

## 2.2 Transportation

The transportation sector is a significant consumer of energy worldwide. According to the International Energy Agency (IEA), transportation accounted for approximately 19% of global final energy consumption in 2007. Their forecasts for demand at the sectoral level suggest that 97% of the increase in world primary oil use between 2007 and 2030 will come from this sector (Kojima and Ryan, 2010). All transport modes are projected to show substantial increases in activity and fuel use in the future. Even in those regions where transportation energy efficiency policy initiatives have been in force for several decades, the growth in energy demand is expected to be substantial. For instance, in Europe, road transport will continue to dominate overall transport energy and oil use, accounting for nearly 80% of oil demand in 2050 (Mantzos and Capros, 2006).

Policymakers have sought to mitigate the accompanying energy security and greenhouse gas emission risks of oil-dominated road transportation. This has usually meant instituting policies that have centered on reducing the fuel used in this sector, essentially improving energy efficiency. Of late, technological change has brought alternative fuel vehicles, such as natural gas vehicles or those that run on biofuels, and electric drive vehicles into the limelight. Shale gas finds in the US and the possibilities of large reserves across the globe have raised the probability of natural gas-powered vehicles becoming a larger part of the vehicle mix. Increasing the proportion of biofuels in transportation is similarly purported to offset the need for imported crude oil. Electric vehicles offer the possibility of highly efficient motility.

However, each of the technological solutions has its own drawback. Electric vehicles offer limited range and require significant investment in the development of charging infrastructure. Most importantly, the vehicles are sold at a substantial premium to conventional internal combustion engine vehicles. These factors limit their suitability as a policy option. And though natural gas vehicles are competitively priced and often have lower operating costs than their petroleum fuelled counterparts, the construction of the requisite fuelling infrastructure is an expensive proposition. Biofuels offer their own set of issues, the fundamental being doubts as to the environmental friendliness of the fuel and the inability to scale up operations.

As of now, given the current state of technology and the projections of evolution of the same over the next few decades, the only feasible option for policymakers seems to be that of reducing energy use in the transportation sector via the institution of smart energy efficiency policies. These will also help economies achieve their environmental objectives. For instance, the International Energy Agency notes that policies that help to improve vehicle fuel economy are one of the most cost effective measures for achieving an overall CO<sub>2</sub> reduction target of 50% below 2005 levels by 2050 across the transport sector (Kojima and Ryan, 2010).

In this section, the transportation policies of the US and the Philippines will be critically examined. The objective will be to ascertain the genesis of each economy's transportation policy, to examine the efficacy of the instituted regulations, and to determine whether policy objectives were met. The differences in the approaches towards transportation policy of the US and the Philippines will also be considered.

## 2.2.1 Transportation in the US

### **Key Findings**

- The main impetus for improving fuel economy in the US is energy security, with reduction of oil imports a national policy goal. Additional benefits of improving fuel economy include improved air quality, reduced carbon emissions and fuel savings for vehicle drivers.
- The key fuel economy policies are mandatory standards and labels, fiscal incentives and Research and Development (R&D) funding. These are used to improve the efficiency of conventional technologies such as diesel and gasoline engines, as well as to promote alternative fuel vehicles.
- Most fuel economy programs are expected to yield net economic benefits, whereas electrification of road transport has proven to be expensive. Policies are scientifically sound and determined by a transparent formulation process, but issues of alignment can arise and the strength of lobby groups can sometimes be problematic.

### **Costs, benefits and promotion**

- Most of the various fuel economy programs that are currently in operation or will be implemented in the future are expected to yield incremental economic benefits that are greater than the incremental costs, though the magnitude of the net benefits depends on the discount rate adopted.
- There is considerable emphasis on the electrification of road transport, with various tax incentives for electric vehicles offered on top of existing incentives for alternative fuel vehicles up to the end of 2011. However, the high cost of electric vehicles has impeded their take-up and many of these tax incentives were not renewed when they expired on 31<sup>st</sup> December 2011.

### **Scientific integrity**

- Fuel economy standards in the US are scientifically sound and are determined by a process that explicitly seeks to maximize lifetime economic net benefits from the imposition of the standards. Fuel economy labels have also been designed by taking into account the factors that influence consumers when purchasing vehicles, so as to maximize their potential effectiveness.

### **Flexibility**

- Fuel economy policies are updated every five years, taking into account stakeholder feedback and changing technology. However the institutional structure does not allow for rapid adjustments to the standards, in response to changing circumstances, other than at the end of every five-year period.
- Fuel economy standards give manufacturers flexibility in how they choose to meet the standards.

### Transparency

- Transparency is widespread as stakeholder engagement is central to the regulatory process for designing fuel economy standards. However, strong lobbying by car manufacturers partially contributed to the stagnation of fuel economy standards for cars.

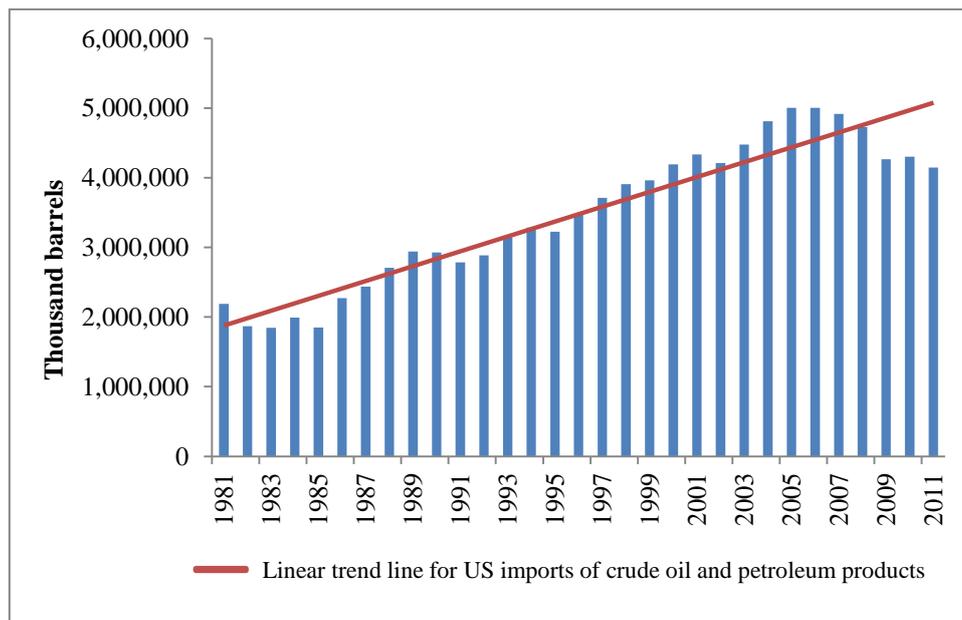
### Alignment

- There have been improvements in coordination and alignment both among the authorities at the federal level and between the federal and the state governments in the management of fuel economy standards. However, in the absence of an institution to coordinate the different regulatory agencies whose policies affect the transportation sector, issues of alignment can arise.

## A. Size and Significance

The transportation sector accounts for a significant proportion of energy consumption in the United States (US). In 2010, it accounted for 28.1% of energy consumption in the US (US Department of Energy, 2011a). Energy consumption in the transportation sector is largely in the form of liquid petroleum products; oil's share in transportation energy consumption stood at approximately 71% in 2010 (National Highway Traffic Safety Administration, 2012). A large part of the liquid fuels demand is increasingly met by imported energy. Figure 2.2.1 below shows the upward trend in crude oil and petroleum product imports from the late 1981 to 2011. As of 2010, net petroleum imports accounted for 57% of US domestic petroleum consumption (National Highway Traffic Safety Administration, 2012). This growing dependence has played an important role in US energy policy, particularly in the transportation sector.

**Figure 2.2.1 US imports of crude oil and petroleum products**



Source: US Energy Information Administration (2012)

## B. Policy Formulation

### (i) History and background

Ever since the twin oil prices shocks of the 1970s, energy security has been the cornerstone of US energy policy. Policymakers have often considered energy dependence or energy independence as a measure of energy security. Energy dependence, which is the ratio of energy imports to total energy consumption, is viewed as a measure of the vulnerability of an economy to disruptions in energy markets.<sup>41</sup> The greater the dependence, the worse off is an economy purported to be. Several US presidents have reiterated the policy direction of energy independence in some form or the other since President Richard Nixon was in office in the early 1970s. Table 2.2.1 shows the long-standing impact that the idea of energy independence has provided to US energy policy.

**Table 2.2.1 US's long-standing policy of energy independence**

<b>President</b>	<b>Term in office</b>	<b>Energy policy goal</b>	<b>Plan</b>
<i>Richard Nixon</i>	1969 - 1974	Energy independence by 1980	<ul style="list-style-type: none"> <li>• Decrease industrial use of petroleum</li> <li>• Ration home heating oil and airplane fuel</li> <li>• Reduce red tape for nuclear power plant construction.</li> </ul>
<i>Gerald Ford</i>	1974 - 1977	Energy independence by 1985	<ul style="list-style-type: none"> <li>• More domestic oil drilling</li> <li>• Tariffs on imported oil</li> <li>• An end to price controls</li> <li>• Fast-tracked, coal-fired power plants</li> <li>• Tax credits for nuclear power plants</li> <li>• Increased home and vehicle efficiency</li> <li>• Development of synthetic fuels</li> <li>• Establishment of a strategic petroleum reserve</li> </ul>
<i>Jimmy Carter</i>	1977 - 1981	Cut U.S. oil imports in half by 1985	<ul style="list-style-type: none"> <li>• Conservation programs</li> <li>• Expanded use of coal and solar power</li> <li>• Development of synthetic fuels</li> <li>• Creation of the Energy Department</li> </ul>
<i>George H. W. Bush</i>	1989 - 1993	Cut oil imports by one-third by 2010	<ul style="list-style-type: none"> <li>• Fast-tracked pipeline construction</li> <li>• Incentives for natural gas use, new investments in energy research and development</li> </ul>
<i>George W. Bush</i>	2001 - 2009	Cut 75 percent of oil imports from the Middle East by 2025	<ul style="list-style-type: none"> <li>• Open more federal lands to oil and gas exploration</li> <li>• Expand subsidies for biofuels production</li> <li>• Fund research into hydrogen fuel cells, coal gasification, and other technologies</li> </ul>
<i>Barack Obama</i>	2009 - date	Cut oil imports by one-third by 2025	<ul style="list-style-type: none"> <li>• Stimulus spending on renewable-energy research</li> <li>• Tax credits for home energy efficiency</li> </ul>

<sup>41</sup> Conversely, energy independence is defined as the ratio of domestically produced energy to total energy consumption. The greater the independence, the better off the economy.

			<ul style="list-style-type: none"> <li>• A cap-and-trade system for reducing carbon emissions and making renewable energy cost-competitive</li> <li>• Expansion of offshore oil and gas drilling.</li> </ul>
--	--	--	--

Source: Adapted from Homans, 2012

Scholars have questioned the desirability of energy independence as a national policy goal for the past three decades. For instance, an inquiry into the relationship between US oil imports and energy security by Crane et al (2009) of RAND Corporation noted that the gap between US production and consumption was substantial and that efforts at eliminating it would entail extraordinarily costly changes to patterns of consumption and production of fuels. Their analysis also revealed that even if there were sharp reductions in US oil imports, the price of oil in the United States would still be determined by global, not national, shifts in supply and demand. Hence, a large, extended reduction in the global supply of oil would trigger a sharp rise in the price of oil and lead to a sharp fall in economic output in the United States, no matter how much or how little oil the United States imports. Nevertheless, reducing energy dependence remains central to energy policy in the US.<sup>42</sup>

As such, given the fact that a large portion of transportation energy demand is met by imported energy, US transportation policy has focused on reducing import dependence. In 2011, President Barack Obama set a national goal of reducing oil imports by a third by 2025 (see Table 2.2.1) while increasing the production of hybrid, electric, and other clean transport alternatives. In particular, the US seems to be placing considerable emphasis on the promotion of electric vehicle technology.<sup>43</sup> In 2008, President Obama announced his goal of putting one million plug-in hybrid vehicles on the road by 2015 (The White House, 2011). Although Electric Vehicles technology dominates alternative fuel programs, there are also programs for fuel cell, natural gas vehicles,<sup>44</sup> and biofuel technology. In addition to the improvement of energy security, the National Highway Traffic Safety Administration has also publicized the other benefits of alternative fuel vehicles such as reduced carbon emissions and improved air quality. This is line with the observation that in recent years, environmental imperatives such as reducing greenhouse gas emissions have grown in importance in the design of transportation energy policy (Gallagher et al., 2007).

## (ii) Policy Description

We consider four broad categories of policies in this section: mandates, fiscal incentives, financial incentives, and information programs.

<sup>42</sup> See for instance Fialka (2006) for the opinions of energy experts across several disciplines on the fallacy of the policy directive of increasing energy independence by using “domestic” but costly alternatives.

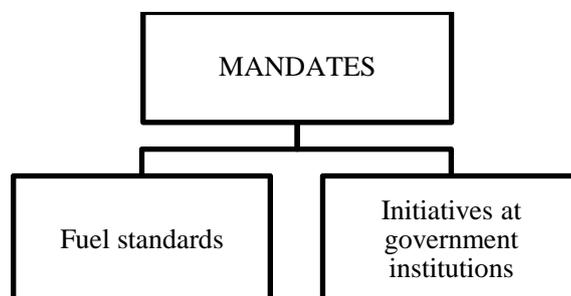
<sup>43</sup> The recent glut in natural gas in the US on account of the shale gas phenomenon has raised expectations of increased use of relatively clean natural gas in the US’s electricity generation mix. By shifting transportation from liquid fuels to electricity via the use of electric vehicles, the expectation is that the US’s energy security and climate change objectives will be met simultaneously.

<sup>44</sup> The perceived glut of natural gas could also drive the development of natural gas vehicles (NGVs). However, the difference in driving characteristics of these vehicles, such as acceleration, might reduce their popularity amongst consumers with strong preferences for vehicle performance. Furthermore, there are high costs associated with setting up refueling infrastructure for gas-powered vehicles.

## MANDATES

There are two broad categories of mandates considered in this section: fuel standards and initiatives at government institutions (see Figure 2.2.2 below).

**Figure 2.2.2 Broad categories of mandates**



### *Fuel standards*

During the 1970s, the growing contribution of crude oil in the primary energy mix and the fact that an increasing proportion of the demand for crude oil was being met by imports led the US government to impose fuel economy standards.<sup>45</sup> The Energy Policy and Conservation Act (EPCA) in 1975 provided the issuance of corporate average fuel economy (CAFE) standards of 18 mpg<sup>46</sup> in 1978 for passenger automobiles (National Highway Traffic Safety Administration, 2012b). Manufacturers who failed to comply with CAFE standards are subject to a civil fine of US\$ 55 per car per mpg (Cato Institute, 2002). This was followed by the enactment of the Gas Guzzler Tax in 1978 on passenger cars below 22.5 mpg (Environmental Protection Agency, 2011a). Manufacturers were fined anywhere from US\$ 1,000 to US\$ 7,700 for each car, depending on the extent of deviation from the standard.

With moderating energy prices following the 1970s, standards for passenger cars stagnated at 27.5 mpg from 1989 to 2010. The oil price spike in 2008 made energy issues prominent once again leading to fuel standards being raised to 30.2 mpg in 2011. These will further be raised to 37.8 mpg by 2016. Standards for light trucks<sup>47</sup> were introduced in 1979. These standards began at 17.2 mpg and rose gradually to 24.1 mpg in 2011. They are slated to be 28.8 mpg by 2016. Figure 2.2.3 below shows historical and future fuel economy standards for passenger cars and light trucks.

In 2007, the Energy Independence and Security Act targeted an increase of combined corporate average fuel economy standards to 35.0 mpg by 2020. In 2011, automakers agreed to a proposal by the White House to double the fuel economy of the vehicles they sell to a fleet wide average of 54.5 mpg by 2025 (Bloomberg, 2011).<sup>48</sup> The National Highway Traffic Safety Administration has proposed raising the corporate average fuel economy standards to 56.0 mpg for passenger cars and to 40.3 mpg for light trucks by 2025, bringing the combined fuel economy for both vehicle fleets to 49.6 mpg (see Figure 2.2.3).

---

<sup>45</sup> Aside from energy security considerations, the fuel economy standards were believed to help alleviate economic impacts such as the downward pressure on the US dollar and an increase in vulnerability to macroeconomic shocks.

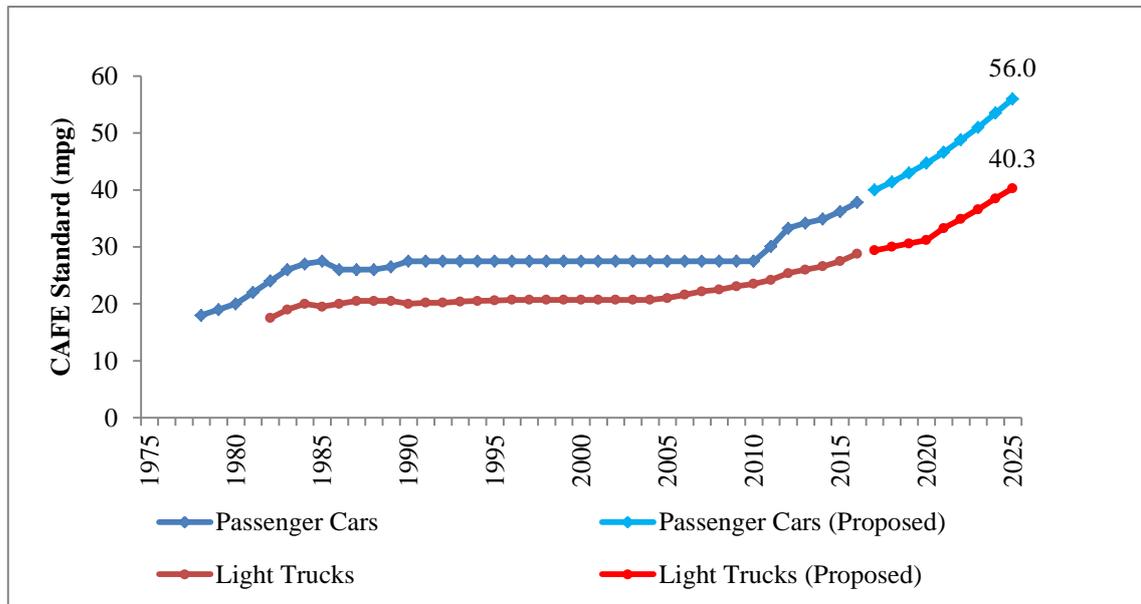
<sup>46</sup> Miles per gallon

<sup>47</sup> Light duty trucks include smaller (1/2 ton) pickup trucks, sport utility vehicles, minivans and similar vehicles with a gross vehicle rating of less than 8,500 pounds

<sup>48</sup> Automakers representing 90% of vehicles sold in the US agreed to the proposal.

In 2008, new Environment Protection Agency (EPA) testing procedures were added to reflect real world fuel economy more accurately (Environment Protection Agency, 2006).<sup>49</sup> From 2011, corporate average fuel economy standards were adjusted to reflect varying targets based on the vehicle size or “footprint.”<sup>50</sup> Setting different standards for vehicles of different sizes solved the problem caused by previous standards which created the incentive for the production of smaller trucks and exposed drivers to greater safety risks.<sup>51</sup>

**Figure 2.2.3 Historical and future proposed CAFE standards, 1978-2025**



Source: National Highway Traffic Safety Administration (2011)

The corporate average fuel economy (CAFE) law provides special treatment of vehicle fuel economy calculations for dedicated alternative fuel vehicles and dual-fueled vehicles,<sup>52</sup> giving them higher fuel economy ratings. For dedicated alternative fuel vehicles, the fuel economy is divided by a factor of 0.15 while for dual-fueled vehicles, the fuel economy is found by taking the average of the fuel economy of the gasoline or diesel engine with the fuel economy of the alternative engine as previously above (National Highway Traffic Safety Administration, 2004).

<sup>49</sup> From 2011, manufacturers will need to perform additional cold temperature, air conditioning and/or high speed/rapid acceleration driving tests for vehicles most sensitive to these conditions. The Environment Protection Agency’s new fuel economy estimates will also reflect other road conditions that influence fuel economy such as road grade, wind, tyre pressure, load and the effects of different fuel properties. From 2008 to 2011, new calculation methods were used to capture these driving conditions, giving manufacturers time to plan for this additional testing and still provide consumers with reliable estimates of fuel economy.

<sup>50</sup> Footprint is determined by multiplying the vehicle’s wheelbase by the vehicle’s average track width.

<sup>51</sup> Earlier standards which were applied to vehicles of all sizes caused manufacturers to produce small light trucks with high fuel economy to offset the low fuel economy of large light trucks. Historically, the safest vehicles have been heavy and large while vehicles with highest fatal-crash rates have been light and small. Both, the crash rate as well as fatality rate per crash are higher for small and light vehicles. In addition, the diversion of car makers’ efforts to improve fuel economy deprived consumers of other desired attributes such as greater acceleration, greater capacity, and reliability.

<sup>52</sup> Dual-fuel vehicles are motor vehicles capable of operating on alternative fuels and gasoline or diesel fuel.

Greenhouse gas (GHG) and fuel economy standards for model year (MY)<sup>53</sup> 2014 medium- and heavy-duty trucks<sup>54</sup> will be introduced. GHG emission standards range from 66-120g CO<sub>2</sub>/ton-mile while final fuel consumption standards range from 6.5-11.8 gal/1,000 ton-mile. Greenhouse gas emission standards will also be introduced for passenger cars and light trucks beginning MY 2017 (Environment Protection Agency, 2012a). Box 2.2.1 below describes the key agencies involved in improving US fuel economy.

### **Box 2.2.1 Key agencies in improving land transport fuel economy**

#### **Key Agencies**

There are two key agencies involved in setting fuel economy standards and developing fuel economy labels

- The National Highway Traffic Safety Administration (NHTSA) administers the CAFE program, setting fuel economy standards for cars and light trucks sold in the US under the Energy Policy and Conservation Act (EPCE), as amended by the Energy Independence and Security Act (EISA).
- The US Environmental Protection Agency (EPA) manages the collection of fuel economy and related emissions data. This data is used in various federal programs such as in designing Fuel Economy and Environment Labels and setting EPA greenhouse gas emissions standards under the Clean Air Act.

Both agencies, upon the President's request in 2010, are working together to develop a national program that will produce a new generation of clean vehicles which responds to the economy's critical need to reduce oil consumption and address climate change.

Source: National Highway Traffic Safety Administration, 2012

#### ***Initiatives at Government Institutions***

Unlike fuel standards, initiatives at government institutions directly affect only a small proportion of the vehicle fleet, since most vehicles are privately owned. Their direct impact on aggregate energy consumption from transportation is therefore likely to be limited. However, such initiatives can potentially have spillover effects if they trigger fuel economy improvements in the rest of the economy. For examples, regulations mandating alternative fuel vehicles for publicly owned fleets create a market for alternative fuel vehicles, which can then become available to private owners as well.

#### ***Federal Agencies and Departments***

---

<sup>53</sup> In the US, automobile model year sales traditionally begin with the fourth quarter of the preceding year. So model year refers to the "sales" model year; for example, vehicles sold during the period from October 1 to December 30 of the following year are considered one model year.

<sup>54</sup> The heavy duty fleet incorporates all on-road vehicles rated at a gross vehicle weight at or above 8,500 pounds and the engines that power them. Trailers are exempted.

The Energy Policy Act of 1992 encouraged the use of alternative fuels<sup>55</sup> through both regulatory and voluntary activities and approaches. It required certain federal fleets to have alternative fuel vehicles (AFVs) as 75% of acquisitions from 2000 and beyond. Executive Order 13423 issued in January 2007 required federal agencies with 20 vehicles or more in their fleet to decrease petroleum consumption by 2% per year relative to their 2005 baselines through to 2015. Agencies were also required to increase their alternative fuel use by 10% year on year.

In October 2009, Executive Order 13514 required federal agencies to develop, implement, and annually update a Strategic Sustainability Performance Plan. Agencies had to measure, reduce, and report their greenhouse gas emissions with an overall goal of a 28% reduction in greenhouse gas emissions by 2020 from the 2008 baseline. These reductions could be achieved through the use of alternative fuel vehicles or through fleet optimization efforts. In May 2011, the Federal government announced the purchase of 100% alternative fuel vehicles by 2015<sup>56</sup> as well as a drive for agencies to reduce petroleum consumption by 30% by 2020 (The White House, 2011). With effect from January 2011, the Department of Defense was required to exhibit a preference for motor vehicles using electric or hybrid propulsion systems, including plug-in hybrid systems. Tactical vehicles designed for use in combat were exempt from this rule (US Code, 2011).

#### *State Government and Alternative Fuel Provider Fleets<sup>57</sup>*

The Energy Policy Act of 1992 also required the state government and alternative fuel provider covered fleets to acquire alternative fuel vehicles. The Act required 75% of covered state fleets' annual light duty, non-excluded vehicle acquisitions to be alternative fuel vehicles and 90% of covered alternative fuel providers' light duty vehicle acquisitions to be alternative fuel vehicles. Fleets are considered "covered fleets" if they own, operate, lease or otherwise control 50 or more non-excluded light duty vehicles and of those, at least 20 are used primarily within a single Metropolitan Statistical Area/Consolidated Metropolitan Statistical Area and are capable of being centrally fueled.

In March 2007, the Department of Energy announced "Alternative Compliance," which allowed fleets to meet the Energy Policy Act of 1992 requirements by reducing their petroleum consumption as an alternative to acquiring alternative fuel vehicles (which came to be known as "Standard Compliance"). Interested fleets have to obtain a waiver from the Department of Energy by proving that they will achieve petroleum reductions equivalent to that achieved by having alternative fuel vehicles running on alternative fuels 100% of the time (Alternative Fuels Data Center, 2011).

---

<sup>55</sup> Alternative fuels are defined under the Energy Policy Act of 1992 as pure methanol, ethanol, and other alcohols; blends of 85% or more of alcohol with gasoline; natural gas and liquid fuels domestically produced from natural gas; liquefied petroleum gas (propane); coal-derived liquid fuels; hydrogen; electricity; pure biodiesel; fuels, other than alcohol, derived from biological materials.

<sup>56</sup> In conjunction with the press release, the General Service Administration announced its initial purchase of more than 100 electric vehicles to be leased to 20 agencies. The General Service Administration manages federal fleets and buildings and hence will also coordinate on the installation of the necessary infrastructure.

<sup>57</sup> An alternative fuel provider is any entity whose principal business involves alternative fuels, persons whose principal business involved generating, transmitting, importing, or selling at wholesale or retail electricity and persons producing and/or importing an average of 50,000 barrels per day or more of petroleum See [http://www1.eere.energy.gov/vehiclesandfuels/epact/alt\\_fuel\\_provider.html](http://www1.eere.energy.gov/vehiclesandfuels/epact/alt_fuel_provider.html)

## **FINANCIAL INCENTIVES**

### ***Research and Development (R&D)***

The Department of Energy supports research and development of alternative fuel systems. In 2007, the Advanced Research Projects Agency-Energy (ARPA-E) was established within the Department of Energy. In 2009, the ARPA-E received US\$ 400 million of funding to support projects that will develop transformational technologies that reduce the nation's dependence on foreign energy imports, reduce the US's energy related emissions, improve energy efficiency across all sectors of the economy, and ensure that the US maintains its leadership in developing and deploying advanced energy technologies. Areas of focus include vehicle technologies, biomass energy, and energy storage (Advanced Research Projects Agency-Energy, 2012).

The latest example of the Department of Energy's support for research and development is the US\$7 million award for research into reducing the costs of electric vehicle charging (US Department of Energy, 2011b). This came just months after US Energy Secretary Steven Chu announced that more than US\$ 175 million would be spent over the next three to five years to accelerate the development and deployment of advanced vehicle technologies. The funding will support 40 projects in 15 states to research better fuels and lubricants, lighter weight materials, longer lasting and cheaper electric vehicle batteries and components and more efficient engine technologies (US Department of Energy, 2011c). A separate US\$ 7 million was appropriated for independent cost analyses to support research into the development of fuel cells and hydrogen storage systems.

The Vehicle Technologies Program supports the Department of Energy and the Office of Energy Efficiency and Renewable Energy in strengthening US energy security, environmental quality, and economic vitality through public-private partnerships (Energy Efficiency and Renewable Energy, 2010a). The Department of Energy partners with industry to identify and select appropriate R&D objectives to achieve its and its partner's strategic goals. Projects are conducted through various mechanisms such as cooperative agreements, university grants, subcontracts, and research funded at the Department of Energy's national laboratories. Key areas of research include hybrid electric systems, advanced combustion engines, advanced materials, and fuels technology.

The Vehicle Technologies Program also undertakes research partnerships with industry and academia to develop and validate technologies. This ensures that the nation's best resources are applied to R&D activities and maximum technology transfer takes place, and allows industry resources to leverage government resources. The two main partnership programs are US DRIVE (Driving Research and Innovation for Vehicle efficiency and Energy sustainability) and the 21<sup>st</sup> Century Truck Partnership. The former seeks to accelerate the development of advanced technologies that are not yet market competitive and the latter is aimed at developing technologies for trucks and buses that can safely and cost effectively move larger volumes of freight and greater number of passengers.

## **FISCAL INCENTIVES**

### ***Tax Incentives***

In order to bring about increased fuel efficiency, the federal government offers tax credits to incentivize consumers to switch to alternative fuels. Alternative fuels used in a manner deemed by the

Internal Revenue Service (IRS) as nontaxable are exempt from federal fuel taxes.<sup>58</sup> Tax credits were available for alternative fuel infrastructure through 31<sup>st</sup> December 2011;<sup>59</sup> tax credits for hydrogen fuelling equipment placed into service after 31<sup>st</sup> December 2005 were available for up to 30% of the cost, not exceeding US\$ 200,000. Tax credits were also available for fueling equipment for natural gas, liquefied petroleum gas, electricity, E85<sup>60</sup> or biodiesel installed through to 31<sup>st</sup> December 2011, up to 30% of the cost, not exceeding US\$ 30,000. Consumers who purchase qualified residential fueling equipment may receive a tax credit of up to US \$1,000.

With regard to fuel cell vehicles in particular, tax credits of up to US\$ 4,000 are available for the purchase of qualified light duty fuel cell vehicles. Tax credits are also available for medium and heavy duty fuel cell vehicles, with the credit amount dependent on vehicle weight. The credits expire on 31<sup>st</sup> December 2014. A tax credit of US\$ 0.50 per gallon is available for liquefied hydrogen that is sold or used as a fuel by registered entities to operate a motor vehicle. As such, tax exempt entities such as state and local governments that dispense qualified fuel from an on-site fueling station also qualify for the incentive. This credit expires on 30<sup>th</sup> September 2014. A tax credit of US\$ 0.50 per gallon is available for the sale or use of liquefied hydrogen used by registered alternative fuel blenders to produce a mixture containing a taxable fuel. This credit expires on 30<sup>th</sup> September 2014.

Additional tax credits are available specifically for new plug-in electric vehicles. The Energy Improvement and Extension Act of 2008, followed by the American Clean Energy and Security Act of 2009, granted tax credits for new qualified plug-in electric vehicles, ranging from US\$ 2,500 to US\$ 7,500.<sup>61</sup> Tax credits of up to US\$ 18,000 were available for the purchase of qualified heavy duty hybrid electric vehicles with a gross rating of over 8,500 pounds. This expired on 31<sup>st</sup> December 2009. Converted plug-ins were also eligible for tax credits of up to 10% of the conversion cost (not exceeding US\$ 4,000) through 31<sup>st</sup> December 2011. Additionally, tax credits of up to 10% of the cost of qualified low speed electric vehicles, electric motorcycles and three-wheeled electric vehicles (not exceeding US\$ 2,500) were available through to 31<sup>st</sup> December 2011. The latter two incentives lapsed at the end of 2011, while the US\$ 7,500 tax credit for new electric vehicles was continued as the Obama administration felt that it built a market for electric vehicles, which helps create jobs (Washington Post, 2012). Additional incentives are available at the state level, ranging from monetary incentives of up to US\$ 7,500 and non-monetary incentives such as carpool lane access.

Incentives are also available for technologies that provide higher efficiencies and lower emissions. For instance, qualified on-board idling reduction devices<sup>62</sup> and advanced insulation are exempt from the 12% federal excise tax imposed on the retail sale of heavy duty highway trucks and

---

<sup>58</sup> Common nontaxable uses are: on a farm for farming purposes, in certain intercity and local buses, in a school bus, exclusive use by a nonprofit educational organization and exclusive use by a state, political subdivision of a state, or the District of Columbia.

<sup>59</sup> The tax breaks for alternative fuel infrastructure were not renewed and lapsed on 31<sup>st</sup> December 2011.

<sup>60</sup> E85 refers to fuel consisting 85% ethanol and 15% gasoline

<sup>61</sup> The tax credit starts from a base sum of a sum of US\$ 2,500 with an addition of US \$ 417 for each kWh of battery capacity over 5 kWh. This credit is capped at US\$ 5,000

<sup>62</sup> Such types of equipment are meant to reduce the idling of a motor vehicle at a rest stop or other locations where they are temporarily parked or remain idle (Advanced Fuels Data Center) 2011.

trailers. States are allowed to exempt low emission and energy efficient vehicles from High Occupancy Vehicle (HOV) <sup>63</sup> lane requirements.

## **INFORMATION PROGRAMS**

### ***Fuel Economy Labeling***

Fuel Economy labeling was introduced in the US in the mid-1970s, with every new car and light-duty truck being required to have a fuel economy label (Environment Protection Agency, 2011b). From model year 2013 onwards, redesigned labels will provide information on vehicles' fuel economy, energy use, fuel costs, and environmental impacts. They will also be required for all new vehicles including plug-in hybrids and electric cars.

### ***Tire Fuel Efficiency Labeling***

The Energy Independence and Security Act (EISA) of 2007 required that the National Highway Traffic Safety Administration develop a national tire fuel efficiency consumer information program to educate consumers about the effects of tires on automobile fuel efficiency, safety, and durability.<sup>64</sup> When the program is fully established, the information will be provided to consumers online and in the form of a label at the point of sale for replacement tires (National Highway Traffic Safety Administration, 2010). This is important as the rolling resistance of tires in the replacement market could be higher than those offered on new cars, and in the absence of information on the greater fuel efficiency of low rolling resistance tires, consumers have little incentive to purchase them as replacement tires due to their high cost and limited market availability.

## **C. Regulatory Review**

### **ECONOMIC EFFICIENCY AND EFFECTIVENESS**

#### **(i) Costs, Benefits and Promotion**

##### ***Effect of standards on fuel economy levels***

As seen in Figure 2.2.4, fuel economy levels rose from 1979 to 1985 and then stagnated. Thereafter, there was a gradual decline in fuel efficiency standards. This decline was a function of the fall in real gasoline prices in the 1980s. A study by the National Academy of Sciences (NAS) found that the corporate average fuel efficiency standards arrested what could have been a precipitous decline in fuel economy levels in the 1980s. Standards were found to push manufacturers in the direction of technology improvement (Board on Energy and Environmental Systems, 2002). In 1985, light duty vehicles had improved enough to meet corporate average fuel efficiency standards and from then on, car makers concentrated on improving performance and other attributes. Fuel economy remained essentially unchanged while vehicles became on average 20% heavier, with 25% faster acceleration from 0-60 mph (miles per hour).

---

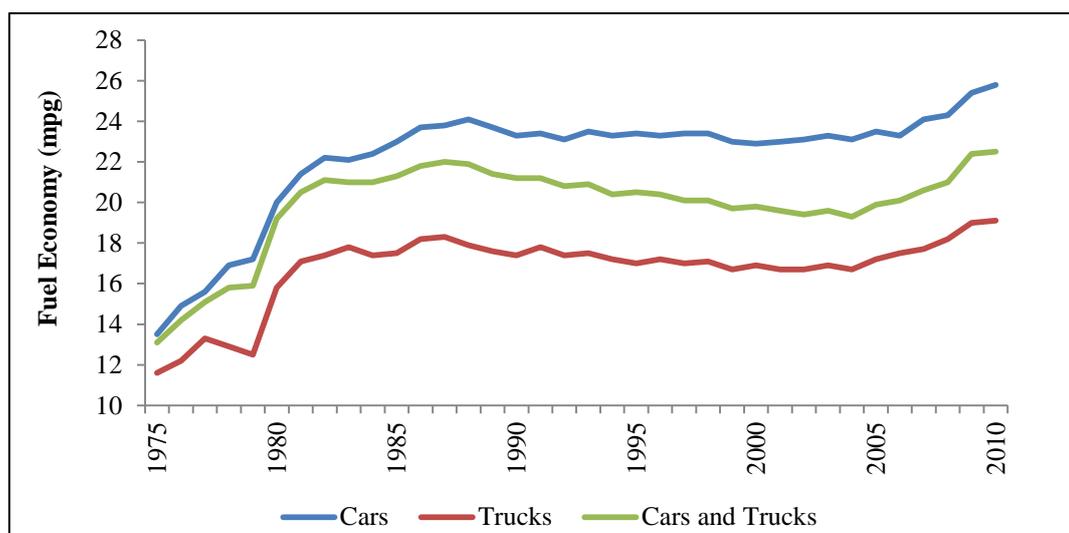
<sup>63</sup> High Occupancy Vehicle (HOV) lanes are added to existing facilities and only vehicles carrying 2-3 persons are allowed to travel on these lanes. The central concept for HOV lanes is to move more people rather than to move more cars.

<sup>64</sup> The rolling resistance, wet traction and tread wear life are measured as metrics of fuel efficiency, safety and durability respectively.

Corporate average fuel efficiency standards for passenger cars remained constant between 1989 and 2010, only being raised in 2011. This did not coincide with the trend in actual fuel economy levels, which began to rise in 2007. A more plausible conclusion is that the trend in fuel economy levels was influenced by the price of oil, which moderated in the 1990s and began a steep upward increase in 2007. This could mean that standards in the past 20 years were unable to influence behavior. The World Resources Institute estimates that revisions to the standards, namely raising car mileage to 42.0 mpg in 2025 and increasing light truck mileage to 32.0 mpg by 2025, would save the US about 3 million barrels of oil per day and reduce oil consumption by nearly 25% (World Resources Institute, 2008). As mentioned previously, the National Highway Traffic Safety Administration has proposed raising corporate average fuel efficiency standards to 56.0 mpg for passenger cars and to 40.3 mpg for light trucks by 2025, which would potentially generate a greater amount of fuel savings.

Aside from high oil prices, there were several other arguments to reverse the stagnation of standards and to raise them in 2011. The study by the National Academy of Sciences found that technologies to reduce fuel consumption significantly already existed and were in use in European and Japanese markets. It was also found that gasoline prices at that time did not take into account the impacts of fuel consumption such as greenhouse gas emissions and world oil market conditions (Board on Energy and Environmental Systems, 2002).

**Figure 2.2.4 Adjusted fuel economy values (1975-2010)<sup>65</sup>**



Source: Environmental Protection Agency, 2010a

The Board on Energy and Environmental Systems has estimated that the corporate average fuel efficiency standards avoided the consumption of 2.8 million barrels of gasoline, or 14% of US consumption in 2001 (Board on Energy and Environmental Systems, 2002). Such benefits, however, are also accompanied by a variety of costs. Regulatory costs are one such cost. For instance, in financial year 2010, the National Highway Traffic Safety Administration spent \$8.9 million administering the corporate average fuel efficiency standards (Department of Transport, 2011).

<sup>65</sup> The US EPA adjusts reported fuel economy values by taking into account conditions that occur on the road that affect fuel economy which do not occur during laboratory testing such as cold temperature, aggressive driving and excessive use of power hungry accessories.

Furthermore, consumers face higher prices when the costs of producing more efficient vehicles are passed on to them by automobile manufacturers.

Table 2.2.2 below shows the estimated costs and benefits of fuel economy standards in the US since standards were raised in 2011. The costs and benefits were calculated over the lifetime of vehicles manufactured in the model years (MY) for which the programs were in effect.

**Table 2.2.2 Estimated costs and benefits of national fuel economy programs over the lifetime of the vehicles manufactured in their respective model years**

Program	Estimated Energy Savings	Estimated Environmental Savings	Estimated Benefits	Estimated Costs
<b>Standards for light trucks, MYs 2008-2011</b>	5.4 to 7.8 billion gallons of fuel	52 to 73 million metric tons (mmt) of CO <sub>2</sub> emissions	Incremental benefits estimated at US\$ 8.1 billion	Incremental program costs estimated at US\$ 6.7 billion from 2008-2011. Incremental cost per vehicle to rise \$188 on average between MYs 2007-2011
<b>Standards for passenger cars and light trucks, MY 2011</b>	887 million gallons of fuel	8.3 mmt of CO <sub>2</sub> emissions	Between US\$ 1 to US\$ 2.3 billion in societal benefits <sup>66</sup>	Between US\$ 0.8 million to US\$ 2.2 billion <sup>67</sup> for owners of MY 2011 passenger cars and light trucks
<b>Standards for passenger cars and light trucks, MYs 2012-2016</b>	61.0 billion gallons of fuel	654.7 mmt of CO <sub>2</sub> emissions	US\$ 52 billion to US\$ 183 billion <sup>68</sup> , most of which comes from reductions in fuel consumption and valuing fuel savings at future pretax prices.	Program costs estimated at US\$ 52 billion. <sup>69</sup> Average vehicle prices were expected to rise on average. This ranges from US\$ 434 per vehicle in MY 2012 to US\$ 926 per vehicle in MY 2016.
<b>Standards for trucks, MYs 2014-2018</b>	530 million barrels of oil	270 mmt of GHG emissions	Fuel savings ranged from US\$ 34 billion to US\$ 50 billion, with benefits ranging from US\$ 6.7 billion to US\$ 7.3 billion. <sup>70</sup> Truck operators were expected to be able to be able to pay for the technology upgrades in less than a year and realize net fuel savings of US\$ 73,000 over the lifetime of the truck.  The US EPA estimates that improvements in air quality due to reductions in particulate matter and ozone will realize an additional US\$ 1.3 billion to US\$ 4.2 billion in societal benefits in 2030.	Program costs were estimated to be US\$ 8.1 billion
<b>Proposed standards for passenger cars and light trucks, MYs 2017-2025</b>	Four billion barrels of oil billion over the lifetimes of vehicles sold.	2 billion metric tons of GHG emissions	US\$ 424 billion to US\$ 522 billion. <sup>71</sup> Benefits to consumers come in the form of fuel savings ranging from US\$ 5,200 to US\$ 6,600, depending on the discount rate.	Programs costs range from US\$ 168 billion to US\$ 178 billion. <sup>72</sup> Vehicles prices to increase by US\$ 2,000 but owners will enjoy fuel savings of US\$ 5,200 to US\$ 6,600 on average over the lifetime of the vehicle.

Source: National Highway Traffic Safety Administration, 2012

<sup>66</sup> These are at 7% and 3% discount rates respectively.

<sup>67</sup> These are at 7% and 3% discount rates respectively.

<sup>68</sup> These are at 7% and 3% discount rates respectively.

<sup>69</sup> The costs were the same at 3% and 7% discount rates.

<sup>70</sup> These are at 7% and 3% discount rates respectively.

<sup>71</sup> These are at 7% and 3% discount rates respectively.

<sup>72</sup> These are at 7% and 3% discount rates respectively.

As Table 2.2.2 illustrates, the National Highway Traffic Safety Administration reports that its fuel economy standards are, in general, expected to result in incremental benefits over their lifetime that exceed the incremental costs (whether the assumed discount rate is 3% or 7%, although incremental benefits are considerably larger with the lower discount rate). The difference between benefits and costs is expected to be greatest for fuel economy standards implemented over the period 2017-2025 for passenger cars and light trucks. The question that remains, of course, is whether these estimated benefits and costs will actually accrue in the future, which would also determine whether the standards are being set at the socially optimal level.

Critics of the standards argue that the program increases car buyers' costs. They estimate that the proposed model years 2017-2025 standards will raise vehicle prices by up to \$5,000, causing an average buyer's monthly payments to go up by US\$ 60 or US\$ 70 (New York Times, 2012). This provides a disincentive for consumers from buying new cars, thus keeping old and less fuel efficient cars on the roads. Critics have also argued that domestic firms are more constrained by the standards than foreign firms. They instead propose raising taxes on gasoline to internalize externalities such as air pollution and traffic congestion (Cato Institute, 2002). According to modeling from Harvard's Kennedy School of Government (Morrow et al., 2010), setting high fuel efficiency standards could reduce carbon emissions from the transportation sector more than paying people to buy alternative vehicles would and cost the government much less. However, they found that a higher tax on gasoline would be much more effective and generate a socially efficient outcome.

More importantly, the true drawback of fuel economy standards, such as the CAFE standards, is that they do not encourage a potentially crucial element to reducing fuel use: driving less. In fact, ironically, increased fuel economy standards could have a perverse and unwelcome effect; better fuel economy will increase the fixed cost of driving (i.e. vehicle prices) but will actually reduce driving's marginal cost (i.e. fuel expenditures). To a degree, more fuel efficient cars will actually cause people to increase the number of kilometers they drive potentially offsetting the gains from improved fuel efficiency of their vehicles. This is commonly referred to as the "rebound effect" in the literature.<sup>73</sup>

The International Energy Agency (IEA) (2008a) has studied testing procedures for different fuel economy standards and compared the advantages and disadvantages of classifying vehicles by weight against classification by size. It was found that size-based standards are consumer-friendly since people would be more interested in comparing the fuel efficiency of vehicles with similar size than comparing the fuel efficiency of different vehicles (such as a sports car with a van) with similar weights. This approach is technology neutral and thus allows manufacturers to determine which measures to undertake in order to increase fuel efficiency of the vehicle. However, unlike weight, size is only indirectly proportionate to the energy required. This presents a possible loophole for the US system where two differently shaped vehicles could have different footprints but could have similar weights and aero dynamic drag, and therefore be subject to different standards while having similar fuel efficiencies.

Consumer preferences may change and cause an increase in the number of vehicles manufactured outside the range originally considered (which are therefore exempt from the standards). For example, there has been a gradual switch from passenger automobiles to light trucks and sport utility vehicles. As such, because the standard for light trucks has historically been less stringent than that for passenger cars, there was a decrease in overall average fuel efficiency in the mid-1990s. This

---

<sup>73</sup> For a description of what the rebound effect entails, see Saunders, Harry (1992), "The Khazzom-Brookes Postulate and Neoclassical Growth," *Energy Journal* 13: 131-148.

“leakage” problem was corrected when the program was reformed in 2006 to extend its scope (IEA, 2008a). In general, standards with greater coverage of vehicle types tend to lead to greater fuel savings but increase the administrative cost of testing vehicles and the cost of compliance.

### *Labeling*

The fuel economy label in the US provides comprehensive information but it did not manage to arrest the slide in overall fuel economy mentioned earlier. This could either mean that labeling alone is inadequate in increasing fuel economy, or that the label was not designed well enough. The International Energy Agency (IEA) recommends the use of labeling accompanied by standards of an appropriate type and stringency to yield results as these work together to influence consumer choice. Labels should contain information such as the expected fuel efficiency range for most drivers, estimated annual fuel cost and a performance comparison with similar vehicles. Furthermore, it should show the relative performance of the vehicle relation to the standards that are in place (International Energy Agency, 2008a). In the absence of any data, it is not possible to obtain a dollar amount on the costs and benefits of such a program.

### *Incentives*

While the US has rolled out several incentives to support plug-in electric vehicles, it recently allowed two of them to lapse at the end of 2011. Electric vehicles are expensive, so the incentives were criticized as being subsidies to the rich. While the government has argued that the tax credits help to stimulate the market for electric vehicles, hence leading to job creation, it is becoming increasingly apparent that electric vehicles are not ready for the mass market at the moment. Electric vehicle sales in 2011 fell short of expectations, with the Chevrolet Volt coming in below its 10,000 units forecast. In addition, safety concerns were raised when crash tests resulted in the battery bursting into flames (Washington Post, 2012). Sales of the Nissan Leaf worldwide also failed to meet its forecast of 20,000 units; however, this was also due in part to supply disruptions brought about by the Japanese earthquake and tsunami (Financial Times, 2012).

On the whole, it may be more cost-effective to focus on improving the fuel economy of conventional vehicles running on gasoline and diesel than to support alternative fuels which are still not cost competitive. The IEA’s 2008 Energy Technology Perspectives projects that the fuel economy of new light-duty vehicles could be improved by 50% by 2030 using cost effective technologies, including but not limited to hybridization (International Energy Agency, 2008b).

Financial incentives targeted at improving fuel economy levels have not always been effective, though. One policy which attracted much controversy was the Car Allowance Rebate System, more popularly known as “Cash for Clunkers”. Over the course of 2 months, nearly 700,000 new cars were bought using a subsidy of US\$ 4,500, costing the government US\$ 3 billion. The effect of this was to raise overall fuel efficiency by 0.65 mpg (Department of Transport, 2010). Proponents of the program hailed it as a success since it boosted the car manufacturing industry while at the same time increasing overall fuel economy, enhancing energy security, and protecting the environment. Critics however, argued that the subsidy did not add to net national wealth since it merely transferred money to one taxpayer’s pocket from someone else’s, in effect paying the taxpayer to destroy a perfectly serviceable asset in return for something he/she might have bought anyway. In addition, it was found that the program boosted US vehicle sales by just 360,000 in July and August of 2009 and provided no stimulus thereafter. Other estimates showed that about 45% of cash-for-clunker vouchers went to consumers who would have bought new cars anyway, meaning that the policy was rather inefficient.

## **(ii) Scientific Integrity**

### ***Setting fuel economy standards***

Fuel economy standards are set based on analysis of currently available technologies. Feedback from manufacturers is also taken in account when deciding which technologies will be feasible (National Highway Traffic Safety Administration). In order to analyze the incremental costs to manufacturers and consumers brought about by fuel economy standards, the National Highway Traffic Safety Administration uses results produced by the CAFE Compliance and Effects Model, also referred to as the Volpe model.<sup>74</sup> The model considers as inputs the technologies along with their cost and energy savings potential. It then estimates the cost of compliance to a particular standard. In addition to this, the National Highway Traffic Safety Administration also studies other potential impacts of raising fuel economy standards. This includes the impact of higher prices on sales and employment, the rebound effect, and benefits from reducing emissions. Discount rates of 3% and 7% are applied to find the net present value of net costs and benefits of raising CAFE standards.<sup>75</sup>

As such, fuel economy standards in the US are scientifically sound, taking into consideration expected technological improvements over time, and are determined by a process that explicitly seeks to maximize the lifetime economic benefits (and minimize the costs) that can accrue from the standards.

### ***Fuel economy labels***

In order to revamp fuel economy labels to ensure that consumers have the most accurate, meaningful and useful information available to them, the US Environmental Protection Agency engaged PRR<sup>76</sup> to work with them in the design and implementation of several information protocols. This involved a literature review, focus groups, a national online survey of new vehicle buyers and engaging an expert to understand the factors that influence consumers when purchasing vehicles. The literature review found that the most important purchase factors were reliability, safety, price, and fuel economy (Environmental Protection Agency, 2010b). The findings of the study shaped the design of the new fuel economy labels, illustrating that the regulatory process aims to design the labels so as to maximize their potential effectiveness.

## **(iii) Flexibility**

The National Highway Traffic Safety Administration updates the fuel economy standards every five years. The National Highway Traffic Safety Administration uses the five year period to elicit feedback on its existing program. This information is used as an input into subsequent programs. This institutional structure allows for limited flexibility, since it does not allow for adjustments to changing circumstances except at the end of every five-year period.

---

<sup>74</sup> This is a software developed by the Department of Transport's Volpe National Transportation Systems Center specifically for NHTSA's CAFE rulings

<sup>75</sup> 3% is considered to be the social rate of time preference, used when discounting future benefits and costs of regulations that primarily affect vehicle purchases while 7% is reflective of real economy wide opportunity cost of capital.

<sup>76</sup> PRR is a consulting firm that works in the fields of research, marketing, media and community relations, graphics design, and public policy.

The standards program, however, gives manufacturers the flexibility to decide how to meet the standards. The CAFE standards are imposed not on individual vehicles, but on a manufacturer's vehicle fleet as a whole. The manufacturer meets the standards as long as the average fuel economy of all vehicles it sells in a given year meet or exceed minimum fuel economy standards; this gives manufacturers the flexibility to decide on which vehicles to concentrate energy efficiency improvements. All of these features are meant to facilitate compliance from manufacturers, and in addition enable fuel economy improvements to be achieved at a lower overall cost.

## **ADMINISTRATIVE AND POLITICAL VIABILITY**

### **(iv) Transparency**

Feedback and compliance from car manufacturers are vital in both the design and implementation stages of policy administration. The views of car manufacturers are taken into account in the process of policy making. In fact, the stagnation of CAFE standards was partially attributed to car companies lobbying successfully against higher CAFE requirements (World Resources Institute, 2008). This suggests that there exists a potential for regulatory capture when lobbies are too strong.

More recently, the National Highway Traffic Safety Administration formally requested comments from manufacturers and the general public on its proposal to reform the automobile fuel economy standards program in 2003 (National Highway Traffic Safety Administration, 2012). It also accepts comments from the public on its proposed rules for 60 days from the date the proposals are published. In addition, public hearings are held for the pros and cons of the program to be debated before the regulation is passed.

The National Highway Traffic Safety Administration and US Environmental Protection Agency have jointly proposed fuel economy standards for model years 2017- 2025. They have noted the long time frame in setting standards for model years 2022-25 and thus will undertake a comprehensive mid-term evaluation. Up-to-date information will be compiled for through a collaborative, robust and transparent process, including public notice and comment (National Highway Traffic Safety Administration, 2012). Thus, stakeholder engagement continues to be integral to the process of designing the CAFE standards, although the risk of regulatory capture by strong lobbies is not mitigated.

### **(v) Alignment**

CAFE standards are implemented jointly by the National Highway Traffic Safety Administration, which sets the standards, and the Environmental Protection Agency, which implements the associated labeling program and tests vehicle efficiency (National Renewable Energy Laboratory, 2009). The clear delineation of roles between the two agencies means there is less likelihood of potential mismatches in coordination and alignment between the regulators.

Historically, the federal government has had jurisdiction over setting fuel economy standards, but in June 2009 the state of California was granted a waiver to allow it to establish a separate and higher fuel efficiency standard. Thereafter, thirteen other states and Washington D.C. followed suit. However, soon after that the federal standards were updated so that they remained in alignment with the California standards. There is also growing alignment of fuel economy standards at the state level, with many states forming regional collaborations (such as the Western Climate Initiative) to address climate change issues and in doing so, aligning their fuel economy standards with each other. Fuel

economy labeling is implemented solely by the federal government, which reduces the chances of policymaking conflict among different government levels.

As mentioned previously, President Obama has requested for the National Highway Traffic Safety Administration and US Environmental Protection Agency to collaborate on building a national program that will produce a new generation of clean vehicles. This has resulted in joint efforts by both agencies to launch its first fuel efficiency and GHG programs for model years 2012-2016, as well as a second program proposed for model years 2017 – 2025, which appears to reflect a move towards increased alignment and coordination among the two authorities. However, in the absence of an institutional mechanism to facilitate the change, it is unclear whether this desirable practice will continue.

## 2.2.2 Transportation in the Philippines

### Key Findings

- Similar to the US, the drive to increase fuel economy in the Philippines is motivated by energy security concerns.
- There is a drive towards alternative fuels as these not only reduce oil consumption but are also considered to be less polluting in nature. Retrofitting of existing vehicles to run on alternative fuels helps to renew the fleet, which provides an additional boost to improving efficiency. The government has made available over US\$ 24 million in soft loans for drivers to convert their engines to natural gas vehicles.
- There are no standards or labeling programs in the Philippines, as insufficient data make it cumbersome for such programs to be implemented. In addition, fuel economy is not a consideration for consumers when they are in the process of purchasing a vehicle.
- The drive towards the use of alternative fuels has been of mixed effectiveness. The use of biofuels in vehicles is likely to lead to significant energy savings and emission reductions at a relatively moderate cost, whereas the use of natural gas vehicles is initially highly expensive and relatively ineffective at reducing either energy use or greenhouse gas emissions. Policymaking is characterized by robust stakeholder engagement, but problems of conflicting objectives of different stakeholders and lack of alignment can arise.

### Costs, benefits and promotion

- The use of biofuels in vehicles is likely to lead to significant energy savings and emission reductions at a relatively moderate cost.
- Natural gas vehicles are relatively ineffective in reducing energy use or greenhouse gas emissions, while they are initially highly expensive due to the large capital investment required in developing pipelines and fueling infrastructure and the high costs of compressed natural gas buses.

### Scientific integrity

- The scientific basis for switching to compressed natural gas, under the government's Alternative Fuels Program, is questionable from an energy efficiency basis, as compressed natural gas buses have been found to be generally less fuel efficient than diesel buses.

### Flexibility

- Most policies do not impose mandatory requirements, giving manufacturers and owners the flexibility to decide whether and how to improve the fuel economy levels of their vehicles.

### Transparency

- The involvement of stakeholders is perceived as important whilst drafting regulatory policy.

However, consultations with several stakeholders have on occasion faced drawbacks arising from conflicting objectives of different stakeholders, which may seem difficult to overcome.

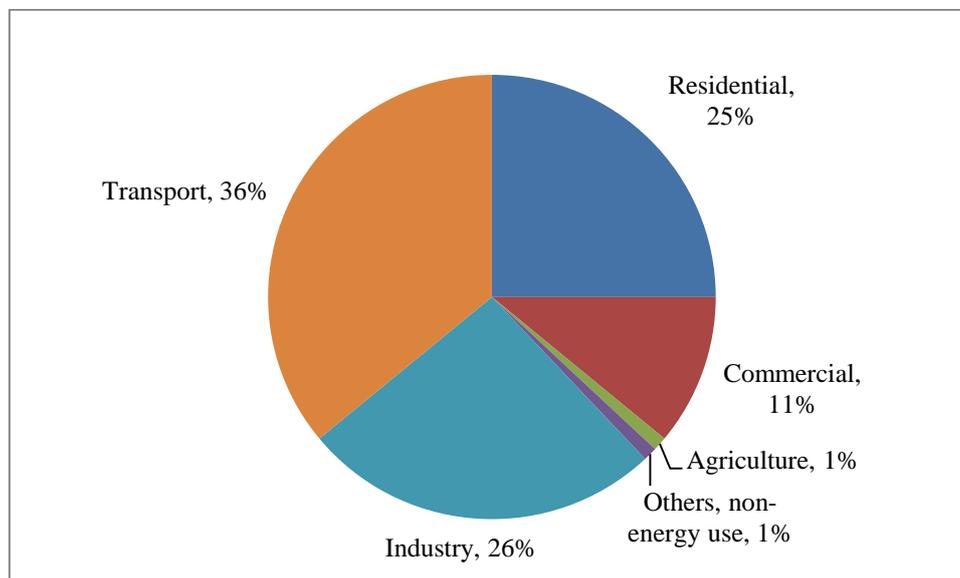
### Alignment

- There are several government organizations with different mandates that are directly or indirectly involved in setting regulations that could affect the transport sector. Given that there is no formal institution to ensure that these organizations coordinate on their policies, issues of alignment can arise.

## A. Size and Significance

As of 2010, the Philippines had an energy demand of approximately 24.74 million tons of oil equivalent (Mtoe). The Philippine Department of Energy estimates that the next two decades will see a growth rate of total energy demand of at least 3.5 to 3.6% per annum. The transportation sector was the biggest contributor to energy demand (amounting to approximately 9 million tons of oil equivalent in 2010). Figure 2.2.5 gives the sectoral shares of final energy demand. It shows that the transport sector's share in final energy demand is approximately 36%. Crucially, energy demand from the transportation sector is expected to grow at a rate of 3.8% per annum up until 2030 (Philippines Department of Energy, 2012).

**Figure 2.2.5 Sectoral demand shares in the Philippines (2010)**

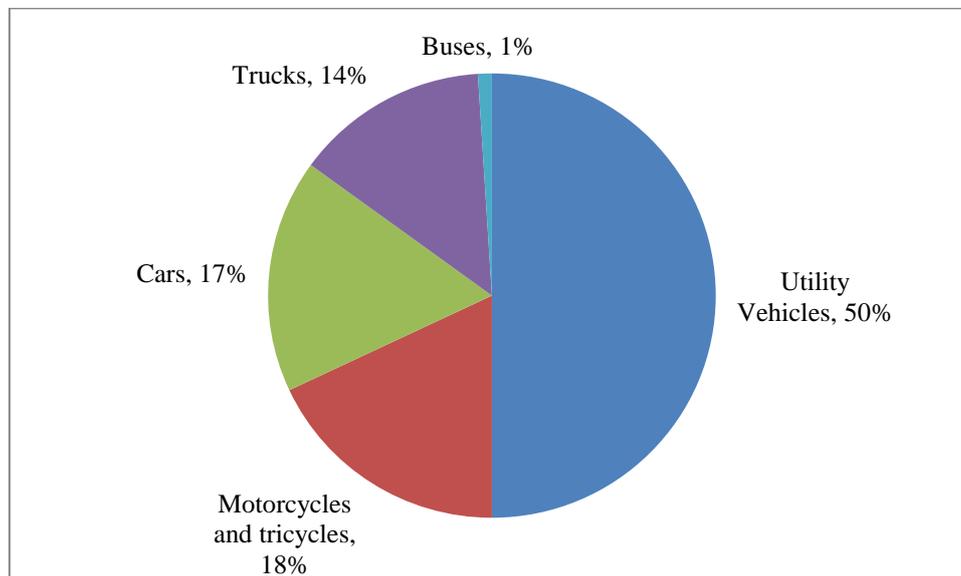


Source: Philippine Department of Energy, 2010

Imported oil comprises over 90% of national oil consumption in the Philippines. The transport sector has been one of the major and fastest growing consumers of oil. In 2003, the transport sector accounted for 46% of total oil consumption of the Philippines, a figure that is rapidly increasing at an annual growth rate of 4.9% (Food and Agriculture Organization of the United Nations, 2009). Of the different vehicle types, public utility vehicles (which include vans and other light duty vehicles) have historically been the largest consumers of fuel. Figure 2.2.6 below shows the fuel consumption of

vehicles by type in 1996. Fuel consumption of public utility vehicles accounted for approximately half of the fuel consumption of the transportation sector. Interestingly, two-wheeler and three-wheeler (motorcycle and tricycle) fuel consumption demand rivaled that of cars in 1998. To date, motorcycles and tricycles still contribute significantly to road transport.<sup>77</sup>

**Figure 2.2.6 Fuel consumption of vehicles by type in 1996**



Source: Philippines Department of Energy, 2010

## **B. Policy Formulation**

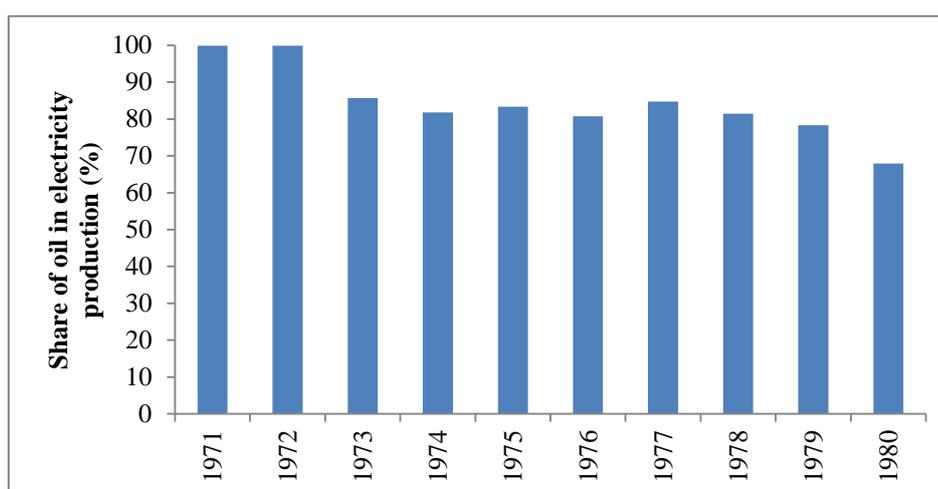
### **(i) History and Background**

The oil shocks of the 1970s set the tone for energy policy in the Philippines. At that time, the Philippines was highly dependent on crude oil not just in the transportation sector but also in the electricity sector. Figure 2.2.7 below shows the share of oil in electricity production in the 1970s.<sup>78</sup> Even at the end of 1970s, oil's share in electricity production was greater than 60%. Energy conservation became the policy objective with strict energy conservation policies such as scheduled rotating brownouts implemented to reduce energy demand.

<sup>77</sup> This is based on interviews with officials from the Philippines Department of Energy (16 April 2012).

<sup>78</sup> Over the years, this share has dropped gradually. From 2005 onwards, oil's share in electricity production has been approximately 10% (Global Energy and CO<sub>2</sub> Data, Enerdata (2012)).

**Figure 2.2.7 Share of oil in electricity production (1970 – 1980)**



Source: Global Energy and CO2 Data, Enerdata, 2012

The energy shocks of the 1970s resulted in the passage of several energy conservation laws by the Batasan Pambansa (BP) or National Assembly of the Philippines. These largely came in the form of Letters of Instructions (LOIs) and Presidential Decrees (PDs). These emphasized the promotion of energy efficiency and conservation and the raising of public awareness of the same. The primary policy focus was the improvement of energy security of the Philippines. Over time, the policy directive has evolved to include goals of developing indigenous resources, reducing local pollution, maintaining reasonable energy prices, and improving the sustainability of the energy system.

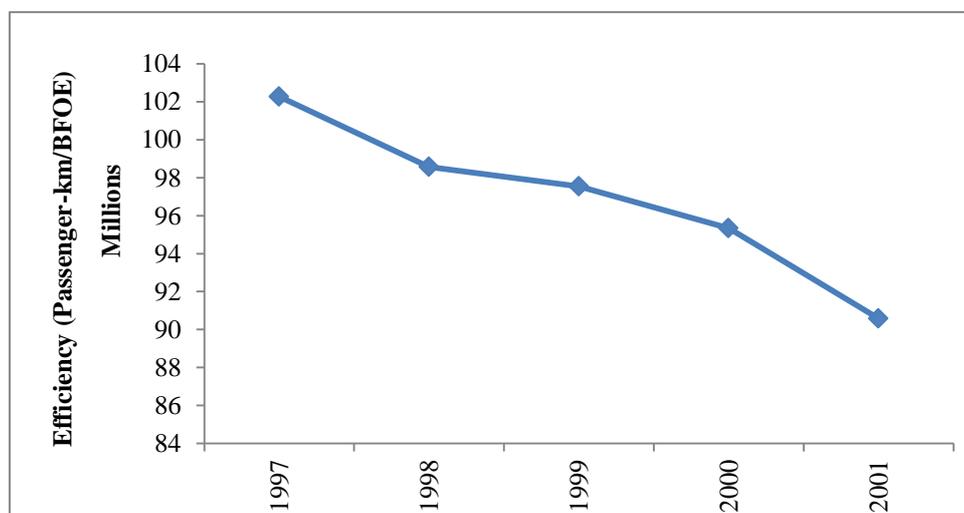
In 2007, the National Energy Efficiency and Conservation Program (NEECP) was implemented as a 7 year program, part of President Arroyo’s goal to achieve 60% energy self-sufficiency by 2010. Aside from transport, the program includes measures that cover the government, industrial, residential, commercial, and agricultural sectors. Subsequently, the Renewable Energy Act of 2008 (also known as the Republic Act 9513) was passed which gave impetus to the development of the economy’s renewable energy resource.

With regard to the transportation sector, it seems plausible that the increase in oil consumption from the sector is partly due to a fall in transport efficiency.<sup>79</sup> Figure 2.2.8 shows the passenger transport efficiencies for road transport. From 1997 to 2001, passenger transport efficiency fell over 10%, from 102,276 passenger-km/energy Bfoe (barrels of fuel oil equivalent) to 90,581 passenger-km/Bfoe. From 1990 to 2005, energy intensity of transport doubled from 0.013 koe/\$95peso (0.52

<sup>79</sup> No formal study has been carried out to study why road transport efficiency has fallen, but it could be partly to the increase in the population of public utility vehicles and motorcycles/tricycles which rose by 19.7% and 40.6%. respectively from 1997 to 2001. Assuming a full passenger load, buses and cars are more fuel efficient than motorcycles and tricycles, while buses are more fuel efficient than public utility vehicles, due to their larger carrying capacities. Furthermore, from 1997-2001, the total vehicle population rose 16.6%. This could have contributed to increased road congestion, thus lowering fuel efficiency. The increased life of vehicles also means that older, more inefficient vehicles are being retired from the market at a slower rate, further contributing to falling transport efficiency.

koe/US\$) to 0.026 koe/\$95peso (1.04 koe/US\$) (Bayot et al, 2006).<sup>80</sup> This shows that transport efficiency has been falling. This has contributed to the rise in the absolute amount of fuel consumed.

**Figure 2.2.8 Road transport efficiency (1997-2001)**



Source: Bayot, et al, 2006

## (ii) Policy Description

### MANDATES

The Philippines has been quite active in setting economy-wide energy efficiency targets including energy efficiency targets for its transportation sector. As per the 2009–30 Philippine Energy Plan (PEP), the government set a target reduction of 10% of final energy demand for the commercial, residential, industrial, transport, and agricultural sectors (Institute of Energy Economics, Japan, 2010). The Department of Transportation and Communication (DOTC) has 5 fundamental strategies to promote fuel efficiency in the land transport sector (Philippines Department of Energy, 20008), namely:

- Increase vehicle efficiency through the modernization of the public transport fleet and the enforcement of vehicle standards.
- Switch to alternative fuels such as liquefied petroleum gas (LPG), compressed natural gas (CNG), and electric vehicles.
- Switch to energy efficient transport modes including high occupancy mass transport system, railways, a rapid bus system, and non-motorized transport.
- Decrease travel distance and travel time through traffic decongestion measures and the clearing of roadways of obstructions.
- Increase vehicle load factor by promoting bigger capacity vehicles.

With regard to the biofuels sector, the national biofuels regulator under the Department of Energy aims to maximize biofuels contribution for fuel transport. The Department of Energy has mandated a minimum of 10% blend of ethanol into gasoline and a 2% blend of biodiesel in petroleum diesel distributed and sold in the Philippines. The development of biofuels policies in the Philippines takes

<sup>80</sup> Koe refers to thousands of barrels of oil equivalent; \$95peso refers to 1995 prices at purchasing power parity. We assume that 1 US\$ = 40 pesos.

into consideration alternative feedstocks,<sup>81</sup> logistics, fuel compatibility, and price (a high price is not sustainable due to the dependence of public transport on diesel).<sup>82</sup>

### ***Standards***

Unlike the US, fuel economy standards have not had a place in the Philippines road transportation policy toolkit. However, standards governing the use of alternative fuels have been implemented. As part of the Natural Gas Vehicle Program for Public Transport, 48 sets of International Standards Organization (ISO) standards were adopted as the Philippines National Standards in June 2003. These covered CNG fuel system components, rules covering the quality of natural gas, and analytical methods to determine the composition of natural gas. Other standards covered code of practice for CNG compressor refueling stations regarding on-site storage and location of equipment (Philippines Department of Energy, 2005a).

In 2006, the Department of Energy implemented standards to regulate the different components of an autogas program.<sup>83</sup> Similar to that for CNG, these standards are not fuel economy standards for vehicles running on autogas but standards for specific equipment, installation of systems, and code of practice (Philippines DOE, 2005a).<sup>84</sup> In addition, 11 sets of Philippine National Standards were implemented in 2008 for electric vehicles (Philippines Department of Energy, 2010).

### ***Initiatives at Government Agencies***

The Government Energy Management Program (GEMP) was put in place in 2004 specifically to improve the conservation of fuel used in government vehicles and improve the energy efficiency of government building electricity use. This Program came into effect as per Presidential issuances such as Administrative Orders Nos. 103, 110,126, and 183. It directs government agencies to reduce their fuel and electricity consumption by at least 10%. Strategies to reduce energy usage include changing behavior to use fuel more efficiently as well as using CME<sup>85</sup> blended diesel fuel, the observance of austerity measures, and the use of energy efficient lighting (Philippines Department of Energy, 2005b). The Department of Energy executes this Program, which involves the monitoring of fuel and electricity consumption of all government departments, bureaus, government-owned and controlled corporations, and academic institutions.

## **FISCAL INCENTIVES**

### ***Fuel Subsidies***

Fuel subsidies lower the salience of the cost of fuel prices and discourage drivers from switching to alternative fuels which are operationally cheaper and can be more efficient (Interlaboratory Working Group, 2000). Hence, fuel subsidies negatively impact transportation fuel efficiency.

---

<sup>81</sup> The feedstock used in the production of biofuels in the Philippines is coconut oil. The price of the same is quite high when compared to the fossil fuel alternatives

<sup>82</sup> This is based on interviews with officials from the Philippines Department of Energy (16 April 2012).

<sup>83</sup> Autogas is the common name for liquefied petroleum gas (LPG) when it is used as a fuel in internal combustion engines in vehicles. It is a mixture of propane and butane.

<sup>84</sup> Philippines DOE, Autogas, Philippines

<sup>85</sup> CME refers to coco-methyl ester, a biodiesel derived from coconut oil

The Philippines has done away with fuel subsidies for the most part. However, although the subsidy of fuel prices was ended in 1998 due to the “Downstream Oil Industry Deregulation Act of 1998,”<sup>86</sup> the government still steps in to provide funding for fuel discounts. In January 2011, soaring oil prices resulted in the price of petroleum rising by more than 20 times. This prompted President Benigno Aquino III to approve a 500 million peso<sup>87</sup> fuel subsidy to public utility jeepneys and tricycles (Inquirer, 2011).

President Benigno Aquino III approved an executive order granting fuel subsidies to public utility vehicles, a move seen to cushion the effects of the continuing oil price increases resulting from political and civil unrest in Middle Eastern economies. The subsidy was to be allotted to jeepney and tricycle drivers through “fuel assistance smart cards,” which will be issued by the Land Bank of the Philippines (LBP). Good for a period of one month, the cards would allow jeepney and tricycle drivers to enjoy discounts of anywhere from 2 to 3 peso per liter of fuel (US\$ 0.05-0.07 per liter).<sup>88</sup> However, the subsidy could only be enjoyed by those who had valid franchises from the Land Transportation Franchising and Regulatory Board (LTFRB). Funds for the subsidy were to be sourced from government savings and were not to cover buses given that a bus fare hike was recently approved. In November 2011, the government confirmed that they were willing to extend the subsidies as the prices of gasoline and diesel had not fallen (Sunstar, 2011).

### ***Legislative Support for Alternative Fuel Vehicles***

In October 2011, Senator Ralph Recto proposed “An Act providing incentives for the manufacture, assembly, conversion, and importation of electric, hybrid and other alternative fuel vehicles.” The proposed act consisted of fiscal and non-fiscal incentives to the importation and manufacture of electric, hybrid, and other vehicles. Fiscal measures include exempting manufacturers from payment of excise taxes and duties and from payment of value added tax for the purchase and importation of materials for nine years. Owners of alternative fuel vehicles would be exempt from paying the motor vehicle user’s charge upon registration of their vehicles. Non-fiscal measures include free parking, priority in registration and issuance of license plates, priority in franchise applications for public utility vehicles and exemption from the Unified Vehicular Volume Reduction Program (UVVRP)<sup>89</sup> (Institute For Climate And Sustainable Cities, 2011). In 2011, Energy Secretary Rene Almendras publicly endorsed the use of electric vehicles and pushed for giving tax incentives for the importation of electric powered vehicles (Malaya, 2010). As of January 2012, there was no news on whether these proposed Acts and incentives were passed.

### ***Demand Side Management***

In addition to the usage of technological means to reduce energy use, the Philippines has plans to use vehicle demand management policies to curb the demand for vehicles. The Unified Vehicular

---

<sup>86</sup> The Downstream Oil Industry Deregulation Act of 1998 allows oil companies the freedom to set prices based on an unregulated, competitive market structure.

<sup>87</sup> This would approximate to a subsidy of US\$ 12.5 million at current market exchange rates of 1 US\$ = 40 pesos.

<sup>88</sup> Assumed exchange rate of 1 US\$ = 40 pesos.

<sup>89</sup> The Unified Vehicular Volume Reduction Program is designed to reduce the amount of vehicular traffic in Metro Manila. Since 1995, motor vehicles whose license plate ends in a particular number are barred from using the main streets of Metro Manila on certain days from 7am to 7pm. For instance, license plates ending with numbers 1 and 2 are banned on Mondays. The rule does not apply on Saturdays, Sundays and official public holidays. See <http://www.mmda.gov.ph/MMDAMC/MMDAMC03-11.html>

Volume Reduction Program (UVVRP) mentioned earlier was carried out to reduce congestion and effectively improve vehicular efficiency. However, elected officials are reluctant to further these initiatives by implementing tougher policies, such as congestion pricing and vehicle taxes based on fuel standards, due to public opposition (World Bank, 2010).

### *Improving public and non-motorized transport*

Given the efficiency of public transportation and the railways, the Philippines is looking to promote public and non-motorized transport in some of its major cities. The Metro Manila Development Authority is planning investments that would enhance bus routes, result in new terminals, improve existing bus stops, and regulate short-running of buses to meet hourly demand. Approximately 50 km of Bus Rapid Transit (BRT) lines have been planned, starting with a 15 km corridor in Cebu by 2013. There is also on-going construction as well as plans to extend light rail transit lines in Manila. In 2011, an additional 11.7 km of light rail transit lines were announced, together with an impending phase-out of taxis after 10 years, utility vehicle expresses after 15 years and 10 years for multi-cabs.<sup>90</sup> Non-motorized transport is promoted by providing segregated cycle paths in cities. Sidewalks are also being cleared and improved to facilitate pedestrian traffic (Vergel, et al, 2005).

## **FINANCIAL INCENTIVES**

### *Alternative Fuel Programs*

The Philippines has several initiatives to rationalize the use of fossil fuels. In September 2011, the Philippine Department of Energy announced plans to accelerate its alternative fuel sources program, the Fueling Sustainable Transport Program (FSTP), which will convert oil-fuelled vehicles to run on electricity, CNG, or LPG (Manila Bulletin, 2011). The program not only serves to modernize the transport system of the economy but also to standardize the type of fleets serving the public. The government is implementing an “Alternative Fuels Program” which taps into the economy’s domestic resources as viable sources of energy. It comprises four major subprograms, namely the Biodiesel Program, Bioethanol Program, Natural Gas Vehicle Program for Public Transport and Autogas Program. Other technologies being advocated are hybrid, fuel cell, hydrogen, and electric vehicles.

In 2004, President Arroyo signed an Executive Order No. 397 to promote low engine displacement and hybrid vehicles by reducing the rates of import duty on completely-knocked-down parts and components for such vehicles. This was followed by Executive Order No. 488 in 2006 which reduced the import duty of components, parts and accessories for the assembly of hybrid, electric, flexible fuel, and CNG motor vehicles (Official Gazette, 2006).

The use of the four-stroke engine for motorcycles and tricycles is also being encouraged together with the entry of electric-powered motorcycles or electric bikes to facilitate the elimination of two-stroke motorcycles (Clean Air Initiative, 2010). In 2008, the government launched a billion (peso) soft loan program to help owners of jeepneys, buses and taxis to convert their diesel or gasoline fed engines into ones that would run on alternative fuels (Clean Air Initiative, 2010). The then-President

---

<sup>90</sup> Utility vehicle expresses and multi-cabs are taxicabs of the Philippines. Similar to jeepneys, they are classified under utility vehicles but vary in seating capacity and ceiling height. See [http://www.easts.info/on-line/proceedings\\_05/90.pdf](http://www.easts.info/on-line/proceedings_05/90.pdf)

Gloria Arroyo announced a goal of 10,000 vehicles that would use cheaper and cleaner alternative fuels. The Philippines Department of Energy expects to reduce the number of gasoline and diesel fed transport vehicles by 30% by 2020.

The Natural Gas Vehicle Program for Public Transport (NGVPPT) was launched in 2002 with various incentives to promote investment from the private sector. The program offers tax holidays, zero rate of duties, accelerated administrative processing, financial assistance from governmental financial institutions (GFIs) and manpower development and capacity building to promote conversion for public transport vehicles to run on natural gas. Executive Order No. 396 was signed in 2004 which reduced the import duties on natural gas motor vehicles to 0% (Clean Air Initiative, 2010). Targets have been set for 600 CNG buses and 3 daughter stations (DS) by 2015 and 2000 CNG buses and 12 daughter stations by 2020.<sup>91</sup>

Plans have also been made to retrofit public jeepneys to use auto-LPG (for subsequent conversion to run on CNG) (Philippines Department of Energy, 2010). Philippines aims to have 300 jeepneys retrofitted by 2015 and 800 by 2020. Other targets include 19,500 auto-LPG taxis by 2015 and 20,500 by 2020 (World LPG Association, 2009). As of 2007, there were a total of 4,275 autogas vehicles/taxis in the Philippines (Philippines Department Of Energy, 2005a). A study on the economic viability, environmental soundness, health impact and social acceptability on jeepneys converting from diesel to LPG is also underway (PhilSTAR.com, 2011).

In 2011, the National Electric Vehicle Strategy (NEVS) was announced. The NEVS is a partnership between the government and the Asian Development Bank (ADB) intended to reduce the carbon footprint of road transport in the Philippines. The program began with a trial in the city Mandaluyong City in Metro Manila involving 20 electric tricycles in May 2011 (Mindanao Examiner, 2011). Positive results of the trial led to the DOE to announce in January 2012 its plans to tap P100 million from the Clean Technology fund to finance the deployment of 20,000 electric tricycles over the next two years<sup>92</sup> (Inquirer, 2012). Targets have also been set for electric vehicles: 20,000 electric tricycles by 2015 and 24,000 by 2020.

## **INFORMATION PROGRAMS**

### ***Road Transport Patrol Program***

In 1998, the Committee on Fuel Conservation and Efficiency in Road Transport launched the Road Transport Patrol Program (Philippines Department of Energy, 2005c). It targets a 10% reduction in fuel consumption<sup>93</sup> and provides consumers with information on the efficient use of fuel through proper vehicle maintenance, efficient driving and values formation among drivers through seminars,

---

<sup>91</sup> Daughter stations are installed at locations where a CNG fill station is needed but there is no natural gas pipeline. Natural gas is brought to the daughter station by mobile storage.

<sup>92</sup> There are presently about 3.5 million tricycles in the Philippines [CNN (2011). Driving ambitions for electric vehicles in Philippines. Accessed at <http://edition.cnn.com/2010/WORLD/asiapcf/12/07/electric.vehicles.philippines/index.html>]. The ADB itself has committed Peso500 million (approximately USD12.5 million at an exchange rate of 1 US\$ = 40 pesos) to supporting the electric tricycle project.

<sup>93</sup> The campaign was launched through Executive Order No. 472 which originally targeted a 5% reduction in fuel consumption.

workshops and use of the tri-media.<sup>94</sup> There are several programs that aim at reducing the use of vehicles so as to reduce fuel consumption and the concomitant carbon emissions such as car less day, carpooling, park and wait, park and ride, park and walk, and park and pick.

The car less day is meant to encourage people to leave their cars at home one day a week. Carpooling in the Philippines requires that three or more individuals travelling to the same destination arrive at an arrangement whereby they utilize just one car. The park and wait or anti-idling campaign, which was launched in 2004, encourages motorists to turn off their engines when parking. The park and ride campaign, which was also launched in 2004, promotes the use of parking spaces where vehicle owners can leave their vehicles and then use public transportation to get to their final destination. Similarly, the park and walk campaign encourages vehicle owners to park their vehicles and walk to their final destination. The park and pick campaign encourages taxis to pick up customers at designated points so as to reduce congestion.

### ***Fuel Economy Run***

To raise awareness amongst the general public regarding judicious use of fuel in transport, the Philippines Department of Energy introduced the Fuel Economy Run program since 2002. This program has been conducted for different types of vehicles and emphasizes the importance of vehicle maintenance and driving habits to achieve better fuel economy ratings. This event has gained support and participation from several vehicle manufacturers and transport organizations. The winners of the Fuel Economy Run are awarded cash prizes and other giveaways. In addition, the winners have their names and fuel economy ratings published in national newspapers with wide circulation.

### ***Electric tricycle design contest***

To raise awareness and encourage local participation, an electric tricycle design contest was launched as part of the program. The Department of Energy envisions that the promotion of electric tricycles will eventually translate to the development of local expertise in designing and maintaining small electric cars (Official Gazette, 2012). However, there are no immediate plans for mass commercialization of electric cars. The government plans to demonstrate their use by testing them.

## **C. Regulatory Review**

### **ECONOMIC EFFICIENCY AND EFFECTIVENESS**

#### **(i) Costs, Benefits and Promotion**

##### ***Standards***

It is worth noting that using fuel efficiency standards is what political scientists and economists call a “second-best” solution. There is a long history of debate on whether “command and control” regulations (like raising CAFE standards) are a good way to bring about desired changes in behavior. The other or “first-best” option is the use of price signals—which in the case of transportation would be increased fuel taxes—to influence consumer behavior. The use of price signals to bring about a change is contentious and can be politically challenging to enforce. The Philippines is no different

---

<sup>94</sup> “Tri-media” is a commonly used term in the Philippines which refers to the three forms of traditional media: print (newspapers), radio, and television.

from any other economy is this respect.<sup>95</sup> However, the Philippines has avoided implementing even the second-best solution preferring to rely on voluntary standards. The International Energy Agency (IEA) recommends setting standards in the place of voluntary programs as the latter have generally fallen short of their targets in most economies where they have been employed. As such, there is a general trend away from the use of voluntary programs worldwide.

However, there are a number of reasons as to why standards have not yet been implemented in the Philippines.<sup>96</sup> It is not feasible to implement standards at the moment due to insufficient data. While the Fuel Economy Run program has been generating data to aid the setting of standards in the future, no formal testing cycle has been adopted (United Nations Environment Program, 2011). Another barrier to setting standards is the fear of the car industry moving to other economies. There is also the perception that it will be difficult to influence manufacturers for whose cars are assembled within the Philippines but whose car components, including the engine, are manufactured elsewhere (Clean Air Initiative, 2010). Furthermore, there are issues of equity that regulators in the Philippines have to contend with. The use of mandatory fuel standards might see lower-cost but inefficient vehicles exit the market. In an economy where alternative modes of transport are scarce, this might impose a penalty on less well-off individuals especially if the two- and three-wheelers are brought under the purview of the fuel standards.

#### ***Initiatives at Government Agencies***

The Government Energy Management Program (GEMP), a continuing program of the Philippine Department of Energy, requires that the spot checks or unannounced energy audits are conducted on various government agencies. A grading system is in force that determines the extent of the compliance of the Agencies with the Administrative Orders. The Agencies' ratings are posted publically with an intent to "name and shame" those whose energy reduction efforts fall below designated thresholds. For those Agencies who manage to reduce their energy consumption, monetary incentives are provided. From September 2005 to July 2011, the Department of Energy reported savings of 1.5 billion pesos<sup>97</sup> on electricity and fuel (Philippines Department of Energy, 2012). The amount of energy saved was equivalent to 0.22 million barrels of fuel oil equivalent (MMBFOE) in 2009 and 2010. The cost of achieving these savings is not been made available. Hence, the cost-effectiveness of the program cannot be evaluated.

#### ***Alternative Fuels Program***

The Alternative Fuels Program has led to 18,731 registered taxis running on LPG in the Philippines with 560 electric vehicles operating in major cities as of March 2011. However, jeepney operators are finding it difficult to convert their vehicles to run on LPG as compared to taxis due to the high cost. It costs about P250,000<sup>98</sup> to convert a jeepney, over 10 times the price for a taxi which

---

<sup>95</sup> In fact, politicians try to gain the support of their electorate by trying to reduce the final cost of energy. For instance, recently, the opposition party member Mito Magsaysay appealed for the reduction of Value Added Tax (VAT) on petroleum products (accessed at <http://www.tempo.com.ph/2012/reduce-fuel-tax-govt-urged/#.T53dPDLa-So>).

<sup>96</sup> It should be noted that the Energy Efficiency and Conservation Action Plan (2010 – 2030) looks to begin the setting of standards and labeling for passenger cars and light duty vehicles by 2015.

<sup>97</sup> This amounts to approximately US\$ 37.5 million at current market exchange rates of 1 US\$ = 40 pesos.

<sup>98</sup> This amounts to approximately US\$ 6,250 at current market exchange rates of 1 US\$ = 40 pesos.

lies between P20,000 to P30,000.<sup>99</sup> Conversions for taxis are much simpler, consisting of add-ons onto the existing engine, while for jeepneys, the process is more complicated and involves replacing the whole engine and then attaching a LPG kit. As such, the Clean Air Initiatives for Asian Cities Center has recommended the implementation of financial mechanisms such as micro-financing to support drivers and operators to convert their vehicles to run on LPG (PhilSTAR.com, 2011). However, such a recommendation would only be justified if the net benefits of the Autogas Program (under the Alternative Fuels Program) were shown to exceed its net costs.

Table 2.2.3 below summarizes the World Bank’s evaluation of the expected benefits (both in terms of fuel savings and emissions reduction) and costs of various programs under the Alternative Fuels Programs. Without quantifying the benefits of energy savings (including energy security benefits) and the benefits of emission reduction in dollar terms, it is not possible to make a definitive judgment as to whether the Alternative Fuels Program has led to net welfare benefits. However, it is possible to compare between different alternative fuels on the basis of costs and benefits.

The results indicate that the use of biofuels in vehicles is likely to lead to significant energy savings and emission reductions, at a relatively moderate cost. The study finds that costs are negative if co-benefits such as health effects are taken into account. In contrast, natural gas vehicles are relatively ineffective in reducing energy use or GHG emissions, while they are also highly expensive due to the large capital investment required in developing pipelines and fueling infrastructure, and the high costs of CNG buses (World Bank, 2010). In the case of the Philippines, switching fuels to LPG (under the Autogas program) is also a relatively inefficient policy tool, achieving no energy savings and minimal reductions in GHG emissions. Energy security motivations for the switch to gas are not compelling either. The Philippines is not a major gas producer, with gas production of 3.6 billion cubic metres (bcm) in 2011 (as opposed to 75.6 bcm in Indonesia, 37.0 bcm in Thailand and 8.5 bcm in Vietnam) (BP, 2012) and there are uncertainties regarding the size of its gas reserves (World Bank, 2010).

**Table 2.2.3 Evaluation of alternative fuels scenario**

Scenarios	Energy Use Impact, Fuel Saved/year in MTOE	Emission Impact, GHG Reduced/year in MtCO <sub>2</sub>	Indicative Cost of GHG Reduction, US\$ per tCO <sub>2</sub>
<b>Biodiesel</b>			
S1: PEP 2008 (20% CME by 2030)	1.1	3.4	30.8
S2: 20% CME by 2020	1.8	3.5	-9.8 (with co-benefits)
<b>Bioethanol</b>			
S1: PEP 2008 (E85 by 2030)	1.4	5.2	
S2: E85 by 2025	4.7	11.3	
<b>Natural Gas</b>			
S1: PEP 2008 (5,000 CNG buses by 2026)	0.02	0.06	442
S2: 10% of all buses and trucks by 2020, 25% by 2025, and 50% by 2030	1.8 (2020-2030)	1.6 (2020-2030)	No estimate for cost with co-benefits
<b>Auto Gas</b>			
S1: 100% conversion of gasoline-fed taxis by 2015	0	0.04	9.7

<sup>99</sup> This amounts to approximately US\$ 500 to USD 750 at current market exchange rates of 1 US\$ = 40 pesos.

S2: 25% conversion of gasoline-fed private cars by 2020, 50% by 2030	0	1.0	–
--	---	-----	---

Source: World Bank, 2010

Of greater pertinence to the alternative fuels program is that it may be, in the case of the Philippines, more cost effective to focus on improving the fuel economy of conventional vehicles rather than supporting alternative fuels which are still not cost competitive. The International Energy Agency projects that the fuel economy of new light-duty vehicles could be improved by 50% by 2030 using cost effective technologies, including but not limited to hybridization (International Energy Agency, 2008a). The welfare effects of such a policy direction, which should plausibly be higher than the alternative fuels program on account of lower switching costs,<sup>100</sup> need to be further explored in the Philippine context.

### ***Information programs***

Car buyers in the Philippines are not familiar with the features of vehicles with respect of fuel economy. More importantly, it has been found that fuel economy is not a consideration for consumers in the decision making process (United Nations Centre for Regional Development, 2010). This suggests that the Road Transport Patrol Program has not yet been effective in providing consumers with information on fuel efficiency or in creating awareness among drivers. More promotion work is necessary. It also highlights the need for information and labeling programs to be implemented on a wider scale in the Philippines, in order to increase the salience of fuel economy in the decision-making process for the purchase of vehicles. Nevertheless, the Philippine Department of Energy estimates that information and education campaigns, which include the transport sector, resulted in energy savings of 3.47 and 3.45 million barrels of fuel oil equivalent in 2009 and 2010 respectively (Department of Energy, The Philippines, 2012). As the costs of achieving these savings have not been reported, it is not possible to ascertain the relative efficacy of this program.

### **(ii) Scientific Integrity**

Among the Department of Transportation and Communication (DOTC)'s 5 fundamental strategies to promote fuel efficiency in the land transport sector, one is to switch to alternative fuels such as LPG, CNG and electric-powered vehicles. The government's Alternative Fuels Program has sought to implement this by encouraging the use of alternative fuels such as bioethanol, biodiesel, LPG and CNG. However, the scientific basis for switching to CNG as a way to enhance fuel efficiency is questionable. In fact, CNG buses are generally between 15% and 40% *less* fuel efficient than diesel buses (World Bank, 2010).

Data from the on-going Fuel Economy Run will be used for the future setting of fuel economy standards. However, no formal testing regarding fuel efficiency has been adopted to date.

---

<sup>100</sup> Switching costs in the context of alternative fuels refers not only to the costs that individuals face in purchasing an alternative fuel vehicles but also to the costs of putting in the requisite infrastructure for refueling and vehicle maintenance. For instance, the large-scale uptake of electric vehicles requires that charging infrastructure is built. This investment is considerable and needs to be considered when planning for any such large-scale transition.

### **(iii) Flexibility**

The Philippines does not have fuel economy standards for its vehicles; the key mandates aimed at improving fuel economy are the biofuel requirements for gasoline and petroleum diesel. Instead, policies to increase fuel economy have largely focused on the use of fiscal and financial incentives and information programs to incentivize both a switch towards alternative fuel vehicles and improvements in fuel economy in conventional vehicles. The fact that most of these policies do not impose mandatory requirements implies that vehicle manufacturers and owners have the flexibility to decide whether and how to improve the fuel economy levels of their vehicles. In particular, because incentives are in place for a variety of alternative fuels, including biofuels, LPG, CNG, hybrid and electric vehicles, manufacturers and owners have the option of deciding which fuel to use, as opposed to being forced to adopt a particular alternative fuel. This is especially pertinent in the Philippine context: given the diversity of vehicle types in use in the Philippines, it could make economic sense for different types of vehicles to adopt different means towards achieving increased fuel economy levels.

## **ADMINISTRATIVE AND POLITICAL VIABILITY**

### **(iv) Transparency**

The official website of the Philippine Department of Energy gives an overview of the policies that are in place. Details are not available on the website but can be found from online presentations and papers.

The involvement of stakeholders is perceived as important whilst drafting regulatory policy. The views of the stakeholders are elicited via public consultation. In addition, the details of proposed policies are set forth in the form of white papers or consultation papers. The feedback received is taken into consideration whilst drafting the proposed regulations.<sup>101</sup> For instance, the Department of Energy's National Biofuels Program (2007–2012) regularly reassesses standards for fuel blends. Before introducing new blends, the Technical Committee of Petroleum Products and Additives (TCPPA) meets stakeholders, which includes academic institutions, car manufacturers, oil companies, farmers, and citizens, to consult with them on emissions impact, vehicle compatibility, and the availability of fuel supply.

However, the process of consulting several stakeholders has experienced its own drawbacks.<sup>102</sup> Consider for instance the case of the Energy Conservation Bill which will be tabled during the State of the Nation Address by President Benigno Aquino III on the second week of July 2012. The Department of Energy along with the Development Academy of the Philippines is still in the process of finalizing draft of the 17-page Bill. The opinion of stakeholders (citizens, non-governmental organizations, members from House of Representatives, and electric power companies) was sought via public consultation. However, it was felt that the public consultation process, wherein several stakeholders are consulted simultaneously, was ineffective. This is because the vested interests of different stakeholders led to proposals that did not align with the objectives of the Bill. Furthermore, given that several stakeholders were consulted simultaneously, time constraints made discussions of the details of the provisions of the Bill difficult. Nevertheless, the inputs from the stakeholders were

---

<sup>101</sup> This information was gleaned from the interviews that we conducted with members of the Philippines Department of Energy.

<sup>102</sup> This information was gleaned from the interviews that we conducted with members of the Philippines Department of Energy.

given due consideration and some of the suggestions will be incorporated into the final draft of the Bill.

#### **(v) Alignment**

In the Philippines, several government agencies are involved when it comes to policies concerning energy efficiency at the economy-wide level. The Department of Energy, which was created under the Republic Act 7638, has the mandate to coordinate and supervise all government plans relevant to the energy efficiency and conservation. The Department of Energy has oversight over the five government-owned or controlled corporations, such as the Philippines National Oil Company. In addition, the Department of Energy has three institutional partners to assist it in its energy efficiency and conservation programs, namely: the Philippine Council for Industry and Energy Research and Development, the Bureau of Product Standards, and the Department of Environment and Natural Resources. The Department of Transportation and Communications, whose mandate is the promotion, development and regulation of a dependable and coordinated network of transportation and communications systems, is not under the purview of the Department of Energy. Similarly, the Department of Finance, which covers vehicle tariffs, taxes, and fuel subsidies, is an independent government agency.

So issues of alignment between the various authorities can arise. For instance, the objectives of the Department of Transportation and Communications and the Department of Energy might be at odds with each other given their respective mandates. This issue has been noted by the Philippine authorities and there have been efforts to get the government agencies efforts aligned. An example of this is the Executive Order 472 that led to the creation of the Committee on Fuel Conservation and Efficiency in Road Transport (CFCERT). This Committee was chaired by the Undersecretaries of the Department of Energy and the Department of Transportation and Communications. In addition, 12 government agency and six private sector representatives were part of the Committee. The principal objective of the Committee was the promotion of energy efficiency in the transport sector via awareness campaigns.

Despite efforts at coordination such as this, it is uncertain whether there is a clear decision maker when it comes to fuel economy policies, given that several government agencies have a stake in energy efficiency policies in the transport sector. As such, the potential for fragmented decision making exists, and there is no guarantee that the different departments will be aligned with one another. Individual decisions by each department might then end up not being cost effective when viewed as a whole. It would thus be more efficient if there was a single agency in charge of energy efficiency with sufficient clout to influence the other departments (Reddy, 1991), or if a better inter-institutional coordination mechanism existed with one of the agencies leading the process with the support of the main authorities.

### 2.2.3 Concluding Remarks

Energy security is the principal driver of policy efforts to improve energy efficiency of transportation in both the US and the Philippines. The positive environmental externalities of reduced fuel use have also been gaining importance in the past few years. Efforts to improve fuel efficiency in the vehicular stock have taken the form of mandatory standards and labels, fiscal incentives, research and development (R&D) funding, and incentives for alternative fuel vehicles in the US, whereas most programs in the Philippines are voluntary in nature.

Given that fuel economy ranks quite low on the list of attributes when buying a vehicle in the Philippines, well-designed fuel economy labeling programs and informational campaigns are essential to raising the salience of this issue. The US has used fuel economy labels for a while and studies have been and are being conducted on the behavioral impacts of these labels on consumer buying behavior. It will be instructive for policymakers in the Philippines to understand these issues such that they make an informed choice when instituting such programs in the future.

Fuel economy standards in the US have been contentious. Proponents argue that these are essential to steer the market towards more energy efficient vehicles whereas opponents point to the increased private cost of vehicles that fuel efficiency standards entail. Furthermore, standards tend to reduce consumer choice as less efficient and in some cases cheaper vehicles forced out of circulation. Issues of the rebound effect wherein the fuel savings from energy efficiency are not as large as expected have been reported in the literature.

While both schools of thought proffer compelling arguments, policymakers should rely on cost benefit analysis to make their decision. Issues like the energy security costs of fuel imports or environmental benefits of reduced fossil fuel consumption are quantifiable. It is possible, as has been done by several researchers, to evaluate the net benefits of any fuel efficiency program. The Philippines can learn from the US experience in carefully ascertaining the true value to introducing fuel standards. Price signals can offer the least cost solution to the issues of energy security and environmental objectives and as such should be preferred to standards.

Standards reduce the flexibility to respond to changing market conditions resulting in welfare losses. The process of setting standards has also seen the influence of strong industry lobby groups in the US, where fuel economy standards were allowed to stagnate between 1989 and 2010, and the Philippines, where efficiency standards or even fuel economy labeling are being resisted by certain groups. The relative weight of industry lobby groups compared with other stakeholders can result in outcomes that are lopsided, lowering societal welfare. Raising the transparency of the policymaking process is a means of reducing this negative outcome.

Both the US and the Philippines have been pushing for the development of alternative fuel vehicles such as natural gas or biofuel vehicles. It should be noted that scaling up these technologies requires substantial investment as far as the setting up of refueling infrastructure is concerned. In the case of electric vehicles, the vehicles come at a significant premium to conventional internal combustion engines vehicles and the requisite electric vehicle charging infrastructure is expensive. Given this and the fact that the energy efficiency and environmental efficacy of conventional internal combustion engines is rapidly improving, the US and the Philippines can look to reevaluate their transportation policies and the emphasis on alternative technologies as the means to achieving their twin goals of energy security and environmental stewardship.

In summary, the effectiveness of policies in both economies has been relatively mixed. Most fuel economy programs in the US are expected to yield net economic benefits, whereas electrification of road transport has proven to be expensive. In the Philippines, the use of biofuels in vehicles is likely to lead to significant energy savings and emission reductions at a relatively moderate cost, whereas the use of natural gas vehicles is initially highly expensive and relatively ineffective at reducing either energy use or greenhouse gas emissions. Policies in the US are scientifically sound and determined by a transparent formulation process, but issues of alignment can arise and the strength of lobby groups can sometimes be problematic. Policymaking in the Philippines is also characterized by robust stakeholder engagement, but problems of conflicting objectives of different stakeholders and lack of alignment can arise.

## 2.2.4 References

Alternative Fuels Data Center (AFDC). (2011). Federal & State Incentives & Laws, Retrieved from <http://www.afdc.energy.gov/afdc/laws/law/US/411>

Advanced Research Projects Agency-Energy (ARPA-E). (2012). About, Retrieved from <http://arpa-e.energy.gov/About/About.aspx>

Bayot, G.B., Majarucon, C.O., Sigua, R.G. "Analysis and Update of the Philippine Transport Energy Demand." Symposium on Infrastructure Development and the Environment 2006.

Board on Energy and Environmental Systems (BEES). (2002). Effectiveness and Impact of Corporate Average Fuel Economy Standards, Retrieved from [http://www.nap.edu/openbook.php?record\\_id=10172&page=R1](http://www.nap.edu/openbook.php?record_id=10172&page=R1)

Bloomberg. (2011). Automakers Agree to 54.5 MPG Fuel Economy Rule, Obama Says, Retrieved from <http://www.bloomberg.com/news/2011-07-29/automakers-agree-to-54-5-mpg-u-s-fuel-economy-rule-obama-says.html>

BP (2012). *Statistical Review of World Energy June 2012*.

Cato Institute. (2002). CAFE changes, by the numbers, Retrieved from <http://www.cato.org/pubs/regulation/regv25n3/v25n3-8.pdf>

Clean Air Initiative. (2010). Improving Vehicle Fuel Economy in the ASEAN Region, Retrieved from <http://cleanairinitiative.org/portal/sites/default/files/documents/ASEAN-fueleconomy.pdf>

Crane, K., Goldthau, A., Toman, M. Light, T., Johnson, S.E., Nader, A., Rabasa, A. and Dogo, H. (2009) "Does Imported Oil Threaten U.S. National Security?" RAND Corporation

Department Of Transport. (2010). Secretary LaHood Touts Success of Cash for Clunkers; Responds to Reports by DOT Inspector General, GAO, Retrieved from <http://www.cars.gov/files/official-information/dot8510.pdf>

Department Of Transport. (2011). Budget Estimates, Retrieved from <http://www.dot.gov/budget/2011/budgetestimates/nhtsa.pdf>

Energy Efficiency and Renewable Energy (EERE). (2010a). Vehicle Technologies Program, Retrieved from [http://www1.eere.energy.gov/vehiclesandfuels/pdfs/pir/vtp\\_goals-strategies-accomp.pdf](http://www1.eere.energy.gov/vehiclesandfuels/pdfs/pir/vtp_goals-strategies-accomp.pdf)

Environmental Protection Agency (EPA) (2006). Regulatory announcement: EPA Issues New Test Methods for Fuel Economy Window Stickers. Retrieved from <http://www.epa.gov/fueleconomy/420f06069.htm>

Environmental Protection Agency (2010a). Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010, Retrieved from <http://www.epa.gov/otaq/cert/mpg/fetrends/420s10002.pdf>

Environmental Protection Agency (EPA) (2010b). Fuel Economy Label Literature Review. Retrieved from <http://www.epa.gov/fueleconomy/label/420r10906.pdf>

Environmental Protection Agency (EPA) (2011a). Fuel Economy, US EPA, Gas Guzzler Tax, US, Retrieved from <http://www.epa.gov/fueleconomy/>

- Environmental Protection Agency (EPA) (2012a). NHTSA and EPA Propose to Extend the National Program to Improve Fuel Economy and Greenhouse Gases for Passenger Cars and Light Trucks. Retrieved from [http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cape/2017-25\\_CAFE\\_NPRM\\_Factsheet.pdf](http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cape/2017-25_CAFE_NPRM_Factsheet.pdf)
- Environmental Protection Agency (EPA) (2012b). Fuel Economy and Environment Labels – Basic Information. Retrieved from <http://www.epa.gov/otaq/carlabel/basicinformation.htm>
- Food and Agriculture Organization of the United Nations (FAO). (2009). Case studies on bioenergy policy and law: Options for sustainability, from <http://www.fao.org/docrep/012/i1285e/i1285e06.pdf>
- Fialka, J. J. (2006). “Energy independence: A Dry Hole,” The Wall Street Journal, July 5, 2006.
- Financial Times. (2012). Electric vehicle sales fail to spark into life, Retrieved from <http://www.ft.com/intl/cms/s/0/d4c53d1c-2c02-11e1-98bc-00144feabdc0.html#axzz1j1RnNgiS>
- Gallager, K. S., G. Collantes, J. H. Holdren, H. Lee, R. Frosch (2007). “Policy Options for Reducing Oil Consumption and Greenhouse-Gas Emissions from the U. S. Transportation Sector,” Discussion Paper, Energy Technology Policy Initiative, Harvard University, July 27, 2007.
- Global Energy and CO2 Data, Enerdata (2012), Multiple Databases on Energy Consumption, Energy Prices and Other Indicators. More Information at <http://www.enerdata.fr/enerdatauk/eshop/index.php>
- Homans, C. (2012). “The Best-Laid Plans,” Foreign Policy Jan/Feb, accessed at [http://www.foreignpolicy.com/articles/2012/01/03/the\\_best\\_laid\\_plans\\_us\\_presidents\\_and\\_their\\_shrinking\\_ambitions\\_for\\_energy\\_indep](http://www.foreignpolicy.com/articles/2012/01/03/the_best_laid_plans_us_presidents_and_their_shrinking_ambitions_for_energy_indep)
- International Energy Agency (IEA). (2008a). “Review of International Policies for Vehicle Fuel Efficiency”, Retrieved from [http://www.iea.org/papers/2008/Vehicle\\_Fuel.pdf](http://www.iea.org/papers/2008/Vehicle_Fuel.pdf)
- International Energy Agency (IEA) (2008b). “Energy Technology Perspectives,” IEA, Paris.
- Institute of Energy Economics, Japan (IEEJ). (2010). “Compendium of Energy Efficiency Policies of APEC Economies”, from <http://www.ieej.or.jp/aperc/CEEP/CEEP-all.pdf>
- Inquirer (2011). P500-M fuel subsidy OKd for jeepneys, Retrieved from <http://newsinfo.inquirer.net/inquirerheadlines/nation/view/20110401-328680/P500-M-fuel-subsidy-OKd-for-jeepneys>
- Inquirer (2012). DOE to spend \$100M on 20,000 electric tricycles, Retrieved from <http://business.inquirer.net/40277/doe-to-spend-100m-on-20000-electric-tricycles>
- Institute For Climate And Sustainable Cities. (2011). Sen. Recto delivers landmark Alternative Fuel Vehicle Incentives bill to plenary debate, from <http://business.inquirer.net/40277/doe-to-spend-100m-on-20000-electric-tricycles>
- Interlaboratory Working Group (2000). Scenarios for a Clean Energy Future: Oak Ridge, TN; Oak Ridge National Laboratory and Berkeley, CA; Lawrence Berkeley National Laboratory.
- Kojima, K., L. Ryan (2010), “Transport Energy Efficiency - Implementation of IEA Recommendations since 2009 and next steps,” Information Paper Series, International Energy Agency.
- Malaya (2010). Electric cars, anyone?, Retrieved from [http://www.malaya.com.ph/11232010/auto\\_ron.html](http://www.malaya.com.ph/11232010/auto_ron.html).

Manila Bulletin (2011). DOE Hastens Alternative Transport Program, Retrieved from <http://mb.com.ph/node/334798/doe-ha>

Mantzios, L., P. Capros (2006), "Scenarios on energy efficiency and renewables," European Energy and Efficiency, European Commission.

Mindanao Examiner. (2011). Manila promotes use of "Green" vehicles, Retrieved from [http://www.mindanaoexaminer.com/news.php?news\\_id=20110724110835](http://www.mindanaoexaminer.com/news.php?news_id=20110724110835)

National Highway Traffic Safety Administration (NHTSA) (2004). Automotive Fuel Economy Manufacturing Incentives for Alternative Fueled Vehicles. Retrieved from <http://www.nhtsa.gov/cars/rules/CAFE/Rulemaking/AMFAFinalRule2004.htm>

National Highway Traffic Safety Administration (NHTSA) (2010). Tire Fuel Efficiency Consumer Information Program – Final Rule. Retrieved from <http://www.nhtsa.gov/staticfiles/rulemaking/pdf/TFECIP%20Final%20Rule.pdf>

National Highway Traffic Safety Administration (NHTSA) (2011). Summary of Fuel Economy Performance (Public Version)

National Highway Traffic Safety Administration (NHTSA) (2012). The National Highway Traffic Safety Administration and Environmental Protection Agency to Propose Greenhouse Gas and Fuel Efficiency Standards for Medium and Heavy Duty Trucks; Begin Process for Further Light Duty Standards: Fact Sheet, US, Retrieved From [http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/2017-25\\_CAFE\\_NPRM\\_Factsheet.pdf](http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/2017-25_CAFE_NPRM_Factsheet.pdf)

National Renewable Energy Laboratory (NREL). (2009). Energy Efficiency Policy in the United States: Overview of Trends at Different Levels of Government, from <http://www.nrel.gov/docs/fy10osti/46532.pdf>

New York Times. (2012). New Gas Economy Rules Generate Wide Support, Retrieved from [http://www.nytimes.com/2012/01/18/business/energy-environment/new-fuel-economy-rules-win-broad-support.html?\\_r=2&ref=energy-environment](http://www.nytimes.com/2012/01/18/business/energy-environment/new-fuel-economy-rules-win-broad-support.html?_r=2&ref=energy-environment)

Official Gazette. (2006). Executive Order No. 488, s.2006, Retrieved from <http://www.gov.ph/2006/01/12/executive-order-no-488-s-2006/>

Official Gazette. (2012). DOE launches e-trike design contest, Retrieved from <http://www.gov.ph/2012/01/18/doe-launches-e-trike-design-contest>

Philippines Department of Energy (DOE). (2005a). Alternative Fuels, Retrieved from <http://www.doe.gov.ph/AF/Alternative%20Fuels.htm>

Philippines Department of Energy (DOE). (2005b). Government Energy Management Program, Retrieved from <http://www.doe.gov.ph/EE/GEMP.htm>

Philippines Department of Energy (DOE). (2005c). Information, Education and Communication Campaign, Retrieved from <http://www.doe.gov.ph/EE/IECC.htm>

Philippines Department of Energy (DOE). (2008). 2008 Philippine Energy Summit Report Chapter 5, Retrieved from <http://www.doe.gov.ph/e%20summit/final/Chapter%205.pdf>

Philippines Department of Energy (DOE). (2010). Philippine Alternative Fuels and Emerging Technologies Program for Transport, Retrieved from

<http://www.egnret.ewg.apec.org/meetings/egnret36/EP5-EGNRET%2036-%20Philippine%20Presentation.pdf>

Philippines Department of Energy (DOE) (2012). “Energy Efficiency and Conservation Program of the Philippines Department of Energy.”

PhilSTAR.com. (2011). To be or LPG? That is the jeepney question, Retrieved from <http://www.philstar.com/Article.aspx?articleId=664241&publicationSubCategoryId=72>

Reddy, A. K. N. (1991). Barriers to Improvements in Energy Efficiency. *Energy Policy*, 19(10), 9.

Stigler. G. J. (1971). “The Theory of Economic Regulation,” *Bell Journal of Economics and Management Science*, 2(1): 3-21.

SunStar. (2011). Government willing to pay for new round of oil subsidies for jeepney drivers, Retrieved from <http://www.philstar.com/Article.aspx?articleId=664241&publicationSubCategoryId=72>

The White House. (2011). Obama Administration Takes Major Step Toward Advanced Vehicles With New Fleet Management, Retrieved from [http://www.whitehouse.gov/administration/eop/ceq/Press\\_Releases/May\\_24\\_2011](http://www.whitehouse.gov/administration/eop/ceq/Press_Releases/May_24_2011)

United Nations Center for Regional Development (UNCRD). (2010). Vehicle fuel economy standards in the ASEAN: Need for harmonized approach, Retrieved from [http://www.uncrd.or.jp/env/5th-regional-est-forum/doc/10\\_Breakout%20Session2-D/BS2-D-1\\_CAI\\_Asia-Bert.pdf](http://www.uncrd.or.jp/env/5th-regional-est-forum/doc/10_Breakout%20Session2-D/BS2-D-1_CAI_Asia-Bert.pdf)

United Nations Environment Program (UNEP). (2011). Philippines Developing Automotive Fuel Economy Policy, Retrieved from [http://www.unep.org/transport/gfei/autotool/case\\_studies/apacific/philippines/Philippines%20CASE%20STUDY.pdf](http://www.unep.org/transport/gfei/autotool/case_studies/apacific/philippines/Philippines%20CASE%20STUDY.pdf)

US Code. (2011). 10 USE 2922g: Preference for motor vehicles using electric or hybrid propulsion systems, Retrieved from <http://uscodebeta.house.gov/view.xhtml?req=granuleid:USC-title10-section2922g&num=0#regulations-note>

US Department Of Energy (DOE). (2011a). Transportation Data Book – Energy. 30<sup>th</sup> Edition, Retrieved from [http://cta.ornl.gov/data/tedb30/Edition30\\_Full\\_Doc.pdf](http://cta.ornl.gov/data/tedb30/Edition30_Full_Doc.pdf)

US Department Of Energy (DOE). (2011b). Energy Department Awards Nearly \$7 Million for Research to Reduce Costs of Electric Vehicle Chargers, Retrieved from <http://energy.gov/articles/energy-department-awards-nearly-7-million-research-reduce-costs-electric-vehicle-chargers>

US Department Of Energy (DOE). (2011c). Awards to Advanced Vehicle Development, Retrieved from <http://energy.gov/articles/awards-advanced-vehicle-development>

US Energy Information Administration (EIA). (2012). U.S. Imports of Crude Oil and Petroleum Products (Thousand Barrels), Retrieved from <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MTTIMUS1&f=A>

Vergel, K. and Tiglao, N., (2005). Assessment of Integrated Environmental Strategies for Metro Manila. *Journal of the Eastern Asia Society for Transportation Studies*, 6, 16.

W. R. Morrow, K.S. Gallagher, G. Collantes, H. Lee (2010). "Analysis of Policies to Reduce Oil Consumption and Greenhouse-Gas Emissions from the U.S. Transportation Sector." *Energy Policy*, Vol. 38, No. 3, March: 1305-1320.

Washington Post. (2012). Overcharged, Retrieved from [http://www.washingtonpost.com/opinions/overcharged/2011/12/30/gIQAzQ0yUP\\_story.html](http://www.washingtonpost.com/opinions/overcharged/2011/12/30/gIQAzQ0yUP_story.html)

World Bank. (2010). A Strategic Approach to Climate Change in the Philippines, Retrieved from [http://siteresources.worldbank.org/INTPHILIPPINES/Resources/PH\\_Low\\_Carbon\\_Transport\\_and\\_Power.pdf](http://siteresources.worldbank.org/INTPHILIPPINES/Resources/PH_Low_Carbon_Transport_and_Power.pdf)

World LPGas Association. (2009). Jeepneys Running on Autogas in the Philippines, Retrieved from <http://www.worldlpgas.com/gain/autogas-is-best/jeepneys-running-on-autogas-in-the-philippines>

World Resources Institute. (2008). Corporate Average Fuel Economy (CAFE), Retrieved from <http://www.wri.org/publication/content/10333#fnref:1>