Minnesota Pathways to Decarbonizing Transportation: Technical Stakeholder Meeting #1

April 18, 2019
This project has an accelerated timeline, and therefore is not meant to be the final word on transportation decarbonization.

This work is meant to be an initial assessment of opportunities within Minnesota and will inform future work.

Timeline:

- April
  - Modeling
  - Technical Presentations*
  - Technical Feedback
  - Public Presentations*

- May
  - Methods
  - Draft Results

- June
  - Final Results

*Exact dates of future presentations to be determined
Introductions

Name
Organization

What is your role in transportation decarbonization?
• What are the most important strategies that offer the most promise for decarbonizing the transportation sector? (pick three)
  • Record one idea per sticky note

• What policies are most likely to achieve transportation decarbonization? (pick three)
  • Record one idea per sticky note
Pathways to Decarbonizing Transportation
A partnership with MnDOT, MPCA, MDA, EQB, Department of Commerce, and the McKnight Foundation

Tory Clark, Director, Energy + Environmental Economics
Agenda

• Background
• Goals and Timeline
• Modeling Approach
• Example Policies and Measures
• Next Steps
• Q&A
Project Team

Snuller Price (E3)  
*Project Advisor*

Amber Mahone (E3)  
*Project Advisor*

Tory Clark (E3)  
*PM: Transportation Pathways Modeling*

Brendan Jordan (GPI)  
*PM: Stakeholder Outreach*

Gabe Mantegna (E3)  
*PATHWAYS Analysis*

Dan Aas (E3)  
*PATHWAYS Analysis*

Katelyn Bocklund (GPI)  
*Stakeholder Outreach*

Lola Schoenrich (GPI)  
*Co-Facilitator*

Abby Finis (GPI)  
*Researcher*
E3 is an industry leading consultancy in North America that operates at the nexus of energy, environment, and economics. We complete 200+ projects a year across the energy sector, emphasizing electricity.

**DERs & Rates**
- Analyzes distributed energy resources, emphasizing their costs and benefits now and in the future.
- Supports rate design and distribution system planning.

**Asset Valuation**
- Determines asset values from multiple perspectives.
- Uses proprietary in-house models and in-depth knowledge of public policy, regulation and market institutions.

**Planning**
- Develops and deploys proprietary tools to aid resource planners.
- Informs longer-term system planning and forecasting.

**Market Analysis**
- Models wholesale energy markets both in isolation and as part of broader, more regional markets.
- Key insights to inform system operators and market participants.

**Clean Energy**
- Provides market and policy analysis on clean energy technologies and climate change issues.
- Includes comprehensive and long-term GHG analysis.
E3 consults extensively for utilities and government agencies on clean energy issues. E3 PATHWAYS projects evaluate long-term, economy-wide energy scenarios, with a focus on electricity and natural gas.

### California PATHWAYS studies
Analyzing strategies to meet 2030 & 2050 GHG targets (Air Resources Board, CA Energy Commission, Southern California Association of Govts.)

### New York Decarbonization Pathways
Evaluating options to meet 80% GHG reduction goals for the state by 2050

### Oregon Market Approaches to Reducing GHGs
Impact of current policies on Oregon’s GHG emissions and potential role of cap and trade, with OR DEQ

### Maryland PATHWAYS
Analyzing impact of existing policies and more aggressive mitigation policies on GHG emissions in Maryland

### U.S. Deep Decarbonization Pathways for the DDPP
 Evaluated scenarios to meet 80% reduction in GHGs in the U.S. by 2050, part of the DDPP

### Minnesota PATHWAYS
Exploring the role of electricity in economy-wide decarbonization for Xcel Energy’s Upper Midwest Integrated Resource Plan
In 2018, E3 created a model of economy-wide energy and emissions as a part of Xcel Energy’s Integrated Resource Plan.

Starting with that model we will focus on transitions in the transportation sector.

Key measures in transportation:
- CAFE fuel economy standards
- Reductions in on-road VMT
- Aggressive sales of LDV, MDV, and HDV ZEVs
- Biofuels
Goals and Timeline
Goals

• Under the Next Generation Energy Act (NGEA), Minnesota is required to reduce greenhouse gas (GHG) emissions 30% below 2005 levels by 2025, and 80% by 2050

• The goal of this project is to complete initial assessment of opportunities in Minnesota’s on-road transportation sector to reduce GHG emissions to meet the levels outlined in the NGEA

• E3 will be completing an analysis to evaluate the energy and emissions implications of different transportation measures and actions, and will create scenarios to meet the goals

• We are interested in your input and feedback, which will inform this analysis and future work
• This project has an accelerated timeline, and therefore is not meant to be the final word on transportation decarbonization.

• This work is meant to be an initial assessment of opportunities within Minnesota and will inform future work.

*Exact dates of future presentations to be determined.*

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Modeling Approach
Modeling Scope

- Transportation emissions made up 26% of 2016 GHG emissions in Minnesota.
- This project will focus on surface transportation, 20% of 2016 emissions.
  - This excludes aviation, marine, rail, and military emissions.

### Minnesota GHG Emissions

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Transportation</td>
<td>Light Duty Autos</td>
<td>Stock Rollover</td>
<td>8.0</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>Light Duty Trucks</td>
<td>Stock Rollover</td>
<td>10.0</td>
<td>32%</td>
</tr>
<tr>
<td></td>
<td>Medium Duty Trucks</td>
<td>Stock Rollover</td>
<td>5.3</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>Heavy Duty Trucks</td>
<td>Stock Rollover</td>
<td>6.2</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>Buses</td>
<td>Stock Rollover</td>
<td>0.3</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>RVs</td>
<td>Total Energy by Fuel</td>
<td>0.1</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Motorcycles</td>
<td>Total Energy by Fuel</td>
<td>0.2</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Mobile Air Conditioning</td>
<td>Total Emissions</td>
<td>1.4</td>
<td>4%</td>
</tr>
</tbody>
</table>

| All Sectors           | 31.5              | 100%              |

4/23/2019

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E3’s PATHWAYS Model

- Economy-wide infrastructure-based GHG and energy analysis
  - Captures “infrastructure inertia” reflecting lifetimes and vintages of buildings, vehicles, equipment
  - Models physical energy flows within all sectors of the economy
  - Allows for rapid comparison between user-defined scenarios

- Scenarios test “what if” questions
  - Reference or counterfactual scenario for consistent comparison in future years
  - Multiple mitigation scenarios can be compared that each meet the same GHG emissions goal
PATHWAYS Modeling Framework

Demand Sectors

End-Use Energy Services Demand
- How many miles do Minnesotans drive per year (2020-2050)?

Stock Rollover
- How many electric vehicles are on the road?

End-Use Energy Demand
- How much fuel of each type is required to meet driving demand?

Supply Sectors

Electricity Supply
- What is the % of zero-carbon generation on the grid?

Pipeline Gas Supply
- What is % blend of biofuels?

Other Fuels (Gasoline, Diesel, Hydrogen, etc.)
- How many GHG emissions are saved?

Model Outputs
- How many electric vehicles are on the road?
- How much fuel of each type is required to meet driving demand?
- How many miles do Minnesotans drive per year (2020-2050)?
- What is the % of zero-carbon generation on the grid?
- What is % blend of biofuels?
- How many GHG emissions are saved?
Categories of Model Outputs

• Technology stocks & sales (e.g. Household appliances, Vehicles)

• Service demands and activity drivers (e.g. Vehicle miles traveled)

• Energy demand

• Energy supply (e.g. Electricity generation, Natural gas supply, Biofuel blends)

• Greenhouse gas emissions

All outputs are tracked by sector, fuel and year
Key Measures to Decarbonize Transportation

- Energy Efficiency and Conservation
  - Federal CAFE fuel economy standards (may be rolled back in 2022)
  - Smart growth and other strategies that may reduce vehicle miles traveled
  - Mode shifting from driving to carsharing or public transit

- Electrification
  - Increasing sales of battery electric vehicles (EV) and plug-in hybrid vehicles (PHEV)
  - Bus electrification

- Cleaner fuels
  - Biofuels
  - Cleaner electricity supply
• Light duty vehicles have an average life of ~15 years, which means they will need an average of 2 replacements over the next 30 years

• Even if Minnesota reaches 100% of new sales as Zero Emission Vehicle alternatives, it will take significant time for existing gasoline vehicles to come off the road.

• Delayed progress in sales could lead to costly programs to retire the existing fleet early (e.g. cash for clunkers programs).
Emissions from Surface Transportation in Minnesota

- Emissions from Surface Transportation were 8% below 2005 levels in 2016
- The goal of this analysis is to model packages of additional measures and actions that could help Minnesota meet 2025 and 2050 NGEA goals
Where are we starting from?

- Creating a Business-As-Usual or Baseline scenario, we see emissions continuing to rise due to population and VMT growth.

- Federal Corporate Average Fuel Economy (CAFE) standards are expected to be frozen in 2020, which significantly impacts emissions.
Next Steps

• Data Updates
  • E3 is updating the Xcel MN model with the latest data (e.g. 2016 MPCA GHG inventory)

• Input and Feedback
  • We are looking for feedback on the types of measures and actions you would like to see in the model for on-road transportation and any existing research or data you think we should be using in our model

• Modeling
  • E3 will characterize mitigation measures in the PATHWAYS model
  • E3 will present draft mitigation scenarios via webinar for feedback in May
  • E3 will present updated and final modeling results in June
Thank you again!

Tory Clark
tory@ethree.com
## Key Drivers for Baseline Scenario

<table>
<thead>
<tr>
<th>Sector</th>
<th>Key Driver</th>
<th>Compound annual growth rate proposed for this study [%]</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light-Duty Autos and Trucks</td>
<td>VMT</td>
<td>0.6%</td>
<td>EIA AEO 2019</td>
</tr>
<tr>
<td>Medium-Duty Vehicles</td>
<td>VMT</td>
<td>1.4%</td>
<td>EIA AEO 2019</td>
</tr>
<tr>
<td>Heavy-Duty Vehicles</td>
<td>VMT</td>
<td>1.4%</td>
<td>EIA AEO 2019</td>
</tr>
<tr>
<td>Motorcycles and RVs</td>
<td>Gasoline consumption</td>
<td>-0.9%</td>
<td>EIA AEO 2019</td>
</tr>
</tbody>
</table>
• Go to the table of your preferred transportation decarbonization strategy

• Facilitators will record group discussion on flip chart, one question per sheet
Why is this strategy important to you?
How do you envision this strategy playing out between now and 2050?
What assumptions or datasets do you want to see incorporated in the modeling?
What questions on this strategy do you hope this analysis will answer for you?
Closing Thoughts & Next Steps

• Follow along with this effort at http://www.dot.state.mn.us/us/sustainability/pathways.html
  • Presentations
  • Webinar information
  • Outreach meetings

• Contact Tim Sexton with questions or comments
  • Timothy.sexton@state.mn.us
  • O: 651-366-3622 | C: 206-427-4949
Thank you again!

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