U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

VEHICLE TECHNOLOGIES OFFICE

Energy Efficient Mobility Systems Program

May 21, 2018

TRANSPORTATION IS FUNDAMENTAL TO OUR WAY OF LIFE

The U.S. population is growing and aging

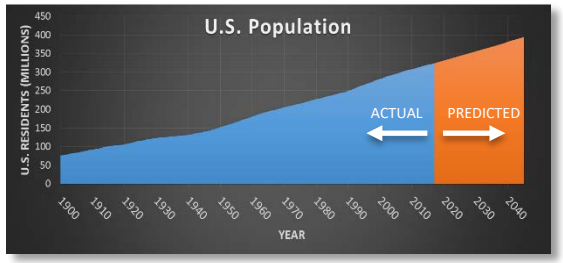
Population density is increasing—**75% of the population** lives in urban mega-regions

Technologies and fuel choices are expanding

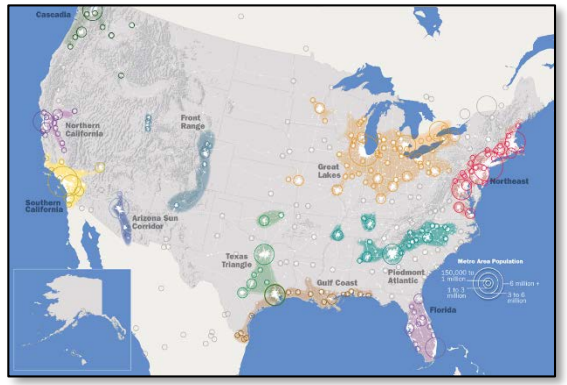
Transportation costs are high—second only to housing expenses

CONVERGING TRENDS ARE SHAPING MOBILITY

Population



Population expected to grow by **70 million** in next **30 years**



75% of population concentrated in **11** Megaregions

Demographics

Americans are Living Longer

By 2045, the number of Americans over age 65 will increase by **77%**.

About **one-third** have a disability that limits mobility.

Millennials are Connected & Influential

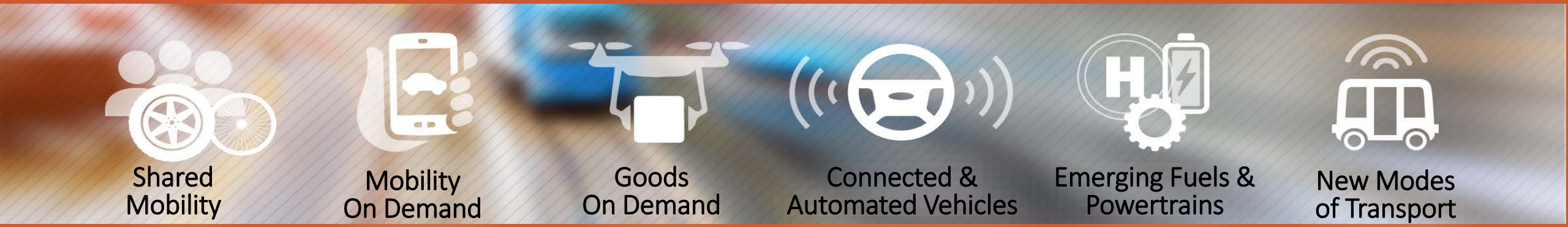
There are **73 million** Americans aged 18 to 34.

They drove **20%** fewer miles in 2010 than at the start of the decade.

Technology

- **Integration of Connected & Automated Technologies**
- **Introduction of Shared Service Platforms**
- **Advancements in Energy Storage Technology**
- **Deeper Application of Big Data**
- **Faster Processing Speeds at Decreasing Cost**

NEW TECHNOLOGIES & BUSINESS MODELS ARE DRIVING DISRUPTION



DOE Vision - Improve "Mobility Energy Productivity "

- Increase Mobility Choices
- Improve Affordability of Choices
- Choices that are convenient
- Opportunity for New Technology to reduce Energy

➔ Move more People and Goods per unit energy

NEW TECHNOLOGIES & BUSINESS MODELS ARE DRIVING DISRUPTION

REQUIRING VTO TO EXPAND ITS FOCUS

The EEMS Program:

- *conducts early-stage R&D at the vehicle, traveler, & system levels;*
- *creating knowledge, insights, tools, and technology solutions;*
- *that increase mobility energy productivity for individuals & businesses.*

Component **Vehicle** **Transportation System**

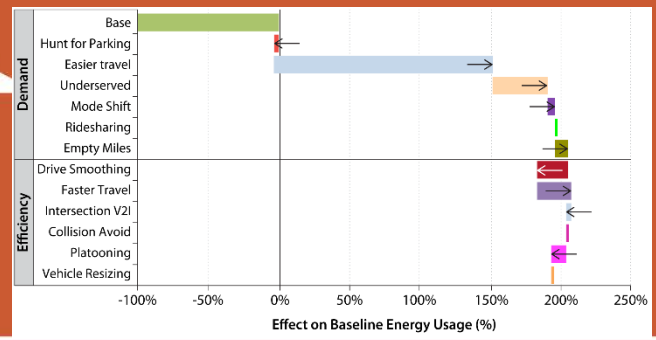
PIONEERING RESEARCH

EXPLORES POTENTIAL ENERGY & MOBILITY IMPACTS

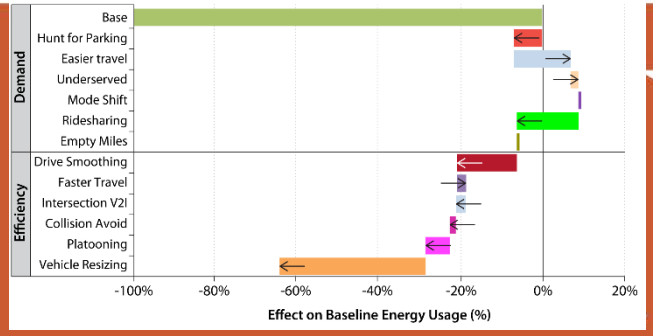
+ 200%

Empty miles
Easier Travel
Increased use by underserved populations

ENERGY USE



Connected & Automated Vehicles



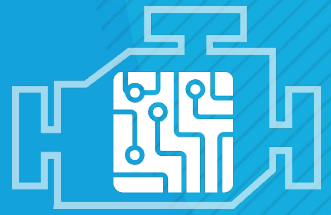
ENERGY USE

Vehicles right-sized
Less hunting for parking
Collision avoidance
Platooning

- 60%

ACHIEVING GOALS

THROUGH FOUR EEMS ACTIVITY AREAS

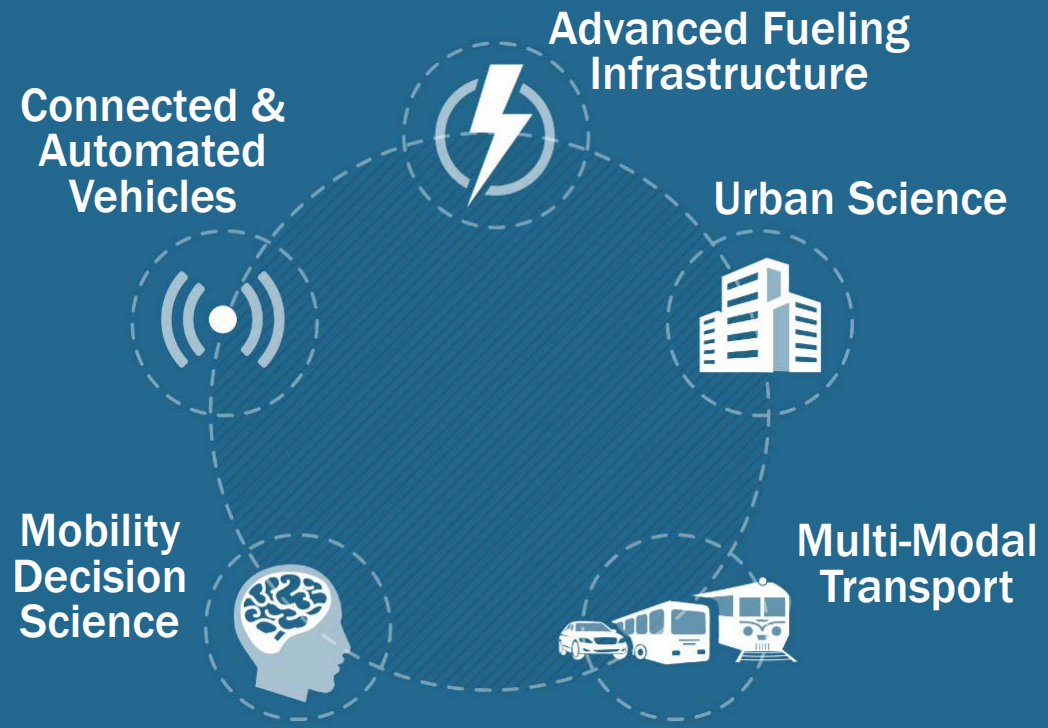


Advanced R&D Projects

Living Labs

SMART Mobility Lab Consortium

HPC4Mobility & Big Transportation Data Analytics



U.S. DEPARTMENT OF ENERGY

SMARTMOBILITY

Systems and Modeling for Accelerated Research in Transportation

7-Lab Consortium
30+ Projects
65 Researchers
$16M in FY2018

Developing tools, knowledge, insights, and understanding about the future of mobility

Argonne NATIONAL LABORATORY · INL Idaho National Laboratory · Pacific Northwest NATIONAL LABORATORY · BERKELEY LAB Lawrence Berkeley National Laboratory · OAK RIDGE National Laboratory · Los Alamos NATIONAL LABORATORY EST. 1943 · NREL NATIONAL RENEWABLE ENERGY LABORATORY

ADVANCED

RESEARCH & DEVELOPMENT

4 University Projects, $6.4M (Through FY2017)

Vehicle & Traffic Control Algorithms

Data Collection from CAV Deployments

CAV Vehicle & Transportation Simulation

Transportation System Optimization

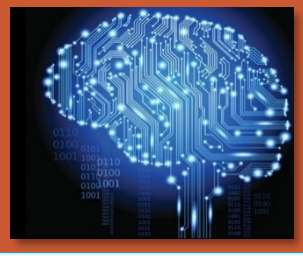
CAV Vehicle-in-the-Loop Testing

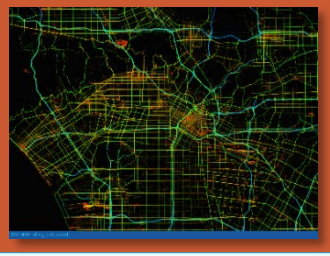
NEW OPPORTUNITIES FOR

HPC4MOBILITY & BIG DATA ANALYTICS

$5.5M planned in FY2018

- Reinforcement Learning-based Algorithms for Vehicle Detection/Classification & Traffic Control
- Digital Twin of Regional Transportation Systems for Real-Time Cyber-Physical Control (LA Metro, Chattanooga)
- Deep-Learning and Simulation for Resilient Autonomous Vehicle Development
- HPC-Based Optimization of Major Transit Hub: Passenger and Freight Efficiency at a Major U.S. Airport





USING REAL-WORLD DATA TO UNDERSTAND ENERGY IMPACTS

LIVING LABS

3 Projects, $4.9M in FY2017

ELECTRIC SHARED MOBILITY
Seattle, Portland, NYC, Denver
Uber, GM's Maven, BMW's ReachNow

ELECTRIC LAST MILE
Austin
Pecan Street, CapMetro

ENERGY EFFICIENT FREIGHT LOGISTICS
NYC-Albany Corridor
Rensselaer Polytechnic Institute, freight carriers & receivers, urban supply chain

Up to $20M Planned in FY2018

- High Performance Computing for Transportation Hubs
- First/Last Mile for People/Goods Movement
- System-Level Data for Energy Efficient Mobility
- Fuel Efficient Platooning
- Multi-Unit Dwelling & Curbside Residential Charging Innovation
- Open Topic

A CRITICAL RESEARCH NEED:

PROOF-OF-CONCEPT TESTING

FOR MODEL VALIDATION

Component/ Powertrain-Level

Vehicle-Level

Transportation System-Level

MODEL VALIDATION

Engine/Powertrain Dyno Testing

Chassis Dyno Testing

?

VTO FY2018 BUDGET
SMART MOBILITY

Program Area	FY2018 ($k)
Batteries & Electric Drive Technologies	160,000
Energy Efficient Mobility Systems	25,000
Vehicle Systems	16,000
Materials Technology	25,000
Outreach, Deployment, & Analysis	46,300
Advanced Combustion Engines & Fuels	65,200
TOTAL	**337,500**

Mobility Specific

→ $25M

→ $6M

→ $20M

$51M Total

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

VEHICLE TECHNOLOGIES OFFICE

ENERGY EFFICIENT MOBILITY SYSTEMS PROGRAM

VEHICLES.ENERGY.GOV