Agenda

• Welcome/Introductions - Commissioner Dominguez/Jared Snyder

• Report out on Market Based Measures/Finance Roundtable – Paul Allen

• State of Transportation Electrification in NYS - Cadmus

• Report out from Panel sub-work groups – Panelists

• Open Panel discussion on Policy Recommendations – Julie Tighe & Others

• Next Steps - Commissioner Dominguez/Jared Snyder

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Meeting Procedures

Before beginning, a few reminders to ensure a smooth discussion:

• Panel members should be on mute when not speaking

• Video is encouraged for Panel members, in particular when speaking

• We will not be muting individuals for this discussion; the chair will call on members individually, at which time please unmute

• If technical problems arise, please contact: Jesse.Way@cadmusgroup.com
Panel Member Roll Call

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Transportation Advisory Panel Members

Marie Therese Dominguez, Chair
NYSDOT

Jared Snyder
NYSDEC

Paul Allen, M. J.
Bradley & Associates

Dimitris Assanis,
Stony Brook University

Steve Finch, AAA
Western & Central
New York

Albert Gore III, Tesla

Kendra Hems,
Trucking Association of New York

Elgie Holstein,
Environmental Defense Fund

Renae Reynolds,
New York City Environmental Justice Alliance

Porie Saikia-Eapen,
Metropolitan Transit Authority

John Samuelsen,
Transport Workers Union of America AFL-CIO

Kerene Tayloe, WE
ACT for Environmental Justice

Julie Tighe, NYS
League of Conservation Voters

Craig Turner, Buffalo
Niagara International Trade Gateway Organization

Nick Sifuentes,
TriState Transportation Campaign

Renae Reynolds,
New York City Environmental Justice Alliance

Craig Turner, Buffalo
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Bob Zerrillo, New York Public Transit Association

Julie Tighe, NYS
League of Conservation Voters

Craig Turner, Buffalo
Niagara International Trade Gateway Organization

Bob Zerrillo, New York Public Transit Association
Market Based Measures/Finance Roundtable
Report Out & Discussion
1. Project Status
2. State of Transportation Electrification in NYS
3. GHG Projections: Reference Case
4. Policy Insights
Status of NYS Clean Transportation Roadmap

Model calibration complete. Currently generating preliminary results.

- **2020 Q1**: Data Collection
- **2020 Q2**: Model Development
- **2020 Q3**: Model Calibration
- **2020 Q4**: Preliminary Results
- **2021 Q1**: Finalize Results
- **2021 Q2**: Final Report
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## State of TE | Barriers to Electrification

Barriers depend on vehicle type; generally higher for non-light-duty vehicles.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Light-Duty Vehicles</th>
<th>Medium-Heavy-Duty Vehicles</th>
<th>Non-Road (Aviation, Marine, Rail, Off-Road)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial purchase price</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Electrical infrastructure impacts</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Reduction in payloads</td>
<td>--</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Cost depreciation</td>
<td>Medium</td>
<td>Medium</td>
<td>Unknown</td>
</tr>
<tr>
<td>Insufficient model availability</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Vehicle range anxiety</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Residential charging access and infrastructure</td>
<td>Medium</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Complex public charging access</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Awareness and education barriers</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Lack of interoperability of equipment</td>
<td>Medium</td>
<td>Medium</td>
<td>Unknown</td>
</tr>
<tr>
<td>Cold weather</td>
<td>Low</td>
<td>Medium</td>
<td>Unknown</td>
</tr>
<tr>
<td>Stock turnover</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Long charge times</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Battery recycling challenges</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Source: Author analysis*

Low / Medium / High refer to the difficulty of electrifying a given vehicle type based on level of complexity, cost, risk, etc.
State of TE | Costs of Electric Vehicles

Price parity / TCO parity between EVs and ICEVs expected this decade for light-duty vehicles.

Total Cost of Ownership

When is Upfront price parity?
- Sedans: 2027
- Pickup Trucks: 2027
- Crossovers: 2028
- SUVs: 2028
- Vans: 2028

When is TCO parity?
- Sedans: 2021
- Pickup Trucks: 2023
- Crossovers: 2023
- SUVs: 2024
- Vans: 2024

Sources:
- Battery pack costs from Kapoor et al. (2020). [https://mackinstitute.wharton.upenn.edu/2020/electric-vehicle-battery-costs-decline/](https://mackinstitute.wharton.upenn.edu/2020/electric-vehicle-battery-costs-decline/)
State of TE | MHDV and Off-Road Sub-sectors

MHDV context is distinct and will require customized policies.

State of TE | **MHDV and Off-Road Sub-sectors**

Many MHDV categories will become cost competitive by 2030 (on TCO basis). Fleets will need support to make the shift to electric even at cost parity because of the risk associated with adopting new technologies.

Example TCO analysis of cargo trucks (left) and medium-duty trucks (right)

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## Reference Case | Narrative Description

Reference Case assumes continuation of current policies, programs, and market trends.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Socioeconomic &amp; Lifestyle</strong></td>
<td></td>
</tr>
<tr>
<td>Urbanization/De-urbanization</td>
<td>New York State does not change its level of urbanization.</td>
</tr>
<tr>
<td>Economic Activity</td>
<td>The global economy grows at rates consistent with historical trends.</td>
</tr>
<tr>
<td>Equity</td>
<td>Equity continues to be a central social issue.</td>
</tr>
<tr>
<td>Consumer/Corporate/Institutional Behavior</td>
<td>COVID-19 results in no long-term structural shifts. E-commerce continues to grow at rates consistent with historical trends.</td>
</tr>
<tr>
<td>Population</td>
<td>Population grows according to Cornell University population projections.</td>
</tr>
<tr>
<td>Federal Action</td>
<td>CA's Clean Air Act waiver is maintained. National fuel economy standards aligned with Obama-era standards.</td>
</tr>
<tr>
<td>State Action</td>
<td>NYS EV incentives persist at same levels. No new transportation electrification policies are introduced beyond those that exist today.</td>
</tr>
<tr>
<td>Mobility Options</td>
<td>SAVs do not gain traction. Micro-mobility (such as e-scooters) grows slowly over time.</td>
</tr>
<tr>
<td>Energy Supply &amp; Delivery</td>
<td>EV battery costs decline consistent with historical trends. Fuel prices stay at approximately today’s levels.</td>
</tr>
</tbody>
</table>

Source: Based on input from Expert Advisory Council workshop held in September 2020
Reference Case | Transportation GHG Emissions

In Reference Case, GHG emissions decline by -0.5% per year relative to today / 1990 levels. Future GHG reductions driven by light-duty vehicles.

**Insight:** Emissions are relatively flat through 2030 then decline slowly to 2050.

**Insight:** MHDV emissions have largest growth.

**Insight:** Emission reductions greatest in gasoline / LDVs.

**Insight:** Aviation emissions increase due to demand increases.

*Figure only shows direct emissions (i.e., electricity not included)*

Source: Cadmus analysis with NY-VISION tool
Reference Case | Light-Duty Vehicles

Fuel economy improvement and shift to EVs has larger impact on GHG emissions than VMT increases.

Emissions by Vehicle Type
100-Yr GWP, Direct Only

Avg Real-World Fuel Economy
(MPGGe)

Annual Vehicle Miles Traveled

Figure only shows direct emissions (i.e., electricity not included)
Source: Cadmus analysis with NY-VISION tool

Source: Cadmus analysis of MOVES model and AFLEET tool

Source: Cadmus analysis of VE-State model
Reference Case | Light-Duty EV Sales

BEV+PHEV new sales share grows from ~2% today to 24% by 2030 and 48% by 2050. Growth to 2025 aligned with ZEV Mandate. After 2025, growth driven by battery cost reductions.

Source: Cadmus analysis using customized NY vehicle choice model
Even in a Reference Case, residential charging plugs grow to nearly 3 million by 2050; public charging plugs grows to nearly 1 million.
Reference Case | Load Profiles for Un/managed Charging

Unmanaged charging for all on-road vehicles results in high peaks

Source: Cadmus analysis using EVSE accounting tool
Reference Case | Medium/Heavy-Duty Vehicles

GHG emissions decline by -0.6% per year (16% total) relative to today, driven largely by vehicle efficiency improvements.

PROVISIONAL FINDINGS – FINAL RESULTS STILL UNDER REVIEW

Source: Cadmus analysis using NY-VISION tool
Reference Case | MHDV Fuel Economy & VMT

VMT increases by +0.6% to +4.2% per year depending on vehicle type.

Fuel economy increases by +0.3% to +0.8% per year

PROVISIONAL FINDINGS – FINAL RESULTS STILL UNDER REVIEW

Source: Cadmus analysis using MOVES output
Reference Case | Aviation

Pass/ton-miles grow at 1.6% while aircraft efficiency grows at 1.3% per year. Overall GHG emissions increase by 9% relative to today with an annual growth rate of +0.3%.

Source: Cadmus analysis using EPA SIT data
Reference Case | Marine, Rail

Marine emissions are stay flat over time. Rail emissions increase by +0.6% per year.
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## Policy Insights | Qualitative Comparison

### High-Priority Policy Suitability Matrix (High is More Desirable)

<table>
<thead>
<tr>
<th>Policy</th>
<th>EV Sales Impact</th>
<th>Fiscal Impact</th>
<th>Equity/Health Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA ACC2 Revised ZEV Mandate Extension</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>CA Advanced Clean Trucks Rule</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Vehicle Purchase Incentives</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Feebates</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Carbon Pricing</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Low Carbon Fuel Standard</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Outreach and Education</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Charging Infrastructure Investment</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Utility Rate Designs</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Cadmus analysis
Policy Insights | Differential Burden of Transportation Costs

Lower income households spend higher share of after-tax income on transportation. Trend very prominent in households under $30K per year.

Sources: Bureau of Labor Statistics, 2020
Policy Insights | Differential Vehicle Ownership Rates

Rates of car ownership vary across the state and can be factored into how equity is considered in policy designs.

Vehicle Ownership Rates in Select Counties

Source: Cadmus analysis
These two policies reduce GHGs by ~40% relative to 2050 Reference Case levels.

**Insights:**
- ACC2 has larger impact on GHG emissions than ACT
- About ~1/2 of remaining emissions in 2050 are from aviation sector
- Some LDV emissions remain because not 100% of vehicles have turned over
Policy Insights | Vehicle Purchase Incentive/Feebate

EV sales shares increase with increasing incentives (figure does not include impact of ZEV Mandate or federal EV tax credit)

**Insights:**
- Elasticity of new EV sales share with respect to incentive value is low
- Increases with incentive value

*Source: Cadmus analysis using customized NY vehicle choice model*
Among New York Drive Clean rebate recipients, 77% of BEV owning participants and 61% of PHEV owning participants have an annual household income greater than $100,000.
Policy Insights | Vehicle Purchase Incentive/Feebate

**Equity Challenge**

- Tax credits require tax liability to claim
- Incentives focused on higher income buyers
- Vehicle Eligibility
- Reaching non-drivers

**Policy Design Choices to Enhance Equity**

- “On-the-hood” rebates are more accessible for consumers across income classes
- Tax refunds are another way to ensure a tax credit is available to consumers that do not have tax liability
- Limit eligibility for higher income EV buyers and/or provide bonuses for lower income EV buyers
- Offering incentives for sales of used EVs in addition to new sales
- Incentives to support electric buses and rail, other modes like biking
Policy Insights | Charging Station Incentives

Challenge

Poor ROI for Charging Stations

EV owners will charge at peak times without appropriate price signals

Current electric tariffs can lead to very high cost per kWh, especially for high-powered charging

Solution

More EVs on the road will improve utilization, ROI

Direct support for EVSE installations

Work with utilities to use technology to manage charging and get customers on TOU rates

Alternative rate structures that encourage EV adoption while also considering costs to electric grid
EV sales share is highly inelastic to changes in gasoline price. Though limited direct impact on electrification, revenues from a carbon price invested in electrification could have larger impact.

Source: Cadmus analysis using customized NY vehicle choice model
Policy Insights | Carbon Price/LCFS

Equity Challenge

- least-cost GHG reductions may not spread benefits evenly across communities
- uniform price signals may have disproportionate impacts on LMI households

Policy Design Choices to Enhance Equity

Design Solution

- Pair GHG programs with programs that specifically target co-pollutants to ensure local impacts are addressed
- focus investment of program revenues in disadvantaged communities

CADMUS
Outreach and education programs that increase EV familiarity have a measurable effect on EV market share. Increasing familiarity matters more in the near-term when awareness is low.

Source: Cadmus analysis using customized NY vehicle choice model
Q&A
Electrification/Fuels Sub-Work Group Report Out & Discussion
Pubic Transportation Sub-Work Group
Report Out & Discussion
Smart Growth Sub-Work Group
Report Out & Discussion
Open Panel Discussion on Policy Recommendations

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Next Steps/Open Discussion

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