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Incentivize Small Travel Behavior Changes for Big Energy Savings, Emissions Reduction and Congestion Mitigation

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Business as Usual in the Transportation Sector

- U.S. invests more than \$120 billion each year in its surface transportation infrastructure
- \$15 million built about one lane mile of freeway
- Energy and GHG impact: more driving and more GHG

Our ARPA-E TRANSNET Challenge

- Reduce all sector energy use and GHG in the U.S. by 1%
- About a 4% reduction in the transportation sector
- Can we accomplish that in the D.C.-Baltimore region with just \$15 million/year?



Personalized Incentive Design







System Model Overview

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VERSI

Person-Level Energy Estimator





MARYLAND

Control Architecture





Optimize: Technology adoption Mode choice Long-term eco-driving target



Day-Ahead Operations

Optimize: Pre-trip mode choice Departure time Route choice Pre-trip eco-driving target



Real-Time Operations

Optimize: En-route diversion En-route eco-driving Update solutions in Day-Ahead Operations



Control Decisions

- Whether or not to incentivize a particular traveler
- Which travel choice to influence
- Type and intensity of optimized and personalized incentives
 Constrained by budget or target

Key Performance Metrics

 Computational efficiency
 Solution quality and robustness
 Reduction in energy use, emissions, and congestion



Big Data and A.I. Integration





UMD incenTrip Technology Overview



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When, Where & Who Get What Incentives







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Technology Impact by Budget Level





Daily Incentive Budget at 20% Penetration (\$1,000)



Energy Savings by Type of Choice



Where do the 10.6% of energy savings come from?

5.4% reduction

By switching 20% users to various transit modes Daily incentive budget: \$156k

1.1% Reduction

By switching 28% users to ride-sharing Daily incentive budget: \$81K

0.9% Reduction

By incentivizing all users to practice eco-driving Daily incentives: \$21k

0.3% Reduction

By switching 6% users to walking/bicycling Daily budget: \$47k

2.9% Reduction

by incentivizing 46% users to change route/departure time Daily incentives: \$31k



Disruptive Technology Features



System Model

- Simulate and predict energy use, travel behavior, and traffic dynamics at the individual traveler and vehicle levels with high accuracy, in real time, and in metropolitan areas of any size.
- Shared-memory, A.I., parallel, cloud computing platform and open API interface for technology integration.
- Real-time data feeds at more than 8 billion records/day.

Control Architecture

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- Personalized, optimized, and real-time incentives that maximize effectiveness.
- System optimum accomplished with user incentives.
 Integrated monetary and non-monetary incentives.

User Interface: Smartphone App







* Reach grade B: \$100/year * Reach grade A: \$250/year

Yes

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Fuel Efficiency

0

20% 82% 92% 100%

EFFICIENCY









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Agency/Client incenTrip Dashboard







incenTrip Technology to Market



API Products









incenTrip

App Products



Mobility asLocation-Baseda ServiceServices

incenTrip is currently deployed in Washington D.C. and Baltimore, MD. Contact Dr. Lei Zhang (<u>lei@umd.edu</u>) for partnership and deployment opportunities in your organization/city.

Government Products

- Trip planning/511 integration
- Multimodal demand management
- Eco-driving and green travel
- Congestion mitigation/Air quality



