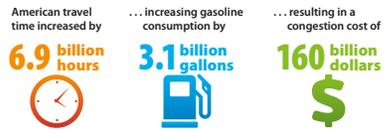


The Connected Traveler

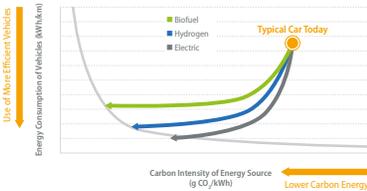
THE MARKET OPPORTUNITY



Source: Texas A&M Transportation Institute 2015 Urban Mobility Scorecard

GETTING THE CO₂ OUT—PATHWAYS TO 2050

Transportation system efficiencies represent a substantial and complementary benefit to current efforts to reduce vehicle energy consumption and the carbon intensity of fuels.



CONNECTIVITY/AUTOMATION WILL TRANSFORM TRANSPORTATION



- Vehicle connectivity and automation can substantially impact the effectiveness of investments in increased fuel economy and low-carbon fuels.
- Huge business around increasing utilization and right-sizing of mobility technologies.
- Increased pressure for transportation infrastructure managers to do more with less.

THE PROJECT

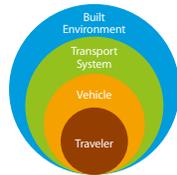
CONNECTED TRAVELER PROJECT OVERVIEW

- Multi-disciplinary undertaking seeks to validate potential for transformative transportation system energy savings by incentivizing efficient traveler behavior.
- Control architecture incorporates adaptive learning, and refined incentive and control strategies to provide high certainty of adoption.
- Metropia platform allows for real-world validation of traveler behavior and assist in refining incentives and control strategies.
- NREL's Transportation Secure Data Center and related tools used to determine individual energy consumption.
- Individual energy impacts extrapolated to estimate transportation system energy consumption.*

*Additional system model development may be required to refine this to a margin of error that can be used by transportation practitioners.

STARTING WITH THE TRAVELER

We need to approach sustainable transportation as a network of travelers, services, and decision points connected by communication technology and decision-making tools—rather than just by vehicles and roads—to significantly reduce related energy consumption.



UNDERSTANDING TRAVELER BEHAVIOR AND DECISION MAKING

- Control Architecture**
- Change in Departure Time
 - Mode Choice
 - Carpooling
- Control Strategies**
- Alternate Routing
 - Alternate Destinations
 - Elimination of Need for Trips

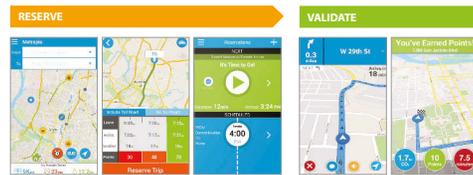
Framing and Refining Control Strategies

Framing the effects of incentives and benefits will be investigated and refined. Additional control strategies will be investigated to allow for additional savings opportunities and incorporation of new mobility opportunities.

- Phase I**
- Change in Departure Time
 - Alternate Routing
 - Alternate Destinations
- Phase II**
- Mode Choice
 - Carpooling
 - uberPOOL Integration

VALIDATING AND OPTIMIZING TRAVELER BEHAVIOR

- Adaptive learning applied to refine control strategies based on energy savings potential and likelihood of adoption by traveler.
- Project leverages Metropia platform to validate incentive effectiveness and hone control strategies.
- In-app micro surveys of users compile data and feedback to tailor presented information and energy estimates.



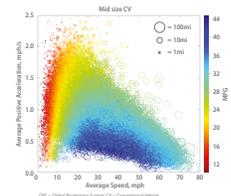
ITERATING A BASELINE FOR ENERGY CONSUMPTION

Accessing Diverse Transportation Data Sets

NREL's Transportation Secure Data Center houses data from travel surveys and studies conducted using GPS devices. It features millions of data points—second-by-second GPS readings, vehicle characteristics (if applicable), and demographics—for all modes of travel.

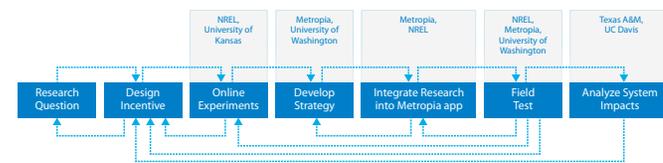
Leveraging Existing Tools to Estimate Energy Impact

- DRIVE
- FASTSim



FASTSim fuel efficiency simulations over hundreds of thousands of real-world trips from the TSDC illustrate the ability to estimate vehicle fuel economy based on drive cycle characteristics.

DEVELOPMENT PROCESS: RESEARCH QUESTION TO RESULTS



PROJECT PROGRESS

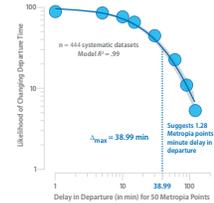
ONLINE EXPERIMENTS

The project team conducted two online survey experiments to identify barriers to the adoption of alternative travel modes as well as incentives to encourage behavioral action. Results indicated that many respondents are keenly aware of the costs associated with car ownership, and are open to the idea of time shifting their trips or choosing alternative travel modes.

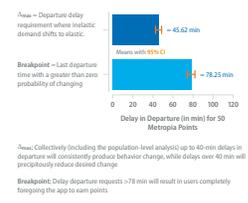


AMT BEHAVIORAL ECONOMIC TASK RESULTS

Population-Level (Aggregate) Analysis



Individual-Level Analysis



SUBSET OF METROPIA DATA

- More than 200M 1-Hz GPS points from over one year of Metropia user trajectories in Austin, Texas
- High-resolution road network for the greater Austin region
- Metropia's routing API combines a route generator and predictive traffic data



ESTIMATING ENERGY SAVINGS

- The project team has developed modeling tools to estimate the transportation energy use impact of the Connected Traveler project.
- Data to construct the estimation model are collected from several sources, including individual vehicle make and model, GPS driving data, and road network traffic prediction data.
- Enhanced energy estimation to inform individual users is currently in beta-test and will be fully deployed by Summer 2018.

PROJECT TEAM

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