



U.S. DEPARTMENT OF ENERGY

Project ID# EEMS056

SMARTMOBILITY

Systems and Modeling for Accelerated Research in Transportation

Overview of the SMART Mobility Workflow

Ann M Schlenker
Argonne National Laboratory
2019 Vehicle Technologies Office Annual Merit Review
June 11, 2019
EEMS056



Advanced Fueling
Infrastructure



Connected &
Automated
Vehicles



Urban
Science

U.S. DEPARTMENT OF ENERGY

SMARTMOBILITY

Systems and Modeling for Accelerated Research in Transportation

5 LABS, 30+ PROJECTS, 50+ RESEARCHERS, \$15M PER YEAR

Mobility
Decision
Science



Multi-Modal
Transport

Argonne
NATIONAL LABORATORY

INL
Idaho National Laboratory

BERKELEY LAB
Lawrence Berkeley National Laboratory

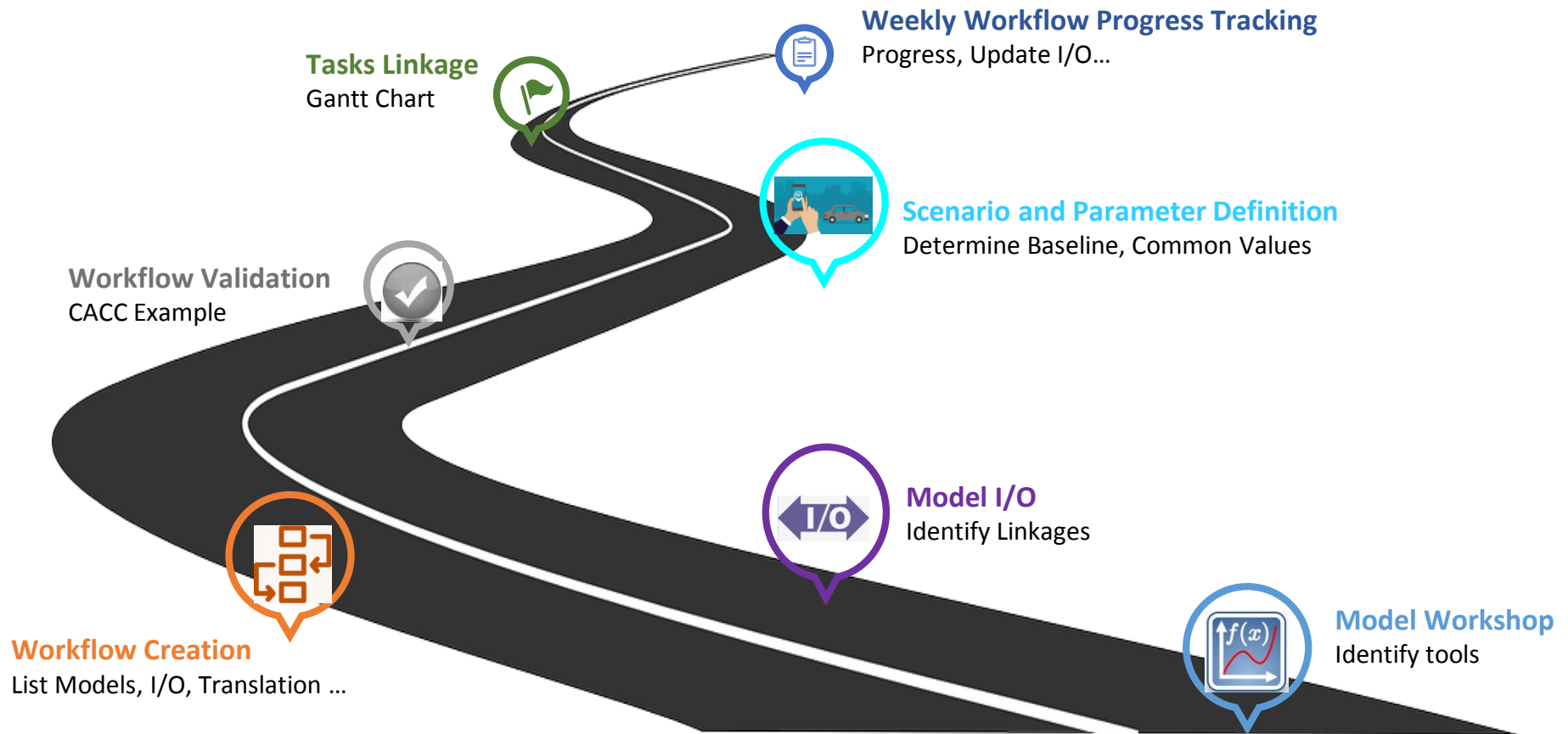
OAK
RIDGE
National Laboratory

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

U.S. DEPARTMENT OF ENERGY

OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY

WORKFLOW Developed using a Detailed Process



Building and Linking Integrated and Scalable Models from Vehicle to City Level

Single Vehicle



Corridor / Small Network

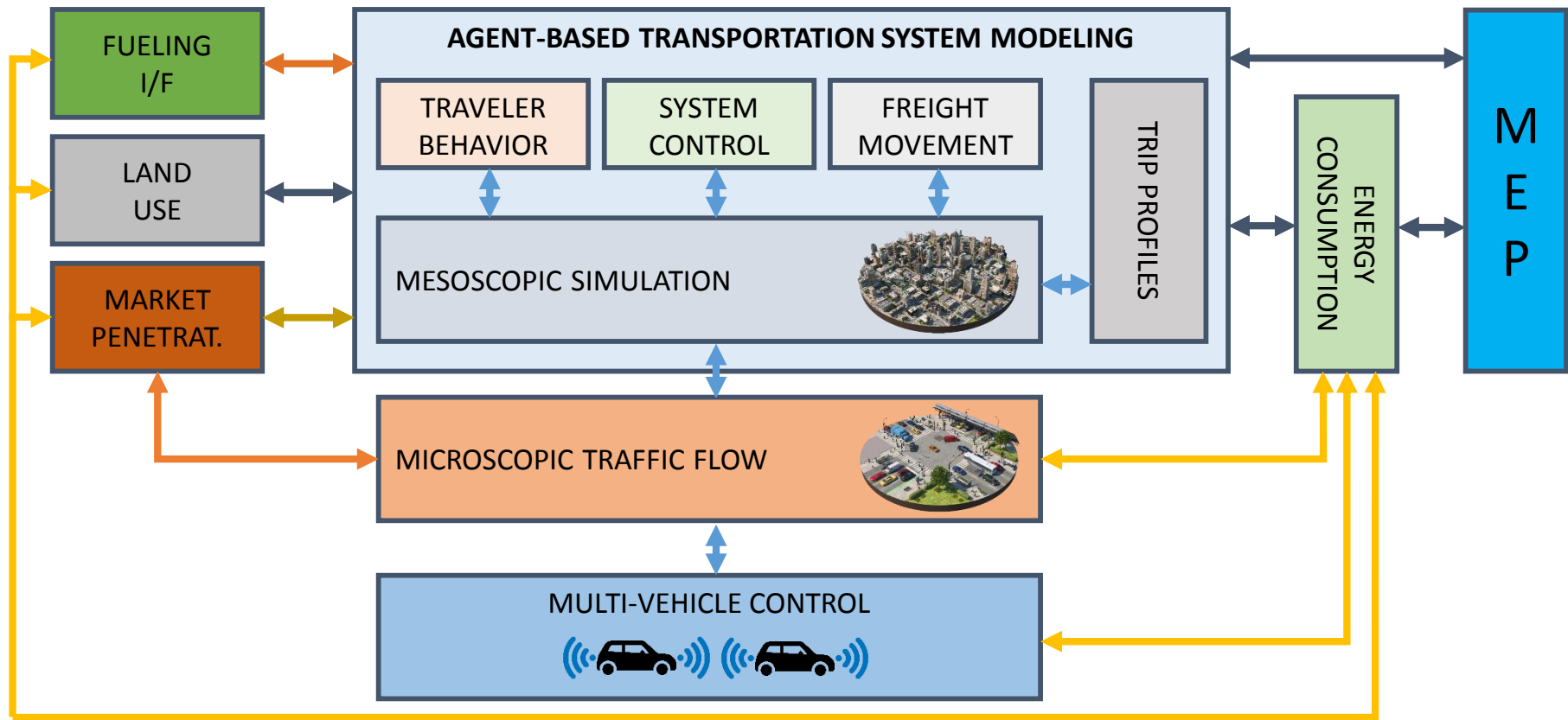


Entire Urban Area



WORKFLOW: Comprehensive Approach to Answer Complex Questions

END-TO-END MODELING WORKFLOW

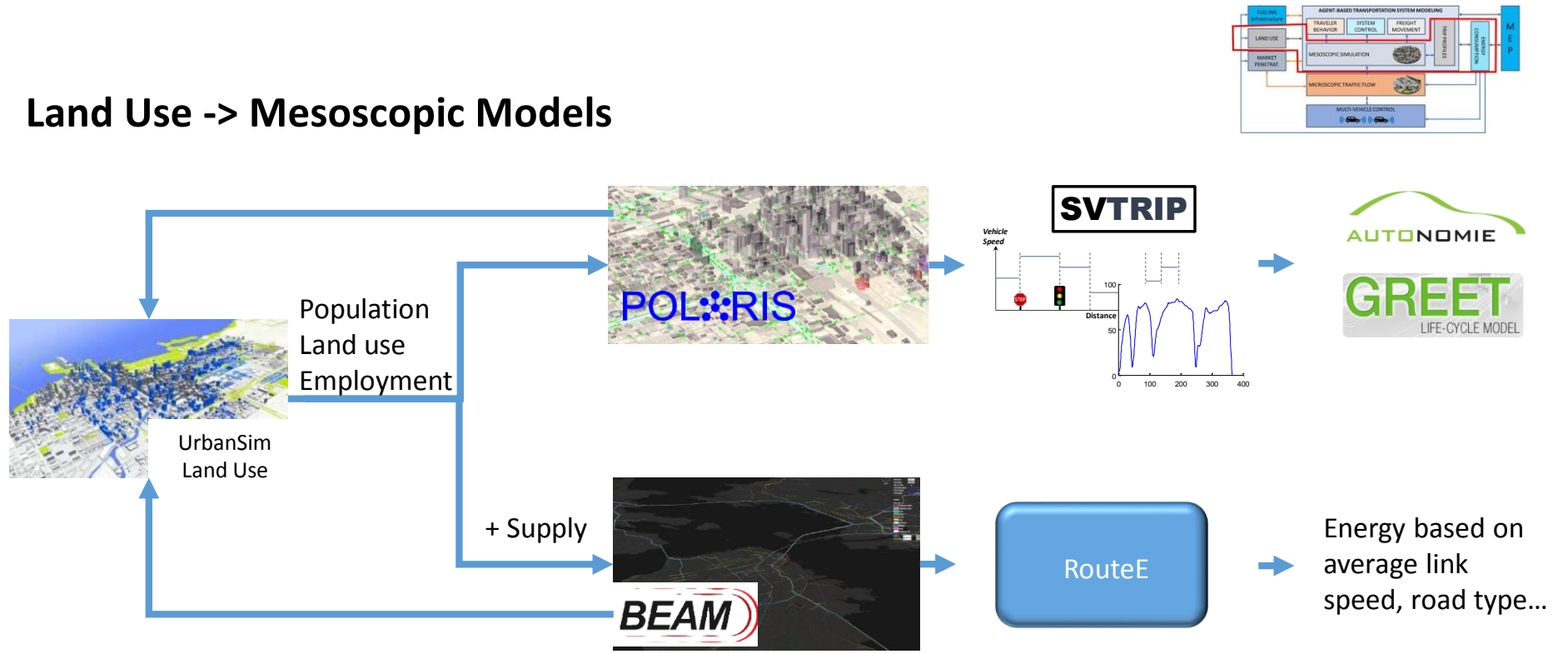


Analysis of Research Questions Better Enabled with WORKFLOW

- **How does light duty vehicle fleet sharing (ride hailing, car sharing) impact mobility, energy, VMT and MEP?**
 - What is the impact of repositioning?
 - What are the impact of VTO technologies?
- **What is the potential impact of multi-modal travel resulting from automation and connectivity?**
- **What effect does / will e-commerce trends have on intra-city freight from a shopping to shipping perspective?**
 - What is the impact on VMT and VHT?
- **How could personally owned fully automated vehicles impact mobility, energy, VMT and MEP?**
 - What is the share of ZOV? How can this be minimized?
- **How is intra-city freight impacted by disruptive technologies, such as electrification and in-route passenger delivery systems?**
- **What is the potential fuel economy gain with advanced control enabled by connectivity and automation?**

WORKFLOW Developed to Mix and Match Models

Land Use -> Mesoscopic Models



Scenarios Considered (Baseline + 3 Futures)

Sharing is Caring



New technology (i.e., integrated apps) enables people to significantly increase the use of transit, **car sharing** and multi-modal travel. **Partial automation** is being introduced mostly on the highway system.

Technology Takes Over



Technology has taken over our lives, enabling a **high usage of ride sharing and multi-modal trips** as they are convenient affordable. As a result, private ownership has decreased, **e-commerce** is common as is **telecommuting**.

All About Me



Fully automated vehicles within households are common with personal ownership resulting in **low ride sharing market**. The ability to own AVs leads to **lower e-commerce** and alternative work schedules, and feeds into urban sprawl.

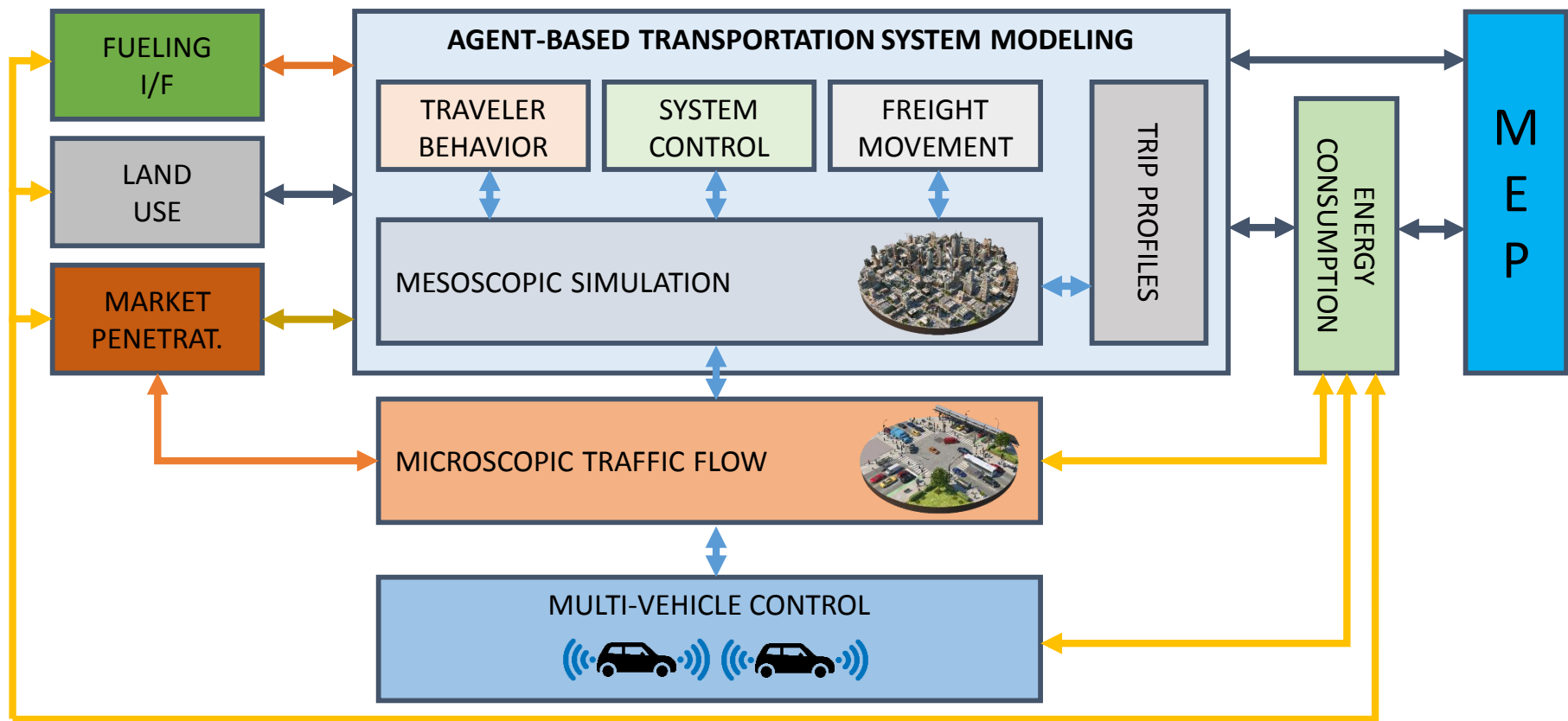
Critical Parameters Defined and Updated

Common Variables and Definitions

Variables	Baseline	(A) Sharing is Caring	(B) Technology Takes Over	(C) All About Me
Private Ownership	Current vehicle ownership based on POLK & current population by ZIP code	Low	Low	High
Shared Use	1.3	1	1	1.3 (vehicle with driver) - 1.6 (vehicle without driver)
VOTT (Car mode only)	1	High (see table below)	Low (See table below)	Low (See table below)
Propensity non-car modes	1	0.5	1	1
Propensity telecommute	0.8 days per month	11.2 days per month	11.2 days per month	3.5 days per month
E-Commerce	0.08 deliveries per person-day	0.5 deliveries per person-day	0.5 deliveries per person-day	0.2 deliveries per person-day
Long Haul Commodity Flow	1% CAGR	1% CAGR	1.3% CAGR	1.3% CAGR
Land use density	2017 Land Use	2017 Land Use	Long term planning (2050)	Urban sprawl
Non-Automated	98%	75% (low tech) / 74% (high tech)	41.5% (low tech) / 37.5% (high tech)	72.5% (low tech) / 35.5% (High tech)
L3/4	0%	5% (low tech) / 6% (high tech)	5% (Low Tech) / 8% (High tech)	5% (Low Tech) / 8% (High tech)
L5	0%	0%	0%	12.5% (Low tech) / 41.5% (High tech)
Non-Automated	2%	15%	36% (low tech) / 3% (high tech)	5%
L3/4	0%	5%	0%	0%
L5	0%	0%	17.5% (low tech) / 51.5% (high tech)	5% (low tech) / 10% (high tech)

SMART WORKFLOW – Providing Greater Insights

END-TO-END MODELING WORKFLOW



QUESTIONS?

Main Models and Associated Outputs



Energy, Cost...
VTO Targets/Benefits



Energy
Component Operating Conditions
VTO Targets/Benefits



Traffic Flow



VHT, VMT, Trips, Time use,...



Vehicle trip profiles

UrbanSim



Population
Land use
Employment

EVI-PRO

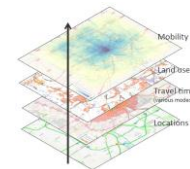


Charging Station
Locations

MA3T, ADOPT



Light Duty Fleet
Composition



MEP



MEP Metric



LCA, GHG,
Emissions