buses by 2040.(HERE). Electrify commuter rail trains and prioritize electrification of trains and buses on routes that primarily serve environmental justice populations.
- **Look closely at use of Hydrogen & Fuel cell technology** *and biofuel. (Nikola Motor,*
  - *Bottom line: myriad technologies that can cost-effectively improve the fuel efficiency of Class8 trucks are readily available on the market today.*
- **Light Duty ZEV adoption and access**
- Expand EV incentive programs, including statewide low-income rebate
- Add dealer incentives and training to rebate programs
- Adopt EV car-sharing and other options to promote access in underserved communities

Ensure EV charging is good for the grid: EVs represent a potential flexible load that if properly managed could help our grid operate more efficiently, shave the peak and integrate intermittent sources of renewable energy. That will largely mean encouraging EVs to charge at night, when grid use is low. Promote policies to support efficient charging of EVs at private charging stations including variable time-of-use rates coupled with advanced metering infrastructure, which would reward drivers for plugging in at the right time or facilitate utilities controlling EV

charging directly in return for subsidized charging infrastructure, and opportunities for EVs to serve as energy storage systems. Promote policies that consider time-differentiated pricing and free charging at public charging stations.
Provide incentives to retire low-efficiency vehicles: Getting our most inefficient vehicles off of our roads is every bit as important as getting the newest technology on the road. New incentives could help residents who are currently driving old and inefficient pickup trucks and SUVs to upgrade to newer and more efficient alternatives.
Clean Fuels Standard (Dan Gatti - UCS)

- California's Low Carbon Fuel Standard has provided a significant incentive for electrification of passenger and heavy duty vehicles, in addition to low-carbon biofuels.
- Bringing a LCFS (or CFS) to the Northeast would provide a significant additional incentive for alternative fuels. A CFS could reduce regional emissions by 30 million tons while creating jobs and adding to our regional GDP.
- A CFS would also encourage the production of low-carbon biofuels such as biomethane, which could play an important role in the sectors that are most resistant to electrification, such as airplanes and long haul (heavy duty) trucks.

Evaluation Criteria & Implementation Notes	
GHG reductions	
Technical feasibility	
Political feasibility	
Energy diversity	Improves with more diversity of fuels/sources
Social equity	
Public Health	Biofuel to be listed and consider, not as public health-y.
State influence	
Leakage	
Adaptation & resilience	
Cost	
Revenue generation	
Jobs	

Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?

Modeling considerations of policy

Inputs	**Linking Constructs**	**Outputs**	**Outcomes**
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #2: Promote alternatives to driving

Policy Name: Promote alternatives to driving

Summary: Increase the number of Massachusetts residents who routinely use alternativesto driving, including public transit. Achieving our emissions and climate goals in the transportation sector will require behavior change. Luckily, behavioral choices are not immutable, but rather are a result of past policy decisions, many of which subsidize single-occupancy car travel and parking, hiding their true costs—congestion, pollution, and public health impacts.

Increase funding for the MBTA and RTAs with an eye towards continued growth in the Boston metro area and throughout Massachusetts, improving reliability, and making critical investments in expanded service and better cross-mode/region connections including funding for bus and rail maintenance infrastructure and fare structures that encourage increased ridership.

Complete Streets (See Boston Complete Streets) (MAPC, T4Mass)

- Designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities. Complete Streets make it easy to cross the street, walk to shops, and bicycle to work.
- State transportation projects generally include Complete Streets components, but there is always room for improvements, including on DCR roads.
- State grant program to incentivize and assist cities and towns to build complete streets has been successful and should be expanded.

Incentivize active transportation options (MAPC)

- Follow recommendations from Massachusetts Statewide Bicycle Transportation Plan to ensure expansion of safe and accessible cycling infrastructure across the Commonwealth. The initiatives described in the plan will expand the network of safe, comfortable, and connected cycling infrastructure, improve roadway safety for cyclists, and increase bicycling as a travel option for people of all ages and abilities. Crucial to this work will be collaboration with cities and towns when considering infrastructure investments and related cycling improvements.
- Work with cities and towns to facilitate bike sharing as an active transportation option and first mile/last mile connection to transit. As more dock-based and dockless system offer pedal-assist electric bicycles, ensure rules and regulations for pedal-assist bicycles operations are clear and prioritize user safety.

Encourage Telecommuting (See 2017 State of Telecommuting in the U.S.): In more than half of the top U.S. metro areas, telecommuting exceeds public transportation as the commute option of choice. Though a small piece of total transportation emissions, it has grown far faster than any other commute mode. Because telecommuting is only available to workers with professional, computer-based jobs and not service or industrial workers, there must be complementary policies that improve public transit options for workers that will not benefit from telecommuting opportunities.

Promote Ride-haringing and Commuter Carpooling : Public, and some private, organizations should be supported in programs that reduce the number of vehicles that are required to move passengers from origin points to destination. A cultural change away from single occupant vehicles, in addition to the current transit model, needs to be fostered, to decrease the VMT of so many cars all crowding together on the same routes.

- **Improve the successful Massachusetts Ride-share Program (MassDEP Air) for commuters:**
  - MA Companies that have 250 employees and hold air operating permits are required to reduce single occupant commuter trips by 25% and thus, require employers to have aggressive programs to get their commuters out of private cars. Good examples of this statewide air quality program are those in Cambridge and Boston. Companies with fewer employees could be encouraged to join.
  - 100's of thousands of single occupant commuter trips have been eliminated through matching for vanpools and carpools, bicycle incentives, offering transit pass sales at workplaces, and regional transit scheduling support
  - 130 companies currently report annually; more could be included and more transit pass subsidies encouraged.

Invest in High Speed Rail: Enhancing and expanding transit and rail infrastructure in the Commonwealth and region has the potential to dramatically reduce car travel. Similarly, enhancing and expanding rail infrastructure in the Northeast Corridor has the potential to dramatically reduce air travel. The creation of a high speed, competitively priced rail network that provides frequent and reliable service between New York and Boston would obviate the need for air shuttle service, while connecting and revitalizing New England's legacy cities, including Springfield, Lawrence, and Fall River.

Evaluation Criteria & Implementation Notes

GHG reductions	Near term high (the worse the vehicle, the better the reduction when an alternative is sought.
Technical feasibility	Range from mostly to very technically feasible
Political feasibility	variable
Energy diversity	
Social equity	Public transportation and other non-car mobility options can improve access
Public Health	
State influence	
Leakage	
Adaptation & resilience	
Cost	
Revenue generation	

Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?

Modeling considerations of policy			
Inputs	**Linking Constructs**	**Outputs**	**Outcomes**
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #3: Price transportation externalities

Policy Name: Price transportation externalities

Summary: Our transportation system is burdened by market distortions, including the unpriced emission of pollution, the underpriced use of public infrastructure, particularly during periods of high traffic, and the heavily subsidized (and often mandated) use of public land for parking. Providing a more rational cost signal to account for these externalities would make our transportation system more efficient, while also providing potential funding to improve our transportation system. If we more accurately price the use of valuable roads and bridges by employing policy tools like smart metering, curb pricing, and dynamic tolling, we can incentivize the use of public transit and carpooling, while raising funds to help lower-income groups impacted by new pricing schemes and make smart investments to expand low/zero emissions public transit.

Transportation and Climate Initiative: Create a regional cap and invest program that will set an enforceable limit on global warming emissions in the transportation sector, reduce that limit each year, and require oil producers to purchase allowances from within those enforceable limits. Use the funds generated by auction sales to invest in clean transportation strategiesin urban, suburban, and rural communities. Develop a community advisory committee that the state TCI officials work with during program design and implementation to ensure public accountability.

- A 2015 Report from Georgetown Climate Center provides information on carbon pricing and reinvestment, along with suite of complementary policies.
- "The report finds that existing federal and state policies are projected to cut greenhouse gas emissions 29 percent by 2030 in the region from 2011 levels. Additional strategies analyzed in the report could further those reductions, achieving total cuts of 31 to 40 percent by 2030 while also resulting in significant public health improvements."
- Economic analysis finds that a comprehensive implementation of state clean transportation policies could bring net cost savings of $32.3 billion to $72.5 billion over 15 years to the region's businesses and

consumers, while at the same time adding $11.7 billion and 91,000 new jobs or more to the regional economy in 2030.

- A 2017 Whitepaper from Georgetown Climate Center on cap & invest explores potential mechanics of the program
  - Addresses many of the "How?" policy design questions
  - Does not include quantitative analysis

Regional/State/Federal and economy-wide carbon pricing (with similar efforts in many northeast and mid-atlantic states)

- Carbon pricing bills have been introduced in Vermont, Mass., Rhode Island, Connecticut, New York, Maryland and DC, and likely soon in New Jersey; plus elsewhere in US.
- These bills would provide a more serious carbon price incentive than is in RGGI or is being contemplated for TCI and would yield greater GHG reductions
- All bills return substantial portions of the funds to households, but differ by state; all attempt to fully compensate low-income people; most bills give a portion of the funds to vulnerable businesses and other employers; all devote a portion of the funds to investment

Smarter Tolling/Roadway Pricing/Congestion pricing: Reduce congestion (and indirectly reduce GHGs and local air pollutants) by establishing time-of-use rates on our most congested roads and highways that encourage travel at off-peak hours.

- Congestion pricing benefits drivers and businesses by reducing delays and stress, by increasing the predictability of trip times, and by allowing for more deliveries per hour.
- It benefits state and local governments by improving the quality of transportation services without tax increases or large capital expenditures, by providing additional revenues for funding transportation, by retaining businesses and expanding the tax base, and by shortening incident response times for emergency personnel and thus saving lives.
- Avoids need/temptation to expand road network, while potentially raising money to reinvest in the transportation system.
- It benefits mass transit by improving transit speeds and the reliability of transit service (especially buses)

Possibilities include time-of-day pricing for tolls, and/or "cordon" pricing (i.e. a charge to enter a downtown business district). Use of smarter tolling policies is widespread and growing across the country and globe.

Pay by the mile auto insurance. (This was part of the 2010 CECP, but removed in the 2015 version)

- A 2010 Study found that Massachusetts' consumers would save money; Insurers would improve the accuracy of their rating plans while providing an incentive to reduce the number and cost of auto accident claims; and the environment will benefit from the reduction in driving that PAYD incentivizes – less driving means reduced fuel usage and lower greenhouse gas emissions.
- HERE is a list of companies that offer pay-by-the-mile insurance
- Carve out for residents living far from where they regularly travel and/or who were displaced -- equity
- Think through the benefits/challenges of this design. How are we subsidizing driving and offering reliable transportation alternatives? (Lizzi Weyant at MAPC has some good thoughts on this as it is similar to VMT pricing…lots of ways to set-up for urban/rural divides, etc…)

Reduce parking subsidies: Eliminate zoning requirements that mandate parking, charge market rates for residential parking passes, increase the price of parking on public land to reflect actual market demand, repurpose large quantities of public parking spaces and put that land to better use doing almost anything else, particularly building housing, bike lanes, and support creation of dedicated bus lanes that operate as bus rapid transit.

Regulate TNCs (such as Uber and Lyft) to encourage electrification and shared trips: Increase the existing TNC fee to account for the impact these fleets have on congestion and emissions, particularly if trips start and end within the MBTA service area. Use TNC fees price signals to encourage carpooling and electrification. Encourage TNC trips that provide "first mile, last mile" services to public transportation centers while discouraging those that overlap with potential public transportation routes. Promote use of municipal TNC funds for innovative and meaningful investments in transportation alternatives.

Evaluation Criteria & Implementation Notes	
GHG reductions	
Technical feasibility	
Political feasibility	
Energy diversity	
Social equity	When designed well, should be very beneficial.
Public Health	
State influence	
Leakage	
Adaptation & resilience	
Cost	
Revenue generation	Yes, i.e. TCI gets revenue, helps to pay for all these other things

Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?

Modeling considerations of policy			
Inputs	**Linking Constructs**	**Outputs**	**Outcomes**
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**

Policy #4: Integrate transportation and land use planning

Policy Name: Integrate transportation and land use planning

Summary: The root of transportation emissions is moving people from point A to point B. There are a suite of opportunities to help improve longer term planning to improve the location and connection between key locations.

Strategies:

Expand the Housing Choice Initiative. Invest more money in programs like Housing Choice that provide grants to communities that produce more housing units and adopt best practices that support a growing workforce and enhance access to opportunity. Some of these best practices include reducing parking requirements at multifamily developments, allowing multifamily development byright, and having an approved 40R Smart Growth or Starter Home District. Advancing programs like Housing Choice will help promote land use reforms necessary to facilitate smart growth, and could be further enhanced by encouraging greater housing production near transit.

Improve Connections Between Housing and Public Transit The MBTA has already developed draft TOD policies and guidelines that are available here.

- **Enforceable master plan for TOD**
- **Reevaluate parking requirements so they are more reflective of parking demand**. Cities and towns should consider reducing parking requirements for developments. A study by the State Smart Transportation Initiative found that there is a relationship between building more parking and increased automobile use. Similarly, MAPC's Perfect Fit Parking report found that parking is often overbuilt at multifamily developments in the Boston region, and the study also identified a reduced demand for parking near transit stations. This should be considered part of a broader TOD strategy (see above).

Institute transportation demand management (TDM) policies to support increased mobility needs as population grows. TDM helps ensure that investment in transit, walking, and biking infrastructure can keep pace with increasing development. The City of Cambridge has a nationally recognized Parking and Transportation Demand Management Ordinance that is triggered when a nonresidential property owner requests to add parking above the registered number. In the case of Cambridge, TDM is linked with the City's mode shift goals

Work with employers to provide incentives to reduce workplace transportation GHG emissions including.

- Promoting employers to limit work-related air travel
- **Consider Increase funding/incentivizing TMAs** (Transportation Management Associations). TMAs in Massachusetts provide services to more than 300 companies and property owners in 40 municipalities
- They work with employers to provide incentives to employees, e.g.
  - In-company or neighborhood-based rideshare matching.
  - Flexible scheduling options
  - Guaranteed ride home in emergencies
  - Bike and transit reimbursement programs

Evaluation Criteria & Implementation Notes	
GHG reductions	Long term reductions
Technical feasibility	
Political feasibility	
Energy diversity	
Social equity	*Opportunity to improve access*
Public Health	
State influence	
Leakage	
Adaptation & resilience	
Cost	
Revenue generation	

Go/No-Go decision: Given #3, should this stay on the short list for consideration/modeling?

Modeling considerations of policy			
Inputs	**Linking Constructs**	**Outputs**	**Outcomes**
What does the policy do?	**How do the program inputs achieve the program outputs?**	**What are the policy's goals?**	**How do those goals fit into the 2050 Roadmap?**