Transportation is undergoing Four Major Revolutions

Shared Mobility:
- carsharing, ride hailing companies (e.g., Uber, Lyft), and advanced transit
- Drivers: Internet connectivity, convenience, and transportation costs

Electrification:
- Electric drivetrains are becoming more common
- Drivers: advances in motors, controls, and batteries

Connectivity:
- Vehicles are increasingly “connected”
- Drivers: cellular communications, dedicated short range communications

Automation:
- Vehicle automation is emerging in many forms
- Automation comes with many social implications
The Progression of Emissions/Energy Evaluation

Transition from Laboratory to On-Road Measurements: SEMS/PEMS/PAMS

In Use Emissions Testing Product Continuum

- Low cost/accuracy
- Moderate cost/accuracy
- High cost/accuracy

New Methods of Evaluation

- Take Advantage of Connected and Automated (Electric and Shared)
- Consider new Drivetrains: Battery Electric, Hybrid Electric, and Fuel Cell
Dynamometer-in-the-Loop Control System