



State of Hawaii Energy Efficiency in Transportation Strategies Study- Phase I

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State of Hawaii Energy Efficiency in Transportation Strategies Study - Phase I

By
Hawaii Energy Policy Forum

With assistance of PB Consult, and Parsons Brinckerhoff Quade & Douglas

Energy Efficiency in Transportation Strategies Working Group

Bob Arrigoni

Research and Development, County of Hawaii

James Burke

Department of Transportation Services, City & County of Honolulu

Mark Glick

Office of Hawaiian Affairs

Francis Keeno

Department of Transportation

Kal Kobayashi

Energy Office, County of Maui

Sharon Miyashiro

College of Social Sciences Public Policy Center,
University of Hawaii

Randy Perreira

Hawaii State AFL-CIO

David Rolf

Hawaii Automobile Dealers Association

Peter Rosegg

Hawaiian Electric Company

Gary Slovin

Alliance of Automobile Manufacturers

Robert Tam

Department of Health

Maria Tome

Strategic Industries Division, Department of Business,
Economic Development and Tourism

Tom Brown

Mass Transit, County of Hawaii

Mitch Ewan

Hawaii Natural Energy Institute, University of Hawaii

Mike Hamnett

Research Corporation of the University of Hawaii

Darren Kimura

Energy Industries

Gordon Lum

Oahu Metropolitan Planning Organization

Clyde Omija

Honolulu Clean Cities

Tom Quinn

Hawaii Center for Advanced Transportation
Technologies, HTDC

Janine Rapozo

Transportation Agency, County of Kauai

Gareth Sakakida

Hawaii Transportation Association

Glenn Soma

Department of Transportation

Lance Tanaka

Tesoro Hawaii Corp.

Richard Torres

Department of Transportation Services, City and
County of Honolulu

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State of Hawaii Energy Efficiency in Transportation Strategies Study Phase I

Executive Summary

In response to Act 254, 2007 Session Laws of Hawaii, the Hawaii Energy Policy Forum (“Forum”) at the University of Hawaii at Manoa conducted a study on energy-efficient transportation strategies to reduce the demand for fuel in Hawaii’s transportation sector and, in so doing, reduce Hawaii’s dependence on imported fossil fuel. The study, conducted in conjunction with the State Department of Business, Economic Development & Tourism (“DBEDT”) included consideration of the following:

- (1) Developing tangible goals, objectives, desired outcomes, and actions to implement an energy-efficient transportation strategy;
- (2) Developing implementation benchmarks for measuring outcomes of energy-efficient transportation strategies; and
- (3) Conducting a cost-benefit analysis of each energy-efficient transportation strategy.

The Forum convened a steering committee to plan the scope of the work and identify the major stakeholders that should be participants in this challenging yet significant undertaking. Invited representatives from business, labor, academia, and government included state, county and Metropolitan Planning Organization transportation planners, state energy and Native Hawaiian agency officials, utility and petroleum company executives, and automobile dealer and manufacturer industry advocates. These members comprise the Energy Efficiency in Transportation Strategies Working Group (“Working Group”).

After much discussion, the Working Group decided to initially focus on energy efficiency in ground transportation and developed the following consensual vision of “an energy efficient transportation system”:

“Hawaii’s energy efficient transportation integrates effective community input and planning (demand), and offers people of all ages and walks of life flexible options (supply) including mass transit, private and public vehicles and self-powered conveyance in alternative combinations that provide mobility at acceptable cost”.

With a short time frame and ambitious scope of work outlined in Act 254, the Working Group has met monthly since its inception. During this period the Working Group established three goals on which the study would focus its efforts:

- (1) Increase choices for modes of travel
- (2) Increase fuel efficiency of vehicle population
- (3) Diversify energy sources available to meet transportation energy needs

One of the major findings of the Working Group is that there is a lack of data upon which to establish goals and to track progress in meeting those goals. In their review of their existing data, Working Group members found significant gaps in the types of data needed to assess energy efficiency in transportation, and the lack of coordination among agencies in the collection and use of energy-related data. Thus, while there is a vast storehouse of data being collected throughout the State, these are fragmented, scattered, and not in usable format. Additionally, there is no systematic means for bringing energy-relevant data together. As a consequence, the potential impact of current or future energy-efficient initiatives or practices in meeting goals or benchmarks cannot be fully evaluated.

Because of the importance of developing energy-efficiency policies and practices in transportation and the potential cost of these actions, it is imperative that the State invest in collecting and analyzing the necessary data to make sound policy decisions.

More specifically, in order to agree upon specific transportation energy efficiency benchmarks and goals for the State, as required in Act 254, additional information such as transportation demand and fuel consumption data from the State and county jurisdictions and their respective government agency sources must be obtained. Specific data on transportation energy demand and supply from business and commercial sources should also be integrated. Finally, in order to develop realistic and achievable performance improvement goals and benchmarks, the data should be analyzed to develop (1) a historical trend, (2) a baseline forecast, and (3) a set of scenarios for potential future patterns of transportation energy consumption.

The State will more likely meet its goals and make progress toward meeting long-term benchmarks if current information on transportation system energy efficiency is regularly available and changes in energy efficiency of the transportation sector are regularly monitored. Regular monitoring can enable the State and counties to have confidence that implemented strategies are proving effective. If the information and monitoring indicates that additional progress is needed, the State and counties can adjust infrastructure investment and other strategies as appropriate.

Finally, the Working Group agreed that in order to regularly monitor progress toward meeting the benchmarks that would be recommended, a statewide

transportation sector energy efficiency information and monitoring system should be established and maintained. The information and monitoring system would be designed to provide consistent and scientifically reliable information on transportation energy consumption and supply trends and provide feedback on progress in meeting the goals and benchmarks that the State agrees upon. The transportation energy information and monitoring system would provide a more reliable means to compare the cost-effectiveness of alternative strategies.

While the Working Group has made significant progress in terms of bringing together a broad cross-section of energy and transportation stakeholders and in identifying major gaps in data and coordination needed to achieve an energy-efficient transportation system for the State, it requires the necessary data and commitment for coordinated data gathering and analysis.

Due in large measure to the enthusiasm and commitment of its diverse members, the Working Group is unified in its dedication to develop a comprehensive energy-efficient transportation strategy for the State, and therefore recommends that the 2008 Legislature appropriate funds in the amount of \$175,000 to continue its efforts, more specifically: (1) to determine data available among government and business sources; (2) identify gaps in critical data; and (3) develop and test models leading to the establishment of a reasonable and workable plan for a statewide transportation energy information and monitoring system.

1.0 Introduction and Background

1.1 Act 254 Directives

Act 254, Session Laws of Hawaii (SLH) 2007, directed the Hawaii Energy Policy Forum at the University of Hawaii at Manoa (“Forum”) to conduct a study on energy-efficient transportation strategies to reduce the demand for fuel in Hawaii’s transportation sector. The Act tasked the Forum in conjunction with the State Department of Business, Economic Development, and Tourism (DBEDT) to conduct the study. Requirements of the study include the following:

- (1) Developing tangible goals, objectives, desired outcomes, and actions to implement an energy-efficient transportation strategy;
- (2) Developing implementation benchmarks for measuring outcomes of energy-efficient transportation strategies; and
- (3) Conducting a cost-benefit analysis of each energy-efficient transportation strategy.

1.2 Energy Efficiency in Transportation Strategies Working Group

The Forum convened a steering committee to plan the scope of work and identify the major stakeholders that should be participants in this challenging yet significant undertaking.

The Forum then established a working group comprised of state and county government, academia, business, labor, and community leaders to assist in preparing the study. It invited representatives from the State Department of Transportation (DOT), each county's transportation division, labor organizations, transportation planning organizations, petroleum companies, and from the automobile dealers and manufacturers industries. These members comprise the Energy Efficiency in Transportation Strategy Working Group ("Working Group"); see Appendix II for a list of Working Group members. From its first meeting in August 2007 through the writing of this report, the Working Group met four times and worked with the consultant¹ and the Forum during this period.

At the first Working Group meeting, DBEDT gave a presentation on the background of energy use in Hawaii. The presentation included information on Hawaii's petroleum consumption by various sectors, the fuel demand for Hawaii's ground transportation sector, the annual average gallons of fuel used per registered vehicle, the relationship between crude oil prices and gasoline prices, and transportation use projections.

The presentation highlighted that:

- 1) Transportation fuel is a necessary resource for the State of Hawaii;
- 2) Global factors affect transportation fuel supply and price;
- 3) Transportation system and vehicle efficiency could promote energy efficiency and moderate the growth in transportation fuel demand; and
- 4) There is a need to identify types of data and to quantify the energy consumption impacts of transportation alternatives.

After carefully reviewing DBEDT's presentation, the Working Group decided to first focus its efforts on energy efficiency in ground transportation for the State of Hawaii.

The Working Group consensually developed a vision of "an energy efficient transportation system" as follows:

"Hawaii's energy efficient transportation integrates effective community input and planning (demand), and offers people of all ages and walks of life flexible options (supply), including mass transit, private and public vehicles,

¹ The Forum contracted with Dr. Lewison Lem and Kathleen Leotta of PB Consult, Parson Brinckerhoff, Quade & Douglas, Inc. to assist in developing preliminary strategies to develop goals and benchmarks for an energy efficient transportation system.

and self-powered conveyance in alternative combinations that provide mobility at acceptable cost.”

The Working Group also discussed the timeless intention to act upon the vision. A number of the driving forces to support the work on the vision and resulting goals were suggested as provided below:

- Create more sustainable transportation systems.
- Improve the energy efficiency of the transportation system while still protecting mobility and choice.
- Increase fuel security.
- Reduce carbon emissions.
- Transform Hawaii into an energy transportation paradise.

The Working Group also unanimously agreed upon the following preliminary goals to advance energy efficient strategies and reduce the intensity and waste in energy of our transportation systems:

1. Increase choices for modes of travel

Multiple modes of travel permit greater public choice for efficient and flexible trip planning.

2. Increase fuel efficiency of vehicle population

Incentives to improve the fuel efficiency of Hawaii’s vehicle population will influence consumer behavior in favor of buying and using more efficient vehicles.

3. Diversify energy sources available to meet transportation energy needs

Greater diversity of energy sources provides additional flexibility in meeting the energy needs of the transportation sector.

Any strategies to meet the above goals must also consider and evaluate socially acceptable economic consequences and cost-effectiveness.

Most of the Working Group’s attention focused on the first two goals, since they were seen as having a direct impact upon the energy efficiency of the transportation system. The third goal was being addressed by other activities of DBEDT.

As a result, the Working Group agreed that the most promising and important means for the State of Hawaii to improve the energy efficiency of its transportation system was through increases in transportation choices and increases in the fuel efficiency of the motor vehicle fleet within the state. The Working Group began

deliberations on a number of different strategies to meet the above goals. The discussion to date is provided in section 5.2.

The Working Group agreed that it was premature to develop specific goals, objectives and benchmarks without first identifying baseline performance. Members sought energy-related data from their respective agencies but found that data were not available yet crucial to this effort. The consultant sought and shared information from other jurisdictions (see Section 5.3), but the need for baseline information and a coordinated data collection and analytical system was the focus of the remaining meetings. The discussion and recommendations are detailed in Section 6.

1.3 Overview of Report

This report summarizes the findings of the Working Group's study, and is organized into the following sections:

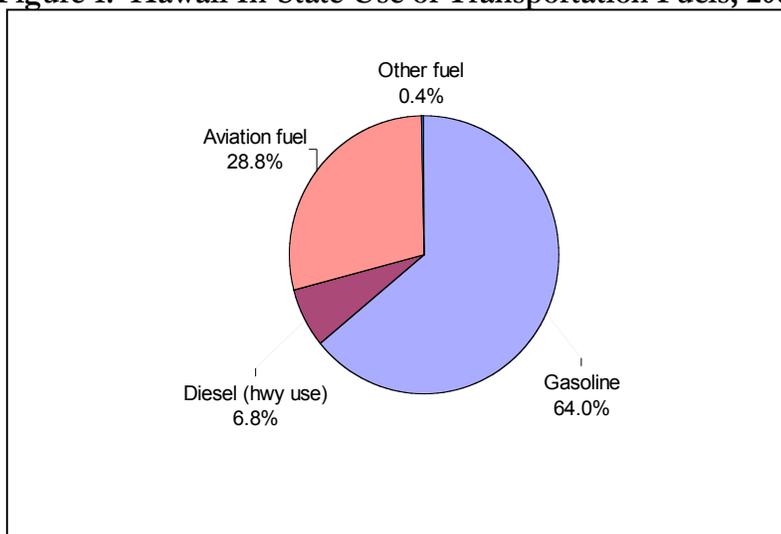
1. Introduction and Background
2. Energy Consumption in the Transportation Sector
3. Overview of State, Regional, and Local Plans
4. Overview of Transportation Energy Efficiency Strategies from Other Jurisdictions
5. Energy Efficiency in Transportation: Goals and Benchmarks
6. Next Steps and Recommended Actions

2.0 Energy Consumption in the Transportation Sector

2.1 Energy and Transportation in Hawaii

Hawaii's ground transportation sector is responsible for the consumption of about 71 percent of Hawaii's transportation fuel use (see Figure 1). It also is most subject to influence by public policy at the State level. The Working Group therefore agreed to focus on ground transportation.

Figure 1. Hawaii In-State Use of Transportation Fuels, 2007

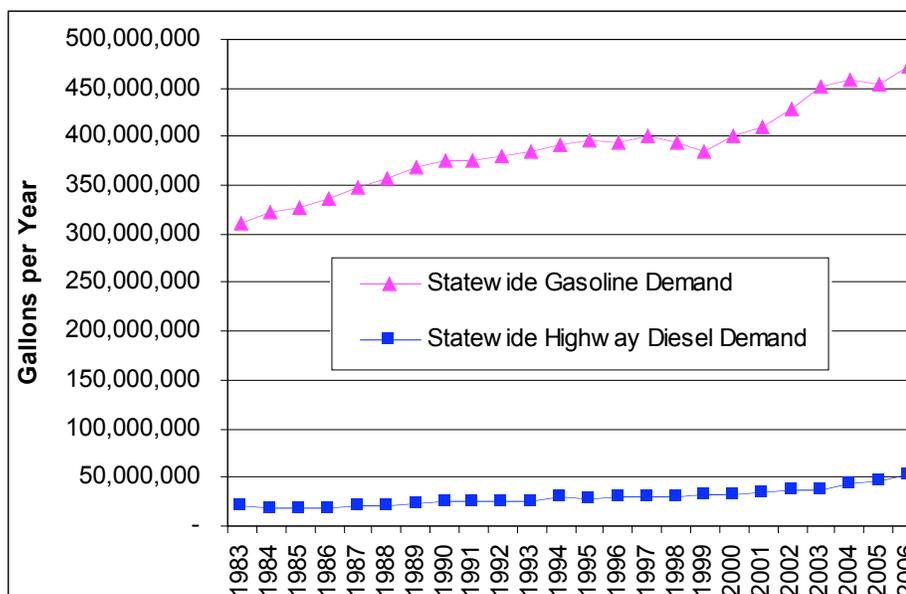


Source: Fuel Tax Records, Department of Taxation, State of Hawaii

2.2 Gasoline and Diesel Demand

Gasoline and diesel consumption in the state has, for the most part, steadily increased since the early 1980s (see Figure 2). Figure 2 also shows the relative consumption of gasoline versus diesel, with the consumption of gasoline, unsurprisingly, much higher than diesel.

Figure 2. Statewide Trend in Gasoline and Diesel Demand



Source: Strategic Industries Division, DBEDT, based on Department of Taxation Data, State of Hawaii

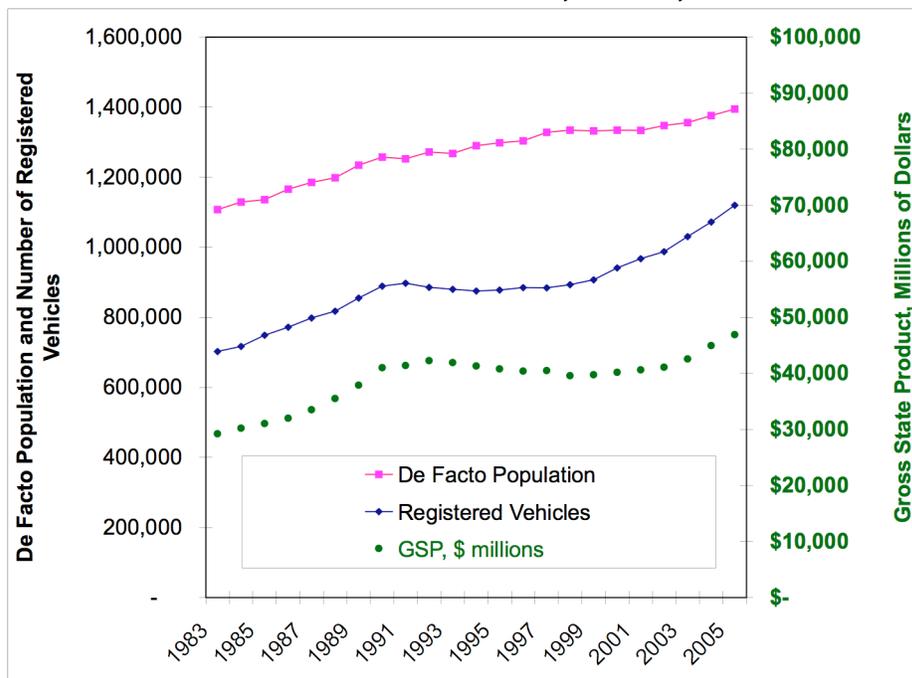
The annual change in gasoline has ranged from -3 percent to +5 percent between 1983 and 2006, with an average annual change of +1.8 percent. With gasoline now selling for about \$3.40 a gallon, this level of consumption now represents a cost of about \$1.6 billion a year.

The annual change in diesel demand fluctuates much more than gasoline, ranging from -17 percent to +19 percent, with an average annual change of +4.23 percent. In total, Hawaii consumed about 525 million gallons of gasoline and diesel in 2006 for ground transportation. For more detail on energy consumption and transportation, see Appendix III.

2.3 Population and Vehicles

Hawaii's de facto population and the number of registered vehicles in Hawaii are both increasing, as shown in Figure 3. Between 1983 and 2005, the number of registered vehicles increased 59%, significantly more than the 26% increase in population over the same period. Also shown in Figure 3 is the change in gross state product (61%) over the same period, including the economic downturn in the 1990s and recovery beginning in 1999.

Figure 3. De Facto Population, Registered Vehicles, and Gross State Product, Hawaii, 1983-2005

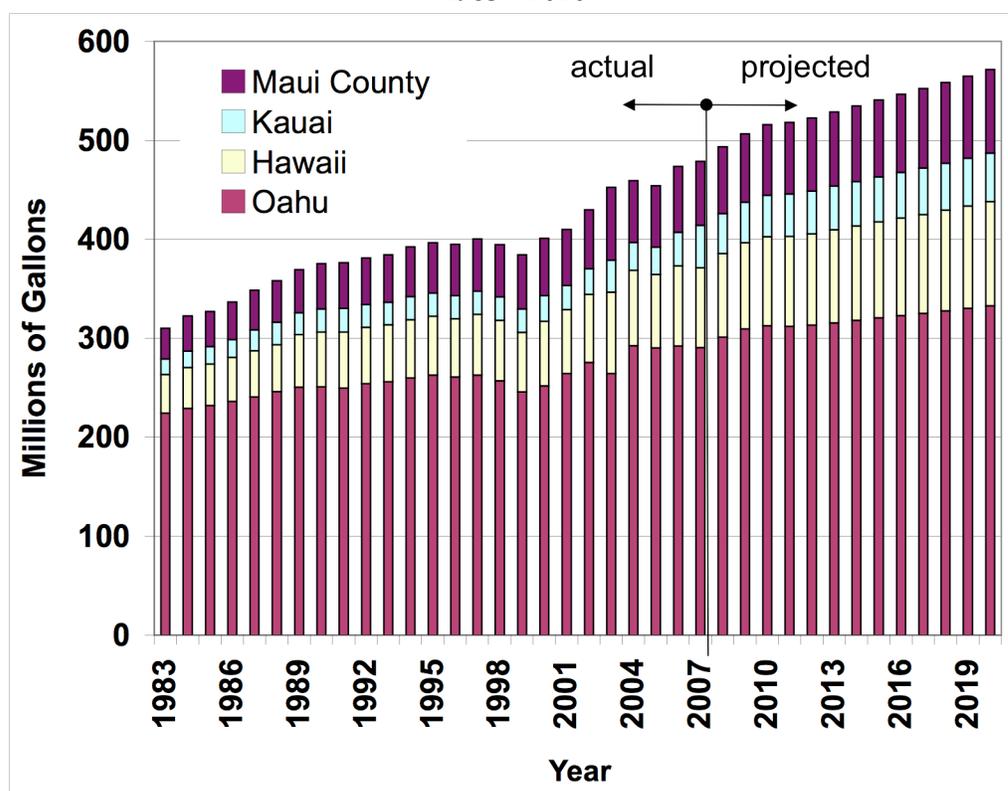


Source: Strategic Industries Division, DBEDT. Based on data from the Hawaii State Data Book, Tables 1.09, 18.07, and 13.02.

2.4 Historical and Projected Gasoline Demand

The historical and projected gasoline demand in the State of Hawaii from 1983 to 2020 can be found in Figure 4. According to the State Energy Office, the gasoline and diesel forecast is based on historical trends, and does not include potential changes due to vehicle efficiency changes, fuel price changes, or changes in transportation and land use plans. Forecasts tied more closely to local, regional, or state transportation and land use plans have not been developed. As shown, the forecast, based on historical trends, indicates gasoline demand increasing by an annual average of 1.4 percent between 2007 and 2020.

Figure 4. Historical and Projected Gasoline Demand in Hawaii, 1983 - 2020



Source: Strategic Industries Division, DBEDT, State of Hawaii

3.0 Overview of State, Regional, and Local Plans

3.1 Overview

A review of Hawaii's state, regional and local transportation plans indicated that, in general, the plans do not explicitly consider energy consumption or energy efficiency. However, the transportation plans in general have some elements that, if implemented, are likely to improve the energy efficiency of the transportation sector.

On the other hand, some elements in the plans, if implemented, would not support the goal of improving the energy efficiency of the transportation systems.

3.2 Plans and Documents Reviewed

The Working Group examined state, local, and regional plans to identify goals or policies relating to energy efficiency in the transportation sector; and, whether they addressed the major goals adopted by the working group.

See Appendix IV for a list of the plans and documents reviewed by the Working Group.

3.3 Energy Efficiency-Related Goals and Policies

The plans were reviewed to assess the degree to which energy efficiency is a key component or included in existing plans.

In general, state and local transportation plans do not focus on improving the energy efficiency of the transportation system. However, the Working Group found a number of goals and policies that have potential for impacting energy efficiency in transportation. These include:

Statewide

- Increase the efficiency of air, land, and water transportation systems (Hawaii Statewide Transportation Plan).
- Encourage production and use of locally produced biofuels (Hawaii 2050 Sustainability Plan).

County of Hawaii (County of Hawaii General Plan)

- Strive towards energy self-sufficiency (goal).
- Encourage the development of alternate energy resources (policy).
- Encourage the development and use of agricultural products and by-products as sources of alternate fuel (policy).
- Provide incentives that will encourage the use of new energy sources and promote energy conservation (policy).
- Strive to diversify energy supplies and minimize the environmental impacts from energy usage (policy).

County of Maui (Maui Countywide Policy Plan)

- Support the development of efficient, economical, and environmentally sensitive means of moving goods and people throughout the County and between islands (objective).

City and County of Honolulu

- Develop and maintain Oahu’s island-wide transportation system to ensure efficient, safe, convenient, and economical movement of people and goods (goal). (Oahu Regional Transportation Plan 2030)
- Use building setback regulations to make room for a dedicated transit lane on Farrington Highway (major transit corridor), and encourage development of medium-density development near stations (Central Oahu Sustainability Communities Plan).

County of Kauai

- Consider transportation alternatives to increasing the size and capacity of roadways. Alternatives include increased utilization of public transit (policy). (Kauai General Plan)

For more detailed description of these items in relationship to energy efficiency, see Appendix IV.

4.0 Energy Efficiency Strategies from Other Jurisdictions

The transportation sector accounts for a significant portion of energy consumption, particularly liquid fuels, in both the US and abroad. In the US, transportation accounts for about 28 percent of domestic energy consumption, and in OECD Europe, about 23 percent. To reduce dependence on fossil fuels and improve energy efficiency, countries and regions across the world have undertaken various strategies. The consultant researched strategies used or proposed in other jurisdictions:

Strategies Related to Modes of Travel

A number of strategies may induce a shift towards more efficient modes and discourage unnecessary driving. Strategies may include: Transit, Pay-As-You-Drive (PAYD) insurance, national car registration quota, transportation system management, increased bike and pedestrian infrastructure, and commuter choice programs.

In addition, through dense, mixed-use, and transit-oriented development, appropriate land use strategies can also reduce overall vehicle-miles traveled by facilitating the shift to non-motorized transport and transit. Smart growth initiatives, “fix it first” funding, and some parking management schemes fall under this category. See Appendix V.

Strategies Related to Fuel Efficient Vehicles

Other strategies may result in more fuel efficient vehicles by improving combustion technologies, using more efficient fuel sources, or enacting policies that encourage the purchase of more efficient vehicles (thereby improving fleet efficiency). The strategies in this category include: “Clean Car Programs,” the “Green Tax Program,”

feebate programs, diesel retrofits, and fuel efficient replacement tires. In addition, operational efficiency strategies reduce the amount of fuel consumed by vehicles per mile traveled by improving driver behavior. See Appendix VI.

Strategies Related to Diversifying Energy Sources

A number of strategies result in more choices in alternative fuels, typically through increased reliance on alternative and renewable fuels, such as bio-diesel; or electric or plug-in hybrid vehicles (PHEV) that are recharged from power generating facilities (that could increasingly rely on wind power, solar power, geothermal, or other renewable energy sources). See Appendix VII.

5.0 Energy Efficiency in Transportation: Goals and Benchmarks

5.1 Current/Existing State Goals

The following are some of the current goals Hawaii has established with respect to energy efficiency:

- Hawaii's energy objectives as described in Chapter 226-18, Hawaii Revised Statutes (HRS):
 - Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people.
 - Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased.
 - Greater energy security in the face of threats to Hawaii's energy supplies and systems.
 - Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use.
- Hawaii's Renewable Portfolio Standard (RPS), as described in Chapters 269-91 through 269-95, HRS: The electric utilities are to provide 10% of their electricity from renewable sources and energy efficiency by 2010, 15% by 2015, and 20% by 2020.
- Gasoline must contain 10% ethanol by volume (HRS 486J-10; Hawaii Administrative Rules 15-35).
- Act 234, SLH 2007, states that by January 1, 2020, the State of Hawaii shall reduce statewide greenhouse gas emissions to levels at or below the best estimations of the inventory of greenhouse gas emissions estimates for 1990.

5.2 Preliminary List of Goals and Strategies

The Working Group made significant progress in responding to the directives of Act 254, due in large measure to the enthusiasm and commitment of its members. Although a very diverse group, all members are unified in their dedication to developing a comprehensive energy-efficient transportation strategy for the state that will be a workable solution to meet everyone's needs and situations. They have even

been so bold as to envision Hawaii becoming an energy-efficient transportation paradise.

To meet that vision, the Working Group developed a preliminary list of goals and objectives as the driving force and incentive for developing comprehensive strategies and actions. While not finalized, they provide the guiding goals for an energy efficient transportation system for Hawaii.

5.2.1 Preliminary Goals and Objectives

- Create more sustainable transportation systems.
- Advance more energy efficient transportation strategies.
- Reduce energy intensity of the transportation system, and wasted energy.
- Improve the energy efficiency of the transportation system while still protecting mobility and choice.
- Increase fuel security.
- Reduce carbon emissions.
- Transform Hawaii into an energy transportation paradise.
- Create more choices in modes of travel.
- Increase the fuel efficiency of vehicles.
- Diversify energy sources available to meet transportation energy needs.

5.2.2 Preliminary Strategy Ideas

The Working Group identified a number of strategies to meet the State's goals and benchmarks. Members **agreed that more information and data are required before goals, objectives, strategies/initiatives, and benchmarks can be adopted.** The strategies listed below, while not accepted by the Working Group as a whole as the preferred strategies, are offered as ideas suggested for further examination:

Strategies Supporting More Choices in Modes of Travel

- Government incentives/subsidies.
- Car-sharing to reduce fleet (e.g., zipcar)
- Big island bus service innovations (free ridership)
- Increase transit ridership
- Increase use of shared ride modes of travel (carpools, vanpools, etc.) through innovative marketing strategies (for example, carpool sweepstakes, etc.)
- Telecommuting
- Build more bike lanes and establish requirement for more bicycle friendly programs
- Build HOV lane on all new highway segments
- Bikes on boats
- Bus and bike parking/lockers

- HOT-lane type elevated highways to increase vehicle throughput and manage traffic congestion

Strategies Supporting More Choices in Fuel Efficiency of Vehicles

- Government incentives/subsidies
- Incentives for fuel efficient cars (e.g. free parking) – Single Occupancy Vehicles (SOV) in ‘zipper’ lanes (like electric vehicles)

Strategies Supporting Energy Source Diversity

- Incentives to encourage development of alternative fuels

Other Strategies (Big Picture or How to Get There)

- Include energy assessment in transportation plans (including project fuel demand)
- Collect additional data i.e., ‘user satisfaction surveys’ on a regular basis (e.g. every other year)
- More and better data on how are we doing, and mine the data we are collecting on a regular basis
- Hawaii energy/transport model/scenario analysis

5.3 Examples of Potential Benchmarks

While the Working Group agreed that specific benchmarks for improving the energy efficiency of Hawaii’s transportation system must be established to monitor changes and adjust the course as necessary, it declined to develop benchmarks without additional data collection and analysis. It did however identify benchmarks used in other jurisdictions, which may be applicable for Hawaii. These require further assessment as to their appropriateness. They include the following:

- State of California: Reduce demand for on-road gasoline and diesel to 15 percent below the 2003 demand level by 2020, and maintain that level for the foreseeable future.
- State of California: Increase use of non-petroleum fuels to 20 percent of on-road fuel consumption by 2020, and 30 percent by 2030.
- City of Portland, Oregon: Reduce oil consumption by 50% in 25 years.
- Iceland: Power all cars and boats with hydrogen made from electricity drawn from renewable resources by 2050.
- Brazil: Power 80% of the transport fleet with ethanol derived mainly from sugar cane within 5 years.
- Sweden: Reduce consumption of oil in transport sector by 40 to 50 percent by 2020.
- U.S. January 23, 2007 State of the Union Address by President Bush: Reduce gasoline usage in the United States by 20 percent in the next 10 years.

6.0 Next Steps and Recommended Actions

6.1 Determine Goals and Benchmarks

The State should adopt specific goals and strategies for improving the energy efficiency of Hawaii's transportation system. Although the Working Group has developed preliminary goals and objectives (see Section 5.2.1), these constitute a starting point which require further analysis before specific strategies and benchmarks can be adopted.

6.2 Identify Data Needed to Measure Performance

The Working Group considered a range of ideas to improve the energy efficiency of Hawaii's transportation system. Many of these ideas for programs and activities were already being undertaken through ongoing transportation system planning. The Working Group considered the contents of state, county, and city transportation plans and other relevant documents to determine what strategies have already been developed and/or implemented in the state. The Working Group made the following additional findings during the course of its meetings:

- There are already activities, programs, and projects in the State of Hawaii that would improve the energy efficiency of the transportation sector.
- Many of the existing activities, programs, and projects fit into the categories of goals the working group had agreed upon.
- Transportation plans generally do not explicitly consider energy consumption or estimate the impacts of changes on energy consumption or energy efficiency.
- Transportation plans in general have some elements that, if implemented, are likely to improve the energy efficiency of the transportation sector.

While the Working Group concluded that many ongoing and planned activities and programs in the State of Hawaii would have a positive impact upon the energy efficiency of the transportation system, it found that it was difficult to estimate or quantify the impact of these ongoing and planned activities and programs using the information and data currently available to them.

One of the major findings of the Working Group is that there is a lack of data upon which to establish goals and to track progress in meeting those goals. In their review of their existing data, Working Group members found significant gaps in the types of data needed to assess energy efficiency in transportation, and the lack of coordination among agencies in the collection and use of energy-related data. Thus, while there is a vast storehouse of data being collected throughout the State, these are fragmented, scattered, and not in usable format. Additionally, there is no

systematic means for bringing energy-relevant data together. As a consequence, the potential impact of current or future energy-efficient initiatives or practices in meeting goals or benchmarks cannot be fully evaluated.

Because of the importance of developing energy-efficiency policies and practices in transportation and the potential cost of these actions, it is imperative that the State invest in collecting and analyzing the necessary data to make sound policy decisions. Therefore the Working Group unanimously agreed that effort must first be devoted to obtaining the necessary data before transportation energy efficiency goals and benchmarks for the State can be determined.

Some examples of the types of data and information identified by the Working Group that would be useful in energy-related planning include the following:

Hawaii petroleum use by category

1. Amount of petroleum products (gasoline / diesel) used by passenger vehicles in Hawaii.
2. Amount of jet fuel used by aircraft serving Hawaii travelers.
3. Amount of petroleum products used by marine-borne transportation serving Hawaii.
4. Amount of petroleum used for generation of electricity (to be used for electric vehicles).
5. Amount of ethanol needed to replace one gallon of gasoline

Energy efficiency per mode of travel

1. BTU's per passenger mile / gasoline / diesel for passenger vehicles
2. BTU's per passenger mile for bus
3. BTU's per passenger mile for proposed Oahu rail
4. BTU's per ton / mile for cargo hauling vehicles
5. BTU's per passenger mile for air travel
6. BTU's per passenger mile for marine commute travel
7. Per passenger load counts on average passenger vehicle commutes
8. Load counts on average express bus commute
9. Projected load counts for proposed rail line on Oahu
10. Actual vehicle miles traveled (VMT)
11. Energy efficiency of vehicle fleet

Sensitivity Analysis

1. Change in fuel efficiency of vehicles purchased based on fuel prices
2. Change in VMT based on fuel prices

Motor Vehicle Fleet Projections

1. Estimated penetration of 35-mpg vehicles (city/highway) by 2012, 2015, 2020, 2030.

2. Estimated penetration of hydrogen fuel cell 35 mpg-equivalent (city/highway) vehicles by 2012, 2015, 2020, 2030.
3. Estimated penetration of all-electric passenger vehicles by 2012, 2015, 2020, 2030.

Energy Impacts of Roadway Congestion

1. Estimated amount of energy (petroleum based or electric or hydrogen fuel-cell) wasted by Hawaii roadway congestion
2. Estimated amount of energy (fuel), which would be saved by introduction of additional lanes (for commutes in Leeward, East Oahu, and congested Neighbor Island corridors).

6.3 Develop Energy Efficiency Information and Monitoring System

The Working Group unanimously agreed that there is a need for data and information to be collected statewide in a more consistent and coordinated manner to be useful in planning energy-efficient transportation strategies and initiatives. It therefore recommends that Hawaii should develop an *energy efficiency information and monitoring system* to provide a foundation for the on-going monitoring of improvements to the energy efficiency of the transportation system. Such a system would address the following:

- Data necessary to establish goals and benchmarks. In order to agree upon specific transportation energy efficiency goals and benchmarks for the State of Hawaii as required in Act 254 (SLH 2007), additional collection and review of relevant data is needed. The data that should be considered include transportation demand and fuel consumption data from the State, county, and regional jurisdictions and their respective government agency sources. In addition, specific data should be integrated on transportation energy demand and supply as may be available from business and commercial sources. Finally, in order to develop realistic and achievable performance improvement goals and benchmarks, the data should be analyzed in a manner to develop (1) a historical trend, (2) a baseline forecast, and (3) a set of scenarios for potential future patterns of transportation energy consumption. These potential future scenarios should be reviewed by the Working Group and compared against options for future goals and with respect to selected benchmarks.
- Regular monitoring of progress in meeting goals. The State will be more likely to meet its goals and make progress toward meeting long-term benchmarks if current information on transportation system energy efficiency is regularly available; and changes in energy efficiency of the transportation sector are regularly monitored. Regular monitoring can enable the State and counties to be confident that implemented strategies are proving effective. If the information and monitoring indicate that additional

work is needed, the State and counties can adjust infrastructure investment and other strategies as appropriate.

- Ongoing feedback on and assessment of strategies and initiatives in meeting goals and benchmarks. In order to regularly monitor progress toward meeting the recommended benchmarks, a statewide transportation energy efficiency information and monitoring system should not only be established but also maintained on an ongoing basis. The information and monitoring system would be designed to provide consistent and scientifically reliable information on transportation energy consumption and supply trends and provide feedback on progress in meeting the goals and benchmarks that the state agrees upon. The transportation energy information and monitoring system would provide a more reliable means to organize and present data on the transportation sector's energy consumption and, potentially in the future, on greenhouse gas emissions. The information system would also provide the data and mechanisms by which the state and counties can assess the impact to the state and local economy of alternative strategies, and to compare the cost-effectiveness of alternative strategies.

6.4 Near-Term Legislative Proposal: Statewide Transportation Sector Energy Efficiency Information and Monitoring System

To begin the process of obtaining the necessary data and developing a statewide system for data collection and analysis, the Working Group therefore recommends that a legislative proposal be submitted to the 2008 Legislature requesting funding in the amount of \$175,000 to determine the energy-relevant data available among government and business sources; identify gaps in critical data; and develop and test models leading to the establishment of a reasonable and workable plan for a statewide transportation energy information and monitoring system. See Appendix VIII for draft proposed legislation and budget.

6.5 Future Strategies and Legislation

Once goals and benchmarks have been established, the Working Group should continue to define strategies and future legislation, including determination of a permanent responsible agency to coordinate efforts to achieve the goals and benchmarks.

A few examples of potential future legislative strategies were presented by the consultant but were considered premature at this time. See Appendix IX for a copy of the legislative strategies presented by the consultant.