Hawaii Transportation Energy Analysis: Vehicle Efficiency Options

Anup Bandivadekar
Josh Miller
Alan Lloyd

8 January, 2015
The mission of ICCT is to dramatically improve the environmental performance and efficiency of cars, trucks, buses and transportation systems in order to protect and improve public health, the environment, and quality of life.

- Non-profit research Institute
- Air Pollution and Climate Impacts
- Focus on regulatory policies and fiscal incentives
- Activity across modes including aviation and marine
- Global outreach, with special focus on largest markets
Disclaimer

The International Council on Clean Transportation (ICCT) is a consultant to the Department of Business, Economic Development, and Tourism (DBEDT) under contract number 63188: Professional Services for Transportation Industry Analyst.

The views and opinions expressed in this presentation are that of the ICCT, and may not necessarily represent the position of the DBEDT.
HCEI 2011 roadmap established an aggressive goal

**Goal:** Reduce the use of petroleum in ground transportation by 70% or ~ 385 MGY by 2030

<table>
<thead>
<tr>
<th>Strategy with 2010 baseline</th>
<th>2015 target</th>
<th>2020 target</th>
<th>2030 target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce vehicle miles traveled (VMT)</td>
<td>2% VMT reduction</td>
<td>4% VMT reduction</td>
<td>8% VMT reduction</td>
</tr>
<tr>
<td>Incorporate renewable fuels into transportation sector</td>
<td>E10 and biodiesel consumption at 2010 level (~45 million gallons)</td>
<td>150 million gallons</td>
<td></td>
</tr>
<tr>
<td>Improve standard vehicle efficiency of fleet</td>
<td>25 mpg cars</td>
<td>30 mpg cars</td>
<td>35 mpg cars</td>
</tr>
<tr>
<td>Accelerate the deployment of electric vehicles (EVs) and related infrastructure</td>
<td>4K EV sales (10K on road)</td>
<td>10K EV sales (40K on road)</td>
<td>30K EV sales</td>
</tr>
</tbody>
</table>

MGY: million gallons per year
Comparing 2015/2020 goals with 2013 status

<table>
<thead>
<tr>
<th>Strategy with 2010 baseline</th>
<th>2015 target</th>
<th>2020 target</th>
<th>2013/2014 Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce vehicle miles traveled (VMT)</td>
<td>2% VMT reduction</td>
<td>4% VMT reduction</td>
<td>19% increase in VMT</td>
</tr>
<tr>
<td>Incorporate renewable fuels into transportation sector</td>
<td>E10 and biodiesel consumption at 2010 level (~45 gallon)</td>
<td>52 million gallons</td>
<td></td>
</tr>
<tr>
<td>Improve standard vehicle efficiency of fleet</td>
<td>25 mpg cars</td>
<td>30 mpg cars</td>
<td>25 mpg for cars &amp; LT combined</td>
</tr>
<tr>
<td></td>
<td>18 mpg LT</td>
<td>22 mpg LT</td>
<td></td>
</tr>
<tr>
<td>Accelerate the deployment of electric vehicles (EVs) and related infrastructure</td>
<td>4K EV sales (10K on road)</td>
<td>10K EV sales (40K on road)</td>
<td>1K EV sales (~3K on road)</td>
</tr>
</tbody>
</table>

On-road fuel use of 525 MGY in 2013 as compared with 496 MGY in 2010; a 6% increase.
Hawaii on-road transportation energy demand projection based on current trends

2025 light-duty fuel economy standards are met
2014-2018 HDV GHG standards
5% BEV + 5% PHEV of new vehicle sales by 2030 (10% total EV)
Vehicle stock and total VMT grow 15% (at a 1:1 ratio with population) from 2013-2030.
Core strategies under consideration for transportation energy roadmap

- Light as well as heavy duty vehicle efficiency improvements
- Transition to electric drive vehicles (EVs and FCVs)
- Alternative fuels including biofuels and natural gas
- Vehicle demand management/promotion of transit, and non-motorized transport
- Improving aviation efficiency
- Improving marine efficiency
Vehicle Fuel Efficiency Improvement Tactics under consideration (not in any particular order)

1. **Vehicle Fuel Economy Standards**
2. Feebates for vehicle fuel efficiency
3. Procure EVs and more efficient vehicles for public fleets
4. Green Freight activities
5. More efficient replacement tires
6. Vehicle retirement incentives for low-income groups
7. High efficiency taxis
8. High efficiency rental cars

CAFE Fuel Economy (miles per gallon)

Past Data
Future Standards

Passenger Cars

Light-Trucks

0 10 20 30 40 50 60


20.8 24.5 34.8 56.2

28.2 40.3

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION
NRC estimates of future fuel consumption reduction potential from light-duty vehicles

Figure 2-1 Historical and Projected Light-duty Vehicle Fuel Economy
Note: All data is new fleet only using unadjusted test values, no in-use fuel consumption. FTP values, projections assume light duty fleet is 38% light duty trucks

National Research Council (2013) Transitions to Alternative Vehicles and Fuels [18264]
Timing of Tractor-Trailer Efficiency Technologies

Fuel consumption reduction in representative real-world line-haul highway operation

- Engine friction reduction
- Accessory improvement
- Combustion optimization
- Turbo improvements
- Engine controls
- Aftertreatment improvement
- Engine downsizing
- Turbocompounding
- Waste heat recovery
- Transmission efficiency
- Single drive axle (6x2)
- Automated manual (downspeeding)
- Stop-start
- Dual clutch (adv. downspeeding)
- Hybrid
- Tractor LRR tires
- Tractor aerodynamics
- Automatic tire inflation
- Trailer LRR tires
- Weight reduction
- Driver feedback/optimization
- Idle reduction technology
- Trailer aerodynamics

High pre-2018 deployment
Post-2018 potential

Stakeholder workshop report on tractor-trailer efficiency technology, 2015-2030
Hawaii on-road transportation energy demand projection based on continuation of CAFE standards and electric drive adoption

- 2030 fuel economy standards for LDV (~5% per year) and HDV (~3.5% a year)
- 6% BEV, 6% PHEV, 3% FCEV of new vehicle sales by 2030 (15% total electric drive)
- Vehicle stock and total VMT grow 15% (at a 1:1 ratio with population) from 2013-2030.
Vehicle Fuel Efficiency Improvement Tactics under consideration (not in any particular order)

1. Vehicle Fuel Economy Standards
2. Feebates for vehicle fuel efficiency
3. Procure EVs and more efficient vehicles for public fleets
4. Green Freight activities
5. More efficient replacement tires
6. Vehicle retirement incentives for low-income groups
7. High efficiency taxis
8. High efficiency rental cars
Implementation of fees for low efficiency/high GHG emission vehicles along with rebates for high efficiency/low GHG emission vehicles

- Feebate rate of $20 per gCO$_2$/mi (equivalent to $1765 per gal/100mi) would be similar to the implied rate of US Gas Guzzler Tax
- New vehicle fuel consumption reduction of 5-7%, and an additional 1-2% reduction in longer term*
  - Benefits scale with feebate rate
  - Hawaii-only feebate program could have smaller benefit
- Pivot point (no fee or rebate point) could be adjusted every three to five years to provide continued incentive and keep program revenue neutral

Vehicle Fuel Efficiency Improvement Tactics under consideration (not in any particular order)

1. Vehicle Fuel Economy Standards
2. Feebates for vehicle fuel efficiency
3. Procure EVs and more efficient vehicles for public fleets
4. Green Freight activities
5. More efficient replacement tires
6. Vehicle retirement incentives for low-income groups
7. High efficiency taxis
8. High efficiency rental cars
Revise statewide vehicle procurement guidelines to ensure vehicle choices are efficient*

Adjust the hierarchy of fuel/technology options within procurement process to:

(i) Allow purchase of more efficient hybrids over flex-fuel/CNG

(ii) Allow purchase of more efficient gasoline/diesel option over hybrid

(iii) Redefine fuel economy leaders as 90th percentile

11,243 light-duty vehicles were licensed to State and County agencies in 2014; 12.3% of these were flex fuel, 1.5% hybrid, 85.9% conventional gasoline/diesel, 0.3% other

* Where Federal Covered Fleet rules can be waived or do not apply
Vehicle Fuel Efficiency Improvement Tactics under consideration (not in any particular order)

1. Vehicle Fuel Economy Standards
2. Feebates for vehicle fuel efficiency
3. Procure EVs and more efficient vehicles for public fleets
4. **Green Freight activities -- Smartway**
5. More efficient replacement tires
6. Vehicle retirement incentives for low-income groups
7. High efficiency taxis
8. High efficiency rental cars
SmartWay is a Public-private partnership with freight sector

- Market based, voluntary and no cost
- Industry standard carbon accounting system
  - Standardized tools and metrics for collecting & reporting data
  - Developed with extensive stakeholder input and peer reviewed

**Goal:** Move more ton-miles of freight with less emissions, and less energy

**How:** Accelerate adoption of advanced technologies and operational practices in the freight supply chain

**Measured by:**
- Gallons of fuel, barrels of oil, and $ saved
- CO$_2$, NOx and PM emissions reduced
To date only five truck carriers in Hawaii have joined the SmartWay partnership*

- Tactic: Promote green freight activities jointly with EPA
- Target carriers to join SmartWay and install fuel-saving technologies
  - Focus on low rolling resistance tires, auxiliary power units, and improved aerodynamic technologies
- Encourage SmartWay certified carriers as preferred carriers for State and County operations
  - Encourage local businesses and shippers to use certified carriers
- Promotes skilled jobs locally for installation of SmartWay certified technology

* Three Dependable Hawaiian Express units (Kona, Honolulu and Wailuku), Hawaii Transfer Company Ltd (Waipahu), Island Movers Inc. (Honolulu). Yellow Pages shows 176 transport carriers in Honolulu alone.
Vehicle Fuel Efficiency Improvement Tactics under consideration (not in any particular order)

1. Vehicle Fuel Economy Standards
2. Feebates for vehicle fuel efficiency
3. Procure EVs and more efficient vehicles for public fleets
4. Green Freight activities -- Smartway
5. More efficient replacement tires
6. Vehicle retirement incentives for low-income groups
7. High efficiency taxis
8. High efficiency rental cars
More efficient replacement tires can improve fuel efficiency of existing stock by 1-2%.

- Support NHTSA’s adoption of tire efficiency labeling and minimum rolling resistance requirements
- Possible state-level incentive program to demonstrate the feasibility, and benefits of low rolling resistance tires

- In order to ensure proper tire inflation:
  - Require state automotive service centers to check for tire underinflation
  - Require gas stations to provide free air to customers

**GOVERNMENT TIRE RATINGS**

**ACME TIRE COMPANY**
**WILEY RR-S**
SIZE: P225/60R16

<table>
<thead>
<tr>
<th>Category</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUEL EFFICIENCY and CO₂ RATING</td>
<td>50</td>
</tr>
<tr>
<td>SAFETY RATING (WET TRACTION)</td>
<td>75</td>
</tr>
<tr>
<td>DURABILITY RATING (TREADWEAR)</td>
<td>75</td>
</tr>
</tbody>
</table>

Ratings range from 0 to 100 with 100 being the best, where the tire is properly inflated.
Source: National Highway Traffic Safety Administration (NHTSA)
For more information visit www.nhtsa.gov

NHTSA’s proposed tire rating scheme, 2009
Vehicle Fuel Efficiency Improvement Tactics under consideration (not in any particular order)

1. Vehicle Fuel Economy Standards
2. Feebates for vehicle fuel efficiency
3. Procure EVs and more efficient vehicles for public fleets
4. Green Freight activities -- Smartway
5. More efficient replacement tires
6. **Vehicle retirement incentives for low-income groups**
7. High efficiency taxis
8. High efficiency rental cars
Offer financial incentives to allow low-income households to retire/replace old vehicles

<table>
<thead>
<tr>
<th>Income Eligibility</th>
<th>Replacement Options</th>
<th>May be also Eligible Low-Carbon Transportation (CVRP) type incentives</th>
<th>Alternative Transportation Mobility Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8 year old or newer</td>
<td>35+ MPG, Plug-In Hybrid(^3), Zero-Emission Vehicle</td>
<td>$4,500 Face Value</td>
</tr>
<tr>
<td>Low Income &lt;225% Federal Poverty Level</td>
<td>$4,000</td>
<td>$4,500, $4,500</td>
<td></td>
</tr>
<tr>
<td>Moderate Income &lt;300% Federal Poverty Level</td>
<td>Not Available</td>
<td>$3,500, $3,500</td>
<td>$3,500 Face Value</td>
</tr>
<tr>
<td>Above Moderate Income &lt;400% Federal Poverty Level</td>
<td>Not Available</td>
<td>$2,500</td>
<td>$2,500 Face Value</td>
</tr>
</tbody>
</table>

Texas and California fund accelerated vehicle retirement programs for low-income

- Texas funds program through $2-6 fee on OBD/IM program
- California funds program through $1 vehicle registration surcharge

Additional air quality benefits and positive environmental justice

California proposed modification of EFMP, 2014

California EFMP: http://www.arb.ca.gov/msprog/aqip/efmp/efmp.htm
Vehicle Fuel Efficiency Improvement Tactics under consideration (not in any particular order)

1. Vehicle Fuel Economy Standards
2. Feebates for vehicle fuel efficiency
3. Procure EVs and more efficient vehicles for public fleets
4. Green Freight activities -- Smartway
5. More efficient replacement tires
6. Vehicle retirement incentives for low-income groups
7. **High efficiency taxis**
8. High efficiency rental cars
~2000 taxis in Hawaii, driven more than average compared with passenger cars

• Opportunity to reduce fuel consumption of taxis
  • Hawaii 2013 SR 144 supported the idea of promoting high efficiency vehicles including hybrids at HNL
  • TheCAB has a fleet of ~900 vehicles

• Fiscal incentives may be needed to encourage conversion to hybrids
  • Preferential treatment at airports and similar incentives may be helpful

• ~$4 million investment may result in fuel savings worth ~ $16 million with a fully implemented program
Vehicle Fuel Efficiency Improvement Tactics under consideration (not in any particular order)

1. Vehicle Fuel Economy Standards
2. Feebates for vehicle fuel efficiency
3. Procure EVs and more efficient vehicles for public fleets
4. Green Freight activities -- Smartway
5. More efficient replacement tires
6. Vehicle retirement incentives for low-income groups
7. High efficiency taxis
8. High efficiency rental cars
~10,000 rental cars in Hawaii*

- Rental cars tend to be newer than average, but tend to get driven more than average as well
- More efficient rental cars may reduce fuel costs for tourists
  - Rental car companies own/lease the vehicles, but consumers pay for fuel
- Fiscal incentives similar to high efficiency taxis may be needed, but little is known about afterlife of rental cars in Hawaii once they leave the rental fleet

Based on 2.07 million rental cars in the US
# Qualitative Assessment of Vehicle Efficiency Alternatives

<table>
<thead>
<tr>
<th>#</th>
<th>Tactics</th>
<th>Major criteria</th>
<th>Co-benefits</th>
<th>Likelihood of implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Petroleum reduction potential</td>
<td>Social acceptability</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost effectiveness</td>
<td>Lifecycle emissions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capital/operating costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VE-1</td>
<td>Vehicle fuel economy standards</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>VE-2</td>
<td>Feebates for vehicle fuel efficiency</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>VE-3</td>
<td>EVs and efficient vehicles for public fleets</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>VE-4</td>
<td>Green freight</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>VE-5</td>
<td>Replacement tires</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>VE-6</td>
<td>Low income Vehicle retirement incentives</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>VE-7</td>
<td>High efficiency taxis</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>VE-8</td>
<td>Rental car efficiency program</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Legend**

- Low
- Medium
- High
- N/A
2030 Fuel Savings from Vehicle Efficiency Tactics

* Fuel savings from different tactics are not necessarily additive.
* Fuel savings impact after VMT reduction tactics are incorporated may be different.
Additional complementary actions

• Better enforcement of vehicle idling restrictions
• Encourage use of fuel economy labels for used car sales:
  http://www.fueleconomy.gov/feg/UsedCarLabel.js
  • Countries like New Zealand require display of fuel economy label at the time of used vehicle sale
Timeline for transportation energy analysis

- **Stakeholder workshop: November 2014:**
- **Continued stakeholder engagement**
  - Workshop on Electric drive vehicles: January 13-14, 2014
    Register at: [http://energy.hawaii.gov/electric-drive-stakeholder-workshop](http://energy.hawaii.gov/electric-drive-stakeholder-workshop)
  - Web-meetings on aviation and marine tactics: early February 2015
- **Qualitative and quantitative evaluation of tactics (January/February 2015)**
- **Assess complementarity with existing Hawaii policies/plans and budgets (February/March 2015)**
- **Seek broad agreement on plan and implementation steps (April/May 2015)**
- **Final report (June 2015)**

- **Late 2015:** Actual work begins on implementing an integrated transportation energy strategy with shared roles and responsibilities
For more information…

- Hawaii Clean Energy Initiative Website: http://www.hawaiicleanenergyinitiative.org/
- Two question HCEI survey: http://tinyurl.com/HCEI-trans
- ICCT website: http://www.theicct.org/
- Contact Information:
  - Anup Bandivadekar: anup “at” theicct.org
  - Josh Miller: josh “at” theicct.org
  - Alan Lloyd: alloyd “at” theicct.org