A survey of emerging transportation technologies with local applications

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Transportation Technology: Innovations in San Joaquin
San Joaquin Council of Governments
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http://pacific.edu/cbpr
Overview

- ZEV Technologies
- Transportation Coordination Technologies
- Autonomous Vehicle Technologies
- Applied Technology: A Megaregional Air Taxi Service
- Local opportunities
ZEV Technologies

Why do these technologies matter?

California needs significant NOx and GHG reductions

- Federal health-based ambient air quality standards (key milestones in 2023 and 2031)
- 40 percent reduction in GHG emissions from 1990 levels by 2030
- 80 percent reduction in GHG emissions from 1990 levels by 2050
- 50 percent petroleum reduction target by 2030
- Continued reductions in criteria pollutants and toxic air contaminants to protect public health

Source: CARB CalACT April 6, 2018
What does current situation look like?

Trends in California GHG Emissions

GHG Emissions in Transportation
ZEV Technologies

- Efficiencies in transportation & warehousing...
ZEV Technologies

- Fuel cell electric
- Battery electric
ZEV Technologies

- Comparative GHG Emissions

Source: Greet v1_2013 – CA Fuel Cell Partnership
ZEV Technologies

Battery and Fuel Cell Electric Buses in California
(107 in operation and 340 on order/awarded as of September 2017)

<table>
<thead>
<tr>
<th>Agency</th>
<th>Total Buses</th>
<th>All ZEB Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antelope Valley</td>
<td>77</td>
<td>2018</td>
</tr>
<tr>
<td>Porterville Transit</td>
<td>15</td>
<td>2018*</td>
</tr>
<tr>
<td>San Joaquin RTD</td>
<td>111</td>
<td>2025</td>
</tr>
<tr>
<td>Foothill Transit</td>
<td>327</td>
<td>2030</td>
</tr>
<tr>
<td>LA DOT</td>
<td>326</td>
<td>2030</td>
</tr>
<tr>
<td>LA Metro</td>
<td>2,457</td>
<td>2030</td>
</tr>
<tr>
<td>Santa Cruz Metro</td>
<td>98</td>
<td>2040</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,411</strong></td>
<td><strong>25% of CA</strong></td>
</tr>
</tbody>
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Source: CARB CalACT April 6, 2018
Transportation Coordination Technologies

- **Transit**
  - Integrated service information
  - Real-time passenger information

- **Goods Movement and Supply Chain Management**
  - Intermodalism
  - E-Commerce

- **Shared Mobility Services**
  - Carsharing
  - Ride-hailing
  - Microtransit
Transit: Integrated service information

Source: Multimodal Applications and Interoperable Data CalACT April 24, 2017
Transportation Coordination Technologies

- **Transit**: Real-time passenger information to any app

Source: Multimodal Applications and Interoperable Data CalACT April 24, 2017
Transportation Coordination Technologies

- Goods Movement and Supply Chain Management
  - Intermodalism
    - Maersk-IBM blockchain

- E-Commerce
  - Amazon, Walmart, etc
Transportation Coordination Technologies

- **Shared Mobility Services**

  - **Carsharing 1.0**
    - Station Based
    - Examples: Zipcar, Hertz
    - Early model of carsharing where vehicles are picked up and returned to the same location; typically through an hourly rental.

  - **Carsharing 2.0**
    - One-to-Many
    - Examples: DriveNow, CAR2GO, scoot
    - Second generation of carsharing where vehicles can be picked up and dropped off in different locations (possibly by zone vs. designated parking spots); typically charged by minute.

  - **Carsharing 3.0**
    - P2P
    - Examples: RelayRides, Getaround
    - Peer-to-peer sharing where individuals can rent out their personal vehicles to others when not in use.

- **Ride-hailing**
  - Examples: Lyft, Uber
  - Platform where individuals can hail and pay for a ride from a professional or part-time driver through an app.

- **Shared Ride-hailing**
  - Examples: UberPOOL, Lyft Line
  - Extension of ride-hailing where individuals can be matched in real-time to share rides with others going on a similar route.

- **Microtransit**
  - Examples: VIA, Chariot
  - App and technology-enabled shuttle services, typically in a van-size vehicle; some with dynamic routing, others with semi-fixed routes.

Source: UC Davis ITS *Disruptive Transportation* October 2017
As of April 1, 2018 Permits for testing autonomous vehicles had been issued to 52 entities (CA DMV)

- Passenger vehicles
- Transit vehicles
- Aerial vehicles
- Marine vehicles
Autonomous Vehicle Technologies

- Passenger vehicles
Autonomous Vehicle Technologies

- **Transit systems**

  - **GPS receiver**
    Communication between a GPS sensor and a reference beacon to determine the vehicle’s location at every moment and accurately.

  - **LIDAR sensors**
    Perception 2D and 3D perception to map the environment, ensure a precise location and provide obstacles detection.

  - **Stereovision camera**
    Obstacles detection and obstacles position estimate regarding the position of the vehicle.

  - **Odometry**
    Wheels speed measure to estimate the vehicle speed and confirm its position.
Autonomous Vehicle Technologies

- Aerial vehicles
A Megaregional Air Taxi Service

- 2018-2022 Air Taxi Stockton-San Jose
  - 10-30 minutes
  - Fuel cost per seat $0.93 to $3
  - CALSTART
A Megaregional Air Taxi Service

Source: Volocopter, 17 April 2018
Additional local opportunities (& challenges)

- Logistics and warehousing
  - Drayage equipment
  - Advanced manufacturing
- Applied technology and development center
- Increased megaregional integration
- Electronic engine maintenance center of excellence
- Leverage skills development to transformational opportunities
- Build new areas of competitive advantage
THANK YOU!

For more information: go.pacific.edu/cbpr