

Implementing the Most  
Effective Transportation  
Demand Management (TDM)  
Strategies to Quickly  
Reduce Oil Consumption



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## EXECUTIVE SUMMARY

In its report, *Saving Oil in a Hurry*, the International Energy Agency (IEA) makes the case for why pre-planning for an oil supply disruption is important:

“...pre-planning is essential in order for transport demand restraint measures to succeed during an emergency. It is not enough for countries to have a list of measures to use; they must be ready to implement those measures on very short notice. To do this, they generally must develop detailed plans and make certain investments ahead of time. Communicating this plan to the public also appears very important; if the public is not well informed of plans ahead of time, and supportive of them, they may be less likely to cooperate and do their part to help the plans succeed during an emergency. Strong support and cooperation from the business community is also essential. In general, providing clear information to the public – that the public can trust – seems to be an important element of any plan.”

The research presented in this report strives to help local and regional government agencies prepare for fuel supply disruptions by:

1. Describing our fuel supply vulnerabilities,
2. Reviewing lessons learned from previous fuel supply disruptions,
3. Identifying the transportation demand management strategies that offer the most potential to quickly reduce fuel and oil consumption,
4. Suggesting implementation timeframes and potential barriers to implementation for these strategies, and
5. Recommending pre-planning actions to better prepare for an oil supply disruption.

As a case study, this report describes strategies that could be implemented in the central Puget Sound region, and also briefly describes how implementation of some of these measures could differ in other regions.

This research does not focus on important long-term strategies that can reduce fuel consumption, such as changes to land use, taxation, vehicle mix, or the transportation infrastructure. Its goal instead is to examine strategies that are relatively low-cost and that can be implemented fairly quickly to improve the fuel-efficiency of the transportation system, and thereby improve its sustainability in times of crisis.

### ***Potential Oil Challenges***

Domestic oil production in the United States peaked in about 1970. Since then the U.S. has become increasingly reliant on imported petroleum products. As our dependence on imported oil deepens and supplies dwindle — as many experts agree is inevitable — the U.S. and other areas of the world may begin to aggressively implement transportation

demand management (TDM) strategies to conserve energy.<sup>a</sup> These are strategies that promote the optimal use of the existing infrastructure and transit services, as well as policies and programs to reduce or shift the demand for transportation. Programs typically focus on carpooling, transit, alternative work arrangements, etc. These strategies may be particularly helpful should any of a number of possible oil supply disruptions occur, including:

1. Geopolitical disruptions.
2. Inadequate petroleum refining or processing capabilities.
3. Global peak in the production of oil (a long-term disruption in supply).
4. Natural disasters, such as hurricanes, in areas where petroleum is extracted, processed or shipped.
5. Coordinated terrorist attacks on critical energy infrastructure in the U.S. or abroad.

Although the U.S. and other countries have strategic stockpiles of crude oil, these are not always useful in a supply disruption. This report describes several current and future limitations of the U.S. Strategic Petroleum Reserve (SPR) for responding to oil or fuel supply disruptions.

In addition, there is now consensus within the scientific community that the transportation sector is contributing to global climate change through the burning of gasoline and diesel, and the subsequent release of carbon dioxide (CO<sub>2</sub>) into the air. Although this report does not attempt to predict the potential severity of or timeframe for climate change impacts, at some point governments may choose to take more drastic action to reduce greenhouse gas emissions. The TDM strategies described in this report could be used to help reduce emissions, although they would likely be much more effective when accompanied by price signals, such as fuel tax increases, carbon emissions taxes, parking charges, or some form of fuel rationing.

## ***Lessons Learned from Previous Fuel Supply Disruptions***

Reviewing impacts of previous fuel supply disruptions can shed some light on how travel behavior might be affected by future fuel supply disruptions. Lessons learned are presented from three fuel supply disruptions:

1. Oil shortages in the U.S. from 1973 to 1981,
2. A fuel blockade in the United Kingdom in 2000, and
3. Fuel shortages in North Carolina immediately following Hurricane Katrina in 2005.

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<sup>a</sup> TDM is usually referred to as mobility management in Europe and parts of Asia.

## *Oil Shortages from 1973-1981*

In 1973, several Arab nations instituted an oil embargo against the U.S. and Holland in response to U.S. support of Israel in the 1973 Arab-Israeli War. By the time the embargo ended six months later, world crude oil prices had tripled, and fuel consumption in the U.S. had declined by about two percent. Additional geopolitical events in 1978 and 1980 resulted in a decrease in global oil production of nearly five percent between 1979 and 1980, and an additional six percent decrease between 1980 and 1981. Several surveys were conducted after these oil crises to assess how and why people changed their travel behavior. The lessons learned from these crises include:

- Changes in non-work trips may occur far more frequently than changes in work trips.
- Fuel availability has affected travel behavior much more than price.
- Transit systems have only limited capabilities for quickly increasing service to respond to fuel price increases or shortages.
- Although planners in the 1970s and 1980s concluded that fuel shortage planning and response should occur at the lowest levels of government, currently fuel shortage planning occurs primarily at the state level.

## *U.K. Fuel Blockade in 2000*

More recently, the United Kingdom experienced a fuel shortage following a blockade of oil refineries. The U.K. fuel blockade began on September 5, 2000, when an increase in the price of crude oil prompted major oil companies to announce an increase in the price of fuel. Within a week, protesters had blocked six of the U.K.'s eight refineries and over half of Britain's filling stations were shut. By the time the protest began to end, on September 14, 2000, it was estimated that 90 percent of filling stations were empty of fuel.<sup>1</sup>

Due to the reliance on just-in-time delivery of fuel, food, and other supplies, the country engaged in "panic buying" of food and fuel, and the impacts were widespread. Following were some of the lessons learned from the U.K. fuel crisis:

- Panic buying of fuel as well as food may be expected during future fuel shortages, especially if the fuel shortages are extreme.
- Rationing schemes (for food and fuel) may be necessary in extreme shortages.
- Working at home does not appear to be an option for a large portion of the population.
- A post-shortage survey indicated that public transport, walking or cycling offered viable alternatives to commuting by car for a significant number of people.
- Ride sharing was not a popular option in the U.K., however analysis indicated that households that owned more vehicles tended to increase ride sharing.
- Conventional bus travel was not a popular alternative for shopping, because of difficulty of use, the inflexibility of the route, lack of reliability, and the cost. Households with more children did not choose to shop by public transport, but the number of children did not appear to affect shopping on foot.
- Few indicated they would do their shopping less frequently, and few indicated they would use the internet for shopping.
- Women expected more disruption to their activities than men.

- Discretionary trips were the first to be reorganized during disruptions, with discretionary trips for children's activities being the first to suffer.

### *North Carolina's Fuel Shortages due to Hurricane Katrina in 2005*

Hurricane Katrina made landfall at New Orleans on Monday, August 29, 2005. The hurricane destroyed much of the U.S. gulf coast and also affected the rest of the nation by damaging energy infrastructure. The entire southeastern U.S., for example, was affected when the Colonial and Plantation pipelines were temporarily shut down. These two pipelines delivered about 90 percent of North Carolina's fuel, so the closure of the two pipelines represented a huge supply disruption. Lessons learned from this fuel supply disruption include:

- Government agencies should confirm that they have identified all fuel supply vulnerabilities and planned for them accordingly .
- Government agencies at all levels should reassess how they can quickly secure fuel in emergencies.
- In some areas of the U.S. transit agencies may need to remind decision makers of the importance of maintaining transit service during fuel shortages.
- Energy contingency planning primarily occurs at the state level, and some local agencies expressed that they felt they were "on their own" in dealing with fuel supply disruptions. Ideally, energy contingency planning would occur at all levels of government, and be coordinated between these different levels of government.
- Since the 1970s, land use patterns have generally continued to develop in ways that are energy inefficient.
- In an emergency, reliance on just-in-time delivery of fuel and other goods is problematic.
- Government agencies at all levels should better understand their daily fuel requirements, and buy some fuel under firm contracts that obligate the fuel supplier to provide that fuel under most circumstances.
- Over the long-term, regions should strive to become more self sufficient regarding fuel supplies (e.g., reduce dependence on a single pipeline or supplier).

### *Summary of Conclusions from Previous Oil Supply Disruptions*

Following are conclusions drawn from a revisiting of lessons learned from previous fuel shortages.

#### **Mode Changing:**

- Changes in non-work trips may occur far more frequently than changes in work trips.
- Transit systems have only limited capabilities for quickly increasing service to respond to fuel price increases or shortages due to a small supply of extra vehicles and drivers.
- In some areas of the U.S. transit agencies may need to remind decision makers of the importance of maintaining transit service during fuel shortages.
- Ridesharing has typically not been widely used as a means of reducing fuel consumption.

- Where transportation options are available, people indicate that they will use them. A post-shortage survey in the U.K. indicated that public transport, walking and cycling offered viable alternatives to commuting by car for a significant number of people. However, conventional bus travel was not a popular alternative for shopping.
- Unlike the 1970s and 80s, today there are many opportunities for telecommuting and on-line commerce. However, the degree to which telecommuting and on-line commerce might help mitigate fuel shortages is unclear. In the U.K. working at home did not appear to be an option for a large portion of the population, and few indicated that they used the internet for shopping. However, since 2000 the use of the internet for shopping has become more commonplace (although in a fuel emergency delivery companies would likely suffer from fuel shortages as well). Similarly, in the last several years the communications tools helpful for telecommuting (high-speed internet access, web conferencing, etc.) are much more widely available.

### **Fuel Supplies:**

- Fuel availability has historically affected travel behavior much more than price.
- Panic buying of fuel as well as food may be expected during future fuel shortages, especially if the fuel shortages are extreme.
- In an emergency, reliance on just-in-time fuel delivery is problematic.
- Government agencies at all levels should reassess how they can quickly secure fuel in emergencies.
- Government agencies at all levels should better understand their daily fuel requirements and typical fuel supply (especially for police, fire, transit, and other essential services), and buy some fuel under firm contracts.
- Over the long-term, regions should strive to become more self sufficient regarding fuel supplies (e.g., reduce dependence on a single pipeline).

### **Energy Emergency Planning:**

- Although planners in the 1970s and 1980s concluded that fuel shortage planning and response should occur at the lowest levels of government, currently nearly all fuel shortage planning occurs at the state level.
- Perhaps because fuel contingency planning primarily occurs at the state level, some local agencies expressed a sense that they were "on their own" in dealing with fuel supply disruptions. Ideally, energy contingency planning would occur at all levels of government, and be coordinated between these different levels of government.
- Rationing schemes (for food and fuel) may be necessary in extreme shortages.
- Since the 1970s, land use patterns in the U.S. have generally continued to develop in ways that are energy inefficient.

## ***Puget Sound Region Case Study***

The IEA's report *Saving Oil in a Hurry*<sup>2</sup> identified the most effective measures to quickly conserve fuel in the event of a fuel supply disruption. To expand upon the *Saving Oil in a Hurry* study, the research conducted and described in this report presents a case study of the Puget Sound region to better understand implementation barriers and timeframes for fuel saving strategies.

Over the past 25 years, local, state and regional officials throughout the Seattle (Puget Sound) region have adopted and endorsed policies and programs that support TDM strategies. This region has also invested in an extensive network of freeway high occupancy vehicle (HOV) lanes, as well as ridesharing and commute trip reduction policies and programs. A few examples of TDM-supportive programs, policies, or facilities include a regional ridematching system, an extensive HOV lane network on area freeways and some arterials, employer assistance programs throughout the region, and passage in 1991 of the state Commute Trip Reduction (CTR) law that requires major employers to provide employee transportation programs that encourage more employees to not drive alone to work every day.

### *Alternative Work Arrangements*

*Saving Oil in a Hurry* included an estimate of potential fuel savings that would result from alternative work arrangements, and estimated a potential overall regional fuel savings in the U.S. and Canada of about 3.4 percent through telecommuting and about 2.4 percent through a compressed work week (i.e., working four ten-hour days).<sup>3</sup> Flexible work hours, for example, can allow employees to come to work early and leave early (e.g., 7:00 am to 3:00 pm). This shift can also help reduce fuel consumption by enabling employees to travel during hours when buses may have more capacity available, or during less congested hours of the day when drivers can travel at more fuel-efficient speeds.

The actual fuel savings due to alternative work arrangements during an emergency would likely depend on the following:

- The degree to which companies or organizations have *pre-existing* alternative work arrangement programs as part of business-as-usual and/or contingency planning *before* an emergency.
- The percentage of employees who have the appropriate equipment to telecommute (e.g., employees who use laptops as their usual work computer and who have high speed internet access at home may be able to more quickly and efficiently increase their telecommuting).
- The number of jobs suitable for alternative work arrangements.

Recommended pre-planning actions include:

- Develop telework policies at the organization or office level that include teleworker agreements for all eligible employees.
- Provide employees with information on all the communications tools available to facilitate web conferencing and information sharing.
- Ensure that all eligible employees telecommute at least occasionally to ensure that the communications systems are operational.
- Identify which job categories are suitable for working a compressed work week.
- Establish a Flex Time (i.e., flexible work hours) policy and worker agreements.
- Identify any local and regional labor and tax issues that may impact alternative work arrangements.

Alternative work arrangements could be implemented within a few days of a fuel supply emergency in response to a request by the Governor, the state Energy Office, or local or regional government agencies. In particular, flexible work hours and compressed work weeks could be implemented fairly quickly. Increased telecommuting could also occur fairly quickly but could require more preparation by companies or organizations that do not have established telecommuting programs.

### *Reduced Speed Limits*

*Saving Oil in a Hurry* estimated that a region in the U.S. or Canada could achieve a potential fuel savings of 2.4 percent by reducing the maximum speed limit to 55 mph (90 km/h). This estimate assumed the program included an information campaign to encourage drivers not to exceed 55 mph (90 km/h), supplemented by enforcement, either through speed cameras or increased presence of patrol units.

The actual fuel savings in a real emergency would likely depend on the degree to which travelers voluntarily comply with a request to reduce speed limits that are not posted or enforceable, as well as on how long it would take to legally reduce speed limits and modify speed limit signs, and how well these reduced speed limits were enforced.

In Washington State, reducing the speed limit to 55 mph would require legislative action. Once the speed limit change was put into law, it would likely take several months to make new signs and replace or modify all 1,700 signs. However in the interim travelers could be strongly encouraged to travel at no more than 55 mph to conserve fuel.

A reduced speed limit on freeways would require increased enforcement, particularly since these facilities have been designed to support higher speeds. According to the Washington State Patrol, the agency that enforces speeds on the interstates and freeways, a change like this would usually be preceded by a very large media campaign, and a short period of very focused enforcement. Staffing this increased enforcement, however, would be challenging. According to WSP, the agency's staffing goal is 667 troopers statewide, but as of March, 2006 they had a shortfall of 57 troopers from that goal. Furthermore, the WSP indicates that all law enforcement agencies are struggling to meet hiring goals due to an overall shortage of law enforcement professionals. A further challenge is the time-consuming hiring process which requires cadets to undergo extensive testing and training, with training courses offered about once every nine months. Quickly ramping up staffing to increase enforcement is therefore unrealistic. According to the WSP, they would do the best they could with their existing staff.

One potential strategy that could enable speed limits to be quickly reduced would be to install electronic variable speed limit signs in advance of a fuel supply disruption. Although these signs are more commonplace in other parts of the world, in the U.S. changeable speed limit signs are rare, used primarily at some mountain passes and areas that experience fog. These signs can be expensive -- about \$15,000 to \$30,000 each.<sup>4</sup> Due to this high cost, the widespread use of electronic variable speed limit signs would seem to be an unlikely strategy to better prepare for fuel supply disruptions (unless there are other reasons to install changeable speed limit signs). A more likely approach would

be to create a panel that could be nailed on top of the existing sign and later removed if appropriate.

Although drivers could be encouraged immediately to reduce their maximum speed to 55 mph to conserve fuel, legally reducing the speed limit (e.g., passing the required legislation, fabricating and installing signs, and implementing a public information campaign) would take about three to six months in Washington State, and, assuming a continuing shortage of troopers, a reduced speed limit would be hard to enforce in the short-term. Therefore, if the fuel shortage was viewed as a “temporary” problem lasting just a few months it would be an unlikely strategy. Instead, a public information campaign urging travelers to voluntarily travel at no more than 55 mph might be preferable.

Following are a few recommended pre-planning actions for conserving fuel by reducing speeds:

- Review legislation to better understand under what conditions the Department of Transportation or others can change speed limits.
- If appropriate, change legislation so speeds can be more easily reduced to quickly reduce fuel consumption.
- Evaluate existing enforcement constraints to the implementation of a rapid reduction in speed limits.
- Research the institutional authority to use electronic variable speed limit signs, and evaluate whether the cost of advance purchase of these signs would be justifiable, and/or if there would be uses for these signs other than responding to fuel emergencies.

### *Driving Ban Based on License Plates*

According to *Saving Oil in a Hurry* a partial ban on driving was found to be one of the most effective means to quickly reduce fuel consumption. Banning driving based on license plates could result in a fuel savings in the U.S. and Canada of 9.5 percent for an odd/even day ban, and a 0.7 percent savings for a one-in-ten day ban. This strategy has been used in several other countries to reduce air pollution, but it has not been used in the U.S. However, following the 1973 OPEC oil embargo, officials in many places did institute “odd-even” rationing systems for fuel purchases.

Banning driving based on license plates is a very unlikely strategy in Washington State since enforcement would be nearly impossible. The current shortage of law enforcement personnel at all levels in the region would further complicate enforcement. In addition, households that depend on fewer vehicles may feel they are being unduly burdened by a driving ban based on license plates. A further drawback is that such a scheme may lose its effectiveness if it encourages people to purchase more vehicles, or simply an extra license plate, so they will have more driving opportunities.

Pre-planning activities for implementing a driving ban based on license plates include:

- Determine policy regarding if, when, and how driving bans might be implemented, and whether law enforcement agencies have the capacity to enforce such a ban.

- Identify, evaluate, and plan how to implement less restrictive rationing measures to use in severe emergencies, such as limits on fuel purchases that establish both maximums and minimums (the latter to prevent unnecessary “topping off”).

### *Public Transit Service Improvements*

Using public transit is generally more fuel efficient than driving alone, and often *much* more fuel efficient. According to a study by the American Public Transportation Association (APTA), current public transportation usage in the U.S. reduces the consumption of gasoline by 1.4 billion gallons each year.<sup>5</sup> It stands to reason, then, that increasing transit ridership to respond to fuel supply disruptions can be a promising way to decrease fuel consumption. *Saving Oil in a Hurry* identified potential regional fuel savings in the U.S. and Canada from various public transit service improvements. For transit fare reductions, the total fuel saved was estimated at 0.3 percent for a 50 percent reduction in transit fares, or 0.6 percent for a 100 percent reduction in transit fares. *Saving Oil in a Hurry* also evaluated potential fuel savings from an expansion of existing transit service, using two scenarios. The first assumed that off-peak and weekend service was increased by 40 percent to equal peak service. For the second scenario, it assumed the same increase in off-peak service but also an increase in peak service by ten percent. The total fuel savings was estimated at 0.2 percent for an increase in off-peak transit service, and 0.3 percent for an increase in both peak and off-peak transit service.

Following are a few implementation issues for improving public transit service during a fuel supply disruption:

- Free or reduced fares could likely be implemented only for a very short time period.
- Some transit routes and park-and-ride lots could quickly become overcrowded.
- King County Metro has a fleet of approximately 1,300 vehicles but no spare buses (beyond the spare ratio needed for unexpected or planned maintenance) to increase peak period service.<sup>6</sup>
- Quickly expanding the bus fleet is difficult as it usually takes at least 18 months from the time funding is available to purchase a new bus, due both to the procurement process and the typical backlog at the few bus manufacturers in the U.S. and Canada.
- While expanding peak-hour capacity would be difficult, there is some capacity in the off-peak if transit agencies can quickly shift operators’ hours around, although even this takes several months to implement.
- Although funding is a constraint, if funding were available, one option that could be considered is using vehicles, and possibly drivers, from other agencies or companies to provide supplementary transit service (e.g., school and charter buses, shuttles, and paratransit vehicles). However, there may be some serious constraints to using these vehicles and services, including union issues.
- In Washington State new public transit services are only authorized by the state legislature. However, an individual company or organization, or a group of companies through a Transportation Management Association (TMA), could create a custom bus route for its employees or members, which would not be subject to union regulations.
- During a fuel supply disruption transit agencies may be facing some of the same fuel shortages that others in the region are facing. King County Metro has a fuel supply of

about two to three days<sup>7</sup>, so is heavily reliant upon just-in-time delivery. In an emergency, transit agencies should coordinate closely with the state's Energy Policy Division to secure fuel. However, there are no guarantees that fuel will be quickly available. For instance, in an extreme shortage, such as that experienced in North Carolina following Hurricane Katrina, the state's Energy Policy Division may be unable to quickly find fuel for all who need it.

Following are a few planning activities transit agencies should undertake to better prepare for fuel supply disruptions:

- Determine policy and financial capacity to reduce/eliminate fares in response to an emergency.
- Determine strategies to consider to quickly increase revenues if either a) revenues such as fares quickly decrease or b) costs, such as fuel costs, increase quickly.
- Plan how to promote the use of buses during shoulders of peak periods to avoid overcrowding.
- Identify supplementary parking, possibly combined with shuttles, at park-and-ride lots at or near capacity. This could include parking at churches, public libraries, public schools, shopping centers, etc.
- Because it can take months to set up park-and-ride lot agreements (with churches, etc.) a transit agency may want to have some emergency park-and-ride lot agreements in place near park-and-ride lots at or approaching capacity.
- Determine the transit agency's current capacity to increase service during the peak or off-peak, and determine how quickly this service could be increased, and any impediments (including identifying funding requirements).
- Review the legality of emergency public transit services, and identify any legislation that might enable this type of service to be implemented more quickly.
- Explore transit agency union issues that could constrain the ability of an agency to quickly expand transit service.
- Inventory vehicles (buses, paratransit vehicles, shuttles, and vans) and drivers that could be available on short notice.
- Explore the feasibility of setting up agreements in advance with charter bus and school bus companies to make use of their vehicles and drivers in an emergency.
- Determine local and regional agency roles and responsibilities during a fuel supply emergency.

The timeframe required to implement public transit service improvements varies widely. Transit fares could be reduced or eliminated very quickly, but only for a very short period of time due to budget constraints. Off-peak transit service capacity could be increased within three to six months, depending on the nature of the emergency. Fixed route bus schedules could be modified to increase ridership within about three to six months. Widely expanding transit service, however, would take much longer. Due to the time needed to purchase buses (18 months) and the additional support system required (e.g., bus maintenance and layover facilities) it would likely take at least two years to widely expand transit service.

## *Public Information Campaign*

In the event of a fuel supply emergency, a coherent public information campaign would be critical. In the Puget Sound region, communication about the nature of the energy emergency and expected duration would be initiated by the Governor and/or the state energy office. According to the *Washington State Energy Assurance and Emergency Preparedness Plan*, the state's Energy Policy Division would begin monitoring the situation, and brief the Office of the Governor if needed. The Governor could then hold a press conference or distribute a press release, if warranted, to provide information on the nature, severity, and expected duration of the emergency, as well as provide information on actions that are being taken to address the situation, and ways that the public can help conserve fuel.

Along with the initial coordination with the Governor's office, the Energy Policy Division would be initiating communication with a number of agencies around the state and region to help assess agencies' current fuel supply situation and coordinating actions. One of these conversations should focus on coordinating a public information campaign that focuses on mobility options to reduce fuel consumption.

Local and regional agencies that already provide transit services, coordinate ridematching, and promote and facilitate alternative work arrangements, are the best agencies to provide more specific information on how travelers can conserve fuel. The transportation agencies, in coordination with the Governor and Energy Policy Division, would likely work together to develop joint or individual information campaigns that provide the public with information on resources available to help them get around using less fuel, as well as providing tips on conserving fuel.

A public information campaign would likely occur in several forms and could begin as soon as a fuel supply disruption occurs, or when the State becomes aware of a coming fuel supply disruption.

Following are several pre-planning activities that agencies should undertake in order to be better prepared to quickly implement a public information campaign:

- Develop a plan for how a regional public information campaign would be coordinated and kept consistent during a fuel supply emergency.
- Identify which fuel saving measures should be promoted through an information campaign (e.g., "ecodriving" strategies that promote more energy efficient driving, voluntarily reducing speeds, ridesharing, using transit, trip chaining, working a compressed work week or telecommuting, using on-line commerce).
- Develop a list of existing resources available (e.g., existing informational websites, ridematching systems, etc.) that could quickly be shared with the traveling public.
- Consider whether a public information campaign should highlight:
  1. How people can change behavior for their own best interest (e.g., cost savings),
  2. Making changes for the greater good, that "we're all in this together," or
  3. Some of each.

## *Increased Carpooling and Vanpooling*

While transit agencies are limited in their ability to quickly increase service and add seats, plenty of extra seats are readily available in most cars and vans. In the three-county Puget Sound region (King, Snohomish, and Pierce Counties), about 72 percent of 1.5 million commuters drive alone and about 12 percent carpool to work<sup>8</sup>. This equates to about 1,090,000 vehicles occupied by only the driver, and an additional 70,000<sup>9</sup> vehicles occupied by the driver plus usually one to two passengers. Together, nearly all of these 1,160,000 vehicles have one to several seats available for additional commuters, and without requiring public expenditure.

Therefore, it is not surprising that *Saving Oil in a Hurry* identified an increase in carpooling and vanpooling as an important way to reduce fuel consumption quickly in the event of a fuel supply disruption. The IEA study indicated that a comprehensive policy to quickly invoke a large network of carpool lanes, preferential parking, and information systems could result in a fuel savings of 5.2 percent for regions in the U.S. and Canada. One important caveat is that although increasing carpooling has considerable potential to reduce a region's fuel consumption, experience during previous fuel shortages indicate that historically ridesharing has not been an option frequently chosen to conserve fuel.

The Puget Sound region, however, is well-positioned to help travelers form carpools and vanpools. In an emergency, some of the following additional measures could be taken to facilitate additional ridesharing:

- Provide rideshare waiting spaces at park-and-ride lots and other locations for regular carpools or casual carpools (also known as “slugs”).
- Encourage people to form their own vanpools.
- Institute widespread promotion of ridesharing.
- For larger employers, promote emergency carpooling within the organization and provide a simple in-house ridematching system based on zip code or address.
- Promote parking pricing to promote ridesharing.
- Expand priority parking for carpools and vanpools.
- Change vehicle occupancy requirements on some HOV facilities (e.g., from HOV-2 to HOV-3).

Although carpooling could increase within days of an emergency, there could be some hurdles to overcome if park-and-ride lots fill, or if transit agencies run out of vans for vanpools. Making changes to HOV lanes, however, is more time consuming. According to WSDOT, changing the occupancy requirement of existing HOV lanes would likely take several months, and converting general purpose lanes on major arterials and freeways to HOV lanes would take six months or more, depending on the number of roads involved.

Following are some pre-planning activities that will help facilitate ridesharing during an emergency:

- Identify supplementary parking for park-and-ride lots.

- Identify potential rideshare waiting locations for regular and casual carpoolers (i.e., “slugs”) at park-and-ride lots, major employment centers, city and town centers, and elsewhere.
- Develop guidance for larger employers on developing their own in-house ridematching tool.
- Develop policies and plans for changes to HOV lanes during an emergency.

### *Promoting Changes to Non-Work Trips*

Although reductions in non-work car trips and fuel consumption can be achieved by many of the preceding strategies (increasing transit usage, carpooling, and vanpooling; public information campaign; reducing speed limits), it is important to call out the importance of non-work trips for potential fuel savings because only a small portion of all trips in the Puget Sound region are work-related trips. In addition, during previous fuel shortages or roadway closures, discretionary trips tended to be the first to be altered.

Many agencies across the U.S. and elsewhere are already implementing programs to address these non-work related trips, and unlike the 1970s and early 80s, today we also have many more opportunities for online commerce. Recommended pre-planning to promote changes to non-work trips include the following:

- Continue to promote use of alternative modes (transit, walking, ridesharing, biking) for non-work trips.
- Promote trip chaining to reduce fuel consumption. Trip chaining is combining several errands into one trip to reduce the total amount of back and forth travel to the home.
- Assess potential fuel savings of on-line commerce.
- Explore how on-line commerce can be promoted to quickly conserve fuel and assess potential barriers, such as delivery charges that might need to increase as fuel prices increase.
- Investigate how the use of alternative modes for non-work trips can be made more practically (for example, exploring ridesharing options or moving bus stop locations closer to storefronts to better serve shoppers).

Changes to non-work trips (e.g., promotion of trip chaining and use of alternative modes for non-work trips) could begin immediately upon a fuel supply disruption or price increase.

### *Differences in Other Areas*

The recommended pre-planning and implementation timeframe from the Puget Sound case study can not necessarily be assumed to apply in other regions of the country or the world. A full analysis of how implementation or pre-planning could differ in other areas of the world goes beyond the scope of this research effort. However, by examining a few ways in which implementation or planning could differ in Australia, Vermont, and rural Oregon, this report provides food for thought on implementation considerations in rural areas, small towns, and areas with different governing frameworks.

## ***Areas for Future Research***

Following are several suggested areas for future research:

### **1. Using Scenario Planning Techniques to Identify Strategies that Reduce Long-Term Fuel Consumption**

The research presented in this report focuses almost exclusively on short-term strategies that can be implemented without new infrastructure. Although it is very difficult to predict how our political and transportation systems will respond to unknown future energy and climate change challenges, most long-range transportation planning efforts assume that the future will largely resemble the past. Many planners are increasingly questioning the value of planning processes based on this assumption.

An emerging planning process, called Scenario Planning, allows for the comparison of several plausible scenarios rather than just one. According to the Federal Highway Administration's Scenario Planning website, the premise of scenario planning is to get the future imprecisely right rather than to get the future precisely wrong. In the areas of transportation, energy, and climate change, it is becoming increasingly apparent that our future may be markedly different from our past. Additional research should be conducted on developing a framework for evaluating alternative future energy or emissions scenarios in a corridor or project-level study.

### **2. Impacts to Vulnerable Populations**

Research on how fuel shortages would affect food banks, the elderly and disabled, and those who depend on both public and volunteer special services should be conducted. This research could also indicate how the needs of these vulnerable populations could be served during a fuel supply disruption.

### **3. Allocating Fuel in an Emergency**

Additional research on the effectiveness of emergency fuel allocation programs and policies should be conducted. For example, although North Carolina has a fuel set-aside program, during the state's recent fuel shortage this program was not activated (likely because the state expected the emergency to end quickly, as it did). In the meantime, cities and local government agencies did not have any legal means by which they could obtain priority shipments of fuel. In at least a couple of instances, government agencies had to depend on favors from fuel suppliers. For example, a gas station reserved one pump for the sheriff's office and other critical government services, and a major fuel terminal that didn't get fuel from the two pipelines allowed the state to purchase two million gallons of fuel. In addition, due to a concern about potential low fuel supplies and an apparent lack of confidence that they would be able to secure the fuel they needed,

some government agencies fueled their agencies' vehicles at public gas stations in order to conserve their own fuel supplies.

Research should be conducted to determine how government agencies can more quickly be assured of access to fuel. In addition, research should be conducted on the use of existing fuel allocation programs in an emergency to better understand whether these fuel set-aside programs and other measures are sufficiently flexible to enable priority users to quickly obtain fuel.

For allocating fuel to the general public, additional research is warranted on how fuel can be quickly and effectively rationed in an emergency. For example, one of the strategies in the *Washington State Energy Assurance and Emergency Preparedness Plan* is to require gasoline stations to establish limits on fuel purchases, with both maximums and minimums. The requirement regarding minimum purchases prevents unnecessary "topping off" (which contributes to an increase in short-term demand for fuel and can also contribute to long lines at fueling stations). Research should be conducted to document how this rationing system could quickly be implemented and enforced to identify potential implementation constraints.

#### **4. Encouraging Changes in Travel Behavior for Non-Work or Discretionary Trips**

Analyses of travel behavior changes from previous fuel supply disruptions indicates that discretionary (non-work) trips were typically the first to be changed or eliminated. Although some travelers combined trips (trip chaining) others simply canceled these trips.

Additional research areas should include:

- To help facilitate some of the activities that were canceled, investigate how shopping, medical, children's activities, and other trips can be made more easily using alternative modes of transportation (shared taxis, carpooling, shopping shuttles, demand responsive shuttles, etc.).
- Conduct more research on how travelers can be encouraged to make better use of trip chaining.
- Investigate how much fuel can be saved through internet shopping (including an analysis of how increased fuel costs and decreased fuel supplies might impact businesses providing these deliveries).

#### **5. Encouraging Changes in Travel Behavior for the Public Good**

Another potential research topic would be an analysis of how we might do a better job of encouraging people to change their travel behavior for the good of society at large. Potential research could include an analysis of potential public information campaigns that would have a greater likelihood of encouraging people to conserve fuel for the public good.

## **6. Mobilizing Transit Agency Resources in an Emergency**

An only partially related topic, but one brought to mind following this research, would be a review of how transit agency resources could be mobilized quickly in the event of a major natural disaster or terrorist strike either in that agency's own region, or in another part of the country.

### ***Implementation Timeframe and Recommended Pre-Planning***

Table 1 identifies the most likely fuel saving strategies for the Puget Sound region, an implementation timeframe, and the strategies that would be most appropriate based on the expected length of a fuel supply disruption. Table 2 summarizes pre-planning actions the region may want to undertake in order to better prepare for future fuel supply disruptions.

### ***Conclusions***

This research concludes that even regions with robust transit and TDM programs and policies already in place could do more to better prepare their regions to quickly reduce fuel consumption, as might be needed in the event of a fuel supply disruption or price increase. The research examines strategies that are relatively low-cost, and that can be implemented fairly quickly. The research also indicates an implementation timeframe for these strategies, and recommends pre-planning that local and regional agencies may want to undertake now to put their regions on better footing to respond to fuel price increases or supply disruptions.

It is important to point out that a number of long-term strategies, such as changes to land use, taxation, vehicle mix, or transportation infrastructure, will be very important in improving the long-term sustainability of our transportation systems. Some of these changes, however, take many years of planning, and may take decades before they result in significantly more sustainable transportation systems. However, because we will be dealing with climate change, the depletion of energy resources, and energy security for many decades to come, we should start planning and implementing many of these long-term strategies immediately.

**Table 1 - Most Appropriate Strategies for the Puget Sound Region Based on Expected Length of Fuel Shortage**

Strategy	Time to Implement (in months)	Most Appropriate Strategies Based on Expected Length of Fuel Shortage			
		0 - 1 month	1 - 6 months	6 - 12 months	12+ months
Public information campaigns on fuel saving strategies	0 - 1	✓	✓	✓	✓
Increased carpooling/vanpooling	0 - 1	✓	✓	✓	✓
Alternative work arrangements	0 - 1	✓	✓	✓	✓
Changes to non-work trips	0 - 1	✓	✓	✓	✓
Free public transit	0 - 1	✓			
Increase off-peak bus service	3 - 6			✓	✓
Adjust existing transit routes	3 - 6			✓	✓
Driving ban based on license plates	3 - 7*			✓	✓
Speed limits reduced to 55 mph	3 - 6*			✓	✓
Expand vanpool/shuttle fleet	2 - 12			✓	✓
Increase HOV lane requirements (e.g., to HOV-3)	2 - 12				✓
Convert arterial lanes to HOV lanes	2 - 12				✓
Widely expand transit service	24 +				✓

\*limited capability to enforce

**Table 2 - Summary of Recommended Pre-Planning to Prepare for Fuel Supply Emergencies**

<b>Strategy</b>	<b>Recommended Pre-Planning</b>
<b>Alternative Work Arrangements</b>	<p><i>Telecommuting:</i></p> <ul style="list-style-type: none"> <li>• Promote the development of telework policies at the organization or office level.</li> <li>• Identify any local labor and tax issues. For example, how does the state labor department classify injuries that occur during work hours but while telecommuting?</li> <li>• Provide employees with information on all the communications tools available to facilitate web conferencing and information sharing.</li> <li>• Develop teleworker agreements for all eligible employees.</li> <li>• Ensure that all eligible employees telecommute at least occasionally to ensure that the communications systems are operational.</li> </ul> <p><i>Compressed work week:</i></p> <ul style="list-style-type: none"> <li>• Develop policies regarding employee eligibility for working a compressed work week.</li> </ul> <p><i>Flexible work hours:</i></p> <ul style="list-style-type: none"> <li>• Promote the establishment of Flex Time policy and worker agreements, which may include a requirement that all employees be in the office during set “core” hours (e.g., 10 am to 3 pm).</li> </ul>
<b>Reduced Speed Limits</b>	<ul style="list-style-type: none"> <li>• Evaluate the legality of changing speed limits (who has authority, etc.).</li> <li>• If appropriate, change legislation to more easily allow for changes to the speed limit to reduce fuel consumption.</li> <li>• Evaluate enforcement constraints to quickly reducing speed limits.</li> <li>• Evaluate the feasibility (cost, etc.) and institutional authority of using variable speed limit signs.</li> </ul>
<b>Driving Ban Based on License Plates</b>	<ul style="list-style-type: none"> <li>• Determine policy regarding if, when, and how driving bans might be implemented, and whether law enforcement has the capacity to enforce such a ban.</li> <li>• Identify, evaluate, and plan how to implement less restrictive rationing measures to use in severe emergencies (such as limits on fuel purchases that establish both maximums and minimums, to prevent unnecessary “topping off”).</li> </ul>
<b>Public Transit Service Improvements</b>	<p><i>Free Public Transit</i></p> <ul style="list-style-type: none"> <li>• Determine policy regarding reducing/eliminating fares in response to an emergency.</li> <li>• Determine financial capacity to reduce fares and strategies to consider to quickly increase revenues if needed (e.g. in case of rapid increases in fuel costs).</li> </ul> <p><i>Making Better Use of Existing Transit Service, Increase Existing Service</i></p> <ul style="list-style-type: none"> <li>• Assess where other emergency or supplementary parking could occur for park-and-ride use (such as at public libraries, public schools, shopping centers, etc.).</li> <li>• Develop emergency park-and-ride lot agreements near park-and-ride lots that are at or approaching capacity so agreements are in place when an emergency occurs.</li> <li>• Determine the transit agency’s current capacity to increase service during the peak or off-peak.</li> <li>• Determine how quickly this service could be increased, any impediments, and a plan for implementation.</li> </ul>

Strategy	Recommended Pre-Planning
<b>Public Transit Service Improvements, Cont.</b>	<p data-bbox="500 237 1214 268"><i>Expanding Transit Service By Using External Vehicles and Drivers</i></p> <ul data-bbox="500 268 1419 510" style="list-style-type: none"> <li>• Review the legality of emergency public transit services, and identify any legislation that might enable this type of service to be implemented more quickly.</li> <li>• Explore transit agency union issues that will need to be considered in order to quickly expand transit service.</li> <li>• Inventory vehicles (buses, paratransit vehicles, shuttles, and vans) and drivers that could be available on short notice.</li> <li>• Explore the feasibility of setting up agreements in advance with charter bus and school bus companies to make use of their vehicles and drivers in an emergency.</li> </ul> <p data-bbox="500 541 802 573"><i>Potential Fuel Supply Issues</i></p> <ul data-bbox="500 573 1419 779" style="list-style-type: none"> <li>• Know how much fuel is needed each day, particularly for first responders and transit operations.</li> <li>• Purchase some fuel under firm contracts.</li> <li>• Develop policies and procedures at the local and regional level for allocating fuel in a fuel supply emergency.</li> <li>• Strive to become more self-sufficient regarding fuel over the long term (e.g., have multiple fuel supply sources, reduce fuel requirements).</li> </ul>
<b>Public Information Campaign</b>	<ul data-bbox="500 789 1419 1119" style="list-style-type: none"> <li>• Develop a detailed plan for how a regional public information campaign would be coordinated and kept consistent during a fuel supply emergency.</li> <li>• Identify which fuel saving measures should be most strongly promoted through an information campaign (e.g., “eco-driving,” voluntarily reducing speeds, ridesharing, using transit, trip chaining, working compressed work week or telecommuting, on-line commerce).</li> <li>• Develop a list of existing resources available (e.g., existing informational websites, ridematching systems, etc.) that could quickly be shared with the traveling public.</li> <li>• Determine whether a public information campaign should highlight how people can change behavior for their own best interest, or promote the idea of making changes for the greater good.</li> </ul>
<b>Increased Carpooling and Vanpooling</b>	<ul data-bbox="500 1129 1419 1335" style="list-style-type: none"> <li>• Identify supplementary parking for park-and-ride lots.</li> <li>• Identify rideshare waiting locations for regular and casual carpoolers at park-and-ride lots and other locations.</li> <li>• Develop guidance for larger employers on developing their own, simple in-house ridematching tool.</li> <li>• Develop policies or plans for changes to and/or creation of HOV lanes during an emergency.</li> </ul>
<b>Promoting Changes to Non-Work Trips</b>	<ul data-bbox="500 1346 1419 1575" style="list-style-type: none"> <li>• Promote use of alternative modes (transit, walking, ridesharing, biking) for non-work trips.</li> <li>• Promote trip-chaining to reduce fuel consumption.</li> <li>• Assess potential fuel savings of on-line commerce.</li> <li>• Explore how on-line commerce can be promoted to quickly conserve fuel and potential barriers, such as increased delivery charges.</li> <li>• Investigate how non-work trips can be made more practically using alternative modes (i.e., shuttles or ridesharing for shopping).</li> </ul>

## 1. INTRODUCTION

Our transportation systems are heavily dependent on petroleum, a resource that is finite in supply and contributes to global climate change. Following are some petroleum production and consumption trends in the U.S. and worldwide.

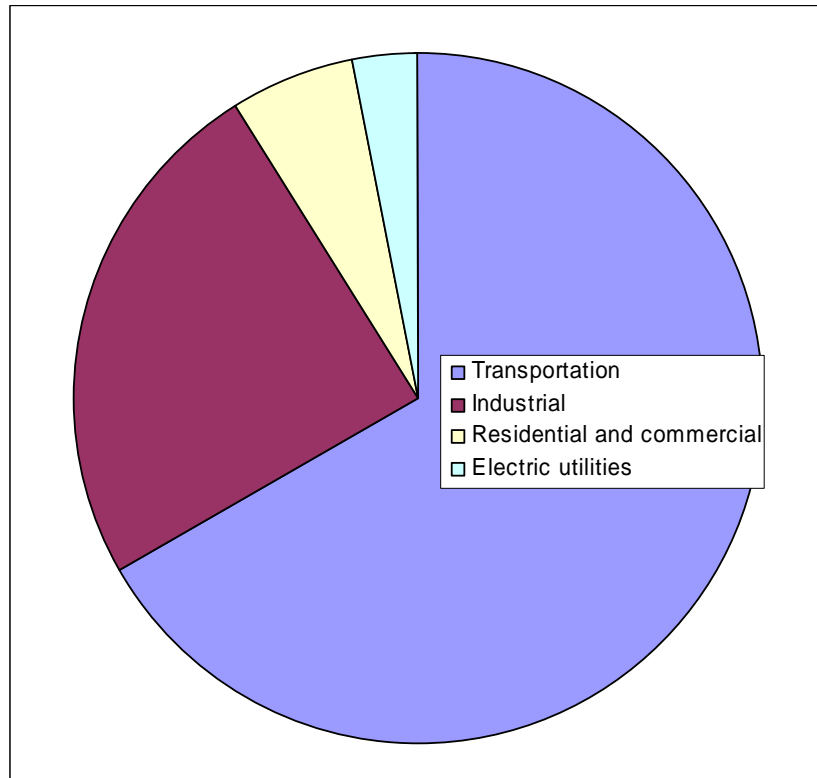
### *In the United States:*

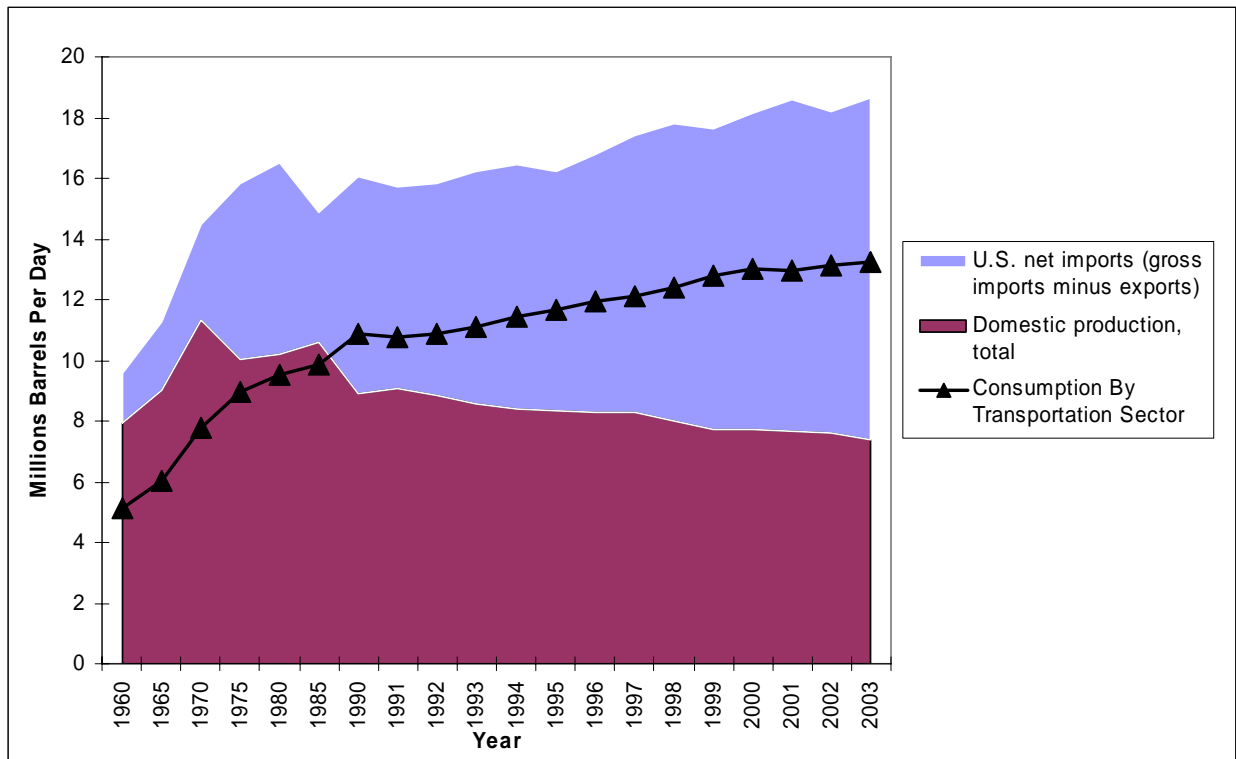
- The transportation sector consumes about 67 percent of all petroleum, as shown in Figure 1.
- The U.S. transportation sector is heavily dependent on petroleum, as it provides about 97 percent of U.S. transportation energy needs.<sup>10</sup>
- As shown in Figure 2, U.S. domestic oil production has been on the decline since 1970.
- In 1970, the U.S. imported just 22 percent of its oil; by 2004 imports had increased to 62 percent.

### *Worldwide:*

- The transportation sector consumes more than 50 percent of the world's petroleum products.<sup>11</sup>
- Demand for oil is increasing as emerging countries such as China and India are requiring more oil to support their growing economies.
- Most energy forecasts predict that the global transportation sector will consume an increasingly large percentage of oil in the future. The U.S. Energy Information Agency (EIA), for example, estimates that the transportation sector will consume nearly 57 percent of all oil by 2025.<sup>12</sup>
- Most oil-producing countries have already reached a peak in their petroleum production. For these countries, their oil production is now in decline or at the plateau phase that typically precedes a decline.

**Figure 1 - U.S. Demand for Petroleum by Sector, 2004<sup>13</sup>**



**Figure 2 - U.S. Oil Production and Consumption 1960 - 2003<sup>14</sup>**

This reliance on petroleum products by our transportation systems is problematic. We are becoming increasingly aware of the impacts of our use of fossil fuels on climate change, and we increasingly rely on oil from parts of the world with a history of instability or antagonism toward the U.S. and several other countries in the western world.

As our dependence on imported oil deepens and supplies dwindle — as many experts agree is inevitable — the U.S. and other areas of the world may need to consider aggressively implementing transportation demand management (TDM) strategies to conserve energy and reduce emissions.<sup>b</sup> These are strategies that promote the optimal use of the existing infrastructure and transit services, as well as policies and programs to reduce or shift the demand for transportation. Programs typically focus on carpooling, transit, alternative work arrangements, etc. These strategies may be particularly helpful should any of a number of possible oil supply disruptions occur, including:

1. Geopolitical disruptions.
2. Inadequate petroleum refining or processing capabilities.
3. A global peak in the production of oil.
4. Natural disasters, such as additional hurricanes in the Gulf of Mexico.
5. Coordinated terrorist attacks on critical energy infrastructure.

<sup>b</sup> TDM is usually referred to as mobility management in Europe and parts of Asia.

The International Energy Agency makes the case for pre-planning for an oil supply disruption in its publication, *Saving Oil in a Hurry*:

*“...pre-planning is essential in order for transport demand restraint measures to succeed during an emergency. It is not enough for countries to have a list of measures to use; they must be ready to implement those measures on very short notice. To do this, they generally must develop detailed plans and make certain investments ahead of time. Communicating this plan to the public also appears very important; if the public is not well informed of plans ahead of time, and supportive of them, they may be less likely to cooperate and do their part to help the plans succeed during an emergency. Strong support and cooperation from the business community is also essential. In general, providing clear information to the public – that the public can trust – seems to be an important element of any plan.”<sup>15</sup>*

## ***Purpose of this Research***

This research report:

1. Describes some of our fuel supply vulnerabilities,
2. Reviews lessons learned from previous fuel supply disruptions,
3. Identifies the transportation demand management strategies that offer the greatest potential to quickly reduce fuel and oil consumption,
4. Suggests implementation timeframes and potential barriers to implementation for these strategies, and
5. Recommends pre-planning actions to better prepare for an oil supply disruption or rapid increase in the price of fuel.

As a case study, this report describes strategies that could be implemented in the central Puget Sound region, and also briefly describes how implementation of these measures in other parts of the country and world could differ.

This research does not focus on important long-term strategies that can reduce fuel consumption, such as changes to land use, taxation, vehicle mix, or the transportation infrastructure. The focus is instead on strategies that are relatively low-cost and that can be implemented fairly quickly to improve the fuel-efficiency of the transportation system and thereby also improve its sustainability.

## ***Potential Need for More Aggressive TDM Strategies***

A few of the possible events mentioned above that could signal the need for immediate implementation of more aggressive TDM strategies to reduce energy consumption and emissions merit further discussion.

## Potential Geopolitical Disruptions

The International Energy Agency's (IEA's) *2004 World Energy Outlook*<sup>16</sup> indicates that, increasingly, oil will be concentrated in some of the more unpredictable areas of the world, stating:

*“A central message of this Outlook is that short-term risks to energy security will grow. Recent geopolitical developments and surging energy prices have brought that message dramatically home. Major oil- and gas importers – including most OECD countries, China and India – will become ever more dependent on imports from distant, often politically-unstable parts of the world. Flexibility of oil demand and supply will diminish.”*

A May 6, 2006 article<sup>17</sup> in the *New York Times* further highlighted some constraints that oil companies face in coming years, including the following:

- The top seven international oil companies control less than five percent of the globe's reserves.
- Western oil companies as a whole have full access to countries with six percent of the globe's known reserves, mainly in North America and Europe.
- They can also invest in countries that own an additional 11 percent of reserves through joint ventures or production-sharing agreements.
- The rest of the world is closed to them.

## Global Peaking in Oil Production

Unlike some of the other potential supply disruptions, such as natural disasters or terrorist attacks, a global peak in the production of oil (i.e., “peak oil”) would result in a long-term supply disruption. Because conventional oil is a finite resource, the production of conventional oil on a worldwide basis will eventually reach a peak and thereafter decline. Worldwide, most oil-producing countries' conventional crude oil production is currently already in decline or in the plateau phase that generally precedes a decline.<sup>18</sup> Oil production in the U.S., for example, peaked decades ago. Examples of petroleum production for a few countries in decline are shown in Figure 3. Among countries that have probably not yet reached their conventional oil production peak, the bulk of this oil is produced by the former Soviet Union and Saudi Arabia. Figure 4 shows global cumulative oil production for all countries from 1970 to 2005.

Within the petroleum industry, there is considerable debate regarding the timing of this peak in global oil production, with estimates ranging from now to well beyond 2030. Some petroleum industry experts argue that the world has recently or will within the next ten years reach a peak in the production of conventional crude oil. Once this global peak in oil production is reached, conventional crude oil output will thereafter decline. This group argues that it is inevitable that world petroleum output will peak since discoveries have been less than consumption for about 20 years.<sup>19</sup> Many of the most productive fields, they argue, are decades old and if not yet in decline, are soon to be. This group generally also argues that unconventional oil resources, such as oil sands and oil shale, will be too difficult and cost-prohibitive to make up for declines in conventional oil resources. In the view of this group, the world will be forced to contend with less oil for some time to come.

The “other side” in this debate instead believes that there will be adequate crude oil supplies for at least 25 years, although not necessarily at low prices. They generally believe that large quantities of conventional oil will be discovered in coming years. This group argues that discoveries have fallen behind consumption over the last ten plus years due to low oil prices in the 1990s, which reduced incentives for exploration. This group generally believes that new technologies will greatly add to the amount of crude oil that can be found and recovered, and that unconventional oil resources will add significantly to global production over the next 20 to 30 years.

The timing of this global peak in oil production may be critical. A consultant working for the U.S. Department of Energy provided congressional testimony on December 7, 2005 on the topic of “peak oil.” His testimony highlighted the urgency of transitioning from conventional oil to other liquid fuels decades in advance of the global peaking in the production of conventional crude oil:

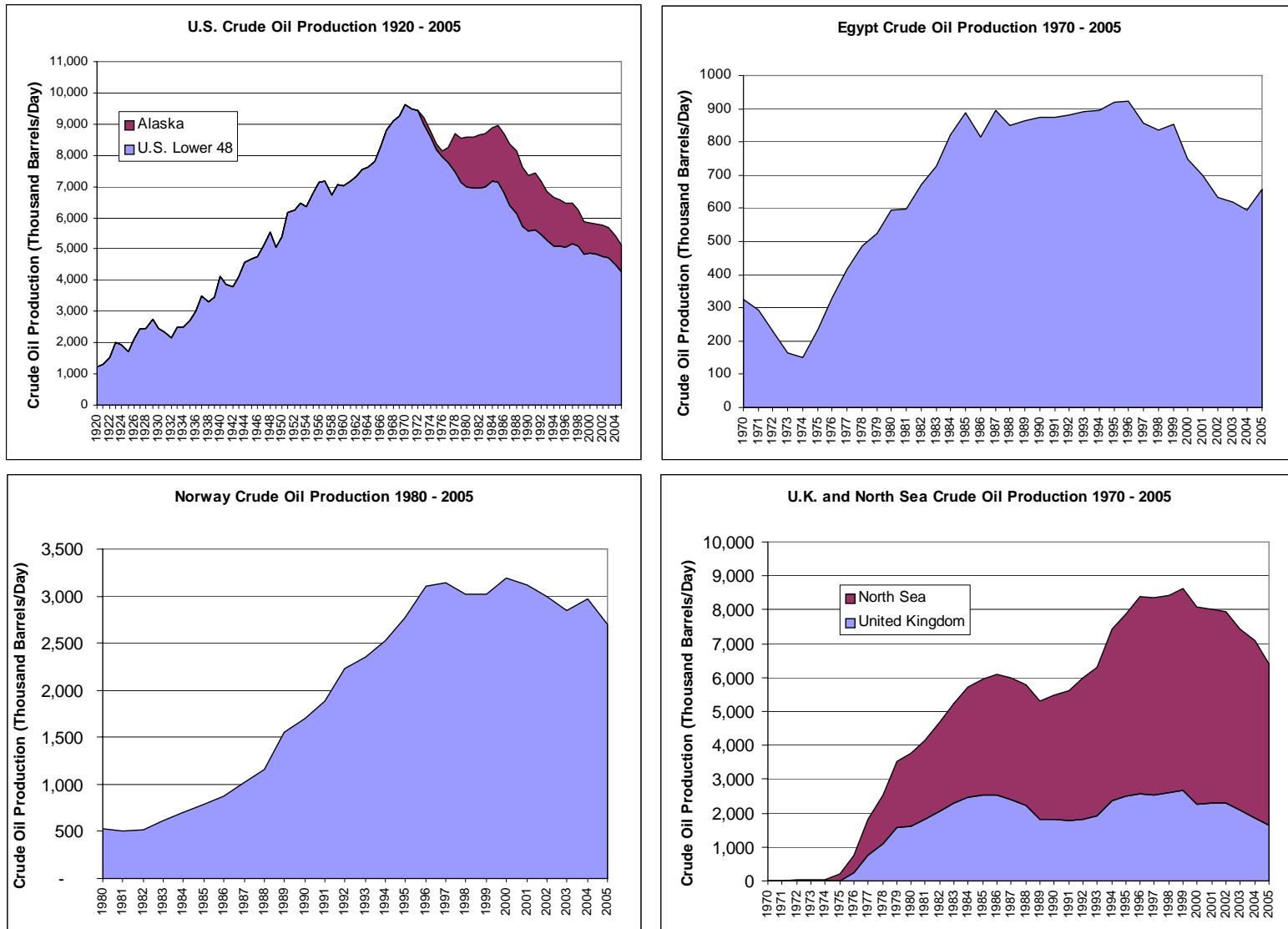
*“A recent analysis for the DOE focused on what might be done to mitigate the peaking of world oil production. It became abundantly clear that effective mitigation will be dependent on the implementation of mega-projects and mega-changes at the maximum possible rate. A scenario analysis was performed, based on crash program implementation worldwide – the fastest humanly possible. The timing of oil peaking was left open because of the considerable differences of opinion among experts. The results were startling: Unless a mitigation crash program is started 20 years before peaking occurs, the economic consequences will be dire.*

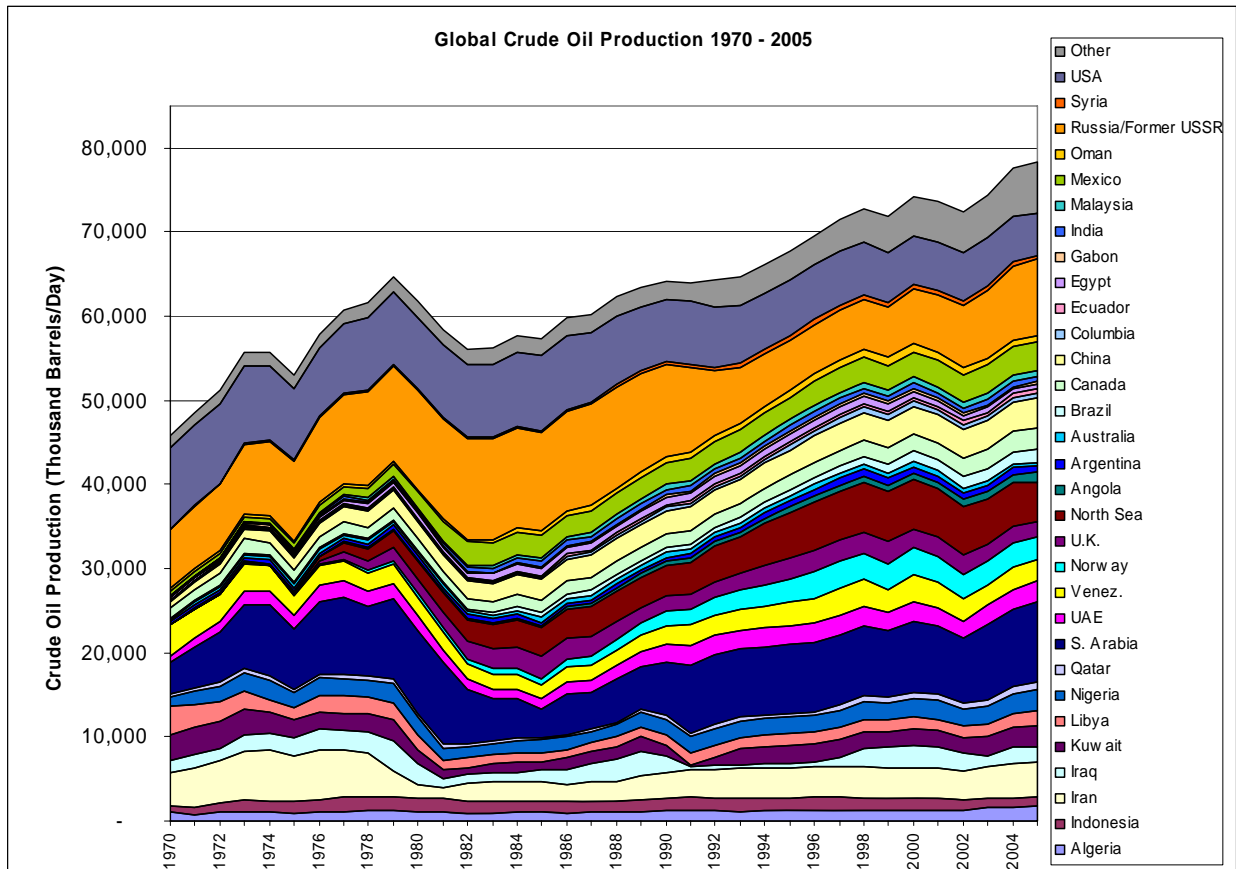
*“Oil peaking represents a liquid fuels problem, because motor vehicles, aircraft, trucks, and ships have no ready alternative to liquid fuels, certainly not for the existing capital stock, which has lifetimes measured on a decade scale.*

*“The world has never confronted a problem like peak oil. Since it is uncertain when peaking will occur, the challenge for decision-makers is vexing. Mustering support for an approaching, invisible disaster is much more difficult than for one that is obvious. We would like to believe that the optimists are right about peak oil being a distant problem, but the risks of error are beyond imagination.”<sup>20</sup>*

According to Dr. Hirsh’s testimony, unless peak oil does not occur until after 2025, at the earliest, oil supply disruptions are likely.

**Figure 3 - Crude Oil Production Profiles for Selected Areas Experiencing Production Declines<sup>21</sup>**



**Figure 4 - Cumulative Global Crude Oil Production 1970 - 2005<sup>22</sup>**

## Environmental Impacts

There is now consensus within the scientific community that the transportation sector is contributing to global climate change through the burning of gasoline and diesel, which release carbon dioxide (CO<sub>2</sub>) into the air. CO<sub>2</sub> accounts for over 80 percent of total greenhouse gas emissions in the United States,<sup>23</sup> and in 2003, the transportation sector accounted for about 27 percent of total U.S. greenhouse gas emissions.<sup>24</sup> In some areas, the transportation sector contributes a much higher proportion of total emissions. In the Puget Sound region, for example, the transportation sector contributes about 51 percent of CO<sub>2</sub> emissions.<sup>25</sup>

Climate researchers worldwide are increasingly concluding that human activities are contributing to global warming. For example, the Intergovernmental Panel on Climate Change (IPCC), in its 2001 climate change report, found that:

*“Human activities have increased the atmospheric concentrations of greenhouse gases and aerosols since the pre-industrial era. The atmospheric concentrations of key anthropogenic greenhouse gases (i.e., carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and tropospheric ozone (O<sub>3</sub>)) reached their highest recorded levels in the 1990s, primarily due to the combustion of fossil fuels, agriculture, and land-use changes. ... There is new and stronger evidence that*

*most of the warming observed over the last 50 years is attributable to human activities.”<sup>26</sup>*

During the 21<sup>st</sup> century carbon dioxide concentrations, globally averaged surface temperature, and sea level are all projected to increase.<sup>27</sup> Glaciers are projected to continue their widespread retreat, and precipitation is projected to increase in some areas of the world, but decrease in others.<sup>28</sup> Although this report does not attempt to predict the potential severity or timeframe for these impacts, at some point governments may need to take more drastic action to implement transportation demand management and other strategies to reduce greenhouse gas emissions.

The sections that follow focus largely on transportation demand management strategies to respond to oil supply disruptions and the expected corresponding increase in fuel prices and/or fuel shortages. These same TDM strategies could also be used to help reduce emissions, although they would likely be much more effective when accompanied by price signals, such as fuel tax increases, carbon emissions taxes, parking charges, or some form of fuel rationing.

### ***Strategic Petroleum Reserve***

Countries throughout the world have strategic stockpiles of oil. The U.S. Strategic Petroleum Reserve (SPR), which was established after the 1973-74 oil embargo, is the largest stockpile of government-owned emergency crude oil in the world. This stockpile is stored in salt caverns along the Texas and Louisiana coastlines. According to the Department of Energy, these storage locations were selected because they provide the most flexible means for connecting to the nation’s commercial oil transport network.<sup>29</sup>

As of January 5, 2007, the SPR held 273.5 million barrels of sweet crude and 415 million barrels of sour crude, for a total stockpile of 688.5 million barrels of crude oil.<sup>30</sup> In 2005, the U.S. imported about 66 percent of its crude oil and petroleum products,<sup>31</sup> and the intention is for a strategic stockpile to provide adequate oil to cover 90 days worth of imports. The current capacity of the SPR system is 727 million barrels, and the Department of Energy is working toward establishing a reserve of up to 1 billion barrels of crude oil. This crude oil could be very useful in cushioning the U.S. against a short-term oil embargo or disruption in crude oil production, and oil has been withdrawn from the stockpile on several occasions.

However, depending on the nature of the oil or fuel supply disruption, the SPR is not *always* useful. For example, the SPR would not protect the U.S. against a lengthy oil supply disruption. In addition, the SPR may not be particularly helpful for some short-term disruptions either. Commander Bruce L. Peck Jr. of the U.S. Navy prepared a report titled *The U.S. Strategic Petroleum Reserve - Needed Changes to Counter Today’s Threats to Energy Security*. This report describes some of the limitations of the SPR:

*“Specifically, the SPR’s concentrated location along the Gulf Coast, its inability to directly send oil to all refining areas in the United States, strategic vulnerabilities in its existing distribution pipelines, its size and limited pumping capacity, and the absence of refined fuels as part of the SPR all combine to make the SPR increasingly unable to protect the United States from major disruptions in oil supply.”<sup>32</sup>*

The fuel shortage experienced in North Carolina following Hurricane Katrina, described in Section 2 – Lessons Learned from Previous Oil and Fuel Supply Disruptions, provides an example. In order for North Carolina to use oil from the SPR in the immediate aftermath of Hurricane Katrina, the oil would have had to be withdrawn from the SPR (it is unknown whether the SPR sites along the heavily damaged and flooded coasts of Texas and Louisiana were accessible at that time). The oil would have then required processing at a refinery, most likely one in Louisiana or Texas where a number of refineries were damaged by Hurricane Katrina. The refined petroleum products would then have had to be transported to North Carolina. This too would have been problematic since North Carolina receives about 90 percent of its motor fuels through two pipelines (the Colonial and Plantation). Both of these pipelines were temporarily shut down following Hurricane Katrina. So in this emergency, the SPR would not have been able to relieve North Carolina's short-term fuel shortages.

### ***Most Effective Transportation Demand Management (TDM) Measures***

In 2005 the International Energy Agency (IEA) published a report titled *Saving Oil in a Hurry*<sup>33</sup>, which identified the most effective measures to conserve fuel for all IEA member countries (i.e., the U.S., Canada, New Zealand, Australia, Japan, Republic of Korea, and 20 European nations including Turkey). The measures are, in order of potential fuel savings:

- Odd/even day driving ban (e.g., odd/even license plate scheme with enforcement).
- Speed limits - reducing to 90 km/hour (55 mph) and enforcement.
- Increased carpooling (carpool lanes, park-and-ride lots, matching riders, etc.).
- Increased telecommuting.
- Free public transit.
- Compressed work week.
- Limited driving ban (e.g., one in ten days based on license plate).

Although some TDM measures, such as voluntary reductions in driving speeds, could occur altruistically with no or very little governmental planning, other measures would require considerable pre-planning and may have significant costs.

An additional area of emphasis, although not specifically called out in the *Saving Oil in a Hurry* report, is using TDM to provide mobility for non-work trips. This could be accomplished through any or all of the other TDM measures identified, but warranted special attention because, as will be described in more detail in this report, non-work trips account for a large portion of all trips and during fuel supply disruptions may be the first trips to be altered or eliminated.

In the longer-term a more fuel-efficient transportation infrastructure, more fuel-efficient vehicles, and changes in land use patterns can reduce the demand for fuel. This research, however, is focused on strategies that can be implemented in the short-term with little capital investment.

## **2. LESSONS LEARNED FROM PREVIOUS OIL AND FUEL SUPPLY DISRUPTIONS**

Reviewing impacts of previous fuel supply disruptions can shed some light on how travel behavior might be affected by future fuel supply disruptions. This chapter summarizes three fuel supply disruptions:

1. Oil shortages in the U.S. from 1973 to 1981,
2. A fuel blockade in the U.K. in 2000, and
3. Fuel shortages in North Carolina immediately following Hurricane Katrina in 2005.

The following sections revisit how travelers' behaviors changed in response to these fuel shortages, how government agencies coped with fuel supply challenges, and lessons learned.

### ***Oil Shortages from 1973-1981***

In 1973, several Arab nations instituted an oil embargo against the United States and Holland in response to U.S. support of Israel in the 1973 Arab-Israeli War. By the time the embargo ended six months later, world crude oil prices had tripled.<sup>34</sup> As shown in Figure 5, while fuel consumption in the U.S. had been increasing by nearly five percent annually for the decade preceding the embargo, in 1974 fuel consumption in the U.S. decreased by almost two percent. Within a couple of years, OPEC restored output to pre-embargo levels, and over the next few years fuel consumption in the U.S. increased by about three percent a year.

A few years later, the Iranian Revolution resulted in a decrease in crude oil production from 1978 to 1981. The beginning of the Iran-Iraq War in 1980 resulted in additional decreases in oil production in the region.<sup>35</sup> Overall global oil production declined by nearly five percent between 1979 and 1980, and by an additional six percent between 1980 and 1981.<sup>36</sup> Crude oil prices rose sharply between 1979 and 1981, but price controls were instituted that kept fuel prices artificially low.

On July 15, 1979 President Jimmy Carter gave his now famous "Crisis of Confidence" speech<sup>37</sup> in which he laid out his six point plan to achieve energy independence for the United States. This included a federal government set-aside of \$16.5 billion for long-term conservation in the transportation sector. The basic goal of the conservation program was to cut oil imports in half by 1990.<sup>38</sup> Contrary to this goal, as oil prices again fell and the urgency of energy independence abated, U.S. oil imports have for the most part steadily increased. In 1980 the U.S. imported about 38 percent of its petroleum, while by 2004 imports had increased to about 62 percent.

### **Fuel Prices, Supplies, and Changes in Traveler Behavior in the 1970s and 1980s<sup>39</sup>**

In 1974 and in 1979/80, many regions of the U.S. experienced occasional or regular gas lines and gas shortages. Figure 5 shows motor fuel consumption from 1949 to 2004. As shown, fuel

## 2. Lessons Learned from Previous Disruptions

consumption in the U.S. decreased by nearly two percent in response to the 1973 oil embargo. In 1979 it decreased by 5.1 percent, with an additional 6.3 percent decrease in 1980.

As shown in Figure 6, motor fuel prices increased considerably in 1974, and continued increasing, although not as quickly, until 1981. Figure 6 shows that when motor fuel prices increased quickly, fuel consumption usually decreased (although at a much slower rate). Clearly, travelers changed their travel behavior during the 1970s and early 80s.

Several surveys were conducted after these oil crises to assess how and why people changed their travel behavior. Following are some key findings regarding traveler response to fuel shortages in the 1970s and early 80s<sup>40</sup>.

### *Off-Peak Discretionary Travel*

Most people changed off-peak discretionary travel first:

- Data from Baltimore's Regional Planning Council and the Maryland DOT indicated that off-peak auto travel decreased much more than peak travel during the first three months of 1974. This suggests that discretionary trips (social, recreational, shopping, etc.) were cut back much more than work trips.<sup>41</sup>
- The journey to work trip was the least flexible in responding to periods of gasoline shortage and price increases. Alterations in shopping trips were typically made long before carpooling or modal changes in the work trip were made.
- In Dutch Fork, South Carolina, a suburb west of Greenville, auto travel by residents was estimated to be reduced by ten to 15 percent. Traffic volumes decreased primarily on weekends, with less decline on weekdays. At the height of the crisis weekend traffic was down by 25 percent.<sup>42</sup>
- Linking of non-work trips, particularly shopping trips, was common.
- Travelers also drove at lower speeds to conserve gas.

### *Changes in Transportation Mode*

- Travelers were more likely to change their travel behavior based on the *availability* of gasoline rather than price.
- Nationally, transit ridership increased. The largest increase was experienced during the month of July 1974, when transit ridership was 12.3 percent higher than in July of 1973.<sup>43</sup>
- However, according to one summary of travel behavior at that time: "The role of transit in alleviating the impact of the 1979 energy crisis is found to be minor: Gasoline savings due to transit patronage increases amounted to less than five percent of the decrease in gasoline sales. Methods of calculating ridership increases and gasoline savings attributable to transit for a variety of energy futures are developed. The results indicate that transit cannot be expected to play a major role in a future energy emergency."<sup>44</sup>
- Another analysis of the capacity of transit to respond to petroleum shortages also indicated that existing transit systems were limited in their ability to respond to any major energy shortfalls. According to one transportation analyst at the time, "Even a modest shift (1-2 percent) of automobile commuters to transit can cause inordinate delays due to overcrowding and may leave regular transit users without service. This contrasts with the WWII situation

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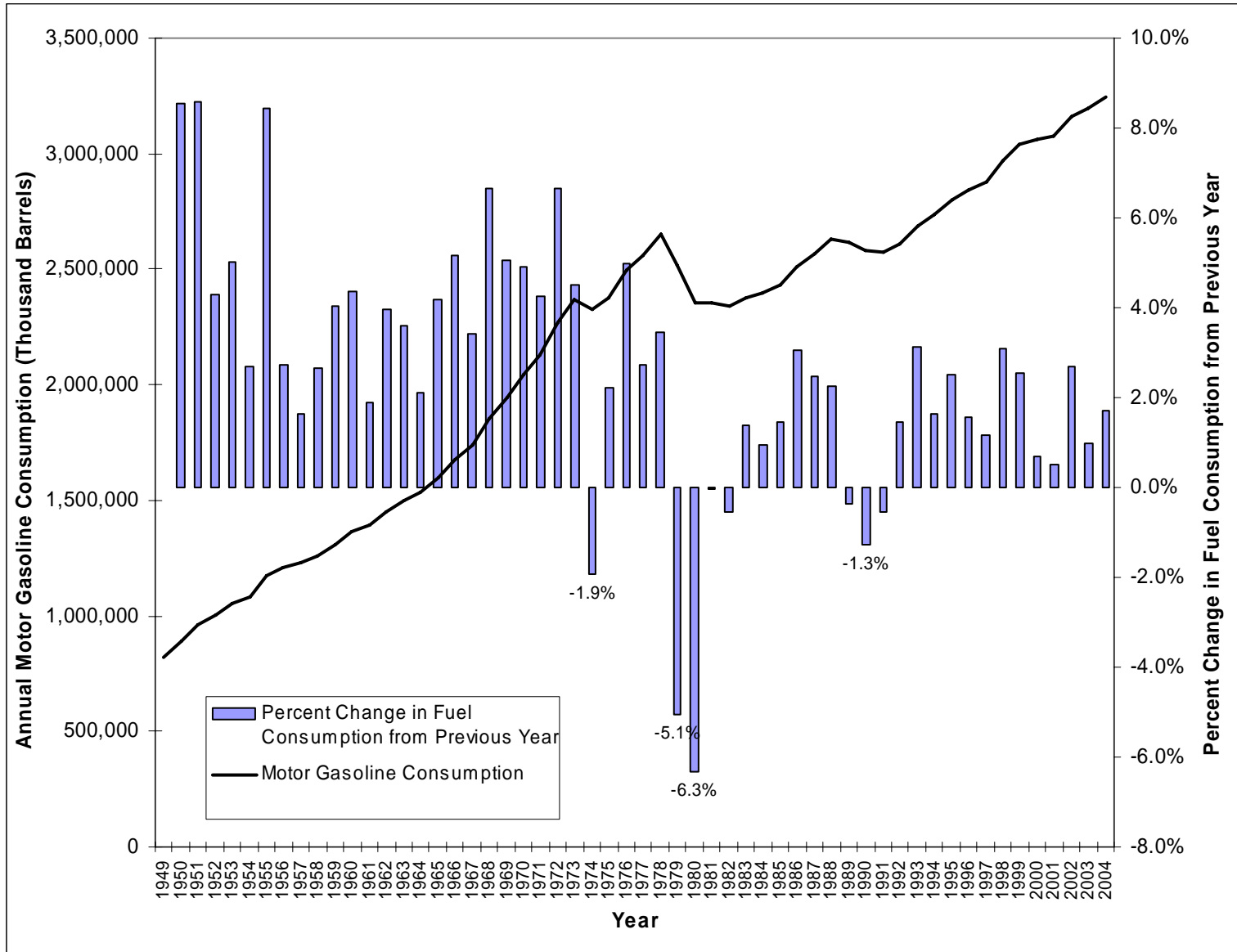
when a 48 percent increase in transit riders was accommodated by the much larger system in existence at that time.”<sup>45</sup>

- During the 1979 shortage, a survey taken in New York State indicated that about 14 percent of household heads said that they increased their carpooling to work.<sup>46</sup> However, carpooling was generally not an option taken in response to shortages. During the 1973 embargo, the number of commuters engaged in carpooling increased by less than four percent, and only one percent of commuters shifted from driving alone to carpooling.
- Much of the reduction in travel was a net loss of travel; very little of this reduction represented shifts of commuters from driving alone to carpooling, transit, or walking.
- In the 1970s many motorists purchased more fuel efficient automobiles rather than alter their travel behavior.<sup>47</sup>

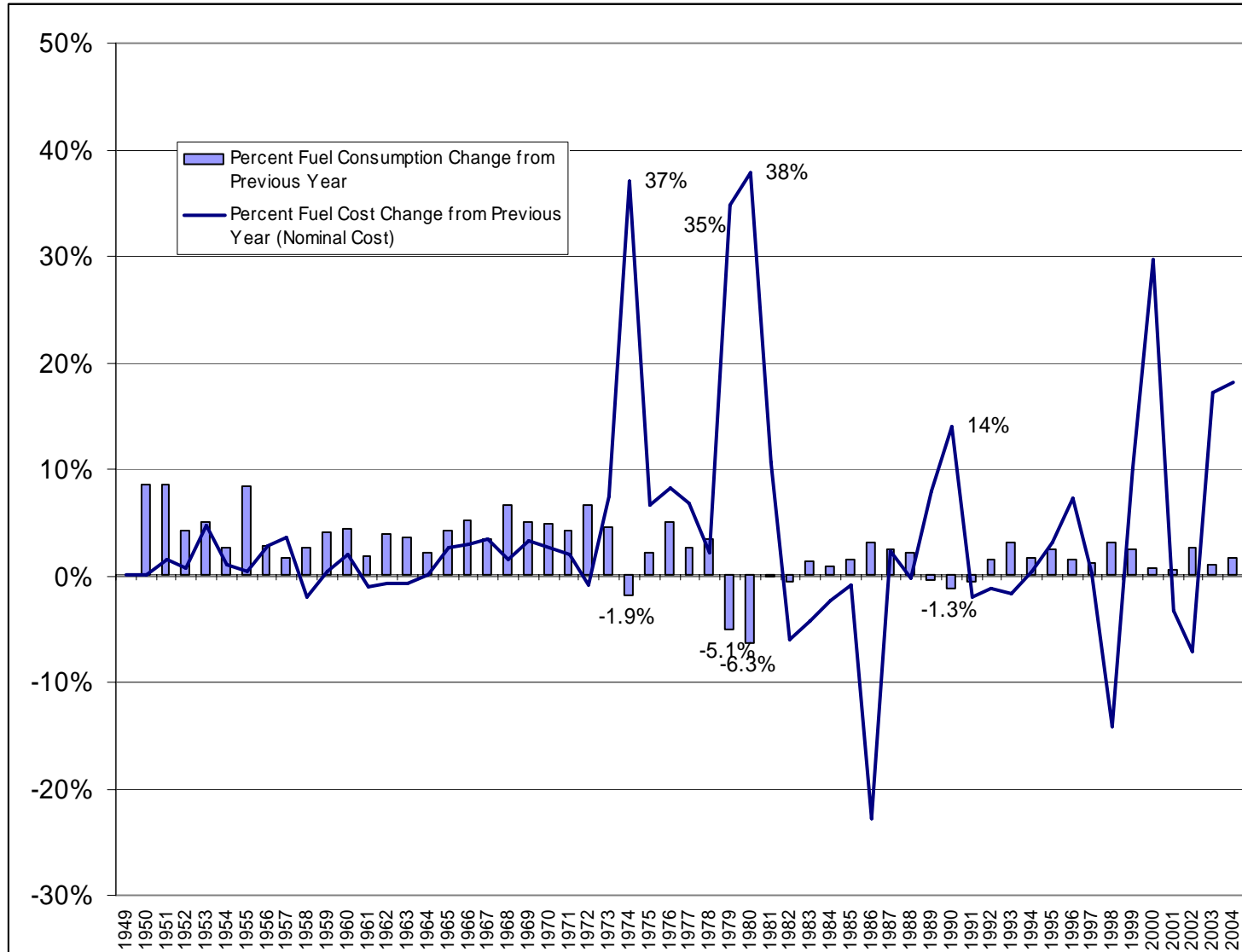
Overall, the public adjusted its travel behavior by altering shopping and recreational trips, but generally avoided altering the automobile trip to work. The public did seem interested in policy actions that would increase travel options and offer incentives for their use. As would be expected, the public was less favorable toward punitive or restrictive measures.

Researchers during the early 1970s concluded that achieving major increases in the use of transit and reducing energy consumption would depend on long-run land use and urban growth policies. They found that existing patterns of metropolitan growth were not conducive to the achievement of these goals, and cited studies by the Council on Environmental Quality that indicated that substantial savings in energy consumption could be achieved through less scattered patterns of metropolitan settlement.<sup>48</sup>

Figure 5 - Total U.S. Consumption of Motor Gasoline and Annual Change (1949 to 2004)<sup>49</sup>



**Figure 6 - U.S. Annual Change in Motor Gasoline Cost Versus Consumption (1949 to 2004)<sup>50</sup>**



## Lessons Learned by Public Agencies

In 1980, transportation planners and staff from transit agencies met at a workshop to reflect on the oil crises of the previous decade and to plan for future energy shortages. Following were some lessons learned by agencies at that time.

### *Transit Systems*

Transit planners concluded that there were five categories of limitations that determine the capacity of the several modes of transportation in response to energy shortages:<sup>51</sup>

1. Capacity of the physical system (vehicles and drivers),
2. Institutional and regulatory constraints on decisive actions to implement fuel contingency plans,
3. Political capacity to make decisions facilitating transportation services,
4. Limitations caused by lack of public information (regarding the seriousness of the energy problem, blaming oil companies, lack of information on travel needs and impacts, etc.), and
5. Fiscal capacity – emergency funding to provide pre-arranged support for both capital facilities and operations that are required by contingency plans.

### *The Role of Government*

Following are a few of the lessons learned regarding government vs. private sector roles during the 1970s fuel shortages:<sup>52</sup>

- Government should serve as the last recourse; it should allow the private sector to respond to relatively minor shortfalls.
- Stronger government response is appropriate when a shortage is so severe that social and economic institutions are threatened.
- Planning and response to shortfalls should occur at the lowest levels of government that can effectively handle specific problems and actions.
- Responsibilities and authorities for all required actions should be agreed upon by the appropriate government units before shortages occur.
- MPOs should serve as technical information sources, forums for coordination of local and regional plans and actions, and channels for financial support.
- Despite a strong private market orientation of participants, especially as it related to government actions vis-à-vis consumer behavior, it was felt that government should not *fail* to act because some sacrifice may be necessary and some opposition may occur regarding contingency plans.

Some of this recommended contingency planning is now being coordinated through state energy offices. Beginning in the mid-1970s<sup>53</sup>, each state in the U.S. has maintained an energy office that typically helps to develop energy policies and programs, and organizes

responses to energy emergencies. Little petroleum contingency planning, however, is currently being conducted at local or regional levels of government.

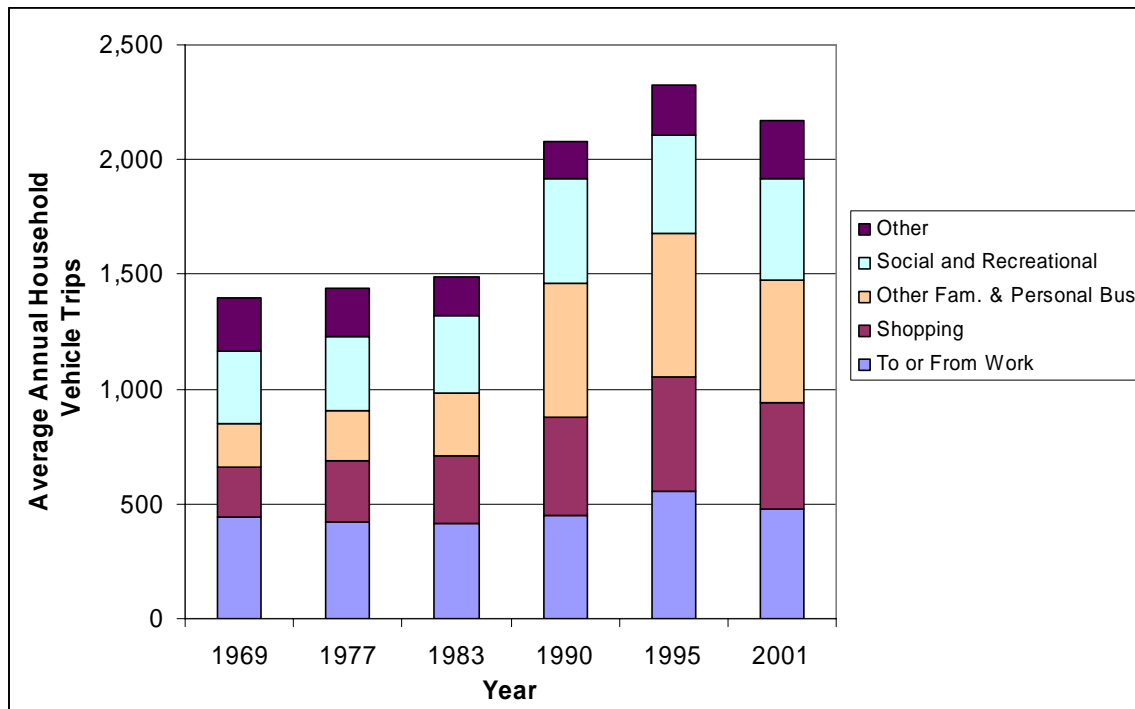
Relatively little occurred in the fuel conservation and energy emergency planning arena between 1981 and 2005, probably largely due to lower oil and fuel prices, and relatively few oil shocks or supply disruptions.

### **A Few Differences Between Today and 1970s and early 80s**

“This is not your parents’ energy crisis,” warns journalist Thomas Friedman at the outset of his 2006 film *Addicted to Oil*.<sup>54</sup> While Friedman’s point is to stress that our energy predicament today may be more dire than it was in the 1970s and 80s, one can’t help but feel a sense of déjà vu when comparing a few of the circumstances that led to fuel shortages decades ago to our political situation today.

As in the 1970s, today in the U.S. we continue to struggle with land use patterns that are difficult to serve efficiently, and perhaps rely even more heavily on the automobile. Other challenges we face today are more families requiring two incomes to make ends meet, and families who are busier transporting kids to sports and other activities. In addition, school consolidations in some areas of the U.S. require many children to travel farther to school than students in previous decades.

For example, Figure 7 shows how household vehicle trip behavior has changed over the last several decades. Since 1969, household vehicle trips have increased by about 55 percent, but primarily for non-work related trips, including shopping, family and personal business, and social and recreational trips. In 1969 vehicle trips to and from work represented about 32 percent of total household vehicle trips, while in 2001 only about 22 percent of all household vehicle trips were for the work commute.

**Figure 7 - U.S. Household Vehicle Trips by Trip Purpose (1969 to 2001)<sup>55</sup>**

Although in the United States we generally depend upon the automobile more today than we did in the 1970s, how we respond to fuel shortages today can be very different. For example, today many more options for online shopping are available, and we have many more systems in place to facilitate and encourage ridesharing. In addition, unlike the 1970s and 80s, today there are ample opportunities for telecommuting; however, it is not always well-promoted.

Because conditions today may differ considerably from those in the 1970s and early 80s, it is important to review more recent fuel shortages to better understand potential impacts. The two more recent shortages described below are the U.K. fuel blockade in 2000, and fuel shortages in North Carolina following Hurricane Katrina in 2005.

### ***U.K. Fuel Blockade***

The U.K. fuel blockade began on September 5, 2000, when an increase in the price of crude oil prompted major oil companies to announce an increase in the price of fuel. The next day, to protest this price increase, a number of trucks blockaded the entrance to the British side of the Channel Tunnel. On September 7, the first oil refinery was blockaded. The fuel blockade spread rapidly, as more refineries were blockaded the next day. Nationwide panic-buying of fuel and food began on the 9th.<sup>56</sup> The next day, the protests had closed Britain's largest domestic oil terminal and very long lines at gas stations were reported. By September 12, protesters had blocked six of the U.K.'s eight refineries and over half of Britain's filling stations were shut. However, the protest ended almost as quickly as it had begun. On the 14<sup>th</sup>, the blockade of the first refinery ended and fuel

deliveries were reaching some gas stations by the next day, although it was estimated that 90 per cent of filling stations were empty of fuel.<sup>57</sup>

### Impacts of U.K. Fuel Blockade

Due to the reliance on just-in-time delivery of fuel, food, and other supplies, the country engaged in “panic buying” of food and fuel, and the impacts were widespread. A September 15, 2000 article in the U.K. newspaper *Guardian Unlimited* titled “Rationing keeps NHS afloat” summarized some of these impacts:<sup>58</sup>

- The country saw hundreds of piecemeal local rationing schemes, with garages (i.e., gas stations) limiting supplies to medical staff, frequently supervised by police.
- Officers turned away a dozen people trying to fill home-brewing barrels and other illegal containers at the BP garage in Leeds where customers were allowed £20 fill-ups after emergency services had been restocked.
- Birmingham city council gave part of its supply to hospitals after warnings that nurses and doctors were stuck at home.
- Shoppers were told to stop panic buying fresh food as widespread rationing was introduced to try to curb people stockpiling basic foodstuffs.
- Some schoolchildren were told to stay away from classes.
- Demand for bread and milk increased by 50 percent.
- The Federation of Bakers said that excessive demand for bread would result in shortages.
- Some stores began limiting customer’s food purchases (e.g., to two loaves of bread each, or to three fresh items and six non-fresh items).
- Slaughterhouses warned that meat supplies could dwindle and livestock might have to be destroyed because of the difficulties distributing animal feed, and six million chicks were in danger of starving unless feed was delivered.
- People were urged to use food in their cupboards and freezers rather than stockpiling food from shops and supermarkets.
- Some food suppliers found that due to panic buying the demand for food was much higher than usual.
- The post office reduced its services to a bare minimum.
- The Confederation of British Industry (CBI) said it would take weeks for companies to resume pre-crisis levels of operation while the London Chamber of Commerce believed things were likely to get worse before they got better. A Chamber spokesman indicated: “At least £1bn will have gone in lost output but it is still going to be a long process getting businesses back to where they were.”

### Lessons Learned from U.K. Fuel Blockade

Alan Hallsworth and Rodney Tolley from Staffordshire University, in their paper “Urban hysteria & panic in the streets – the British fuel blockade September 2000 – a social interpretation,” analyzed the public’s reaction to the fuel blockade and concluded that:

*“...the apparently irrational and often antisocial behaviours that follow in the wake of a public panic are by no means unusual or unpredictable. ...some media commentators felt that the ‘antisocial’ behaviours stood in stark contrast to the*

## 2. Lessons Learned from Previous Disruptions

*more cohesive ‘Dunkirk spirit’ so often invoked. Yet past fuel crises have been met by Government action in the form of rationing – which suggests that a reliance on self-restraint is the exception rather than the rule. In fairness, rationing books take time to print and will only apply when a long interruption or diminution of supply is anticipated. However, contingency planning by Governments ought to take into account more ‘socialised’ reactions to shortage. ... It might (also) be useful to incorporate simple measures to regulate the hitherto self-interested behaviour at the pumps. For example (in the manner of a hosepipe ban during water shortages) fuel purchases could be limited to exactly £10. Those requiring less than this would still pay £10 – which offers both a disincentive to greed and a free opportunity for legitimate profiteering by filling stations. For once, the uncertainty would be in the minds of the excessively self-interested – they would have the challenge of deciding when their fuel tank would accommodate £10 worth of fuel.... The above suggestions can hopefully be added to – with the aim of ensuring more orderly behaviour in future ‘mass hysterias and panics.’”<sup>59</sup>*

Regarding transportation impacts and choices made in response to fuel shortages, several researchers from the University of Newcastle, Imperial College of London, and the Social and Transport Research Services conducted a detailed survey in the U.K. to identify lessons learned from this fuel crisis.<sup>60</sup> Following are the principal conclusions and policy recommendations from their research:

- 1. The focus groups confirm that working at home is only an option for certain people some of the time...(the study) found that higher income and smaller household size increase the likelihood of seeing working at home as an option.*
- 2. Public transport, walking or cycling offers a viable alternative to commuting by car for a significant number of people. However, the focus groups confirm that many regard public transport as unreliable, slow and unsuited to certain types of trip (like shopping). Policy could focus on improving the quality and reliability of public transport as well as on the provision of trip planning and travel information services. The telephone survey suggests that proportionately fewer car commuters in London regard public transport as an option, probably due to the increased hurdles already faced by drivers in the capital.*
- 3. Ride sharing is not a popular option. However, the telephone sample suggested a lower aversion to ride sharing in London than elsewhere, perhaps because fewer regarded public transport as an option (see 2), higher residential density and longer commutes. Multivariate analysis of the telephone survey data showed that the number of motor vehicles owned was significant in increasing ride sharing.*
- 4. Surprisingly many don't know whether with better planning they could save car trips. This points to a niche for improved personal logistics, involving better trip*

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*chaining and/or destination choices. Research in this area would be welcome, perhaps harnessing the power of networked electronic organisers.*

*5. A switch to more fuel-efficient vehicles is not a short-term option for most, but may be part of the long-term solution. The focus groups suggested an awareness of environmental issues, particularly via the young at school. It was accepted by the focus groups that policy should be directed to encouraging the use of more environmentally friendly fuels and more fuel efficient vehicles. There was a belief that private transport was here to stay and that fossil fuels will gradually be replaced by alternatives.*

*6. A significant number are able to shop on foot while a less significant number are not. The focus groups confirmed that conventional bus travel is not a popular alternative for shopping, because of difficulty of use for the encumbered, the inflexibility of the route, lack of reliability and the cost. The multivariate analysis clearly showed that households with more children do not like to shop by public transport, but this does not appear to affect shopping on foot. As families with children need to carry more shopping, greater reliability and improved access through the use of low floor vehicles is unlikely to substantially increase bus use for shopping. In communities with low car ownership, such as in Gateshead, significant use has long been made of shared taxis for shopping trips. There appears to be a market for demand responsive services, delivering greater route flexibility with higher reliability using smaller, more accessible vehicles. The logistics behind demand responsive services can now be solved by a combination of modern vehicles, telecommunications and logistics software.*

*7. Few would do their shopping less frequently, presumably because of the need for fresh food. The telephone survey indicates that even fewer would use the internet for shopping. The focus groups suggest that this is due to a desire for social interaction as well as a wish to see and touch the produce. There is little evidence in the qualitative or quantitative data that the fuel crisis significantly advanced the use of the internet for either shopping or work.*

*8. Gender differences appear to be significant, with women expecting more disruption to their activities than men. Not surprisingly, discretionary trips are the first to be reorganised during disruptions. Children appear to be the largest losers, as their discretionary trips appear to be the first to suffer.<sup>61</sup>*

In summary, following are some of the lessons learned from the U.K. fuel crisis:

- Panic buying of fuel as well as food may be expected during future fuel shortages, especially if the fuel shortages are extreme.
- Rationing schemes (for food and fuel) may be necessary in extreme shortages.
- Working at home does not appear to be an option for a large portion of the population.
- In the U.K., a post-shortage survey indicated that public transport, walking or cycling offered viable alternatives to commuting by car for a significant number of people.

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- Ride sharing was not a popular option in the U.K., however analysis indicated that households that owned more vehicles tended to increase ride sharing.
- Conventional bus travel was not a popular alternative for shopping, because of difficulty of use, the inflexibility of the route, lack of reliability, and the cost. Households with more children did not like to shop by public transport, but the number of children did not appear to affect shopping on foot.
- Few indicated they would do their shopping less frequently, and few indicated they would use the internet for shopping.
- Women expected more disruption to their activities than men.
- Across the affected areas, people cut discretionary journeys. These included visiting friends and relatives, social and leisure journeys, children's extra-mural activities and non-food shopping trips. There was a common response that the car was used only for essential journeys to travel to and from work, to buy food or to care for elderly and infirm relatives.

### ***North Carolina's Fuel Shortages due to Hurricane Katrina***

Hurricane Katrina made landfall at New Orleans on Monday, August 29, 2005. While the Gulf region was devastated, other areas of the country were affected due to the damage Hurricane Katrina inflicted on energy infrastructure, including oil platforms, refineries, and pipelines. The entire southeastern United States, for example, although many hundreds of miles away from the gulf region, was affected by Hurricane Katrina when the Colonial and Plantation pipelines were temporarily shut down.

Detailed evidence on travel behavior changes in North Carolina due to the fuel shortage is scarce, perhaps because the shortage occurred very suddenly, the country was distracted by the terrible devastation of Hurricane Katrina in the Gulf region, and the crisis was also over fairly quickly. Because every organization and individual was affected in some way by this fuel shortage, this summary is not offered as a comprehensive analysis. Rather, it is a snapshot of some of the problems encountered along with lessons learned, and is based on phone interviews with five transit agencies, the state energy office, and the North Carolina Department of Transportation (NCDOT). It is unknown whether North Carolina's fuel shortages were more or less severe than other states in the southeastern U.S. or elsewhere.

### **Dependence on Pipelines Leads to Shortages**

Because there are no refineries in North Carolina, the state depends entirely on pipelines, rail, barges, or trucks for its motor fuel. Motor gasoline provides about 75 percent of the state's transportation energy, distillate fuel (primarily diesel) provides about 20 percent, and jet fuel represents about five percent of the state's transportation energy use.<sup>62</sup>

The great majority of motor fuels, 90 percent, is transported to North Carolina by the Colonial and Plantation pipelines. These two pipelines originate in the Gulf area (the

Colonial in Houston, Texas, and the Plantation in Baton Rouge, Louisiana), and both were shut down by Hurricane Katrina.

According to the U.S. Department of Energy, at the outset the scope of damage, loss of communications, and lack of access to affected facilities delayed an assessment of when the pipelines would be operational.<sup>63</sup> Due to limitations of the Strategic Petroleum Reserve (SPR) described previously, the SPR could not relieve this short-term fuel crisis. Fuel supplies in the southeastern U.S. quickly began to diminish, and on August 31<sup>st</sup>, Governor Easley of North Carolina issued a press release to explain the problem and direct the state to take various measures to conserve fuel. He asked residents to conserve gas and suspended all non-essential state government travel. He also asked state employees to carpool whenever possible and asked residents to limit non-essential road trips.<sup>64</sup>

Gas shortages persisted. Some parts of the state were affected more severely than others. According to NCDOT, some gas stations in the western part of North Carolina completely ran out of fuel. For example, the day after the Governor's announcement, more than 60 of about 100 gas stations in Buncombe County ran out of fuel.<sup>65</sup>

### **North Carolina's Energy Emergency Plan**

Like other state energy offices, North Carolina's state energy office has an energy emergency plan to prepare for energy emergencies.<sup>66</sup> The *Energy Emergency Plan* identifies four categories of petroleum shortages, along with mitigation measures, as described in Table 3. However, according to the state energy office, the energy emergency that occurred did not clearly fit into any of the four categories.<sup>67</sup> This energy emergency was a very severe and sudden shortage, but one that was not expected to last long. During this time the Governor did not declare an energy emergency, although according to the state energy office, the state came close to declaring one. If the Governor had declared an energy emergency, the state could have taken even more drastic actions than those described below, such as initiating the fuel set-aside program that is described later in this section.

#### *State Actions*

For about two weeks the state limited travel to only that which was absolutely necessary, and the state energy office estimates that at one point the state was about one day from having to close the schools because of a shortfall in fuel for school buses.

The state energy office convened all major players, agencies, and major users of fuel, including, for example, a member of the department of public instruction (DPI), which could influence all 108 school systems in North Carolina. Each prepared a list of how each could curtail fuel consumption, and each agency made decisions on fuel priorities. Some travel was required to continue. For example, meat inspectors could not stop inspecting the food supply.

## 2. Lessons Learned from Previous Disruptions

The list of how agencies could curtail fuel consumption was published through news conferences with the governor and through written memoranda that were then distributed throughout each department.

Following are some examples of actions taken by the state or other agencies:

- The State DOT implemented a compressed work week (four-day work week).
- The ferry systems curtailed a number of ferry trips.
- Athletic events and field trips at schools were cancelled, and they were considering going to a four-day school week.
- The state school superintendent distributed a memo to all schools providing guidelines on school closures in the event of a shortage of fuel for school buses.<sup>68</sup>
- Prisoners were not transferred.
- Meetings were cancelled so there would be no transportation involved.

According to NCDOT, cities also developed their own lists of priorities. For example, operating a meals-on-wheels<sup>c</sup> type of program might be considered a priority while upgrading a functioning traffic signal would be postponed. Some agencies provided their entire staff with daily updates on the current inventories of fuel on site.

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<sup>c</sup> Services that provide home-delivered meals to people in need (such as the elderly and disabled).

## 2. Lessons Learned from Previous Disruptions

**Table 3 - North Carolina Energy Emergency Plan Stages of Petroleum Emergency**

	Conditions (one or more may apply)	Probable Impacts Observed	Mitigation Measures
<p><b>Shortage Level 1 - Monitor and Alert - No discernable shortage in North Carolina. Possible shortages elsewhere.</b></p>	<p>Reports of shortages in other parts of the United States, or reports of natural or political difficulties in oil producing countries, may affect petroleum and petroleum product prices on the New York Mercantile Exchange (NYMEX).</p> <p>Local prices may move up rapidly in response to spot market prices.</p>	<p>Jobbers (state &amp; local fuel companies) may report temporary supply difficulties.</p> <p>Some gasoline stations, if queried (especially during the summer driving season), will report greater than normal buying as motorists attempt to secure the current lowest price.</p>	<ul style="list-style-type: none"> <li>● Public information for energy conservation</li> </ul>
<p><b>Shortage Level 2 - Mild Shortage - 5 to 10% reduction in petroleum supply for a week or more.</b></p>	<p>The Department of Energy (DOE), American Petroleum Institute (API) or other sources report a decrease in the availability of product (e.g., from Middle East, South America, and domestic refineries).</p> <p>Spot prices increase rapidly. National and regional oil companies (prime suppliers) put more dealers on “allocation.”</p> <p>Regional prices rise due to temporary imbalances between supply and demand. Causes may include refinery outages, transportation problems or sudden increases to tertiary (consumer level) storage and higher spot market prices.</p> <p>Dealers report increased pressure on their ability to deliver fuel.</p>	<p>Some jobbers report supply and delivery problems or related issues (such as long queues at fuel loading racks). Deliveries extend into evenings and weekends to keep up with demand.</p> <p>Dealers are uncertain about product availability and question information received from prime suppliers.</p> <p>Government assistance in removing retail driver hour limitations may be sought.</p> <p>Some customers call dealers to top off home storage tanks.</p>	<ul style="list-style-type: none"> <li>● Public information for energy conservation</li> <li>● Employer-based travel assistance</li> <li>● Variable work hours and telecommuting</li> </ul>

## 2. Lessons Learned from Previous Disruptions

Table 3 continued

Conditions (one or more may apply)	Probable Impacts Observed	Mitigation Measures
<p><b>Shortage Level 3 - Moderate Shortage - 10 to 15% reduction in petroleum products for three weeks or more</b></p>	<p>Petroleum product imports to the state drop 5% from the previous year or other base period. Allocations for a growing number of petroleum retailers are reduced.</p> <p>Local weather or storms in other regions result in problems that lead to temporary curtailment in North Carolina.</p> <p>Product prices are rising steadily. Prices for key fuels rise at a rate of 10% or more per week.</p> <p>Demand from other countries draws product away from the U.S.</p>	<p>Jobbers report difficulty in obtaining or delivering enough supply to satisfy customers. Queuing at wholesale loading racks keeps drivers in line for several hours or more.</p> <p>Some transportation companies add a “fuel charge” to their usual price.</p> <p>Some retail dealers have difficulty meeting contract obligations.</p> <p>Supplies diminish as demand for heating oil increases. Prices increase significantly.</p> <ul style="list-style-type: none"> <li>• Public information for energy conservation</li> <li>• Reduce government hours of operation.</li> <li>• Modify fuel purchase times (i.e., reducing fuel station hours of operation) to alleviate long lines at retail gas stations.</li> <li>• Employer-based travel assistance</li> <li>• Temporary HOV lanes</li> <li>• Compressed work week</li> <li>• School system fuel conservation</li> <li>• Parking management</li> <li>• Variable work hours and telecommuting</li> <li>• Odd/even min/max fuel purchases</li> </ul>
<p><b>Shortage Level 4 - Severe Shortage - 20% to 30% and upwards reduction in petroleum product for more than two weeks.*</b></p>	<p>Regional and state fuel dislocation is brought on by hurricane-scale storms; extended, widespread, winter cold; embargo or terrorist acts.</p> <p>Prices do not level off but continue to rise.</p> <p>Local product storage is extremely low or exhausted.</p> <p>Dealers are on less than 75% allocation and have difficulty maintaining contract delivery.</p> <p>Shortages are regional and possibly broader.</p>	<p>In peak driving seasons, gasoline stations curtail operating hours and motorists form lines to purchase available fuel regardless of price.</p> <p>During winter months, noncontract customers have serious difficulty locating heating oil even if they can afford it.</p> <p>Petroleum fuel hoarding is observed.</p> <p>Suppliers sharply reduce allocations to dealers and dealers cannot manage customer inquiries.</p> <p>Government agencies are called upon to provide relief.</p> <ul style="list-style-type: none"> <li>• Public information for energy conservation</li> <li>• Reduce government hours of operation.</li> <li>• Modify fuel purchase times (i.e., reducing fuel station hours of operation) to alleviate long lines at retail gas stations.</li> <li>• Employer-based travel assistance</li> <li>• Temporary HOV lanes</li> <li>• Enhanced speed limit enforcement</li> <li>• Compressed work week</li> <li>• School system fuel conservation</li> <li>• Parking management</li> <li>• Variable work hours and telecommuting</li> <li>• Odd/even min/max fuel purchases</li> <li>• State petroleum fuel set-aside</li> </ul>

\* In addition, the Energy Emergency Plan indicates that conditions may deteriorate to what might be called “beyond severe.” The probable causes include war, concerted petroleum embargo, widespread natural disasters or other calamities that can initiate a long-term reduction in fuel availability.

## **Lessons Learned from North Carolina**

Following are a few lessons learned from this fuel shortage based on the description of events from state agencies and local transit agencies.

### *Identify Fuel Supply Vulnerabilities and Plan for the Unexpected*

Government agencies should confirm that they have identified all fuel supply vulnerabilities and planned for them accordingly. In North Carolina, some agencies appeared to be caught off-guard that the state received about 90 percent of its fuel from the two pipelines, with most of the remaining ten percent coming from the Wilmington Port. The closure of the two pipelines represented a huge supply disruption. This major, but brief, supply disruption did not clearly fit into any of the four categories of energy emergencies.

### *Government Agencies at All Levels Need to Better Understand Their Daily Fuel Requirements*

In North Carolina, the state energy office found that cities and counties have little understanding of how much fuel their services require per day. The state energy office is recommending that cities and counties determine their fuel requirements, especially for first responders (fire, police, etc.), and buy some percentage of that fuel under a firm contract.

### *Government Agencies Should Buy Some Fuel Under Firm Contracts*

Within a few days after Hurricane Katrina hit Louisiana, fuel suppliers in North Carolina informed the state that their fuel contracts were not going to be honored. Because the state bought fuel from independents based on the lowest bid, the state had no firm supply for its fleet of 28,000 vehicles. In addition to the state's own vehicles, prisons, some mental hospitals, some local agencies, and many school systems bought fuel through the state contract.

A firm contract would not guarantee that local agencies would be able to obtain fuel, but North Carolina's energy office believes that under a firm contract the dealer may feel more commitment to provide that fuel.

### *For an Emergency, Reliance on Just-in-Time Fuel Delivery is Problematic*

The North Carolina DOT manages 122 fueling sites. According to NCDOT, when North Carolina developed the fueling infrastructure 15 years ago the state did not include extra capacity to accommodate future growth. The fuel storage facilities were sized to take the state's fleet through a 10-day period. With the additional growth in vehicle travel since then, today the state's fuel storage capacity is insufficient and the state is very dependent on just-in-time fuel delivery.

## 2. Lessons Learned from Previous Disruptions

In addition, some local agencies indicated that they need to expand fuel storage capacity in order to be better prepared to handle future emergencies. The state energy office found that few state and local agencies have fuel storage on site and that most are also relying on just-in-time delivery.

One transit agency that typically buys fuel from the local DOT fuel depot indicated that during any kind of crisis the DOT immediately cuts down on the purchase of fuel by other agencies<sup>69</sup>.

An additional potential problem is that the National Guard relies on the state for its fuel supplies. According to the state energy office, if an emergency had been declared, the state would have had a very difficult time providing them with fuel and would have been unable to support the National Guard for very long.

According to NCDOT, within recent years North Carolina has experienced about nine major hurricanes. During these events, NCDOT periodically experienced situations in which they could not get to their fueling sites, which were put under water due to the hurricanes. NCDOT has an emergency contact list for fuel suppliers that can be contacted at any time, but when Hurricane Katrina hit the situation was different because the supply to the entire state was low.

NCDOT knew that Amerada Hess in Wilmington was the only major fuel supplier that did not get fuel from the two pipelines. So immediately following Hurricane Katrina NCDOT contacted Amerada Hess and locked in a million gallons each of diesel and gasoline. According to the state energy office, the state understood that this sale was made as a favor to the state and they paid market price, but without it the state would have had to shut down.

### *States or Regions May Want to Become More Self Sufficient Regarding Fuel Supplies*

North Carolina has determined that over the long term it needs to become more self-sufficient regarding fuel. One action the state took toward this goal was the purchase of its own fuel tanker truck. This allows the state to independently move fuel from one part of the state to another in the event of an emergency.

North Carolina is also trying to increase its usage of alternative fuel. The state already uses B20, a fuel blend consisting of 20 percent biodiesel and 80 percent petroleum diesel, on state vehicles. They are seeking to develop additional alternative fuel sources within the state, and also reduce the fuel usage of state-owned vehicles by 20 percent. The state and regions are also looking into increasing their fuel storage capacity, and considering additional fuel sources/providers beyond the two pipelines<sup>70</sup>. One transit agency indicated that it would like to see more stockpiles of diesel available for transit agencies.

### *Government Agencies Should Reassess How They Can Most Quickly Secure Fuel Supplies for Priority Needs*

During this fuel shortage, government agencies at all levels quickly developed their own strategies and plans for securing their own fuel supplies. For instance, according to the state energy office, early in the shortage the state highway patrol fueled vehicles at public fueling stations in order to save their fuel supplies. At least one city advised critical city employees to immediately fill up their vehicles at public gas stations before word got out to the public about the impending fuel shortages. One transit agency described how a local convenience store had a contract with the county to supply most of the fuel for the sheriff and some others. Apparently this convenience store “took some heat from the public” when it took steps to reserve part of their fuel for the county<sup>71</sup>. Although the City of Winston-Salem appeared to be adequately supplied with fuel during this emergency, the City understood that state statutes would not allow the City to qualify for priority delivery of fuel purchases. However, similar to the example of the convenience store provided above, one of the City’s suppliers voluntarily offered priority status to local governments.<sup>72</sup>

By the second week, the state was getting calls from municipalities who asked where they could obtain fuel for their first responders. The state let municipalities know that because they did not have enough fuel for all the state responders, and Hurricane Ophelia was approaching, the state was unable to provide fuel for cities or counties<sup>73</sup>. The state did, however, continue to fuel the highway patrol<sup>74</sup>.

### *Some Agencies May Feel They are “On Their Own” in Coping with Energy Emergencies*

Some of the interviews suggest that local municipalities to at least some degree felt they were on their own in dealing with their fuel shortage concerns. The state energy office was working primarily with NCDOT, trying to find fuel supplies for the state. Because transit agencies are normally funded by the county or municipality, the state’s perspective was that transit agencies would work with local government agencies rather than the state<sup>75</sup>.

One transit agency representative indicated that at meetings he attended with the city, they had not received any directives or plans from the state that he was aware of, other than the directive provided by the governor<sup>76</sup>. Another transit agency representative indicated that he was not aware of any organized plan of action, but hoped there would be one: “I would imagine, and I would like to believe, that the elected leaders of the City and State, if it got to that point, would come up with a plan of action to stretch out the limited supplies of fuel, much as they did in the 70s gas rationing and fueling on even days based on license plates. I would like to believe that there would be some type of plan to stretch the fuel as far as it would go and provide priority allotments to provide some to public safety and public transportation.”<sup>77</sup>

### *In Some Areas, the Need to Maintain Transit Service May Not Be Widely Recognized*

Although public transportation is one of the State of North Carolina's suggested "priority users" of fuel, public transportation was not always recognized as a critical service during this fuel shortage. Some transit agencies and ferries cut service to conserve fuel.<sup>78</sup>

One transit agency representative indicated that transit agencies were not exempted from the Governor's call for state agencies and citizens to conserve fuel<sup>79</sup>. This representative described attending meetings and reminding others that public transportation helps save fuel by keeping cars off the road. Although the Governor asked citizens to carpool, he did not ask them to take public transportation.<sup>80</sup> This particular transit agency never suffered a fuel shortage since it was a college campus transit agency, and the campus steam plant runs off of diesel fuel. Because the campus was not making steam at that time, the diesel was available for transit usage.

Another transit agency indicated that public transit in their area was identified as one of the priority services within the City since it was a method to conserve fuel, and the mayor did emphasize using public transportation and carpools<sup>81</sup>. However, this agency also developed a plan where they could, if needed, reduce transit service levels.

At the City of Asheville in Buncombe County, the priority users for fuel controlled by the City were police and fire, followed by public works and then transit. The transit agency had its own tanks that they believed contained a nine-to-ten day supply. Their supply was as low as three days at one point. Asheville also had a plan in place that had certain service thresholds that related to fuel reserves (see Appendix 2). They planned to reduce service depending on the fuel stockpile, but maintain enough fuel to assist with evacuations. Although the City did not have these plans in advance, they were able to formulate them very quickly because they knew what the priorities were.

### *Public Announcements of Fuel Shortages Appeared to Result in Some Fuel Hoarding*

North Carolina's State Energy Office, in its description of stages of energy emergencies, recognizes that in severe shortages hoarding may be observed. This appears to have occurred, at least to some degree, in North Carolina during the 2005 fuel shortage.

According to one transit agency representative<sup>82</sup> although there had been discussions on how to get the message out about fuel shortages without creating panic, it didn't seem to work. The numerous public announcements and news conferences, issued at both the state and local levels, may have instead contributed to a run on gasoline stations, causing many stations to run out of fuel. The state energy office also indicated that because drivers were "topping off" their tanks to keep their tanks full, the demand for fuel increased as people were not letting the tank empty down before going back for a refill.<sup>83</sup>

Although fuel hoarding may be difficult to avoid when people are informed of pending fuel shortages, it may be possible to develop public information that could reduce fuel hoarding.

### *Increases in Transit Ridership and Carpooling*

A number of transit agencies in North Carolina reported increases in transit service and ridesharing. According to the *Asheville Citizen-Times* on September 2, 2005, “It was standing room only on the Route 6 bus between downtown Asheville and the airport Thursday morning. That hasn’t happened before. But with gas prices climbing and some local stations running out of gas, some in Western North Carolina are scrambling to find an alternative way to work.”<sup>84</sup> Another newspaper article indicated that several Triangle Transit Authority routes in the north-central part of the state showed ridership gains of 25 percent or more at the peak of the Katrina-fueled gas shortages.<sup>85</sup>

According to the Charlotte Area Transit System (CATS), transit ridership rose by 16 percent during this period. CATS reported that their express services had greater ridership increases than their local services. They were able to add buses and vanpools to meet demand, but received some complaints on overcrowding.

In Charlotte, the mayor held press conferences which emphasized the use of carpools, vanpools, and public transportation. To respond to the increase in calls, the transit agency added staff to their customer service center and put information on their website.

Charlotte also initiated an early launch of its commute trip program for city employees. They had been planning to launch it in December 2005, but in order to reduce fuel usage they introduced it in early September to allow city employees who work downtown (about 5,000 employees) to give up their parking space in exchange for a free transit pass.

In Asheville, people were urged to carpool and the transit agency publicized the carpooling website. Their carpooling program, which was only a few weeks old at that time, jumped from 75 people registered to 200 people registered overnight.

### *Dealing with Increased Fuel Costs*

One issue common to all public agencies in North Carolina, as well as the rest of the country, was the increase in the cost of fuel. Some agencies covered increased fuel costs by making cuts in other areas of the budget, but a very sudden and prolonged fuel price increase could be problematic.

### *If Fuel Shortages Had Persisted...*

If fuel shortages had persisted, the Governor likely would have declared an energy emergency.<sup>86</sup> Doing so would have allowed for additional actions (such as activation of the fuel set-aside program described below) but also would have presented challenges.

## 2. Lessons Learned from Previous Disruptions

For instance, as described previously, due to low state fuel supplies the state DOT would have had trouble providing the National Guard with fuel,<sup>87</sup> and would also have had to cut off other state and local agencies that rely on NCDOT fueling stations.<sup>88</sup>

According to NCDOT, most other state agencies use the DOT's fuel services. In addition, the state was receiving requests from every city and county in the state for fuel, and for the most part they were unable to provide fuel to other non-state agencies. One complication the DOT was facing post-Katrina was that another hurricane (Ophelia) was on the way, and the DOT felt that it needed to keep fuel on hand to enable the DOT to clear roads after that hurricane hit.

In general, many hard choices would have had to be made had the fuel shortage persisted. Just a few other actions being considered at the time include:

- Public schools and at least one university looked at having to alter the academic schedule and shut down for a period of time.
- Consideration was given to a compressed school week.
- Some transit agencies were planning which routes they could cut or reduce service on.

### **North Carolina's Fuel Set-Aside Program**

North Carolina has a fuel set-aside program that can be activated during a declared energy emergency to redirect fuel to "priority" customers. Following is a description of the fuel set-aside program:

*"During a proclaimed state of emergency, the distribution of intrastate petroleum and petroleum product stocks that are essential to life, property, and critical services, and designated to be set-aside, shall be physically held by the wholesaler-reseller (prime supplier) subject to release orders from the State Energy Office. The allocation of these essential fuels constitutes the Petroleum Fuels Set-Aside Program. The total amount of all fuel types available for the Petroleum Fuels Set-Aside Program is based on the amount of petroleum fuel imported into the state as recorded on the monthly U.S. Department of Energy, Energy Information Agency form EIA-782C.*

*"You may be eligible for the program, if you use petroleum fuel for operating equipment, producing crops, moving goods and people, or maintaining essential services, and can prove justifiable hardship.*

*"The Petroleum Fuels Set-Aside Program is implemented only after the Governor proclaims a state of emergency and when market forces, voluntary conservation, or other mandatory programs are unable to maintain an adequate and equitable distribution of fuel.*

*"The State's Petroleum Fuels Set-Aside Program is designed to cause only minimal interference with the market, using a percentage of imported volumes*

## 2. Lessons Learned from Previous Disruptions

*that are sufficient only to satisfy hardship and emergency cases. The program makes no attempt to reduce or inhibit the market price of fuels. All fuel delivered through the program will be purchased at the market price, and whenever possible, through the usual supplier.”*<sup>89</sup>

Under the set-aside program, fuel is allocated on a month-by-month basis. To obtain fuel, applicants must fill out an application form, and that form must be filed within a certain number of days of the beginning of each month (e.g., seven business days). The state energy office will then send a receipt of approval or denial. The applicant may receive approval for emergency fuel but not for the full amount requested. The applicant must then deliver the letter received from the state energy office to their distributor (or retailer) to obtain their fuel. In addition, they must make their own arrangements with the supplier for delivery and payment. If an application was denied (or only partially approved), they may appeal the decision.

Had the Governor declared an energy emergency, the fuel set-aside might have been activated during this emergency. This program establishes a maximum percentage of incoming product to be set aside by major suppliers and reallocated to priority users. For example, a suggested maximum monthly set-aside level is five percent of motor gasoline.

The State’s suggested priority customers include:

- Agricultural production and distribution,
- Aviation including ground support,
- Cargo, freight, and mail,
- Emergency services,
- Energy production,
- Government/sanitation,
- Health care,
- Public passenger transportation,
- Telecommunications,
- Utility services (including water), and
- Nonmilitary shipping.<sup>90</sup>

Other states have their own programs and policies for a fuel set-aside program. Washington State implements a fuel set-aside program during a Stage 4 energy emergency when declared by the Governor.<sup>91</sup> The State of California’s fuel set-aside program appears to be almost identical to North Carolina’s.<sup>92</sup> The states of Vermont and New York allow up to three percent of fuel to be set-aside during an energy emergency.<sup>93</sup>

However, it is unknown whether the fuel set-aside programs will be sufficiently flexible to enable priority users to quickly obtain fuel. For example,

- Would states have the flexibility to easily adjust the set-aside level depending on supply circumstances (for example, if fuel supplies are greatly reduced, say by 75 percent, will three to five percent of available fuel adequately supply all priority users)?

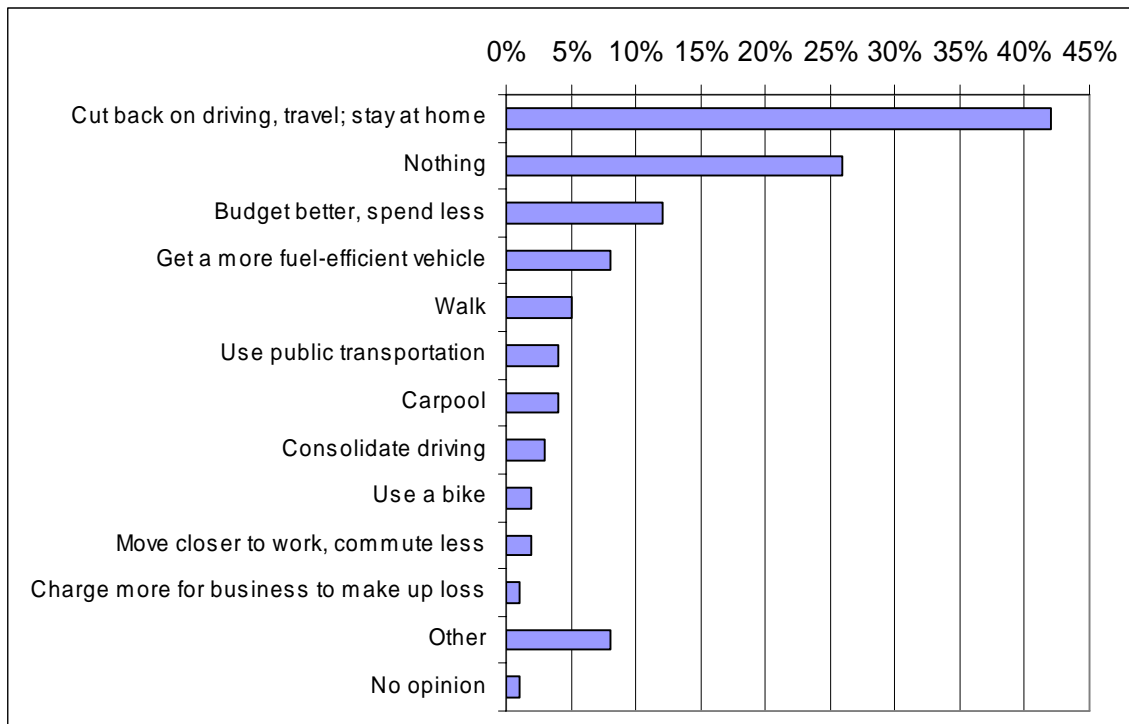
## 2. Lessons Learned from Previous Disruptions

- Can the requirement that applications be submitted by a certain day during the month (e.g., the eighth business day) be waived?
- During a sudden and severe emergency, would the state energy office be inundated with applications from every priority user across the state, and if so is there prioritization for which priority users would be approved first?
- Is there a quicker to way, at the outset of an energy emergency, to ensure that priority users can very quickly obtain fuel?

### ***Recent Surveys on U.S. Travel Behavior Change Due to High Prices***

Although little data is available on how people changed their travel behavior in North Carolina and elsewhere during fuel shortages following Hurricane Katrina, some data is available on how people either changed or indicated they would change their travel behavior in response to higher fuel prices. Figure 8, for example, presents results from a CNN/Gallup Poll of adults nationwide from April 28-30, 2006. As shown in Figure 8, the greatest percentage of respondents indicate that they would cut back on driving and travel, and stay at home. Only a small portion of respondents indicate they would use another mode.

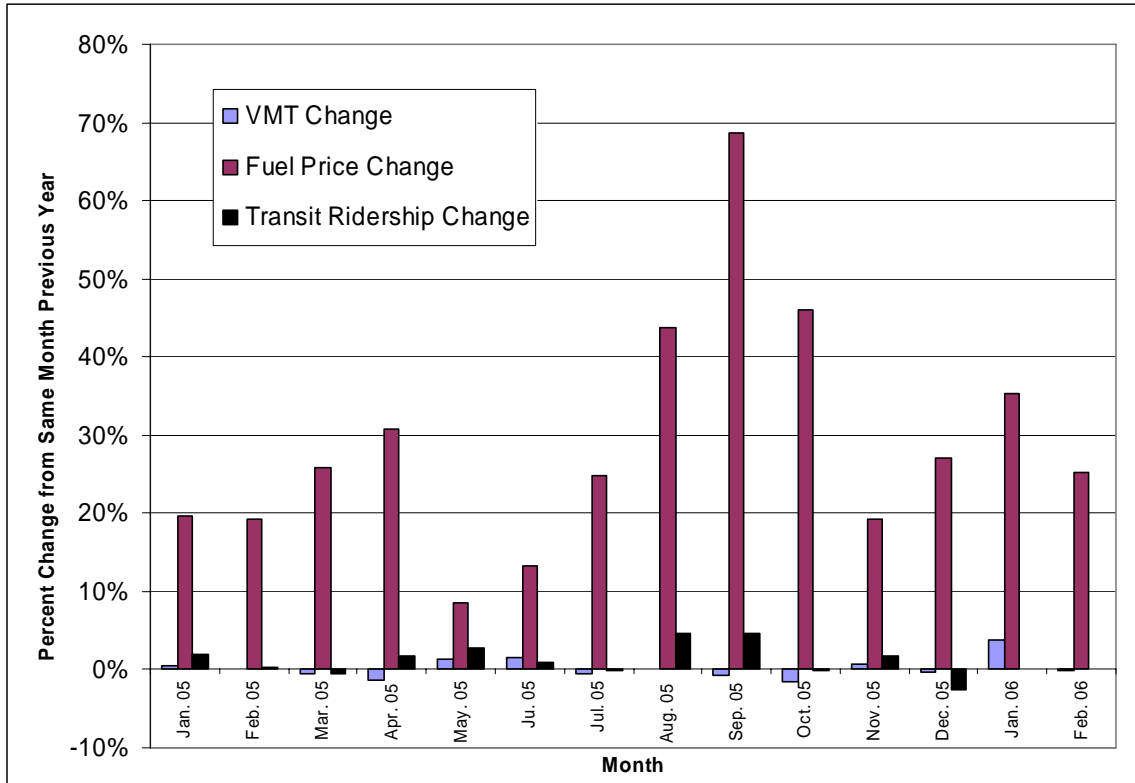
**Figure 8 - Poll: What Americans Indicate They'll Do if High Gas Prices Persist**



Nationwide, data on actual changes in travel behavior show a slight change between 2004 and 2005, a period that corresponded to a large increase in fuel prices. While the cost of fuel increased by about 29 percent on average, vehicle miles traveled (VMT) decreased

by about 0.04 percent and transit ridership increased by about 1.3 percent. Although VMT decreased only very slightly, it is notable that it decreased at all since annual VMT has typically increased by about two to three percent each year for the last several decades.<sup>94</sup>

**Figure 9 - Year Over Year Changes in VMT, Fuel Price, and Transit Ridership (Same Month, Previous Year)<sup>95</sup>**



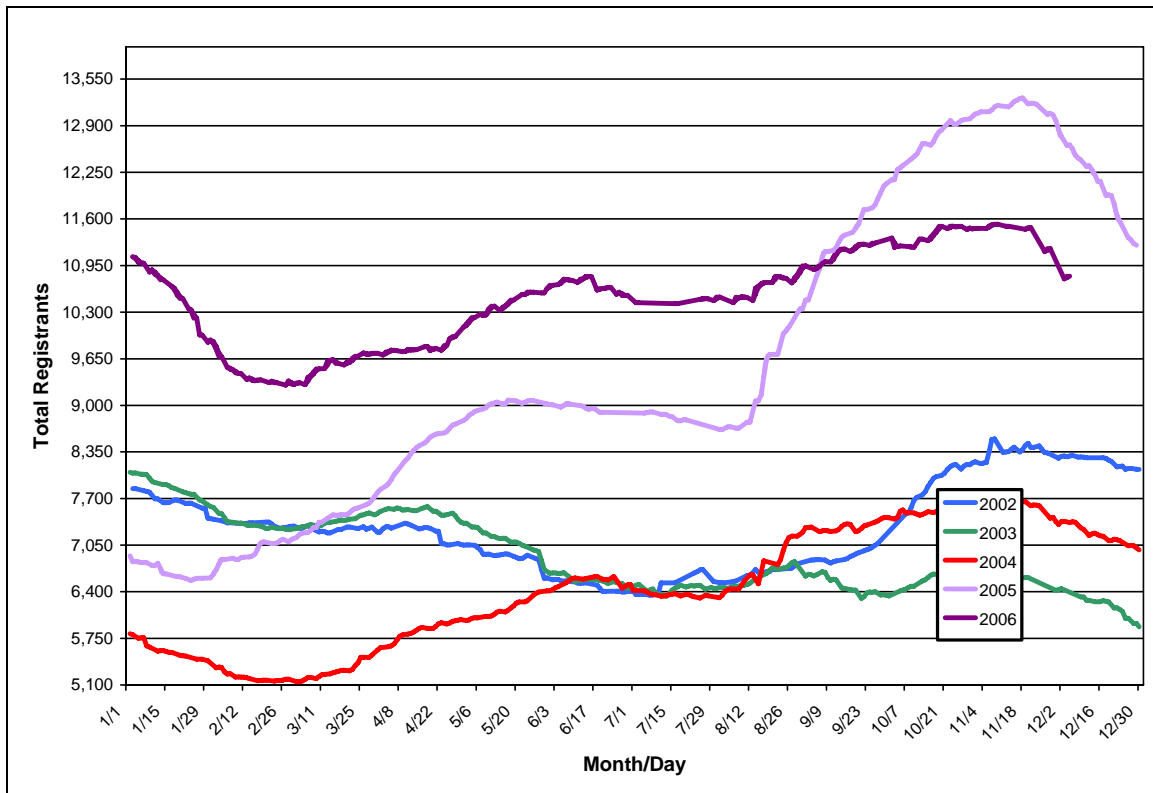
In the Puget Sound region in Washington State, RideshareOnline is a regional ridematching database. As shown in Figure 10 below, the number of registrants increased dramatically after Hurricane Katrina and the corresponding increase in the cost of fuel. Between August 1, 2005 and mid-November, 2005, the number of registrants increased by more than 50 percent. Although the number of registrants fell during the winter of 2005/2006, they have remained substantially higher than levels from 2004 and previous years.

Transit ridership in King County increased by about seven percent during September 2005 (or 20,000 daily trips) compared to September 2004.<sup>96</sup> In addition, the use of park-and-ride lots across the county increased by about nine percent between the spring and fall of 2005, although these changes are not all necessarily related to higher fuel costs (as employment and transit service levels changed during that time as well).

This data shows that in the Puget Sound region there appeared to be some correlation between fuel prices and interest in carpooling, vanpooling, and transit ridership. Still, the

percentage of ridesharers and transit riders is still relatively small in the region. For example, for the trip to work in the year 2000, over 72 percent of commuters in the region drove alone, while about 12 percent carpooled and seven percent used transit.<sup>97</sup>

**Figure 10 - Total Puget Sound Region RideshareOnline Registrants (2002-2006)<sup>98</sup>**



### ***Conclusions from Previous Supply Disruptions***

Following are conclusions drawn from a revisiting of lessons learned from previous fuel shortages.

**Travel Behavior:**

- Changes in non-work trips may occur far more frequently than changes in work trips.
- Transit systems have only limited capabilities for quickly increasing service to respond to fuel price increases or shortages.
- In some areas of the U.S. transit agencies may need to remind decision makers of the importance of maintaining transit service during fuel shortages.
- Ridesharing has typically not been widely used as a means of reducing fuel consumption.
- Where transportation options are available, people indicate that they will use them. For example, in the U.K., a post-shortage survey indicated that public transport, walking or cycling offered viable alternatives to commuting by car for a significant

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number of people. However, conventional bus travel was not a popular alternative for shopping.

- Unlike the 1970s and 80s, today there are many opportunities for telecommuting and on-line commerce. However, the degree to which telecommuting and on-line commerce might help mitigate fuel shortages is unclear. In the U.K. working at home did not appear to be an option for a large portion of the population, and few indicated that they used the internet for shopping. However, since 2000 the use of the internet for shopping has become more commonplace (although in a fuel emergency delivery companies would likely suffer from fuel shortages as well). Similarly, in the last several years the communications tools helpful for telecommuting (high-speed internet access, web conferencing, etc.) are much more widely available.

### **Fuel Supplies:**

- Fuel availability has historically affected travel behavior much more than price.
- Panic buying of fuel (and possibly other items such as food) may be expected during future fuel shortages, especially if the fuel shortages are extreme.
- In an emergency, reliance on just-in-time fuel delivery is problematic.
- Government agencies at all levels should reassess how they can quickly secure fuel in emergencies.
- Government agencies at all levels should better understand their daily fuel requirements, and buy some fuel under firm contracts.
- Over the long term, regions should strive to become more self sufficient regarding fuel supplies.

### **Energy Emergency Planning:**

- Although planners in the 1970s and 1980s concluded that fuel shortage planning and response should occur at the lowest levels of government, currently nearly all fuel shortage planning occurs at the state level.
- Perhaps because fuel contingency planning primarily occurs at the state level, some local agencies expressed a sense that they were "on their own" in dealing with fuel supply disruptions. Ideally, energy contingency planning would occur at all levels of government, and be coordinated between these different levels of government.
- Rationing schemes (for food and fuel) may be necessary in extreme shortages.
- Since the 1970s, land use patterns in the U.S. have generally continued to develop in ways that are energy inefficient.

To many experts in the petroleum industry, it is not a question of whether or not we will experience fuel shortages, but rather when. By planning for those shortages at the local and regional level now, our agencies will be on better footing to respond during an emergency.

### 3. IEA'S *SAVING OIL IN A HURRY*

In 2005, the Organization for Economic Cooperation and Development (OECD) and the International Energy Agency (IEA) prepared a report titled *Saving Oil in a Hurry*. This publication identifies the most effective strategies for reducing oil use for all IEA countries<sup>d</sup> under the circumstances of a temporary oil supply disruption that may result in physical shortages of oil or a sudden severe spike in price.

According to the IEA, since the 1973 oil embargo by several Middle Eastern countries, oil supply disruptions affecting world oil supply and prices have occurred fairly regularly, averaging one or two significant episodes per decade. In each instance, supplies of retail fuel went into shortage in one or more countries, and oil prices rose rapidly and substantially.

This book explores measures to help cope with oil supply disruptions, and focuses on options to rapidly reduce oil demand in the passenger transportation sector in a short period of time. The OECD/IEA also make the case for why governments may want to cut oil demand during supply disruptions.

*“One obvious reason is to conserve fuel that might be in short supply. A rapid oil demand response can also send a strong market signal. In the case of a moderate reduction in fuel supplies, a reduction in IEA transport demand of even a few percent could have a substantial dampening effect on surging world oil prices. Achieving even this much of a reduction in transportation energy use would be challenging, but if successful, the value to IEA and other oil-importing countries in terms of maintaining adequate supplies and moderating oil price spikes could be far greater than the costs associated with the measures themselves.”<sup>99</sup>*

Table 4 lists the Organization for Economic Cooperation and Development (OECD) and strategies, across all IEA countries, that were found to be the most effective in quickly saving oil. Table 5 shows estimated regional fuel savings if the measures are implemented in the U.S. and Canada.

The effectiveness of the strategies varied by country. For example:

- A one in ten day driving ban was much more effective in IEA countries outside the U.S. and Canada.
- Reducing speed limits to 55mph/90kph saves a larger percentage fuel in the U.S. and Canada than in Japan and the Republic of Korea.
- In the U.S., carpooling programs are most effective, while in Japan free transit is most effective.

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<sup>d</sup> IEA countries include Australia, New Zealand, Japan, the Republic of Korea, Canada, the U.S., and 20 countries in Europe. and North America

**Table 4 - *Saving Oil in a Hurry* Summary of Oil-saving Effects of Policies Summed Across all IEA Countries**

Potential Oil Savings by Category if Implemented in All IEA Countries	Measure
VERY LARGE More than one million barrels per day	Carpooling: large program to designate emergency carpool lanes along all motorways, designate park-and-ride lots, inform public and match riders
	Driving ban: odd/even license plate scheme. Provide police enforcement, appropriate information and signage
LARGE More than 500 thousand barrels per day	Speed limits: reduce highway speed limits to 90km/hr. Provide police enforcement or speed cameras, appropriate information and signage
	Transit: free public transit (set fares to zero)
	Telecommuting: large program, including active participation of businesses, public information on benefits of telecommuting, minor investments in needed infrastructure to facilitate
	Compressed work week: program with employer participation and public information campaign
	Driving ban: one in ten days based on license plate, with police enforcement and signage
	Promoting "Ecodriving:" adjusting tire pressure, maintaining a steady speed, switch off engine at short stops, etc.
MODERATE More than 100 thousand barrels per day	Transit: 50% reduction in current public transit fares
	Transit: increase weekend and off-peak transit service and increase peak service frequency by 10%
	Carpooling: small programme to inform public, match riders
SMALL Less than 100 thousand barrels per day	Bus priority: convert all existing carpool and bus lanes to 24-hour bus priority usage and convert some other lanes to bus-only lanes

Source: OECD/IEA, *Saving Oil in a Hurry*, p. 19.

**Table 5 - *Saving Oil in a Hurry* Estimated Fuel Savings for Various Measures in U.S./Canada**

<b>Measure</b>	<b>Potential Total Regional Petroleum Fuel Saved (Percent)</b>
Odd/even day driving ban	9.5
Comprehensive policy of carpool lanes, preferential parking, and information systems	5.2
Comprehensive promotion of "Ecodriving"	3.7
Telecommuting twice/week	3.4
Speed limit reduced to 55 mph	2.4
Compressed work week (4/40)	2.4
Policies to provide rideshare information and link ride sharers	0.7
One in ten day driving ban	0.7
100 percent transit fare reduction	0.6
Increased peak and off-peak transit service	0.3
Increased off-peak transit service	0.2
Bus and HOV expansion	0.05
Bus and HOV enhancement	0.02

## **4. SAVING OIL IN A HURRY PUGET SOUND CASE STUDY**

The Puget Sound region in Washington State is home to almost 3.5 million<sup>100</sup> people, and includes the City of Seattle and dozens of smaller cities and towns in King, Snohomish, and Pierce Counties. The largest cities in the region are Seattle (pop. 573,000), Tacoma (pop. 198,100), Bellevue (pop. 115,500), and Everett (pop. 97,500).<sup>101</sup>

Over the past 25 years, local, state and regional officials throughout the Puget Sound region have adopted and endorsed policies and programs that support TDM strategies. This region has also invested in an extensive network of freeway high occupancy vehicle (HOV) lanes, as well as ridesharing and commute trip reduction policies and programs. A few examples of TDM-supportive programs, policies, and facilities include a regional ridematching system, an extensive HOV lane network on area freeways and some arterials, employer assistance programs throughout the region, and passage in 1991 of the state Commute Trip Reduction (CTR) law that requires major employers to provide employee transportation programs that encourage more employees to not drive alone to work every day.

The region has relatively robust ridesharing and transit programs, but like the great majority of metropolitan regions in the U.S., the majority of trips are made by people driving alone in their cars. For the trip to work in the year 2000, over 72 percent of commuters in the region drove alone, about 12 percent carpooled, seven percent used transit, and three percent walked or biked to work.<sup>102</sup>

To better understand implementation barriers and timeframes, a case study was conducted on implementation of fuel saving measures in the Puget Sound region. This case study was based on interviews or correspondence with about 25 transportation or energy professionals in the Puget Sound region and Washington State.

### ***Washington State Energy Assurance and Emergency Preparedness Plan***

Like North Carolina, Washington State has an energy emergency plan, called the *Washington State Energy Assurance and Emergency Preparedness Plan*, Draft November 15, 2005. This plan, which is prepared by the Energy Policy Division of the Washington State Department of Community, Trade, and Economic Development (CTED), prepares the state to address energy emergencies, ranging from blackouts to pipeline explosions to petroleum shortages.

Also like North Carolina, Washington State is vulnerable to several potential fuel supply disruptions, such as:

- Disruption in crude oil supply from one or more of the state's major crude oil supplying regions (e.g., Alaska, Canada, Argentina, Saudi Arabia).
- Closure or damage to one or more of the state's five refineries.

- Closure or damage to the Olympic Pipeline, which delivers all jet fuel for the Seattle-Tacoma International Airport, and a major portion of finished petroleum products used throughout western Washington.<sup>103</sup>

According to this plan,

*“CTED Energy Policy Division plays a central role advising the state on response alternatives and coordinating state-level decision making and response plan implementation. However, most actions that will help the state weather an energy emergency must be taken by individual agencies, businesses, and citizens.”*

## Four Stages of Energy Emergency

Washington State’s energy emergency plan has four stages of energy emergency, as shown in Table 6.

**Table 6 - Stages of Energy Emergencies in Washington State**

Energy Emergency Stage	Description
I Monitoring	A situation where no immediate supply problems exist, yet conditions are such that it is possible that problems could develop in the near future.
II Preparation	A worsening from Stage I conditions but no immediate threat to public health, safety, and welfare.
III Energy Supply Alert	A situation which threatens to disrupt or diminish the supply of energy, to the extent that public health, safety, and welfare may be jeopardized.
IV Energy Emergency	A situation in which the unavailability or disruption of the supply of energy poses a clear and foreseeable danger to public health, safety, and welfare

Stages I and II are informal determinations made by CTED. Stages III and IV are formal declarations made by the governor through executive order. The most recent issuance of an executive order regarding energy occurred in January 2001, when Governor Locke issued an Energy Supply Alert (Stage III) in response to potential electricity shortages.<sup>104</sup>

## Options to Increase Petroleum Efficiency

In general, Washington State’s energy plan tries to allow natural market forces (as opposed to regulatory actions) resolve a fuel shortage since higher prices reduce demand. However, in some cases the state may want to take steps to reduce demand, for example by using petroleum resources more efficiently.

Options listed in the plan for using petroleum resources more efficiently include the following:

- Improve vehicle efficiency (proper tire pressure, etc.), and manage car/truck fleets for improved efficiency.
- Increase transit service and ride sharing.
- Control parking (preferential parking for carpools, etc.).
- Add emergency/temporary HOV lanes.
- Lower and/or enforce speed limits.
- Increase flex-time, teleconferencing, telecommuting.
- Request or mandate a general reduction in petroleum use (through allocation or rationing programs).
- Reduce travel (land, air and marine).
- Hold fewer public events.
- Turn down thermostats (heating oil, propane customers).
- Use substitute products (bio-diesel, etc.).

Adding emergency/temporary HOV lanes and lowering and/or enforcing speed limits are two options considered by CTED to be high cost, time-intensive options.

The CTED believes that most fuel allocation actions can be carried out voluntarily and implemented directly by energy companies. For example, the CTED might ask oil companies to set up a local program of fuel allocation to ensure that certain customers, such as emergency vehicles, receive sufficient fuel. During a Stage IV Energy Emergency, the state of Washington has statutory authority to *mandate* fuel allocation on a localized or statewide basis so the state could order oil companies to set aside a certain percentage of supplies for priority customers.

### ***King County's Fuel Conservation Policy***

King County has a fuel conservation policy that governs procedures the County would follow during a national fuel crisis.<sup>105</sup> This policy was made effective in 1991. Appendix 3 includes the full text of this policy. This policy statement indicates how fuel for county vehicles will be prioritized during a national fuel crisis and assigns agency roles and responsibilities, as shown in Table 7.

King County runs the region's largest transit service through King County Metro Transit. Like other transit agencies throughout the U.S., King County Metro transit may be vulnerable to fuel supply disruptions since the agency depends largely on just-in-time delivery of fuel, and typically has about two to three days of fuel on hand.<sup>106</sup>

**Table 7 - King County Roles and Responsibilities During a National Fuel Crisis**

<b>King County Position</b>	<b>Responsibilities</b>
County Executive	<ul style="list-style-type: none"> <li>Establishes priority rankings of county programs for fuel allocation during a fuel crisis.</li> </ul>
Executive Cabinet	<ul style="list-style-type: none"> <li>Allocates fuel to county programs.</li> </ul>
Department Directors	<ul style="list-style-type: none"> <li>Develop operational plans that ensure that high priority program services are not disrupted by fuel shortfall;</li> <li>Educate county personnel under their supervision on proper vehicle operation to ensure maximum fuel savings;</li> <li>Justify any request for additional fuel during a fuel crisis to the County Executive.</li> </ul>
Fleet Administration	<ul style="list-style-type: none"> <li>Monitors, on an ongoing basis, fuel consumption by department and reports this information to departments;</li> <li>Identifies fuel suppliers and the quantity of fuel each can supply to King County;</li> <li>Allocates fuel to departments during a fuel crisis based on (1) Executive program priority; (2) Executive Cabinet allocations; (3) departments historical fuel usage; and (4) King County fuel allotment from suppliers.</li> <li>Identifies all non-County owned vehicles which may depend on King County for fuel and uses the established priority for fuel access of those vehicles;</li> <li>Identifies the location and capacity of any additional fuel storage sites for inclusion in County fuel storage inventory.</li> </ul>
Vehicle operators	<ul style="list-style-type: none"> <li>Remove excess weight from vehicle;</li> <li>Operate vehicle at speeds below 55 mph;</li> <li>Avoid unnecessary idling of vehicle;</li> <li>Develop and maintain proper driving habits;</li> <li>Inflate tires properly.</li> </ul>
Purchasing Department	<ul style="list-style-type: none"> <li>Obtains contracts with any available commercial fuel suppliers to ensure that the County has sufficient resources for obtaining fuel.</li> </ul>

When a fuel supply disruption occurs, King County may find it helpful to have this policy in place, as it can help to clarify roles and responsibilities during an energy emergency.

### ***Measures Evaluated***

This section presents an analysis of the implementation barriers and recommends pre-planning for the Puget Sound region for the fuel-reduction measures listed in *Saving Oil in a Hurry*.

## Alternative Work Arrangements

Alternative work arrangements can be manifested in several forms. The alternative work arrangements evaluated in this research effort include telecommuting, a compressed work week, and flexible work hours. All of these can help to reduce the demand on the transportation system.

### *Telecommuting*

*Saving Oil in a Hurry* included an estimate of potential fuel savings due to telecommuting, also known as teleworking. The *Saving Oil in a Hurry* study estimated that about 58 percent of those who are employed in the U.S. and Canada can telecommute, and that during a fuel emergency, all of those who can telecommute would do so twice a week. But they also assumed a 25 percent increase in non-work driving on telecommuting days. This would result in an overall regional fuel savings of about 3.4 percent.<sup>107</sup>

In reality, the fuel savings due to telecommuting during an emergency would likely depend on the following:

- The degree to which companies or organizations have *pre-existing* telecommuting programs as part of business-as-usual and/or contingency planning *before* an emergency.
- The percentage of employees who have the appropriate equipment to telecommute (e.g., employees who use laptops as their usual work computer and who have high speed internet access at home may be able to more quickly and efficiently increase their telecommuting),
- The number of jobs suitable for telecommuting.
- For working parents, continued operation of schools and/or availability of daycare. (Note that while lack of access to childcare may reduce productivity for telecommuters, this issue could have a similar or worse productivity impact on employees *not* telecommuting.)

The Puget Sound region would seem to have several characteristics that would tend to support telecommuting, including a high proportion of “information workers,” and a likely high proportion of households with high speed internet access.<sup>c</sup> What the Puget Sound region may still be lacking is widespread pre-existing telecommuting programs among the region’s employers.

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<sup>c</sup> Although data on the proportion of homes in the Seattle region with high speed internet access was unavailable, the Seattle area is likely to have more high-speed internet access than most areas in the U.S. A recent survey indicated that high-speed internet access is more prevalent in families with higher education and income ([http://seattlepi.nwsourc.com/national/243543\\_internet06.html](http://seattlepi.nwsourc.com/national/243543_internet06.html)), and Seattle has one of the highest education rates in the U.S. (<http://www.bizjournals.com/specials/pages/12.html>). Seattle was also identified by Intel Corporation as “The Most Unwired City” in America in 2005, in recognition of the increasing opportunities for wireless internet access.

### *Importance of Pre-existing Telecommuting Programs*

According to Rita Mace Walston, General Manager of the Telework Consortium, Inc., starting a telecommuting program to respond to an emergency generally does not work well. “We are strong proponents of telework as a component of a ‘business as usual’ Continuity of Operations plan. The key, however, is to implement such a plan before you need such a plan. No one in their right mind, for instance, is going to hand me a manual on how to sail and then ask me to get their boat from Seattle to San Francisco. A plan on paper is basically useless in an emergency.” The agencies and companies that the Telework Consortium have worked with have not created a telework program for emergency use only. “If a program is planned and correctly implemented, the benefits become so clear that it doesn't make sense to save it for emergency use only.”

Telecommuting has been identified as one of the major strategies for a continuity of operations plan to enable an organization to continue functioning in an emergency situation. A fuel supply disruption would likely occur less suddenly than many other types of emergencies (e.g., natural disasters, pandemic, etc.). In the case of a fuel supply disruption, a telecommuting program could be implemented to help respond to this emergency, but there would likely be many inefficiencies early on until employees were properly set up. However, unlike some other types of emergencies, people could most likely continue coming into the office while their office was setting them up to telecommute.

### *Ramping up Telecommuting for an Emergency*

Following are some of the challenges that could be encountered when a telecommuting program is implemented in response to an emergency (i.e., an existing and operational telecommuting program is not already in place):

#### *Technical Challenges*

- Computers: either transitioning all employees to laptops or other computers that they can take home or getting all the software needed on employees' home computers. Either of these could be very time consuming. For example, in many organizations, everyone with an internet connection at home can connect to e-mail but to get onto the server requires special software. In theory, this software could be distributed via a CD-ROM or a file transfer protocol (FTP). A bigger issue would be getting all the necessary work-related software onto people's home computers.
- Protecting proprietary and sensitive data.
- Setting up systems for teleconferencing, virtual meetings, etc.
- Obtaining adequate bandwidth for employees.

#### *Management Challenges*

- Assessing whether the employer has the types of positions and employees suitable for telecommuting.
- Equity issues could be problematic if some supervisors support telecommuting while others do not.

### *Legal and Regulatory Challenges*

- Possible workplace safety and liability for injuries.
- Taxation (e.g., changes to state tax liabilities for the employer and employee when an employee telecommutes from a state other than the one in which the employer is located).<sup>108</sup>
- Other recordkeeping issues.

### *Recommended Pre-Planning*

The challenges identified above may limit the degree to which a telecommuting program can *quickly* reduce fuel consumption in an emergency. However, if a telecommuting program is already well-established before absolutely needed, an organization will be able to much more easily ramp up use of the program in response to a fuel shortage or other emergency. Therefore, all employers should consider establishing a regular telecommuting program for as many employees as possible so that any kinks in the system can be worked out before an emergency.

Recommended actions include:

- Develop telework policies at the organization or office level. A sample telework policy can be found at [http://www.commuterchallenge.org/cc/lib\\_wo\\_policy.doc](http://www.commuterchallenge.org/cc/lib_wo_policy.doc).
- Identify any local and regional labor and tax issues. For example, how does the state labor department classify injuries that occur during work hours but while telecommuting?
- Provide employees with information on all the communications tools available to facilitate web conferencing and information sharing.
- Develop teleworker agreements for all eligible employees.
- Ensure that all eligible employees telecommute at least occasionally to ensure that the communications systems are operational.

### *Compressed Work Week*

*Saving Oil in a Hurry* included an estimate of potential fuel savings from a compressed work week (four ten-hour days per week). The *Saving Oil in a Hurry* study estimated that about 60 percent of jobs lend themselves to a compressed work week in the U.S. and Canada, and that during a fuel emergency, all of those who are able to work four ten-hour days per week actually do. But they also assumed a 32 percent increase in non-work driving on days off. This would result in an overall regional fuel savings of about 2.4 percent.<sup>109</sup>

Following are some benefits of employers switching to a compressed work week during a fuel shortage:

- Employees who compress their workweeks are generally able to avoid the peak commute time each day by arriving early and/or staying late (and may therefore be able to travel and more fuel-efficient speeds).

- For employees who use transit, by starting earlier and leaving later they may be able to take advantage of shoulders of the transit peak, during which more seats may be available (since transit ridership should increase during a fuel shortage).
- Little pre-planning is necessary, although policies in place will be helpful.
- Can be fairly quickly revised when an emergency is over.

### *Pre-Planning for Compressed Work Week*

Before an emergency occurs, employers should develop policies regarding employees working a compressed work week. Following are some issues the policy should specify<sup>110</sup>:

- The job categories that are suitable for working a compressed work week.
- Whether an entire office or organization would work the same compressed work week, or if instead the days off would be staggered (i.e., 20% of employees off each work day). Some businesses may need to look into how other businesses are altering their schedules. As an example, a consulting firm may wish to mimic the schedule changes of its major clients to better facilitate communications.
- How employees' schedules are determined and what is required to change schedules.
- What, if anything, is required of employees to qualify.
- Periodic review of the arrangement.
- Model contracts and forms for establishing and tracking alternative work schedules.

### *Flexible Work Hours*

Flexible work hours, sometimes referred to as Flex Time, is a work schedule that allows employees to choose their starting and stopping times within limits set by management. Like compressed workweeks, commuters who use Flex Time generally avoid peak commute times.

Flexible work hours would be expected to save less fuel than either telecommuting or a compressed work week, but can offer some benefits during a fuel shortage:

- For employees who use transit, by starting earlier or leaving later they may be able to take advantage of shoulders of the transit peak, during which more seats may be available (since transit ridership should increase during a fuel shortage).
- Employees are better able to avoid the peak commute time each day, which can save some fuel by allowing drivers to travel at more fuel-efficient speeds.

### *Pre-Planning for Flexible Work Hours*

Agencies should encourage companies and organizations to establish a Flex Time policy and worker agreements. To better facilitate face-to-face interaction, this may include a requirement that all employees be in the office during set "core" hours (e.g., 10 am to 3 pm).

### *Implementation Timeframe for Alternative Work Arrangements*

Some alternative work arrangements could be implemented within a few days of a fuel supply emergency in response to a request by the Governor, the state Energy Office, or local government agencies. In particular, flexible work hours and a compressed work week could be implemented fairly quickly. Increased telecommuting could also occur fairly quickly but could require more preparation by companies or organizations that do not have telecommuting programs established.

### **Reduced Speed Limits**

During the oil shocks of the 1970s, the U.S. passed legislation designed to, among other things, reduce fuel consumption. The Emergency Highway Energy Conservation Act, signed on January 2, 1974, established a national 55 miles per hour speed limit to reduce gasoline consumption. It was extended indefinitely on January 4, 1975,<sup>111</sup> but repealed in 1995, returning the power of setting speed limits to the states.

*Saving Oil in a Hurry* included an estimate of potential fuel savings due to a reduction in the maximum speed limit to 55 mph (90 km/h). That study's estimate assumed the program included an information campaign to encourage drivers not to exceed 55 mph (90 km/h), supplemented by enforcement, either through speed cameras or increased presence of patrol units. The total fuel savings was estimated at 2.4 percent for a region in the U.S. or Canada.

### *Quickly Reducing Speed Limits in the Puget Sound Region*

The actual fuel savings in a real emergency would likely depend on the degree to which travelers voluntarily comply with a request to reduce speed limits that are not posted or enforceable, how long it would take to legally reduce speed limits and modify speed limit signs, and how well these reduced speed limits were enforced.

In the Puget Sound region, State agencies, and particularly WSDOT, would take the lead in reducing speed limits since only state and interstate facilities currently operate above 55 mph. Although in theory speed limits could be reduced in the Puget Sound region only, a more likely scenario is that the state would be trying to save as much fuel as possible so this speed reduction would apply to all facilities within the state operating at over 55 mph.

All of the interstates in Washington State have speed limits over 55 mph. The speed limit is typically 60 mph in urban areas and 70 mph in rural areas. On state routes, limited access facilities generally have speed limits of 60 mph, while speed limits for rural 2-lane facilities are generally 55 to 65 mph. Washington State has over 7,000 centerline miles on the state and interstate highway systems. Altogether, approximately 1,700 signs would have to be replaced or modified to reduce the maximum speed limit statewide to 55 mph.

### *Legislative Action Required to Reduce Speed Limits*

Reducing the speed limit to 55 mph would require legislative action. In Washington State, according to Revised Code of Washington (RCW) 46.61.405, unless a national maximum speed limit has been set, the Secretary of Transportation can only reduce speed limits for safety concerns.<sup>112</sup> Therefore, a directive to reduce speed limits to conserve fuel would be required from the governor or legislature. This might require an amendment to RCW 46.61.405, in which case the governor's office would likely have to draft legislation, convene a special session, and allow some time for debate.

### *Signage*

Once the speed limit change is put into law, according to WSDOT's sign shop and a signing engineer, it would likely take several months to make new signs and replace or modify all 1,700 signs. However in the interim travelers could be strongly encouraged to travel at no more than 55 mph to conserve fuel.

According to WSDOT, the cost for fabrication, installation, labor, and traffic control would likely range from about \$300,000 to \$375,000, assuming signs were fabricated and installed over an approximately four-month time period.

### *Enforcement*

A reduced speed limit would require increased enforcement, particularly since most state highway and interstate facilities have been designed for higher speeds. According to the Washington State Patrol (WSP), the agency that enforces speeds on the interstates and freeways, a change like this would usually be preceded by a very large media campaign, and a short period of very focused enforcement.

Staffing this increased enforcement, however, would be challenging. According to the WSP, the agency's staffing goal is 667 troopers statewide, but as of March 2006 they had a shortfall of 57 troopers from that goal. Furthermore, the WSP indicates that all law enforcement agencies are struggling to meet hiring goals due to an overall shortage of law enforcement professionals. In addition, higher law enforcement salaries at other agencies have made it harder for the WSP to compete.

A further challenge is that the hiring process at WSP is time consuming as trooper cadets are required to:

1. Participate in Trooper Cadet Testing, which is offered about once a month.
2. Participate in an interview and additional testing.
3. Attend a 26-week basic training course, followed by eight weeks of practical instruction with experienced training officers. WSP schedules these classes approximately every nine months.

Quickly ramping up law enforcement staffing to increase enforcement is therefore unrealistic. According to the WSP, they would do the best they could with their existing staff in a fuel emergency.

One potential strategy that could enable speed limits to be quickly reduced would be to install electronic variable speed limit signs in advance of a fuel supply disruption. In the U.S. these signs are currently used at some mountain passes and areas that experience fog, so they can be remotely changed as weather conditions require. These signs are used more widely in other parts of the world, for instance on the M25 motorway near London.

These changeable speed limit signs can be expensive — about \$15,000 to \$30,000 each.<sup>113</sup> Due to this high cost, the widespread use of electronic variable speed limit signs would seem an unlikely strategy to better prepare for fuel supply disruptions. A more likely approach would be to create a panel that could be nailed on top of the existing sign and later removed if appropriate, as shown in Figure 11 below.

**Figure 11 - Photo of Highway Workers Changing A Speed Limit Sign from 70 mph to the New Federally-mandated Limit of 55 mph in 1974**



Photo Credit: Walter P. Reuther Library, Wayne State University.

### *Pre-Planning for Reducing Speed Limits*

Following are a few recommended actions to prepare for implementing reduced speed limits:

- Review legislation to better understand under what conditions the Department of Transportation or others can change speed limits.

- If appropriate, change legislation so that speed limits can be more quickly reduced to quickly conserve fuel.
- Evaluate whether the cost of electronic variable speed limit signs would be justifiable, and/or if there would be uses for these signs other than responding to fuel emergencies.

#### *Implementation Timeframe for Reduced Speed Limits*

Although drivers could immediately be encouraged to reduce their maximum speed to 55 mph to conserve fuel, legally reducing the speed limit (e.g., passing the required legislation, fabricating and installing signs, and implementing a public information campaign) would take about three to six months in Washington State. However, due to a current shortage of troopers, the state patrol would be limited in the degree to which it could enforce a statewide reduction in the speed limit.

#### **Driving Ban Based on License Plates**

According to *Saving Oil in a Hurry* a partial ban on driving was found to be one of the most effective means to quickly reduce fuel consumption. Banning driving based on license plates could result in a fuel savings in the U.S. and Canada of 9.5 percent for an odd/even day ban, and a 0.7 percent savings for a one-in-ten day ban.

While this strategy has been used in other countries to reduce pollution, such as Mexico, Iran, and Greece, it has not been used in the U.S. However, following the 1973 OPEC oil embargo, officials in many places did institute “odd-even” rationing systems where motorists with odd numbered license plates could buy gasoline only on odd numbered days and those with even numbered plates could buy only on even numbered days.

Washington State’s *Energy Assurance and Emergency Preparedness Plan* does not include a driving ban as one of the possible strategies for reducing fuel consumption. However, the plan does indicate that various gasoline station queue management controls can be implemented to reduce public frustration with gas lines. These include odd/even day gas sales based on license plate numbers, and maximum gasoline purchase limits as well as a minimums (to stop people from “topping off”).

Banning driving based on license plates is a very unlikely strategy in Washington State. Enforcement of such a ban would be nearly impossible in the near-term as it would further stretch the region’s already thinly stretched law enforcement capacity. A fairness issue may arise as well, as households that own fewer vehicles may feel they are being unduly burdened by a driving ban based on license plates. A further drawback is that such a scheme may lose its effectiveness if it encourages people to purchase more vehicles so they will have more driving opportunities, or simply obtain (illegally or otherwise) an extra license plate.

Several pre-planning activities that could be undertaken include:

- Determine policy regarding if, when, and how driving bans might be implemented, and assess whether law enforcement has the capacity to enforce such a ban.

- Identify, evaluate, and plan how to implement less restrictive rationing measures to use in severe emergencies (such as limits on fuel purchases that establish both maximums and minimums, to prevent unnecessary “topping off”).

## Public Transit Service Improvements

Using public transit is generally more fuel efficient than driving alone. As shown in Table 8 a full bus requires less energy per passenger mile (750 Btu) than a full automobile (1,125 Btu). This difference in energy savings is even more apparent when a bus is compared to a car with only one person in it (single occupancy vehicle or SOV). A full bus, with an energy expenditure of 750 Btu per passenger mile uses 87 percent less energy per person than an SOV at 5,623 Btu per passenger mile. Even if the bus has only ten passengers, the energy expenditure at approximately 3,749 Btu per passenger mile is a third less than that for an SOV. According to a study by the American Public Transportation Association (APTA), current public transportation usage in the U.S. reduces the consumption of gasoline by 1.4 billion gallons each year.<sup>114</sup>

**Table 8 - Comparison of Energy Per Passenger Mile for Full Vehicles**

Vehicle	Load Factor Assumed (Persons/Vehicle)	Btu Per Vehicle Mile	Btu per Passenger Mile
Automobiles	5	5,623	1,125
Personal Trucks	5	6,978	1,396
Motorcycles	2	2,502	1,251
Vanpool	15	8,568	571
Transit Buses	50	37,492	750
Light and Heavy Rail	110	72,287	657

Adapted from Table 2.11- Passenger Travel and Energy Use 2002, from *Transportation Energy Data Book*, Edition 24, 2004, Oak Ridge National Laboratory. Table uses Btu for less than full vehicles, so Btu per vehicle mile may be somewhat higher for full vehicles.

It stands to reason, then, that increasing transit ridership to respond to fuel supply disruptions can be a promising way to decrease fuel consumption. However, as described below, it is difficult to quickly increase transit service, which limits the degree to which transit service can play a major role in quickly responding to an energy shortage.

### *Free Public Transit*

*Saving Oil in a Hurry* identified free or reduced fare public transit as one way to increase transit ridership to reduce fuel consumption. That study included an estimate of potential fuel savings due to a reduction in transit fares of 50 or 100 percent. For the U.S. and Canada, total fuel saved was estimated at 0.3 percent for a 50 percent reduction in transit fares, and 0.6 percent for a 100 percent reduction in transit fares.

According to King County Metro, the largest transit agency serving the Puget Sound region, free or reduced fares could likely be implemented for a very short time period only. For the year 2005, total farebox revenues totaled almost \$73 million, and King County Metro recovered about 19 percent of its operating cost from transit fares.<sup>115</sup> Given higher fuel costs that could be expected to occur with a fuel shortage, King County Metro would likely already be struggling to meet its budget without further cuts in its revenue due to a reduction in transit fare revenue.

King County Metro currently receives most of its revenue through a local sales tax. It is possible that this tax or another revenue source could be increased to fund a reduction in transit fares, but this might require a public vote. In addition, King County Metro could very well decide that there would be better uses for a funding increase than using it to decrease fares.

### *Pre-Planning to Offer Free or Reduced Fare Transit Service*

Following are a few planning activities a transit agency can take to prepare for a reduction or elimination of transit fares to respond to a fuel shortage:

- Determine policy regarding reducing/eliminating fares in response to an emergency.
- Determine financial capacity to reduce fares.
- Determine strategies to consider to quickly increase revenues to respond to either a reduction in fare revenues, or a rapid increase in fuel costs.

### *Making Better Use of Existing Transit Service*

In a fuel shortage situation, some transit routes and park-and-ride lots could quickly become overcrowded. Should this occur, King County Metro could make better use of existing transit service to increase ridership and reduce the area's fuel consumption.

Following are a few strategies to make better use of existing transit service:

- If buses are experiencing crowding during the peak period, promote use of buses during shoulders of the peak. Employers should also be encouraged to allow employees to work flexible hours (e.g., 7:00 am to 3:00 pm; 10:00 am to 6:00 pm, etc.).
- Restructure existing routes to increase overall ridership (takes about three to six months).
- Consider supplementary parking, possibly combined with shuttles, at park-and-ride lots that are operating at or over capacity.

Changes in transit service would likely be made in response to specific changes brought about by a fuel shortage. For example, if a particular park-and-ride lot becomes overly crowded with many people parking illegally or in undesirable locations, a transit agency may be able to fairly quickly consider options to either restructure service to a park-and-ride lot with more capacity or find temporary parking elsewhere.

### *Pre-Planning to Quickly Make Better Use of Existing Transit Service*

Following are recommended pre-planning actions to quickly make use of existing transit service:

- Transit agencies should assess where additional emergency or supplementary parking could be made available (such as using existing parking capacity at public libraries, schools, churches, shopping centers, etc.).
- Because it can take months to set up park-and-ride lot agreements (with churches, etc.) a transit agency should have some emergency park-and-ride lot agreements in place near park-and-ride lots that are at or approaching capacity.

### *Increase Transit Service*

*Saving Oil in a Hurry* identified an increase in public transit service as one way to increase transit ridership to reduce fuel consumption. The *Saving Oil in a Hurry* study evaluated two scenarios. The first assumed that off-peak and weekend service was increased by 40 percent to equal peak service. For the second scenario, it assumed the same increase in off-peak service but also an increase in peak service of ten percent. The total fuel savings was estimated at 0.2 percent for an increase in off-peak transit service, and 0.3 percent for an increase in both off-peak and peak transit service in the U.S. and Canada.

In practice, due to limitations regarding availability of buses and bus operators, transit agencies are limited in how much service they can add in the short-term. King County Metro, which is the largest transit agency serving the Puget Sound region with a fleet of approximately 1,300 vehicles, has few spare drivers and buses and a very constrained budget. According to King County Metro, although they have an adequate “spare ratio” of buses so that coaches can be taken out of service for regular or unexpected maintenance without affecting transit service, they have virtually no ability to increase transit service during peak hours.<sup>116</sup>

In general, transit agencies do not have a lot of spare buses because these buses are expensive and would need to be maintained. In addition, federal regulations limit the number of spare buses a transit agency can keep in its fleet.

According to King County Metro, there is some capacity in the off-peak if they can quickly shift operators’ hours around. Under normal circumstances it would take about six months to increase off-peak service, but during an emergency it might take about three months.<sup>117</sup> However, quickly expanding bus service at peak hours is difficult as it would require the purchase of new buses.

### ***Purchasing New Buses***

The procurement of new buses can take two years or more. King County Council must first approve a budget for them. Typically buses are paid using both local and federal money, with the federal share at King County ranging from 50 to 80 percent. This means the transit agency also has to apply for federal grants to pay for these buses.

Once the transit agency has funding to buy new buses and they have determined the options and other specifications, it takes about six months to select the builder and an additional 12 months until the bus is delivered, depending on the bus manufacturer's backlog. There are very few transit bus manufacturers in the U.S. and Canada. According to King County Metro, in an average year all the manufacturers together build 3,500 to 4,000 buses for all of the U.S. and Canada.

Transit agencies that are using federal funds to pay for new buses are subject to "Buy America" regulations. According to King County Metro, this regulation requires that final assembly occur in the U.S., and that 60 percent of the value of components have to originate in the U.S. In a protracted nationwide fuel shortage, bus manufacturers could quickly develop a large backlog.

King County Metro indicated that during the oil shocks of the 1970s they were "scrounging" for buses.<sup>118</sup> They managed to quickly lease or buy a few buses but the quality was less than desired. In 1974 they bought 30 buses from New Jersey that were built in 1954. According to King County Metro, they drove these buses across the country, but experienced bus breakdowns in many states. Their shop people were appalled at the condition of the buses, which had to be rebuilt. The number of transit buses available for lease is very small, and if there was a nationwide oil shock numerous agencies would quickly be competing for the same buses.

If King County wanted to widely expand transit service, it would likely take two years or more to put in place all the elements of the system, including purchasing buses, hiring drivers, and building or leasing bus maintenance and layover areas.

### ***Pre-Planning to Quickly Increase Existing Transit Service***

Following are some strategies that government agencies may want to undertake before a fuel supply emergency:

- Determine the transit agency's current capacity to increase service during the peak or off-peak.
- Determine the degree to which drivers' hours could be increased, planned vacations postponed, or retired drivers re-hired in an emergency.
- Determine how quickly this service could be increased, and any impediments.
- Develop a plan for quickly increasing service.
- Explore options for how an increase in service could be funded.

### ***Expanding Transit Service By Using External Vehicles and Drivers***

As described previously, King County Metro can not easily or quickly expand bus service because of the scarcity of spare buses and drivers, and the length of time required to procure new buses. Funding is also a constraint. If funding were available, one option that could be considered is using vehicles, and possibly drivers, from other agencies or companies to provide supplementary transit service. For example, it may be possible to use school and charter buses, shuttles, and paratransit vehicles to quickly respond to a

fuel shortage. However, there are some serious constraints to using these vehicles and services.

### ***Constraints on the Use of External Providers***

Several issues affect the degree to which external buses and/or drivers could be used to expand King County Metro's transit operations. These relate to union issues, and school bus and paratransit vehicle constraints.

***Union Issues:*** In Washington State, bus operators working for King County Metro Transit are required to join the local transit union. The union agreement guides driver pay, schedules, and so forth. If a large number of new drivers were brought on board to drive King County Metro routes, these new drivers would be subject to joining the union, and be hired and paid according to the union contract. It is unclear whether King County Metro could hire another transportation provider (such as Laidlaw) to run King County Metro bus routes. These bus operators could possibly also be subject to union pay scales and schedules.

In either case, quickly increasing bus service would require writing new bus schedules, which would require a "shake-up," which is a process that typically occurs three times a year. During a shake up, every route and schedule is reassigned to drivers based strictly on seniority. According to King County Metro, if the transit agency quickly increased service, it would require a shake-up of the entire schedule. In a serious emergency, it is reasonable to expect that the union would try to be as flexible as possible. But if the emergency extended for a lengthy period time, the union may have less flexibility.

***School and Charter Buses:*** During the school year, most school buses are busy transporting students nearly the entire day. Some school districts stagger their school hours so drivers can transport as many students using the fewest number of buses and drivers. For example, the high school runs from 7:30 am to 2:00 pm, middle school runs from 8:00 am to 2:30 pm, and elementary school runs from 9:00 am to 3:30 pm. Therefore, although there might be the possibility of some buses and drivers being available in the late afternoon and early evening, for the most part there would be little opportunity to make use of school buses during the day during the school year. There may be more flexibility in the summer, although some of these buses are used to transport students to camps and other activities.

Some transportation providers, such as Laidlaw, also operate charter buses. According to Laidlaw, the company has about 100 buses in Tacoma, Washington that are dedicated to charter work. In an emergency, about 80 percent of these would likely be available immediately. They also typically have extra drivers available, should an emergency arise.

However, if King County Metro were to contract with a school bus transportation service provider or charter bus operator, such as Laidlaw, it may violate the contract with the union, which requires all bus drivers to be members of the local transit union.

***Paratransit Vehicles or Vans:*** King County’s paratransit network is paid for and dispatched separately from regular bus routes. The paratransit network could theoretically be brought on-line to provide some additional seats on transit routes. However, if this action requires taking away service from disabled or transit-dependent passengers, there could be a number of environmental justice issues to contend with. If other paratransit-type vehicles, shuttles, or vans were available, it may be possible to lease them. Some of these would be small enough such that they do not require licensed bus drivers, although they would still require some driver training. According to the WSDOT Office of Transit Mobility, a couple of major yards in this region have excess paratransit vehicle fleets that could possibly be leased.

### ***New Transit Service***

In Washington State, public transit services are only authorized by the state legislature. However, an individual company or organization, or a group of companies through a Transportation Management Association (TMA), could create a custom bus route for its employees or members that would not be subject to union regulations. For example, Microsoft Corporation can operate a custom bus route for its own employees. However, if it were to open up this bus route to the general public, this action would violate the constitution of Washington State, which requires that any public transit services must be regulated.<sup>119</sup> Setting up a new regulated transit service would not be a realistic way to quickly respond to a fuel supply emergency.

### ***Pre-Planning for Expanding Transit Service By Using External Vehicles and Drivers***

Following are a few actions transit agencies should undertake before an emergency occurs.

- Review the legality of emergency public transit services, and identify any legislation that might enable this type of service to be implemented more quickly.
- Explore transit agency union issues that could constrain the ability of an agency to quickly expand transit service.
- Inventory vehicles (buses, paratransit vehicles, shuttles, and vans) and drivers that could be available on short notice.
- Explore the feasibility of setting up agreements in advance with charter bus and school bus companies to make use of their vehicles and drivers in an emergency.

### ***Potential Fuel Supply Issues for Transit Agencies During a Fuel Emergency***

During a fuel supply disruption, transit agencies will likely face their own fuel shortage. King County Metro has a fuel supply of about two to three days for its fleet of 1,300 buses,<sup>120</sup> and so is heavily reliant upon just-in-time delivery. Lack of fuel could provide an additional constraint on the ability of transit providers to increase either peak or off-peak service during an emergency.

Transit agencies should coordinate closely with the state's Energy Policy Division to secure fuel. However, in an extreme shortage, such as that experienced in North Carolina following Hurricane Katrina, the state's Energy Policy Division may be unable to quickly find fuel for all who need it. King County may find it helpful to follow their Fuel Conservation Policy (shown in Appendix 3) to conserve fuel and monitor supplies.

### *Implementation Timeframe for Public Transit Service Improvements*

The timeframe required to implement public transit service improvements varies widely. Transit fares could be reduced or eliminated very quickly, say within a week or two, but only for a very short period of time due to budget constraints. Off-peak transit service could most likely be increased within several months, depending on the nature of the emergency. Fixed route bus schedules could be modified to increase ridership within about three to six months. Widely expanding transit service, however, would take much longer. Due to the time needed to purchase buses, and either build or lease bus maintenance and layover facilities, it would likely take two years or more to widely expand transit service.

### **Public Information Campaign**

In the event of a fuel supply emergency, a coherent public information campaign would be critical. There could be a great deal of information and misinformation, which could lead to confusion and potentially alarm the public unnecessarily. One challenge is to share information about the shortage without creating a panic that leads to hoarding. Based on evidence from fuel shortages in the U.K. and North Carolina, this is more easily said than done.

In the Puget Sound region, communication about the nature of the energy emergency and expected duration would be initiated from the Governor and/or the state energy office. According to the *Washington State Energy Assurance and Emergency Preparedness Plan*, the state's Energy Policy Division would begin monitoring the situation, and brief the Office of the Governor as needed.

### *Information Sharing by the Governor*

If warranted, the Governor could hold a press conference or distribute a press release to provide information on the nature, severity, and expected duration of the emergency. She could also provide information on actions that are being taken to address the situation. The Governor would also likely suggest ways that the public can help conserve fuel. For example, here are a few possible actions the Governor could encourage:

- Avoid topping off the tank or filling it up before necessary so the demand for gasoline doesn't spike unnecessarily, and to help reduce lines at fueling stations.
- Drive no faster than 55 mph.
- Follow "ecodriving" strategies, such as keeping tires properly inflated, maintaining a steady speed, shifting up as soon as possible, switching off the engine at short stops, avoiding reductions in vehicle aerodynamics from items attached to the exterior of the car (e.g., roof boxes).<sup>121</sup>

- Take the bus, carpool, or vanpool when possible.
- Encourage employees to work a compressed work week, flexible hours, or telecommute as much as possible.
- Combine shopping trips or errands (i.e., trip chaining).
- Conduct meetings over the phone or via web-conferencing.

In addition, if the Governor is made aware in advance of some specific issues that could arise, she could mention those as well. Here are two examples:

1. The Governor could indicate that because transit agencies have very limited capabilities for quickly increasing transit service, some buses may experience overcrowding. Along with this warning, the Governor could again recommend that employers allow employees to work flexible hours so their employees can catch buses during the less crowded times of the day.
2. If there is a concern that some local agencies' first responders (fire, police, ambulance) may also experience fuel shortages, the Governor could indicate that she may ask oil companies to reserve some fuel for first responders only, and request that the public understand why some gas stations may limit the amount of fuel they can purchase. She could explain that in a severe emergency the state could require oil companies to allocate fuel for emergency service providers and others, but that a voluntary program would be the first and preferred strategy.

Finally, the Governor should direct the public to additional information (such as carpool ridematching services and transit schedules) to help them conserve fuel.

### *Coordinated Public Information Campaigns on Mobility Options*

Along with the initial coordination with the Governor's office, the Energy Policy Division would initiate communication with a number of agencies around the state and region to help assess agencies' current fuel supply situation and to coordinate actions. One of these conversations should focus on coordinating a public information campaign that focuses on mobility options to reduce fuel consumption. The Division recognizes the critical role of local agencies and individuals in it's plan, which states that, "...most actions that will help the state weather an energy emergency must be taken by individual agencies, businesses, and citizens."<sup>122</sup>

Local agencies that provide transit services, coordinate ridematching, and promote and facilitate alternative work arrangements, are likely the best agencies to provide more specific information on how travelers can conserve fuel. Following are some of the agencies that would most likely be involved in providing public information in the Puget Sound region:

- Office of the Governor,
- Washington State CTED Energy Policy Division,
- Washington State Department of Transportation,
- Transit agencies: King County Metro, Sound Transit, Pierce Transit, Community Transit, Everett Transit, Kitsap Transit,

- Transportation Management Associations (TMAs): TransManage, Greater Redmond TMA, Duwamish TMA, Urban Mobility Group, and
- Superintendent of Public Schools.

The transportation agencies, in coordination with the Governor and Energy Policy Division, would likely work together to develop joint or individual information campaigns that would provide the public with information on resources available to help them get around using less fuel, as well as providing tips on conserving fuel. This information campaign could quickly provide information about existing websites and other information sources, and the campaign would likely be delivered through the media, public service announcements, and possibly a new website or phone hotline.

### *Pre-Planning for a Public Information Campaign*

Following are several pre-planning activities that agencies should undertake in order to be better prepared to promote a reduction in fuel consumption:

- Develop a plan for how a regional public information campaign would be coordinated and kept consistent during a fuel supply or price emergency.
- Identify which fuel saving measures should be promoted through an information campaign (e.g., “eco-driving,” voluntarily reducing speeds, ridesharing, using transit, trip chaining, working a compressed work week, telecommuting, or using on-line commerce).
- Develop a list of available resources (e.g., existing informational websites, ridematching systems, etc.) that could quickly be shared with the traveling public.
- Consider whether a public information campaign should highlight:
  1. How people can change behavior for their own best interest (e.g., cost savings)
  2. Making changes for the greater good, that “we’re all in this together,” or
  3. Some of each.

### *Implementation Timeframe*

A public information campaign would likely occur in several forms and could begin as soon as a fuel supply disruption occurs, or when the State becomes aware of a coming fuel supply disruption.

## **Increased Carpooling and Vanpooling**

While transit agencies are limited in their ability to quickly increase service and add seats, plenty of extra seats are readily available in most cars and vans. In the three-county Puget Sound region (King, Snohomish, and Pierce Counties), of about 1.5 million commuters, about 72 percent drove alone and about 12 percent carpoled to work in the year 2000.<sup>123</sup> This equates to about 1,090,000 vehicles occupied by only the driver, and an additional 70,000 vehicles occupied by the driver plus usually one or two passengers.<sup>124</sup> Together, nearly all of these 1,160,000 vehicles have one to several seats available for additional commuters, and without any additional public expenditure.

Therefore, it is not surprising that *Saving Oil in a Hurry* identified an increase in carpooling and vanpooling as an important way to reduce fuel consumption quickly in the event of a fuel supply disruption. The IEA study developed a range of estimates of the impact of carpooling on fuel consumption. The upper bound estimate assumed that every urban area car trip had one additional person who previously drove alone. The low estimate was based on a policy to provide information and link ride sharers. In between were several additional estimates. For example, another low end estimate was based on the impact of the addition of carpool lanes on vehicle miles traveled (although not under emergency conditions). Table 9 below shows the results of their analysis for regions in the U.S. and Canada.

**Table 9 – *Saving Oil in a Hurry* Percent Total Petroleum Saved in a U.S. or Canadian Region by an Increase in Carpooling**

<b>Scenario</b>	<b>Petroleum Saved</b>
Adding one person to every car trip	21.5 percent
Adding one person to every commute trip	10.4 percent
Adding one person to every motorway (highway/freeway) trip	5.2 percent
Reducing motorway (highway/freeway) vehicle miles traveled by ten percent	1.3 percent
Comprehensive policy to quickly invoke large network of carpool lanes, preferential parking, and information systems	5.2 percent
Policy to provide information and link ride sharers	0.7 percent

One important caveat is that although increasing carpooling has considerable potential to reduce a region's fuel consumption, experience during previous fuel shortages in the U.S., as described previously, indicates that historically ridesharing has not been an option frequently chosen to conserve fuel. For example, although during the 1979 fuel shortage a survey taken in New York State indicated that about 14 percent of household heads increased their carpooling to work,<sup>125</sup> carpooling was generally not an option taken in response to shortages. During the 1973 embargo, the number of commuters engaged in carpooling increased by less than four percent, and only one percent of commuters shifted from driving alone to carpooling. However, as described previously in this report and displayed in Figure 10, the number of registrants in the Puget Sound region's ridematching system increased by about 50 percent following Hurricane Katrina. In addition, since the 1970s and 80s we have become more sophisticated in our ability to promote and facilitate car and vanpooling. Given that we have better tools to match riders and mechanisms to provide benefits to ridesharers, in a fuel supply emergency carpooling may be one of the most viable means to maintain mobility while conserving fuel.

### *Existing Ridesharing Programs in the Region*

Over the past 25 years, local, state and regional officials throughout the Puget Sound region have adopted and endorsed policies and programs that advance carpooling and vanpooling.<sup>126</sup> This region has shown a basic commitment to demand management

strategies by investing in an extensive network of freeway HOV lanes, as well as ridesharing and commute trip reduction policies and programs.

Following are a few of the existing ridesharing programs, facilities, and supportive policies:

- Regional ridematching system: <http://www.rideshareonline.com>.
- Extensive HOV lane network on area freeways and some arterials.
- Passage in 1991 of the state Commute Trip Reduction (CTR) law that requires major employers to provide employee transportation programs that encourage more employees to not drive alone to work every day.<sup>127</sup>
- Hundreds of employers have employee transportation coordinators (ETCs) who coordinate with local agencies and help other employees at their own worksites to find transit, carpooling or vanpooling options.<sup>128</sup>
- In 2005, approximately 1,300 vans were owned and maintained by transit agencies for the purpose of vanpooling.<sup>129</sup>
- King County Metro and other transit agencies employ a number of employer transportation representatives and rideshare specialists, and each jurisdiction in King County has an appointed CTR representative.<sup>130</sup>
- Other employer assistance programs and organizations throughout the region, including several Transportation Management Associations (TMAs).

### *Strategies to Increase Carpooling and Vanpooling*

While the Puget Sound region is well positioned to help commuters form carpools and vanpools, in an emergency some of the following additional measures could be taken to facilitate additional ridesharing:

#### ***Instant Carpooling or “Slugging”***

Slugging is a term used to describe a system of commuting in the Washington, DC area and elsewhere in which people commuting into the city stop to pick up other passengers who are usually unknown to them. In the Washington, D.C. area, slugging has an informal set of rules, proper etiquette, and specific pickup and drop-off locations, and the system works well in the Washington D.C. area because some HOV lanes there require three or more passengers. According to the website <http://www.slug-lines.com>, a car needing additional passengers to meet the required HOV lane requirement pulls up to one of the known slug lines. The driver either displays a sign with the specific destination or simply lowers the passenger window to call out the destination, such as “Pentagon.” The slugs first in line for that particular destination get into that car. No money is exchanged because the car driver needs riders just as much as the slugs need a ride.

Slugging typically is not sponsored or sanctioned by government agencies. Northern Virginia transportation officials, for example, do not sanction slugging because of potential liability issues.<sup>131</sup> According to an article in the June 24, 2002 *Potomac News* (“VDOT Steers Clear of Slugging”), the Virginia DOT does not ordinarily mark slug lines specifically, but creates “rideshare” waiting areas for bus riders that also end up being used for slug traffic.

In a major fuel crisis, buses may quickly fill up beyond capacity and carpooling may then be the best option for mobility. Although government agencies may not want to actually organize slugging at park-and-ride lots or elsewhere due to liability and other issues, they may want to designate safe locations for ridesharers to wait at park-and-ride lots.

It should be pointed out that if slugging starts to occur to any great extent in the Puget Sound region, park-and-ride lots that are already operating near capacity may rapidly exceed capacity. Park-and-ride lot operators may want to plan in advance where they may locate emergency supplementary parking. Agencies may also want to identify and promote less utilized park-and-ride lots for carpoolers. However, some travelers prefer having the option of taking the bus home, so many carpoolers may opt to rideshare from their usual bus route stop.

### ***Encourage People to Form Own Vanpools***

In a serious energy crisis, transit agencies may run short on vans for new vanpools. However, many residents in the area have their own vans. The Washington State Ridesharing Organization has produced a guide on creating your own vanpool. This guide is available online at <http://www.wsdot.wa.gov/Mobility/TDM/DoVanpool/diyvg.html>. In some circumstances, vanpool drivers could even consider charging riders for the service beyond that required to recoup costs.

### ***Expand Promotion of Ridesharing***

Through the region's employee transportation coordinators and TMAs employers could be encouraged to provide additional, possibly temporary, benefits for carpoolers and vanpoolers. This could include additional preferential parking spaces for carpoolers and vanpoolers, and more flexibility with work hours. The employee transportation coordinators should promote the benefits of ridesharing, such as decreased fuel costs, a faster commute, better parking space locations, and a good feeling of "doing your part" to address our energy challenges.

### ***Promote Emergency Carpooling Within Organizations and Provide Guidance on a Simple In-house Ridematching System***

Larger employers, such as hospitals, schools, and larger companies, could be encouraged to organize emergency carpools within the organization. Employers likely have a database or spreadsheet of employees with their addresses. If not, for most employers one could be created fairly easily. An in-house ridematching system could be as simple as sorting a spreadsheet of employees by zip code and sharing that information with employees so they can contact others within the organization for possible rideshare partners.

### ***Encourage the Use of Parking Pricing to Promote Ridesharing***

Many employers and parking facilities in the Puget Sound region discount the cost of parking for ridesharers and/or designate the premier parking spaces (i.e., those closest to the building) as carpool or vanpool spaces. A public information campaign via the media, through TMAs, or the network of employee transportation coordinators should further encourage employers and parking lot operators to consider changing parking pricing to promote ridesharing, either by increasing parking costs for single-occupancy vehicles (SOVs), decreasing costs for carpools and vanpools, or both. In addition, this public information campaign could also encourage employers or parking lot operators to increase the number of HOV parking spaces in optimal locations to help address the fuel shortage situation.

### ***Change Ridesharing Requirements on Some Facilities***

In some circumstances, it may be necessary to take more drastic actions to increase ridesharing. For instance, New York City required ridesharing on some roads to cope with a four-day transit strike during December 20-23, 2005. Because New York City, unlike most cities in the U.S., depends very heavily on public transportation, the transit strike had the potential to cripple the City. One strategy the City implemented to reduce demand on major roads was requiring cars traveling into Manhattan during morning hours at certain locations to carry four or more people.<sup>132</sup> Although this ridesharing requirement had great potential to increase carpooling, according to John Galgano at CommuterLink, a non-profit commuter organization in New York City, because the strike was so short and occurred near the Holidays, the actual impact was negligible since many people chose to take vacation days.

In the Puget Sound region it might be possible to change ridesharing requirements on some facilities in an emergency. This could include increasing the HOV lane occupancy requirements for existing HOV lanes (i.e., change the HOV lane requirement from two or more occupants in a vehicle to three or more occupants), or adding new temporary HOV lanes on freeways or arterials. Both of these have potential drawbacks and constraints. For example, it takes time to fabricate and install temporary signs, as well as stripe the road. Perhaps more time-consuming would be the interagency negotiations needed to make such changes quickly. In addition, there is some danger in changing the designation or use of HOV lanes in an emergency since it could lead to a strong negative public outcry that could result in a turning of public opinion against HOV lanes once the emergency is over.

According to WSDOT, if travelers were to be strongly encouraged to utilize more shared ride modes, and the existing two-person carpool lanes became overcrowded, it would probably make more sense to simply change the occupancy requirements on existing HOV lanes.<sup>133</sup>

WSDOT points out that under a very serious fuel shortage, the overall congestion levels on the freeways should be greatly reduced as well, possibly to the point of not even

needing HOV lanes. If so, a better use for the HOV lanes might be for emergency services, or shipment of freight, food, or other vital supplies.<sup>134</sup>

That said, if the State were to convert an existing general purpose lane to an HOV lane, it would likely take at least two to four weeks for analysis, and assuming directives were coming from the Governor, WSDOT would not require additional time for agency or legislative consensus building. Once the roads to be converted are identified, the required actions would include restriping (and required traffic control), signage, and public information (which would occur simultaneous to striping and signage).

According to WSDOT it would likely take at least six months to convert general purpose lanes to HOV lanes on many of the major freeway and arterial facilities in the region. Many more months would be required if this conversion is applied to all major freeway and arterial facilities, and less time would be needed if only select facilities are included. Changing eligibility designations on existing HOV lanes would likely take at least a couple of months, depending on how many lane miles are altered.

### *Pre-Planning to Increase Carpooling and Vanpooling*

Following are several recommended pre-planning actions to increase carpooling and vanpooling.

#### ***Availability of Vans for Vanpooling***

During a fuel shortage scenario, transit agencies could run short of transit agency vans for vanpooling. People could volunteer to use their own vehicles, but agencies might want to look into ways residents could be encouraged to make their privately-owned vans available for usage in vanpooling.

#### ***Identify Supplementary Parking for Park-and-Ride Lots***

Agencies should identify emergency supplementary parking for park-and-ride lots, especially those already operating near capacity. This could include parking at public libraries, schools, churches, and shopping centers. It may be helpful to meet with the owners of these sites in advance of an emergency and have agreements in place. Transit agencies could also evaluate park-and-ride lots operating under capacity and plan how these could be more fully utilized in an emergency.

#### ***Identify Potential Rideshare Waiting Locations at Park-and-Ride Lots, Major Employment Centers, City and Town Centers, and Elsewhere***

In a major fuel crisis, buses may quickly fill up beyond capacity and carpooling may then be the best option for mobility. In advance of an emergency, government agencies should identify safe waiting locations for regular or casual carpoolers (“slugs”) at park-and-ride lots, major employment centers, and other frequent commute destinations such as city and town centers. Ideally these locations would also offer some protection from the weather.

### ***Develop Guidance for Larger Employers on Developing Their Own In-House Ridematching Tool***

Many in the region will be able to find carpooling partners through <http://www.rideshareonline.com>. Some employers, however, may want to further assist employees by enabling them to find potential ridematching partners within their own organization. Agencies could provide instructions on how employers can set up their own in-house ridematching system. This could be as simple as telling employers to sort all employees by zip code and address, and sharing that information with employees so they can contact potential ridesharing partners. Employers may want to give employees an “opt out” option if they do not want to be included in the information sharing. Some larger companies with Geographic Information Systems (GIS) software could map the home address of employees on a map that could then be used by employees to find co-workers who live near them.

### ***Develop Policies or Plans for Changes to HOV Lanes During an Emergency***

In a serious emergency, it may be necessary to take more drastic actions to conserve fuel by requiring ridesharing on some facilities, increasing ridesharing requirements on existing HOV lanes, or creating new freeway or arterial HOV lanes altogether. Changes to HOV lanes require considerable interagency coordination, as well as new striping, signing, public information, and enforcement. WSDOT should develop policies on the use of HOV lanes during emergencies, including potential changes to occupancy requirements. Having a policy in place would save time and negotiation during an emergency. This may be particularly true for new arterial HOV lanes, which require even more inter-agency coordination.

### ***Implementation Timeframe***

The Puget Sound region is well-positioned to help travelers in the region form carpools and vanpools. Although carpooling could be increased within days of an emergency, there could be some hurdles to overcome if park-and-ride lots fill, or if transit agencies run out of vans for vanpools. Making changes to HOV lanes is more time consuming. According to WSDOT, changing the occupancy requirement of existing HOV lanes would likely take several months, and converting general purpose lanes on major arterials and freeways to HOV lanes would take six months or more, depending on the number of facilities included.

### **Promoting Changes to Non-Work Trips**

Although affecting non-work trips can encompass many of the preceding strategies (increasing transit usage, carpooling, and vanpooling; public information campaign; reducing speed limits), it is important to call out the importance of non-work trips for potential fuel savings. Table 10 below shows the primary purpose of trips made by residents in the Puget Sound region based on a survey of over 12,000 residents. “Go Home” trips, at 31 percent, represents the most frequently indicated primary activity, and includes trips home from work, school, shopping, etc. If “Go Home” trips are excluded,

as shown in the third column of Table 10, work or work-related trips represent only about 21 percent of trips. The greatest primary activity indicated is shopping, personal business, or medical-related trips, which represent about 36 percent of trips.

As described previously in this report, during previous fuel crises people were much more willing to change their travel behavior for non-work trips than for work-trips. For example:

- Data from Baltimore’s Regional Planning Council and the Maryland DOT indicated that off-peak auto travel decreased much more than peak travel during the first three months of 1974, suggesting that discretionary trips (social, recreational, shopping, etc.) were cut back much more than work trips.<sup>135</sup>
- The journey to work trip was the least flexible in responding to periods of gasoline shortage and price increases. Alterations in shopping trips were typically made long before carpooling or modal changes in the work trip were made.
- In Dutch Fork, South Carolina, a suburb west of Greenville, auto travel by residents was estimated to be reduced by ten to 15 percent. Traffic volumes decreased primarily on weekends, with less decline on weekdays. At the height of the crisis weekend traffic was down by 25 percent.<sup>136</sup>
- Linking of non-work trips, particularly shopping trips, was common.
- Much of the reduction in car trips was a net loss of travel; very little of this reduction represented shifts of commuters from driving alone to carpooling, transit, or walking.

This reduction in non-work or discretionary trips has also occurred in response to roadway closures. For example, in Seattle one of the most heavily used freeway segments is I-5 at the Ship Canal Bridge. This facility required resurfacing in 1985, which involved closing two lanes at a time for an entire summer. According to transportation researchers who evaluated the traffic impact on this facility and parallel facilities, although there was an increase in ridesharing during the pavement rehabilitation project, it was modest compared to the decrease in total throughput that occurred.<sup>137</sup> Researchers concluded that some discretionary travel across the ship canal disappeared or traveled elsewhere. Another study evaluated the impact of reducing road space for single-occupancy vehicles for over 70 case studies in eleven countries. This study found that “predictions of traffic problems are often unnecessarily alarmist, and that, given appropriate local circumstances, significant reductions in overall traffic levels can occur, with people making a far wider range of behavioral responses than has traditionally been assumed.”<sup>138</sup>

**Table 10 - Primary Activity for Trips in Puget Sound Region<sup>139</sup>**

<b>Primary Activity</b>	<b>Percent of All Trips</b>	<b>Percent of Trips Excluding “Go Home”</b>
Go Home	31%	N/A
Shopping or Personal Business, Medical	25%	36%
Go to Work, or Work-Related	15%	21%
Social, Recreational, Eating Out	15%	21%
Picking Up / Dropping Off	8%	12%
To Primary or Secondary School	2%	3%
Other	4%	6%

Puget Sound travel trends are similar to national trends. The *Bureau of Transportation Statistical Pocket Guide to Transportation*, 2006 edition, shows travel behavior by trip purpose for the U.S. as a whole. As shown in Table 11 below, only 15 percent of trips are work/commute trips, and an additional three percent are work-related.<sup>f</sup> This means that the remaining 82 percent of trips are taken for other purposes. The most common trip purpose, at 23 percent of trips, falls into the family/personal business category. This includes medical appointments, banking, haircuts, and so forth. Social/recreational trips, which represent 19 percent of trips, include vacations, pleasure driving, and other trips for entertainment or recreation.

**Table 11 - United States Trips by Trip Purpose, 2001<sup>140</sup>**

<b>Trip purpose</b>	<b>Percent Trips</b>
Family/personal business	23
Social/recreational	19
Shopping	19
Work (commute)	15
School/place of worship	10
Visit friend/relative	8
Work-related	3
Other	3

Many agencies across the U.S. and elsewhere are implementing programs to address these non-work related trips. For example:

- Portland, Oregon’s “Drive Less, Save More” campaign aims to reduce single-person car trips as part of a larger solution to regional traffic congestion.<sup>141</sup> This program provides details on trip options, such as tips on how to chain trips (combine several errands into one trip) to save time and money.<sup>142</sup>

<sup>f</sup> Note that these numbers are for work-related trips (although not exclusively *vehicle* trips). As described previously, work-related *vehicle* trips represented about 22 percent of all vehicle trips in 2001.

- Seattle’s “Way to Go” campaign represents the City of Seattle's umbrella for a variety of initiatives intended to improve livability by reducing automobile usage for non-work trips, and increasing the use of transit, biking, walking, trip consolidation and carpooling instead.<sup>143</sup>
- King County Washington’s “In Motion” program is a partnership with local communities to encourage residents to use healthier travel options such as the bus, carpooling, bicycling and walking.<sup>144</sup>
- PCC Natural Markets in the Seattle area sponsored a “Take the Metro Challenge” event which encouraged shoppers to bus, bike, walk, or carpool to their store by giving them ten free bus tickets and a PCC gift card at the end of the challenge.<sup>145</sup>
- In California, Kern Council of Government’s campaign “Connect the Dots” was developed to help and encourage travelers to plan errands and combine trips into one excursion.<sup>146</sup>
- The Midway Transportation Management Organization’s “Midway in Motion” program in St. Paul, Minnesota asked people to pledge to replace at least one car trip each week with a biking, walking, or transit trip.<sup>147</sup>
- Vancouver, British Columbia’s “Going Active” program encourages cycling and walking to community destinations.<sup>148</sup>
- TravelSmart Programs in many areas, including Western Australia, aim to accommodate growth in ways that are environmentally, socially, and economically acceptable to the next generation.<sup>149</sup>

Unlike the 1970s and early 1980s, today we also have many more opportunities for online commerce. Groceries, medications, and nearly any consumer product can be purchased online and delivered. However, much of our online shopping is relatively new and the degree to which people will switch to on-line shopping to respond to a fuel shortage is unknown. Because shipping costs can be high, consumers would have to weigh shipping charges against potential fuel savings. It is also unknown how retailers will cope with increasing fuel costs in such a situation, and whether fuel surcharges for deliveries may discourage online shopping.

### *Pre-Planning for Promoting Changes to Non-Work Trips*

Following are several recommended pre-planning actions to promote changes to non-work trips to quickly conserve fuel, either now or in the event of an energy emergency:

- Continue to promote the use of alternative modes (transit, walking, ridesharing, biking) for non-work trips.
- Begin or continue to promote trip chaining to reduce fuel consumption.
- Explore how on-line commerce can be promoted to quickly conserve fuel and assess potential fuel savings as well as potential barriers, such as delivery surcharges.

- Investigate how non-work trips can be made more practically using alternative modes (e.g., how ridesharing or bus use for shopping could be more easily facilitated).

### *Implementation Timeframe*

Changes to non-work trips (e.g., promotion of trip chaining and use of alternative modes for non-work trips) could begin immediately upon a fuel supply disruption.

### ***Summary of Findings of Puget Sound Region Case Study***

The Puget Sound region is fortunate to have many policies and programs in place to promote ridesharing, alternative work arrangements, and transit usage. Nevertheless, there are a number of potential barriers that might need to be overcome to quickly conserve fuel in the region. Table 12 lists the fuel saving strategies for the Puget Sound region that are most likely to be used, identifying an implementation timeframe, and indicating the strategies that would be most appropriate based on the expected length of a fuel supply disruption. Table 13 summarizes pre-planning actions that the region should undertake in order to better prepare for future fuel supply disruptions.

**Table 12 - Most Appropriate Strategies for the Puget Sound Region Based on Expected Length of Fuel Shortages**

Strategy	Time to Implement (in months)	Most Appropriate Strategies Based on Expected Length of Fuel Shortage			
		0 - 1 month	1 - 6 months	6 - 12 months	12+ months
Public information campaigns on fuel saving strategies	0 - 1	✓	✓	✓	✓
Increased carpooling/vanpooling	0 - 1	✓	✓	✓	✓
Alternative work arrangements	0 - 1	✓	✓	✓	✓
Changes to non-work trips	0 - 1	✓	✓	✓	✓
Free public transit	0 - 1	✓			
Increase off-peak bus service	3 - 6			✓	✓
Adjust existing transit routes	3 - 6			✓	✓
Driving ban based on license plates	3 - 7*			✓	✓
Speed limits reduced to 55 mph	3 - 6*			✓	✓
Expand vanpool/shuttle fleet	2 - 12			✓	✓
Increase HOV lane requirements (e.g., to HOV-3)	2 - 12				✓
Convert arterial lanes to HOV lanes	2 - 12				✓
Widely expand transit service	24 +				✓

\*limited capability to enforce

**Table 13 - Summary of Recommended Pre-Planning to Prepare for Fuel Supply Emergencies**

<b>Strategy</b>	<b>Recommended Pre-Planning</b>
<b>Alternative Work Arrangements</b>	<p><i>Telecommuting:</i></p> <ul style="list-style-type: none"> <li>• Promote the development of telework policies at the organization or office level.</li> <li>• Identify any local and regional labor and tax issues. For example, how does the state labor department classify injuries that occur during work hours but while telecommuting?</li> <li>• Provide employees with information on all the communications tools available to facilitate web conferencing and information sharing.</li> <li>• Develop teleworker agreements for all eligible employees.</li> <li>• Ensure that all eligible employees telecommute at least occasionally to ensure that the communications systems are operational.</li> </ul> <p><i>Compressed work week:</i></p> <ul style="list-style-type: none"> <li>• Develop policies regarding employee eligibility for working a compressed work week.</li> </ul> <p><i>Flexible work hours:</i></p> <ul style="list-style-type: none"> <li>• Promote the establishment of Flex Time policy and worker agreements, which may include a requirement that all employees be in the office during set “core” hours (e.g., 10 am to 3 pm).</li> </ul>
<b>Reduced Speed Limits</b>	<ul style="list-style-type: none"> <li>• Evaluate the legality of changing speed limits (who has authority, etc.).</li> <li>• If appropriate, change legislation to more easily allow for changes to the speed limit to reduce fuel consumption.</li> <li>• Evaluate enforcement constraints to quickly reducing speed limits.</li> <li>• Evaluate the feasibility (cost, etc.) and institutional authority of using variable speed limit signs.</li> </ul>
<b>Driving Ban Based on License Plates</b>	<ul style="list-style-type: none"> <li>• Determine policy regarding if, when, and how driving bans might be implemented, and whether law enforcement has the capacity to enforce such a ban.</li> <li>• Identify, evaluate, and plan how to implement less restrictive rationing measures to use in severe emergencies (such as limits on fuel purchases that establish both maximums and minimums, to prevent unnecessary “topping off”).</li> </ul>
<b>Public Transit Service Improvements</b>	<p><i>Free Public Transit</i></p> <ul style="list-style-type: none"> <li>• Determine policy regarding reducing/eliminating fares in response to an emergency.</li> <li>• Determine financial capacity to reduce fares and strategies to consider to quickly increase revenues if needed (e.g. in case of rapid increases in fuel costs).</li> </ul> <p><i>Making Better Use of Existing Transit Service, Increase Existing Service</i></p> <ul style="list-style-type: none"> <li>• Assess where other emergency or supplementary parking could be made available for park-and-ride use (such as at public libraries, schools, churches, shopping centers, etc.).</li> <li>• Develop emergency park-and-ride lot agreements near park-and-ride lots that are at or approaching capacity so agreements are in place when an emergency occurs.</li> <li>• Determine the transit agency’s current capacity to increase service during the peak or off-peak.</li> <li>• Determine how quickly this service could be increased, any impediments, and a plan for implementation.</li> </ul>

<b>Strategy</b>	<b>Recommended Pre-Planning</b>
<b>Public Transit Service Improvements, Cont.</b>	<p data-bbox="548 233 1268 260"><i>Expanding Transit Service By Using External Vehicles and Drivers</i></p> <ul data-bbox="548 266 1463 506" style="list-style-type: none"> <li>• Review the legality of emergency public transit services, and identify any legislation that might enable this type of service to be implemented more quickly.</li> <li>• Explore transit agency union issues that will need to be considered in order to quickly expand transit service.</li> <li>• Inventory vehicles (buses, paratransit vehicles, shuttles, and vans) and drivers that could be available on short notice.</li> <li>• Explore the feasibility of setting up agreements in advance with charter bus and school bus companies to make use of their vehicles and drivers in an emergency.</li> </ul> <p data-bbox="548 541 850 569"><i>Potential Fuel Supply Issues</i></p> <ul data-bbox="548 575 1463 779" style="list-style-type: none"> <li>• Know how much fuel is needed each day, particularly for first responders and transit operations.</li> <li>• Purchase some fuel under firm contracts.</li> <li>• Develop policies and procedures at the local and regional level for allocating fuel in a fuel supply emergency.</li> <li>• Strive to become more self-sufficient regarding fuel over the long term (e.g., have multiple fuel supply sources, reduce fuel requirements).</li> </ul>
<b>Public Information Campaign</b>	<ul data-bbox="548 785 1463 1115" style="list-style-type: none"> <li>• Develop a detailed plan for how a regional public information campaign would be coordinated and kept consistent during a fuel supply emergency.</li> <li>• Identify which fuel saving measures should be most strongly promoted through an information campaign (e.g., “eco-driving,” voluntarily reducing speeds, ridesharing, using transit, trip chaining, working compressed work week or telecommuting, on-line commerce).</li> <li>• Develop a list of existing resources available (e.g., existing informational websites, ridematching systems, etc.) that could quickly be shared with the traveling public.</li> <li>• Determine whether a public information campaign should highlight how people can change behavior for their own best interest, or promote the idea of making changes for the greater good.</li> </ul>
<b>Increased Carpooling and Vanpooling</b>	<ul data-bbox="548 1121 1430 1331" style="list-style-type: none"> <li>• Identify supplementary parking for park-and-ride lots.</li> <li>• Identify rideshare waiting locations for regular and casual carpoolers (known as “slugs”) at park-and-ride lots and other locations.</li> <li>• Develop guidance for larger employers on developing their own, simple in-house ridematching tool.</li> <li>• Develop policies or plans for changes to and/or creation of HOV lanes during an emergency.</li> </ul>
<b>Promoting Changes to Non-Work Trips</b>	<ul data-bbox="548 1337 1398 1575" style="list-style-type: none"> <li>• Promote use of alternative modes (transit, walking, ridesharing, biking) for non-work trips.</li> <li>• Promote trip-chaining to reduce fuel consumption.</li> <li>• Assess potential fuel savings of on-line commerce.</li> <li>• Explore how on-line commerce can be promoted to quickly conserve fuel and potential barriers, such as increased delivery charges.</li> <li>• Investigate how non-work trips can be made more practically using alternative modes (i.e., shuttles or ridesharing for shopping).</li> </ul>

## 5. CASE STUDY FINDINGS APPLIED TO OTHER AREAS

The recommended pre-planning and implementation timeframe from the Puget Sound case study can not necessarily be assumed to apply in other regions of the country or the world. A full analysis of how implementation or pre-planning could differ in other areas of the world goes beyond the scope of this research effort. However, by examining a few ways in which implementation or planning could differ in Australia, Vermont, and rural Oregon, this report provides food for thought on implementation considerations in rural areas, small towns, and areas with different governing frameworks. Regions may want to consider conducting a more detailed analysis of potential pre-planning for their regions.

### *Less Populated Areas in the United States*

Feedback on how implementation could differ in less populated areas of the United States was obtained from Paige West at the Rogue Valley Transportation District (RVTD) in Oregon, Dan Moore at the Rogue Valley Council of Governments, Peter Keating at the Chittenden County (Vermont) Metropolitan Planning Organization (MPO), and Glenn Barry at the Johnson City (Tennessee) MPO.

### **Differences in Selection of a Coordinating Agency**

Feedback from transportation planners in less populated areas of the U.S. indicated that the most appropriate coordinating agency could differ from area to area.

For example, Rogue Valley, Oregon is a semi-rural region in southwest Oregon. The region extends for about 50 miles north-south along Interstate 5, and includes several small cities and towns including Ashland (pop. 20,800), Central Point, Eagle Point, Jacksonville, Medford (pop. 70,100), Phoenix, Talent, and White City. The total population in the region is about 154,000.<sup>150</sup> The population for the state of Oregon as a whole is about 3.64 million.

In Rogue Valley, the distribution of transportation funding occurs at the Rogue Valley Council of Governments, which is the MPO for the region. This is also where cities, counties, and the state can work together in a collaborative setting. Therefore, in this region it might make the most sense for the MPO to serve as the political body that coordinates action and re-directs funding to address fuel shortages. According to planners in this region, it might also be helpful to work through local chambers of commerce, which may be more active in smaller communities.<sup>151</sup> The chambers of commerce could also be helpful in getting information out to the public and businesses.

Feedback from Chittenden County, Vermont was a little different. The city of Burlington (pop. 40,000) is Vermont's largest city, and serves as the core of Chittenden County (pop. 140,000). The entire state's population is about 600,000, spread across about 9,250 square miles. (This can be compared to the City of Seattle, which has a similar population of about 573,000, but spread across about 92 square miles.) According to the

Chittenden County MPO, approximately 80 percent of the population lives in Burlington or its adjacent communities. The peripheral towns are more rural in nature, and are home to about 20 percent of the state's residents. The state's public transportation system is confined to the core area around Burlington.

According to the Chittenden County MPO, because of the region's small size and lack of any regional government (i.e., no county government so the State has the most responsibility, with local municipalities the next level of government) nearly any effort, even pre-planning, would likely occur at the state level. The MPO in Vermont would likely look to state government to lead and implement strategies.

To summarize, in large metropolitan areas planning and implementation would likely be primarily the responsibility of county, city, and regional governments (all depending on the particular region), with input and/or coordination from regional and state government. In smaller cities or rural areas, the State, MPO, and even chambers of commerce may play larger roles in the planning and implementation of fuel conservation strategies.

### **Most Feasible Strategies in Less Populated Regions**

A coordinated public outreach campaign would likely be the most critical strategy to reduce fuel consumption in less populated regions. Other potential strategies could include alternative work arrangements (e.g., compressed work week and flex time), increased carpooling, employer-provided assistance on alternative modes (e.g., carpooling), and promotion of changes to non-work trips (e.g., internet shopping, a shopping shuttle service).

The less feasible or applicable strategies include teleworking, free public transit or other transit-related strategies, driving ban, or speed limit reductions. One planner indicated that regardless of the threat of a fuel shortage, less populated regions need to have successful TDM programs in place to reduce fuel consumption, traffic congestion, and the costs of building and expanding roadways.

### ***Australia***

A number of researchers and planners in Australia are evaluating impacts of oil and fuel supply concerns and price increases.<sup>§</sup>

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<sup>§</sup> A few examples include:

- Jago Dodson and Neil Sipe of Griffith University in Brisbane who wrote the papers "Oil Vulnerability and the Australian City" and "Suburban Shocks: Assessing Locational Vulnerability to Rising Household Fuel and Mortgage Interest Costs."
- David Meiklejohn of the Department of Infrastructure in Victoria, author of "Addressing Oil Vulnerability Through Travel Behaviour Change."
- Tiffany Lester and Vince Dravitzki from Opus International Consultants in Wellington, New Zealand who wrote the paper "The Response of Travel Behaviours and Transportation Patterns to Fuel-price Increases and Legislative Constraints."

## 5. Case Study Findings Applied to Other Areas

Australia is a bit different than the U.S. in that it is characterized primarily by large cities and small towns, with little in between. Because state responses in emergencies are varied, it is difficult to compare all of Australia to the Puget Sound region. Most of the feedback below is based on potential strategies in the Sydney area. Many of the strategies and pre-planning for Sydney would be similar to the Puget Sound region, but following are a few additional or different strategies suggested.

**Alternative Work Schedules:** The city of Sydney has a very narrow peak period during which buses are quite full. Because of this, the use of alternative work schedules (flex-time and compressed work week) could help in making better use of transit service during the shoulders of the peak period. An informational campaign to promote alternative work hours would be helpful in Sydney.

**Bus Service Enhancements:** One potential strategy in Sydney would be for transit agencies to develop plans to acquire buses and possibly drivers from other sources (private buses, tourist coaches, etc.). These transit agencies could also consider retaining older buses in case of emergency, rather than selling them. Unlike most transit systems in the U.S., public transit systems in Australia are generally run by private operators. The Bus and Coach Association would likely be a key player in advocating for an emergency bus allocation plan. In addition, transit agencies may want to consider whether some non-essential or discretionary maintenance service to coaches (e.g., tire rotation) could be postponed in order to maximize the number of buses available during a short-term fuel shortage. These agencies should also consider how additional bus drivers could quickly be secured (for example, through reviewing potential changes to maximum bus driver hours, canceling driver holidays, encouraging retiring drivers or retired drivers to stay active so they are available on-call, etc.).

**Bus/Carpool Lanes:** In Sydney, many lanes are bus only for a few hours in the peak direction. When not used as bus lanes, they can be used as parking lanes. During a fuel shortage situation, these lanes could be reserved for exclusive bus use all day.

**Call Center Staffing:** Planners may want to consider how agencies could quickly increase staffing at the call center for the 131500 transit information line (<http://www.131500.com.au>). Emergency staff would be needed to handle extra calls from people who normally don't use the transport services in Sydney.

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Bruce Robinson and Sam Powrie of the Sustainable Transport Coalition, "Oil Depletion: the Crucial Factor in Transport Planning."

## 6. AREAS FOR FUTURE RESEARCH

Following are several suggested areas for future research:

### 1. Using Scenario Planning Techniques to Identify Strategies that Reduce Long-Term Fuel Consumption

The research presented in this report focuses almost exclusively on short-term strategies that can be implemented without new infrastructure. Although it is very difficult to predict how our political and transportation systems will respond to future energy and climate change challenges, most long-range transportation planning efforts assume that the future will largely resemble the past. Many planners are increasingly questioning the value of planning processes based on this assumption.

An emerging planning process, called Scenario Planning, allows for the comparison of several plausible scenarios rather than just one. According to the Federal Highway Administration's Scenario Planning website, the premise of scenario planning is to get the future imprecisely right rather than to get the future precisely wrong. In the area of transportation, energy, and climate change, it is becoming increasingly apparent that our future may be markedly different from our past. Additional research should be conducted on developing a framework for evaluating alternative future energy or emissions scenarios for corridor or project-level studies.

### 2. Impacts to Vulnerable Populations

Research should be conducted on how fuel shortages would affect food banks, meals-on-wheels programs, and other services to the elderly, disabled, and others who depend on special services. This research could indicate how the needs of these vulnerable populations could be served during a fuel supply disruption.

### 3. Allocating Fuel in an Emergency

Additional research on the effectiveness of emergency fuel allocation programs and policies should be conducted. For example, although North Carolina has a fuel set-aside program, during the state's recent fuel shortage this program was not activated (likely because the state expected the emergency to end quickly, as it did). In the meantime, cities and local government agencies did not have any legal means by which they could obtain priority shipments of fuel. In at least a couple of instances, government agencies had to depend on favors from fuel suppliers. For example, a gas station reserved one pump for the sheriff's office and other critical government services, and a major fuel terminal that didn't get fuel from the two pipelines allowed the state to purchase two million gallons of fuel. In addition, due to a concern about potential low fuel supplies and an apparent lack of confidence that they would be able to secure the fuel they needed, some government agencies fueled their agencies' vehicles at public gas stations in order to conserve their own fuel supplies.

Research should be conducted to determine how government agencies can more quickly be assured of access to fuel, and how uses should be prioritized within the public sector (e.g., police, transit, social services, airports, etc.).

In addition, research should be conducted on the use of existing fuel allocation programs in an emergency to better understand whether these fuel set-aside programs and other measures are sufficiently flexible to enable priority users to quickly obtain fuel. For example,

1. Do these allocation programs give government agencies the flexibility to easily adjust the set-aside level depending on supply circumstances?
2. Do allocation programs enable waiving of certain requirements (e.g., that applications be submitted by a certain day during the month)?
3. During a sudden and severe emergency, would the state energy office be inundated with applications from every priority user across the state, and if so is there prioritization for which priority users would be approved first?
4. Can government agencies come up with a quicker way, at the outset of an energy emergency, to ensure that priority users can very quickly obtain fuel?

For allocating fuel to the general public, additional research is warranted on how fuel can be quickly and effectively rationed in an emergency. For example, one of the strategies in the *Washington State Energy Assurance and Emergency Preparedness Plan* is to require gasoline stations to establish limits on fuel purchases, with both maximums and minimums. The requirement regarding minimum purchases prevents unnecessary “topping off” (which contributes to an increase in short-term demand for fuel and can also contribute to long lines at fueling stations). Research should be conducted to document how this rationing system could quickly be implemented and enforced to identify potential implementation constraints.

#### **4. Encouraging Changes in Travel Behavior for Non-Work or Discretionary Trips**

Analyses of travel behavior changes from previous fuel supply disruptions indicates that discretionary (non-work) trips were typically the first to be changed or eliminated. Although some travelers combined trips (trip chaining) others simply canceled these trips. Additional research areas should include:

- To help facilitate some of the activities that were canceled, investigate how shopping, medical, children’s activities, and other trips can be made more easily using alternative modes of transportation (shared taxis, carpooling, shopping shuttles, demand responsive shuttles, etc.).
- Conduct more research on how travelers can be encouraged to make better use of trip chaining.
- Investigate how much fuel can be saved through internet shopping (including an analysis of how increased fuel costs and decreased fuel supplies might impact businesses providing these deliveries).

### **5. Encouraging Changes in Travel Behavior for the Public Good**

Another potential research topic would be an analysis of how we might do a better job of encouraging people to change their travel behavior for the good of society at large. Potential research could include an analysis of potential public information campaigns that would have a greater likelihood of encouraging people to conserve fuel for the public good.

### **6. Mobilizing Transit Agency Resources in an Emergency**

An only partially related topic, but one brought to mind following this research, would be a review of how transit agency resources could be mobilized quickly in the event of a major natural disaster or terrorist strike either in that agency's own region, or in another part of the country.

## 7. CONCLUSIONS

This research concludes that even regions with robust TDM and transit programs and policies already in place could do more to better prepare their regions to quickly reduce fuel consumption, as might be needed in the event of a fuel supply disruption or price increase.

There are a number of strategies available to quickly reduce fuel consumption. The effectiveness of these actions can be enhanced, or the implementation timeframe can be shortened, by a number of pre-planning actions recommended throughout this report. Local and regional agencies may want to undertake these now to put their regions on better footing to respond to fuel price increases or supply disruptions. Speed of implementation can be critical in an energy emergency, which can often hit with little or no warning. Emergency services and evacuation plans depend on fuel availability, in addition to the everyday needs of commuting, delivery services, schools, shopping, social services and medical appointments.

It is important to point out that a number of long-term strategies, such as changes to land use, taxation, vehicle mix, vehicle technologies, alternative fuels, or the transportation infrastructure, will be very important in improving the long-term sustainability of our transportation systems. Some of these changes, however, take many years of planning, and may take decades before they result in significantly more sustainable transportation systems. However, because we will be dealing with climate change, the depletion of energy resources, and energy security for many decades to come, we should start planning and implementing many of these long-term strategies immediately.

## **APPENDIX 1 – LIST OF PEOPLE CONTACTED**

I would like to extend a very sincere thank you to the many professionals who generously allowed me to pick their brains as part of this research effort. These include transportation and energy professionals in the Puget Sound region and North Carolina, as well as transportation professionals in many other parts of the world. I offer apologies in advance for any who I may have inadvertently left out.

Scott Alford, East Carolina University Student Transit Authority (ECUSTA)

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Mike DeCapau, King County Metro Transit

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Kathy Koss, King County Metro Transit

Rebecca Lehman, PB Australia

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Brad Miller, Charlotte Area Transit System (CATS)

David Meiklejohn, State Government of Victoria, Australia

Dan Moore, Rogue Valley Council of Governments (Oregon)

Rick Moulds, WSDOT

Gloria Newby, City of Redmond, Washington

John Resha, WSDOT Transit Mobility

Marcel Rommerts, European Commission

Scott Rutherford, University of Washington

John Shadoff, WSDOT (retired)

Don Sims, WSDOT

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Russ Stark, Midway Transportation Management Organization, St. Paul, Minnesota

Sharon Stroud, North Carolina State Energy Office

Michael Voris, King County Metro Transit

Rita Mace Walston, Telework Consortium, Inc.

Paige West, Rogue Valley Transportation District (Oregon)

## **APPENDIX 2 – ASHEVILLE NORTH CAROLINA TRANSIT AUTHORITY EMERGENCY ACTION PLAN FOR FUEL SHORTAGE**

### LEVEL I:

1. Transit and Parking will cease unnecessary support trips and
2. Consolidate support trips as possible.
3. Parking will use only electric vehicles, relying on transit for any other needs.
4. Transit route vehicles will operate at full service until next level threshold is reached. Service will then begin to be phased out as follows:

### LEVEL II, or, Five Days Supply Remaining at Level I Fuel Consumption:

1. Transit will begin operations on at a full rate, but when down to five days supply in tanks and buses at Level I fuel consumption, service will be reduced by five hours daily by running all routes every other hour instead of hourly from 10:00 AM through 3:00 PM. Intercity routes will be reduced and operated in accordance with historical time-of-day demand. The net effect will be to reduce fuel consumption to half its normal level during these five hours, or reduction of approximately 20% in daily fuel consumption. All evening service will be curtailed at 9:30 PM.

### LEVEL III, or, Four Days Supply Remaining at Level II Fuel Consumption:

1. When fuel supplies are below four days in the tanks and buses at Level II fuel consumption, service will be available only to the public housing projects and on main streets such as Tunnel, Patton, Merrimon, and Hendersonville Roads.
2. At two days of fuel remaining in the tanks and in buses at Level III fuel Consumption, any remaining route where utilization falls below 30% of its normal rider ship may also be closed.
3. System will close with one day's operating reserve of fuel in tanks and buses at Level III fuel Consumption.
4. System will remain available for emergency assistance as requested by authorities until fuel is exhausted.

### RECOVERY:

System will reopen serving to the maximum capacity allowed by fuel supply and in the reverse order of priority.

## **APPENDIX 3 – KING COUNTY FUEL CONSERVATION POLICY<sup>152</sup>**

### **King County Administrative Policies and Procedures - Executive Orders, Policies & Procedures**

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Title: Fuel Conservation Policy

**Document Code No.:** FES 12-3 (AEP)

**Department/Issuing Agency:** Department of Public Works - Fleet Administration

**Effective Date:** April 5, 1991

**Approved:** /s/ Tim Hill

**Type of Action:** New

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#### **1.0 SUBJECT TITLE: Fuel Conservation Policy**

#### **2.0 PURPOSE:**

- 2.1 To develop policy and procedures to ensure that fuel conservation is an ongoing priority.
- 2.2 To reduce the County's dependency on fossil fuel by implementing programs using alternative fuels.
- 2.3 To ensure that high priority and essential services are not disrupted in the event of a fuel shortage.
- 2.4 To establish a policy for prioritizing the use of King County vehicles in case of a national fuel crisis.
- 2.5 To establish a hierarchy of fuel access priority.
- 2.6 To monitor the monthly fuel consumption of the various County departments.
- 2.7 To identify fuel suppliers that will provide King County with bulk fuel delivery in case of a national fuel crisis.
- 2.8 To obtain pre-authorization to purchase fuel from other suppliers in the event existing County fuel suppliers cannot furnish the needed volume of fuel.
- 2.9 To seek and obtain assurance from commercial vendor that King County fuel allocations will be at a minimum, equal to, or greater than the amount purchased during the previous year.
- 2.10 To identify the total capacity of County's fuel storage capacity, and the potential of expanding current storage capacity on a temporary or permanent basis.
- 2.11 To determine the monthly fuel consumption of non-County vehicles that depend on the County for fuel.

2.12 To put in place a fuel allotment and fuel usage procedure to ensure agency compliance.

**3.0 ORGANIZATIONS AFFECTED:**

Applicable to all King County, Executive Departments and agencies.

**4.0 REFERENCES:**

4.1 Paul Tanaka, Director  
Department of Public Works  
500 4th Avenue, Room 917  
Seattle, WA 98104

4.2 FES 12-1-1 (AEP) - Use of King County Vehicles

4.3 FES 12-2 (AEP) - Take Home Policy For County Owned Vehicles

**5.0 DEFINITIONS:**

5.1 "Emergency Vehicles" refers to vehicles which are used as police patrol vehicles, crisis and crime respondent vehicles, medical vehicles, and fire vehicles.

5.2 "Emergency Response Vehicles" refers to vehicles used for deployment in an emergency situation such as: vehicles responding to flooding situations, malfunction of traffic signals, Public Safety Proactive units, etc.

5.3 "Health and Safety Vehicles" refers to vehicles which are used as police traffic vehicles, animal control vehicles and solid waste vehicles.

5.4 "Operational Vehicles" refers to vehicles which are used for routine (Non-Emergency) Public Works, Parks, Building and Land Development, and Social Services programs.

5.5 "Administrative Vehicles" refers to vehicles which are assigned to departments or employees and are used for administrative purposes only.

5.6 "Take Home Vehicles" refers to any vehicle which is owned by King County but is assigned to an employee and may be driven home.

5.7 "Non-County Owned Vehicles" refers to vehicles owned by other government jurisdictions, that are fueled at County fuel stations under Work Authorization Agreements. Vehicles leased or rented by County agencies are exempt.

**6.0 POLICIES:**

6.1 King County will at all times, pursue all avenues of fuel conservation.

6.2 King County will pursue alternative fuel programs to reduce dependency on fossil fuels.

6.3 The fuel conservation measures will not disrupt services to the health, welfare and safety of County residents.

6.4 County vehicles will be managed with priority given to fuel conservation.

**6.5 During a national fuel crisis**, departments will be allocated fuel based on the priority of their use and County fuel allotments.

**6.5.1 During a national fuel crisis**, County vehicles are prioritized as follows (priority listed in descending order):

- 6.5.1.1 Emergency vehicles
- 6.5.1.2 Emergency response vehicles
- 6.5.1.3 Health and safety vehicles
- 6.5.1.4 Operational vehicles
- 6.5.1.5 Administrative vehicle
- 6.5.1.6 Take home vehicles
- 6.5.1.7 Non-County owned vehicles

**6.6** Department Directors will develop and implement internal departmental fuel conservation policies and procedures that ensure that:

**6.6.1** These Executive Order policies and procedures are followed by County employees under their supervision.

**6.6.2** A process for prioritizing and "pooling" the use of County assigned or dispatch vehicles by employees under their supervision which allows for the close monitoring of fuel consumption by their department.

## **7.0 PROCEDURES:**

Procedures for implementing the Fuel Conservation Policy will be developed as indicated in the Responsibility Section, 8.0.

## **8.0 RESPONSIBILITIES:**

**8.1** The County Executive is responsible for establishing priority ranking of County programs for fuel allocations during a fuel crisis.

**8.2** The Executive Cabinet is responsible for allocating fuel to the various County programs during a fuel crisis.

**8.3** Department Directors are responsible for:

**8.3.1** Developing internal policies and procedures relative to fuel conservation and monitoring consumption that will ensure strict compliance of these policies and procedures;

**8.3.2** Developing operational plans that ensure that high priority program services essential to County residents are not disrupted by fuel shortfall; and

**8.3.3** Educating County personnel under their supervision on proper vehicle operation to ensure maximum fuel savings;

**8.3.4** Justifying any request for additional fuel during a fuel crisis to the County Executive. Justification shall include (1) reason for increase in demand; (2) program areas being impacted; (3) where the fuel will be

allocated; and (4) any change in productivity or services that will be achieved from increased fuel allocation.

8.4 Fleet Administration is responsible for:

8.4.1 Implementing alternative fuel programs to reduce dependency on fossil fuels;

8.4.2 Assigning the most fuel efficient vehicles to employees who have high mileage driving records.

8.4.3 Coordinating Dispatch Vehicle Request and monitoring the daily dispatching of Motor Pool vehicles to ensure maximum "pooling" of trips.

8.4.4 Monitoring vehicle Preventive Maintenance Program to ensure that vehicle scheduled maintenance is performed at established intervals.

8.4.5 Monitoring, on an ongoing basis, fuel consumption by department and report this information to departments.

8.4.6 Identifying fuel suppliers and the quantity of fuel each can supply to King County.

8.4.7 Allocating fuel to departments during a fuel crisis. Fuel allocation will be based on (1) Executive program priority; (2) Executive Cabinet allocations; (3) departments historical fuel usage; and (4) King County fuel allotment from suppliers.

8.4.8 Identifying all non-County owned vehicles which may depend on King County for fuel and using the established priority for fuel access of those vehicles.

8.4.9 Identifying the location and capacity of any additional fuel storage sites for inclusion in County fuel storage inventory.

8.4.10 Monitoring vehicle usage for rotations to ensure the most fuel efficient vehicles are used by personnel with highest mileage records (except Public Safety CPO Program).

8.5 Vehicle Operators are responsible for:

8.5.1 Operating County vehicles in a manner that will ensure maximum fuel savings including compliance with the following fuel saving tips:

8.5.1.1 Eliminate unnecessary trips.

8.5.1.2 Plan all travel routes in advance.

8.5.1.3 Remove excess weight from vehicle.

8.5.1.4 Operate vehicle at speeds below 55 mph.

8.5.1.5 Avoid unnecessary idling of vehicle.

8.5.1.6 Develop and maintain proper driving habits, i.e., do not over accelerate, avoid constant braking.

8.5.1.7 Inflate tires properly.

8.5.1.8 Take assigned vehicles to County Motor Pool for maintenance as scheduled.

8.5.1.9 Use alternative fueled vehicles whenever available.

8.6 Purchasing Department is responsible for obtaining contracts with any available commercial fuel suppliers to ensure that the County has sufficient resources for obtaining fuel.

**9.0 APPENDICES:**

None

Updated: September 24, 2001

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