To: Transportation and Climate Initiative Technical Analysis Workgroup Christine Kirby and Chris Hoagland, Co-Chairs https://www.transportationandclimate.org/main-menu/tci-regional-policy-designstakeholder-input-form

Re: Joint Comments on 8/8 TCI Reference Case Results Webinar and Next Steps

Thank you for the opportunity to provide comments on the reference case modeling results presented by the Transportation and Climate Initiative (TCI) states on August 8, 2019,¹ as well as the states' next steps in modeling potential policy and sensitivity cases. As recognized on the webinar, modeling is only part of the process of developing an equitable and environmentally robust regional clean transportation policy, but it can be a valuable tool to help shed light on the anticipated effectiveness of different policy proposals and inform the eventual policy design.

The TCI states are undertaking a multifaceted modeling effort to understand how a proposed regional carbon cap-and-invest policy for transportation would affect emissions, public health, economic growth, jobs, and households. We strongly support this approach.

Because no single model can provide all this information, the states' plan to combine multiple modeling frameworks is key to providing a more complete picture of the benefits and costs of proposed policies and the distribution of benefits and costs. While most of this modeling effort is still to come, the states have thus far presented an overview of their intended approach² and have completed the first phase: development of a draft reference case that looks at anticipated, business-as-usual emissions and fossil fuel use in the transportation sector in the absence of potential regional clean transportation policies.

Below, we provide recommendations on the states' next phase of modeling—consideration of potential policy cases—as well as initial feedback on the draft reference case and potential sensitivity cases to evaluate, based on the information released to date. We anticipate providing further comments as additional modeling results and information are provided.

<u>Stakeholders Require More Information to Provide Effective Feedback</u>: Moving forward, to help stakeholders better understand and comment on the states' modeling, we request that TCI states post comprehensive information from each stage of their modeling online, including detailed spreadsheets that contain key modeling assumptions and provide comprehensive outputs

¹ Transportation and Climate Initiative, "TCI Webinar: Reference Case Results" (Aug. 8, 2019), https://www.transportationandclimate.org/tci-webinar-reference-case-results.

² Transportation and Climate Initiative, "Technical Workshop: Regional Cap and Invest for Transportation, Key Design Elements" (Apr. 30, 2019),

https://www.transportationandclimate.org/technical-workshop-april-30-2019-boston.

from this modeling.³ To facilitate timely stakeholder feedback, this information should ideally be made available to stakeholders at the same time as high-level summaries of modeling results.⁴

I. <u>Policy Case Modeling Recommendations</u>

We provide the following initial recommendations on selecting and modeling policy cases:

A. The time horizon for policy case carbon caps and analysis should be through 2035

The August 8th reference case webinar provided results from the NEMS energy-economy model through the year 2032. We recommend adopting a longer horizon, such as 2035, for both the reference case and policy cases. A longer horizon is likely to better capture and enable turnover of the existing vehicle fleet to cleaner models. In contrast, adopting too short of a timeframe will not enable many older and less efficient vehicles to be economically retired in the model before the end of the time horizon, thus limiting the effectiveness of any policies modeled. The timeframe for analysis should ideally span the assumed average vehicle lifetime in NEMS (e.g., 15 years from 2021-2035). Emissions caps considered by the states should similarly utilize this timeframe and account for deeper emissions reductions that could be achieved due to increased vehicle turnover over this horizon.

To the extent possible, we also encourage the states to explore sensitivities in NEMS and/or ensure that the modeling fully considers the effects of technological innovation, economic trends, and investments that could accelerate vehicle turnover rates in both policy and reference cases. For example, cost declines in electric vehicles (EVs), including as a result of rebate programs and other incentives; more accessible and affordable public transit; planning and investments to create more walkable and bikeable communities; and other initiatives, such as "cash-for-clunkers"-style programs could make earlier retirements of older, less efficient vehicles economical.

B. Carbon caps should be consistent with achieving states' 2030 and 2050 greenhouse gas emission reduction targets and on the scale needed to address the climate crisis

TCI states have adopted both legally-binding and aspirational economy-wide greenhouse gas (GHG) emission reduction targets for 2030, 2050, and other years. Transportation sector carbon caps considered in the policy case modeling should be consistent with achieving these commitments. Because the transportation sector is the biggest source of GHG emissions in the region, an insufficiently ambitious regional transportation carbon caps considered in the modeling should be consistent or achieve state emission targets. The carbon caps considered in the modeling should

³ For example, RGGI states provide detailed information on modeling assumptions and comprehensive spreadsheets containing modeling outputs as part of their program review stakeholder process. See RGGI, Inc., "Program Review," at https://www.rggi.org/program-overview-and-design/program-review.

⁴ Since the TCI states have already provided a high-level summary of the draft reference case, we request that detailed information on reference modeling assumptions and outputs be provided as soon as possible.

further account for the IPCC's recent finding that we must rapidly reduce use of all fossil fuels, including in the transportation sector, by 2030 to avoid the worst effects of climate change.⁵

While a regional transportation carbon cap-and-invest policy might only establish a legallybinding carbon cap through 2035, we encourage the states in the policy case modeling to assume continued emission reductions will also be needed beyond 2035.

C. Investment of carbon allowance auction proceeds are key to the success of a transportation cap-and-invest policy and should be included as part of a rigorous policy case analysis

Evaluating the effects of an emission cap without also considering the investment side of a capand-invest policy, would provide an incomplete picture, likely resulting in an analysis that unreasonably inflates the policy's costs while underestimating its benefits. Our understanding is that the states seek to avoid such skewed results by modeling a carbon cap and potential investments of carbon allowance auction proceeds together: by combining energy-economic modeling outputs from NEMS with a custom transportation investment model that has been developed by Cambridge Systematics and iterating between these two models. We support this approach and encourage the states, when they present policy case results to stakeholders, to do so by providing the combined results of these modeling frameworks.

More stakeholder input is needed on specific investment priorities and decisions and should be solicited through open, inclusive, and accessible stakeholder forums held regionally and in individual states. However, for purposes of the current modeling, the states should consider a range of potential investment options or portfolios to help stakeholders understand how different approaches could affect outcomes under different policy cases and cap levels.

The states should also present outputs for policy cases from the other modeling efforts they are undertaking to help stakeholders understand the health, economic, jobs, and distributional effects of policy choices. While further refinements of these additional models may continue beyond the initial policy case modeling, it will be important for the states to provide as complete a picture as possible of the differences between policy cases and between policy cases and the reference case when they present policy case results. Ultimately, the success of a regional clean transportation policy will be judged not only on its projected GHG emission and economic effects, but also on its ability to reduce health-harming pollution and enhance equity in the region.

II. <u>Reference and Sensitivity Case Modeling Recommendations</u>

To be most valuable, it is critical that the TCI states incorporate the best available information and projections in their reference case model, which is the starting point for considering policy cases and provides an important basis for comparison. Because assumptions about the future are inherently uncertain, where possible, sensitivity analyses should be used to test uncertainties and understand how changes in key modeling assumptions would affect projected outcomes.

⁵ IPCC (2018), *Special Report: Global Warming of 1.5 °C: Summary* for Policymakers, https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf.

As noted above, it would be helpful for the states to provide more information about the reference case modeling presented on the August 8th webinar to facilitate stakeholder feedback. However, based on the information provided thus far, we offer several suggestions—some of which we also provided in earlier comments⁶—to improve the reference case further, as well as recommendations for sensitivity cases and analyses that could provide valuable information to the states and stakeholders towards the development of a regional clean transportation policy.

A. Electric Vehicle Costs

In our earlier comments following the May technical webinar, we recommended that the TCI states use the most recent, 2019 EV battery price forecast from Bloomberg New Energy Finance (BNEF)⁷ in their reference case, instead of the states' original proposal to use price projections from a NYSERDA study. <u>We continue to recommend using the 2019 BNEF forecast.</u>

In the draft reference case, the states have taken a hybrid approach: projecting battery prices at the start of the analysis that are consistent with BNEF's (lower) 2019 forecast but then transitioning to NYSERDA's (higher) forecast values by 2030. This approach is preferable to using the NYSERDA study alone but results in a reference case forecast that is still likely to overestimate future EV battery prices and underestimate price reductions in the coming years.

As pointed out in comments by Synapse Energy Economics, the NYSERDA study was itself based on a BNEF forecast, relied on a version of that forecast—from 2016—that is now several years out of date.⁸ In the intervening years, lithium-ion battery prices have continued to fall much faster than most analysts predicted, including a 35 percent drop between 2018 and 2019 alone.⁹ This rapid technological development makes it imperative to use the most up-to-date information. By relying on outdated information, NYSERDA's study projected battery pack prices in 2018 that were significantly above what BNEF found was the actual average price last year. This calls into question the relative accuracy of using a modeling approach that relies on NYSERDA's forecast—even in the hybrid approach described above—compared to a more recent data source.

⁶ Joint advocates group comments on May 23, 2019 webinar (May 29, 2019), https://www.transportationandclimate.org/sites/default/files/webform/tci_2019_input_form/Advocate%20 Group%20Comments%20on%205_23%20TCI%20Webinar.pdf.

⁷ Bloomberg New Energy Finance, *Electric Vehicle Outlook 2019*, https://about.bnef.com/electric-vehicle-outlook/.

⁸ Synapse Energy Economics, Inc., *TCI Reference Case Assumptions Comments* (May 29, 2019), https://www.transportationandclimate.org/sites/default/files/webform/tci_2019_input_form/TCI% 20Refer ence% 20Case% 20Assumptions% 20Comments.pdf.

⁹ Jeff St. John, "Report: Levelized Cost of Energy for Lithium-Ion Batteries Is Plummeting," *Greentech Media* (Mar. 26, 2019), https://www.greentechmedia.com/articles/read/report-levelized-cost-of-energy-for-lithium-ion-batteries-bnef.

BNEF has surveyed average battery prices for nearly 10 years, has provided annually-updated battery price forecasts for several years, and continues to refine its forecasting methodology.¹⁰ Rather than relying on a hybrid approach that incorporates the now out-of-date NYSERDA study, the states should use the most recent BNEF forecast to set EV battery prices in the reference case model.

If the states continue with their current approach, we recommend including a sensitivity analysis that uses the unaltered BNEF forecast, to provide a comparison to the NYSERDA-BNEF hybrid.

B. Vehicle Introduction Years

We continue to recommend that the reference case assume that light-duty PHEV and EV cars and trucks will be available across segments by 2025, and in most cases earlier, given the rapid pace of PHEV and EV technology development and new model announcements. As shown in the vehicle-introduction-year table presented on the August 8th webinar, the TCI states currently assume in the reference case that many light-duty-vehicle segments will effectively never be served by PHEV or EV models, by assigning vehicle introduction years of 2051, which is beyond the modeling timeframe. We do not believe this is a realistic assumption.

The lack of public announcements of PHEV and EV models for certain segments is more likely to be a function of automakers' vehicle roadmaps for the mid-2020s not yet being made public than it is to reflect insurmountable technological hurdles in bringing PHEV and EV technologies to these segments that will persist, as the states are currently assuming, for the next 30 years. Accordingly, we recommend replacing the reference case's remaining assumptions of 2051 PHEV and EV model introduction years with introduction years of 2025 or earlier.

The TCI states have not provided information on the medium- and heavy-duty vehicle introduction year assumptions used in the reference case. As noted above, we request that the states publicly release this information along with other key assumptions as soon as possible for stakeholder review. As noted in our earlier comments, similar to light-duty technology availability, the state of technology for electrified heavy-duty vehicles is progressing rapidly with battery cost decreases. Accordingly, with respect to heavy-duty vehicles, we recommend that the reference case's entries up through Class 8 be unconstrained post-2020 for the various technologies including battery-electric vehicles and hydrogen fuel cell vehicles.

C. Vehicle Turnover Rates

As noted above, to the extent possible, we encourage the states to explore sensitivities in NEMS and/or ensure that the reference case and policy cases fully consider the effects of technological innovation, economic trends, and investments under existing policies that could accelerate vehicle turnover rates. For example, cost declines in EVs, including as a result of rebate programs and other incentives; more accessible and affordable public transit; planning and

¹⁰ Bloomberg New Energy Finance, "A Behind the Scenes Take on Lithium-ion Battery Prices" (Mar. 5, 2019), https://about.bnef.com/blog/behind-scenes-take-lithium-ion-battery-prices/.

investments to create more walkable and bikeable communities; and other initiatives could make earlier retirements of older, less efficient vehicles economical.

D. Vehicle Miles Traveled (VMT)

We recommend including a sensitivity case or cases with lower projected VMT in future years than in the current reference case, to account for demographic changes as well as the potential for strategies such as bike plans, pedestrian-friendly streets, light-rail corridors, bus rapid transit, and road pricing to reduce VMT during the modeling horizon.¹¹ Such a sensitivity analysis could draw from the "Low VMT" case included in AEO 2014, which resulted in nearly flat VMT growth between 2012 and 2040 (and a 0.7% annual decline in VMT per driver over that period), and a 9% reduction in CO₂ emissions in 2040 relative to the AEO 2014 reference case.¹²

E. Fuel Economy Standards

We support the states' decision to include the federal augural fuel economy standards and adopted federal and CA/section 177 GHG emission standards for light- and heavy-duty vehicles in the reference case through model year 2025.

As noted in our previous comments, if the TCI states include a sensitivity case to evaluate the negative effects on emissions, public health, and consumer costs of the Trump Administration's proposed rollback of federal light-duty vehicle standards, we also recommend including a sensitivity that considers the possibility and benefits of more stringent federal and CA/section 177 standards, by assuming a rate of improvement that is at least consistent with the rate of improvements required over the last five years, through at least 2035.

F. Electricity Sector and RGGI

We support the states' decision to update the AEO 2018 assumptions in NEMS to reflect the values NJDEP used in its RGGI modeling <u>as the starting point</u> for the reference case. However, the reference case should also be updated further to reflect recent updates in TCI states' climate and clean energy laws, states' offshore wind targets and ongoing procurements, and the current, best available information on load forecasts and renewable energy costs in the region. Specifically:

1. State Climate and Clean Energy Laws

¹¹ According to Smart Growth America, these strategies can reduce VMT in an area by between 1% and 10%. Smart Growth America (2016), *Driving Down VMT*,

https://www.smartgrowthamerica.org/app/legacy/documents/smartgrowthclimatepolicies.pdf.

¹² U.S. EIA, "Issues in Focus: Light-duty vehicle energy demand: demographics and travel behavior" (Apr. 16, 2014), https://www.eia.gov/outlooks/archive/aeo14/veh_demand.php; U.S. EIA (2014), *Annual Energy Outlook 2014*, https://www.eia.gov/outlooks/archive/aeo14/.

All state climate and clean energy laws should be reflected in the reference case, including the Climate Leadership and Community Protection Act (CLCPA) in New York¹³ and new climate and clean energy laws in Maine.¹⁴ As previously recommended, DC's 100% renewable energy by 2032 requirement and Maryland's adoption of a 50% by 2030 renewable portfolio standard should also be reflected in the reference case, if these laws have not already been incorporated.¹⁵

2. Load Forecasts and Energy Efficiency

Where available, more recent load forecasts than included in the NJDEP RGGI modeling should be used in the reference case, including ISO New England's 2019 CELT forecast.¹⁶ Load forecasts should be further adjusted, where necessary, to fully reflect states' energy efficiency commitments, including New York's CLCPA commitment to reduce energy consumption by 185 trillion BTUs from the 2025 state forecast through energy efficiency improvements.¹⁷

3. Offshore Wind Targets

The reference case should fully incorporate TCI states' offshore wind commitments, including New York's recent selection of new offshore wind projects totaling 1,700 MW and the state's

¹⁴ Maine's LD 1679 requires economy-wide GHG emission reductions of 45 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050, while LD 1494 sets statewide goals of achieving 80 percent renewable electricity by 2030 and 100 percent renewable electricity by 2050. State of Maine Office of Governor Janet T. Mills, "Governor Mills Signs Major Renewable Energy and Climate Change Bills Into Law" (June 26, 2019), https://www.maine.gov/governor/mills/news/governor-mills-signsmajor-renewable-energy-and-climate-change-bills-law-2019-06-26.

¹³ Among its provisions, the CLCPA requires: (1) economy-wide GHG emission reductions of 40 percent below 1990 levels by 2030 and 85 percent below 1990 levels by 2050, with remaining emissions offset by 2050 to achieve net zero emissions; (2) 70 percent renewable electricity by 2030 and zero-emissions electricity by 2040; (3) 9,000 MW of offshore wind by 2035; (4) 6,000 MW distributed solar by 2025; (5) reduction in energy consumption of 185 trillion BTUs from the 2025 state forecast through energy efficiency improvements; and (6) 3,000 MW energy storage capacity by 2030. State of New York, Office of Governor Andrew M. Cuomo, "Governor Cuomo Executes the Nation's Largest Offshore Wind Agreement and Signs Historic Climate Leadership and Community Protection Act" (July 18, 2019), https://www.governor.ny.gov/news/governor-cuomo-executes-nations-largest-offshore-wind-agreementand-signs-historic-climate.

¹⁵ Maryland Clean Energy Jobs Act (2019), https://legiscan.com/MD/text/SB516/id/2034938/Maryland-2019-SB516-Chaptered.pdf; City of Washington, D.C., Department of Energy and Environment, "Mayor Bowser Signs Historic Clean Energy Bill, Calling for 100% Renewable Electricity by 2032" (Jan. 18, 2019, https://doee.dc.gov/release/mayor-bowser-signs-historic-clean-energy-bill-calling-100-renewable-electricity-2032.

¹⁶ ISO New England, CELT Report: 2019-2028 Forecast Report of Capacity, Energy, Loads, and Transmission (May 1, 2019), https://www.iso-ne.com/static-assets/documents/2019/04/2019_celt_report.xls.

¹⁷ State of New York, Office of Governor Andrew M. Cuomo, "Governor Cuomo Executes the Nation's Largest Offshore Wind Agreement and Signs Historic Climate Leadership and Community Protection Act," *supra* note 13.

commitment to install 9,000 MW of offshore wind by 2035 under the CLCPA.¹⁸ In the last two years, a number of other states have also added offshore wind targets. In 2018, both New Jersey and Massachusetts passed new laws requiring 3,500 MW of offshore wind by 2030 and 2035, respectively.¹⁹ Connecticut and Maryland committed in 2019 to offshore wind additions of 2,000 MW and 1,200 MW, respectively, and have begun the request for proposal (RFP) process for achieving these targets. The map below from S&P shows that in total TCI states have committed to add more than 19,000 MW of offshore wind by 2035.



US East Coast states to add more than 19,000 MW of offshore wind by 2035

Map compiled Aug. 21, 2019.

PPA = power purchase agreement

Source: S&P Global Platts; S&P Global Market Intelligence; Bureau of Ocean Energy Management; NYSERDA

4. Renewable Energy Costs

¹⁸ Id.

¹⁹ American Wind Energy Association, *U.S. Offshore Wind Industry Status Update* (Sep. 2018), https://www.awea.org/Awea/media/About-AWEA/U-S-Offshore-Wind-Fact-Sheet-September-2018_2.pdf.

Renewable energy costs should be updated in the reference case to use the National Renewable Energy Laboratory's (NREL) 2019 Annual Technology Baseline.²⁰

5. Energy Storage Targets

The reference case should incorporate all state mandates for on-grid battery storage, including New York's mandate of 3,000 MW energy storage capacity by 2030 under the CLCPA.²¹ There are similar procurement targets in New Jersey and Massachusetts.

6. On-grid Battery Costs

The reference case should utilize up-to-date forecasts of on-grid battery costs, such as from individual TCI states, if available, or from sources such as BNEF.²²

7. Virginia and RGGI

Consistent with the final rule approved by Virginia's Air Pollution Control Board, the reference case should assume that Virginia's power sector CO₂ Budget Trading Program enters into force in 2021, at which time the state will link with RGGI.²³

8. Decarbonization of the Electricity Grid

The reference case should assume the region's electricity sector is decarbonized no later than 2050. New York's electricity sector should be fully decarbonized in the model by 2040, consistent with the CLCPA.²⁴ D.C. has also committed to 100% renewable energy by 2032, while Maine has adopted a goal of 100% renewable electricity by 2050.²⁵ Several TCI governors have also committed to power sector decarbonization by 2050 or earlier. Maryland's governor

²³ Virginia Regulatory Town Hall, CO2 Budget Trading Program (Final Text), https://www.townhall.virginia.gov/L/ViewXML.cfm?textid=13287.

²⁴ State of New York, Office of Governor Andrew M. Cuomo, "Governor Cuomo Executes the Nation's Largest Offshore Wind Agreement and Signs Historic Climate Leadership and Community Protection Act," *supra* note 13.

²⁰ NREL (2019), 2019 Annual Technology Baseline: Electricity, https://atb.nrel.gov/electricity/.

²¹ State of New York, Office of Governor Andrew M. Cuomo, "Governor Cuomo Executes the Nation's Largest Offshore Wind Agreement and Signs Historic Climate Leadership and Community Protection Act," *supra* note 13.

²² See Bloomberg New Energy Finance, "Energy Storage Investments Boom As Battery Costs Halve in the Next Decade" (July 31, 2019), https://about.bnef.com/blog/energy-storage-investments-boom-battery-costs-halve-next-decade/ (referencing BNEF's Energy Storage Outlook 2019).

²⁵ City of Washington, D.C., Department of Energy and Environment, "Mayor Bowser Signs Historic Clean Energy Bill, Calling for 100% Renewable Electricity by 2032," *supra* note 15; State of Maine Office of Governor Janet T. Mills, "Governor Mills Signs Major Renewable Energy and Climate Change Bills Into Law," *supra* note 14.

has established a 100% clean electricity by 2040 goal, while Connecticut and New Jersey's governors have committed to 100% clean and renewable electricity by 2050.²⁶

G. Federal EV Tax Credit

We support the states' assumptions regarding the federal EV tax credit in the reference case.

We further recommend including a sensitivity case that extends the federal EV tax credit, consistent with introduced bipartisan legislation, to an additional 400,000 purchasers per manufacturer at \$7,000.²⁷

H. ZEV Mandates and State EV Incentives

We support assuming section 177 states maintain and enforce their existing Low Emission Vehicle (LEV) and Zero Emission Vehicle (ZEV) programs. As previously noted, the states adopting these programs in the reference case should include Colorado, since it previously adopted LEV and, on August 16, 2019, officially adopted ZEV.²⁸

We further recommend that the states assume, either in the reference case or in a sensitivity case, that these programs continue at a rate at least consistent with the last five years of regulation, though 2035. During this period, the analysis should also assume existing state incentives, including rebates and tax credits, are available.

I. Fuel Prices

As noted in our previous comments, we recommend that the states update the reference case to include the most recent projections of fuel supply and prices from AEO 2019.

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²⁶ State of Maryland Office of Governor Larry Hogan, "Governor Hogan Outlines Bold Energy Strategy" (May 22, 2019), https://governor.maryland.gov/2019/05/22/governor-hogan-outlines-bold-energy-strategy/; State of Connecticut, Governor John G. Rowland, Executive Order No. 32 (Apr. 22, 2004), https://www.ct.gov/governorrowland/lib/governorrowland/Executive_Order_No._32.pdf; State of Connecticut, Office of Governor Ned Lamont, Transition Policy Working Group, *Energy Policy Committee Final Memo: Supporting Materials*, https://portal.ct.gov/-/media/Office-of-the-Governor/Working-Groups/Transition-Policy-Working-Group/Energy-Policy-Committee---Supporting-Materials.pdf, at 8; State of New Jersey, Governor Philip D. Murphy, Executive Order No. 28 (May 23, 2018), http://nj.gov/infobank/eo/056murphy/pdf/EO-28.pdf.

²⁷ "Stabenow, Alexander, Peters, Collins, Kildee Introduce Bipartisan Bill to Expand Electric Vehicle and Hydrogen Fuel Cell Tax Credits" (press release), April 10, 2019,

https://www.stabenow.senate.gov/news/stabenow-alexander-peters-collins-kildee-introduce-bipartisan-bill-to-expand-electric-vehicle-and-hydrogen-fuel-cell-tax-credits.

²⁸ Colorado Department of Public Health and Environment, "Air Quality Control Commission adopts a zero-emission vehicle standard" (Aug. 16, 2019), https://www.colorado.gov/pacific/cdphe/news/AQCC-ZEV.

Thank you again for the opportunity to provide these comments.

Sincerely,

Acadia Center Climate Law & Policy Project Climate XChange Connecticut League of Conservation Voters Conservation Law Foundation EarthKind Energy Environmental League of Massachusetts Health Care Without Harm Natural Resources Council of Maine Natural Resources Defense Council Sierra Club Transportation for Massachusetts Union of Concerned Scientists