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A systems approach to improving fleet policy compliance within the US Federal Government

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ABSTRACT

To reduce dependence on foreign sources of energy, address climate change, and improve environmental quality, the US government has established a goal of reducing petroleum fuel use in its federal agencies. To this end, the government requires its agencies to purchase alternative fuel vehicles, use alternative fuel, and adopt other strategies to reduce petroleum consumption. Compliance with these requirements, while important, creates challenges for federal fleet managers who oversee large, geographically dispersed fleets. In this study, a group of 25 experienced federal fleet managers participated in a pilot study using a structured methodology for developing strategies to comply with fleet requirements while using agency resources as efficiently as possible. Multi-criteria decision making (MCDM) methods were used to identify and quantify agency priorities in combination with a linear programming model to optimize the purchase of fleet vehicles. The method was successful in quantifying tradeoffs and decreasing the amount of time required to develop fleet management strategies. As such, it is recommended to federal agencies as a standard tool for the development of these strategies in the future.

1. Introduction

In developing vehicle fleet acquisition strategies, federal agencies must fulfill several statutory requirements while also achieving agency-specific goals. Agencies also must address further complicating issues including increased costs for alternative fuel vehicles (AFVs), lack of alternative fuel infrastructure, and uncertain usage patterns. Adding to the complexity is the fact that agency objectives often conflict with one another. As a result of these challenges, federal agencies have achieved mixed results in compliance with fleet requirements in recent years (GAO, 2008). Although agencies have generally met the AFV acquisition requirements, they have largely fueled these vehicles with gasoline, not alternative fuel, circumventing the original intent of the laws (Helwig and Deason, 2007).

This study demonstrated a systems approach to addressing the many challenges faced by agencies in developing fleet strategies, thereby increasing compliance rates and more effectively fulfilling the objectives of the statutes. As shown in Fig. 1, each agency's objectives were identified, quantified, prioritized and then provided as inputs to a linear optimization model. The model output provided agency-specific vehicle acquisition strategies based on measured tradeoffs and specific characteristics of the fleet.

2. Background

2.1. Policy and legislative overview

The federal government has promulgated multiple laws and executive orders requiring federal agencies to purchase AFVs and alternative fuels in an attempt to provide leadership and stimulate the market for alternative fuels across the country (see Table 1). While the objectives of these laws and executive orders are similar, their methods are inconsistent, making it difficult for agencies to comply with all requirements simultaneously. Efforts to do so have led fleet managers to spend money on AFVs at the expense of buying actual alternative fuel or investing in infrastructure improvements needed to make alternative fuels more available in the future (Helwig, 2006).

Federal fleet purchase requirements were first set forth in the Energy Policy Act of 1992 (EPAct 1992). EPAct 1992 requires that 75% of agencies' newly acquired light-duty vehicles (LDVs) be AFVs. The definition of AFV includes those that run solely on alternative fuels, as well as those that can use either alternative or conventional fuels, such as flex-fuel vehicles (FFVs) which can use either gasoline or ethanol. In order to track compliance with EPAct

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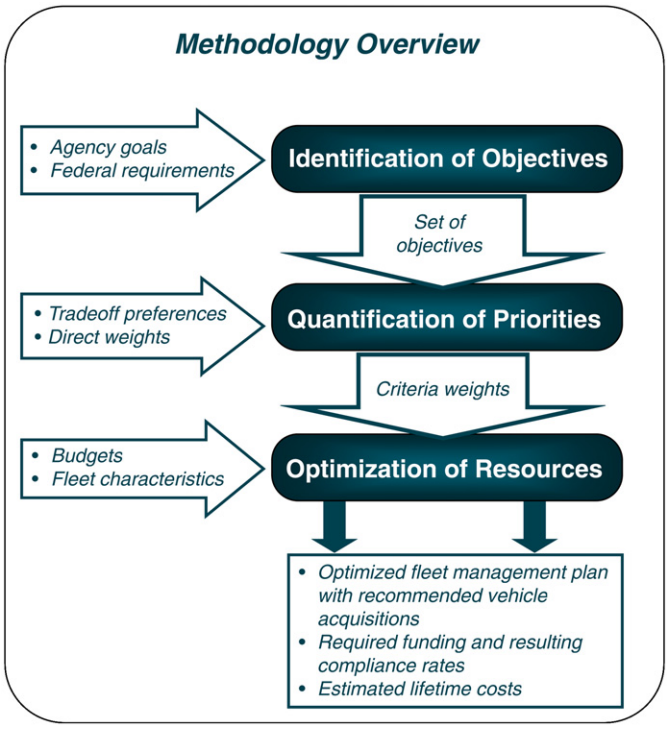

Fig. 1. An overview of the methodology showing the inputs and outputs of each step.

1992, a system of compliance credits is used. Agencies must earn enough credits every year to equal at least 75% of their LDV acquisitions in large cities. Credits cannot be saved up or traded. Table 2 shows the various ways in which agencies can earn credits. Compliance is reported by each agency via a yearly written report to Congress and a Transportation Management Scorecard submitted biannually to the Office of Management and Budget (OMB).

EPAct 1992 resulted in the purchase of more AFVs by the federal government, but because it did not specifically require that alternative fuels be used in the vehicles, it did little to reduce petroleum fuel use. For example, in fiscal year (FY) 2000, 44% of federal fleet vehicles acquired were AFVs, but overall petroleum consumption did not decrease—in fact it increased 2% over the previous year (DOE, 2001).

In 2000, Executive Order (E.O.) 13149 attempted to address this problem by requiring agencies to reduce petroleum fuel use by 20% by 2005, relative to a 1999 baseline. The E.O. specified two methods that agencies must use to achieve this goal. They were directed to use alternative fuels a "majority" of the time that AFVs were in use and to improve overall fleet fuel economy by 3 mpg by 2005 (DOE, 2000a).

The Energy Policy Act of 2005 (EPAct 2005) extended the requirements of E.O. 13149 by requiring that alternative fuels be used at all times in federal AFVs. However, EPAct 2005 also included a provision that allows this fuel use requirement to be waived by the Department of Energy (DOE) in cases where the fuel is "not reasonably available" or is "unreasonably more expensive, compared to gasoline" (DOE, 2006a). Because alternative fueling stations were not readily available when the law was passed, the waiver was able to be applied to many vehicles.

E.O. 13423, enacted in 2007, revoked E.O. 13149 and requires similar, but slightly modified goals for reducing petroleum use and increasing alternative fuel use in federal fleets. It requires agencies to reduce total petroleum use by 2% per year until 2015 (relative to a 2005 baseline) and to increase alternative fuel use by 10% per year (relative to the previous year). It also requires agencies to use plug-in hybrid vehicles if they are commercially available "at a cost reasonably comparable, on the basis of life-cycle cost," to conventional vehicles (DOE, 2007, E.O. 13423, 2007).

The Energy Independence and Security Act (EISA), also enacted in 2007, essentially codified the fleet-related provisions of E.O. 13423 into law, requiring a 20% reduction in petroleum use and a 10% increase in alternative fuel consumption by 2015 (an overall increase, as opposed to E.O. 13423, which required an increase of 10% per year, relative to the previous year) (EISA, 2007). EISA also includes a requirement that agencies install "at least one renewable fuel pump by 2010" (EISA, 2007). The National Defense Authorization Act of 2008 provided agencies additional opportunities to receive credits for acquiring AFVs by expanding the EPAct definition of AFVs to include hybrid electric vehicles (HEVs), fuel cell vehicles, advanced lean burn vehicles, and other vehicles that reduce petroleum consumption (NDAA FY08, 2008).

2.2. Problem statement

In the years covered by E.O. 13149, federal fleet compliance with EPAct 1992 was generally good, but compliance with the E.O. requirement to reduce petroleum consumption and use alternative fuel a majority of the time in AFVs was often poor, reflecting the difficulty fleets had in obtaining alternative fuel (DOE, 2009). In 2007, all 21 federal agencies met or exceeded EPAct 1992 AFV acquisition targets, with an overall fleet-wide compliance rate of 171%. E.O. 13423 targets were nearly achieved in 2007 (the first year of compliance reporting). Petroleum consumption in that year was reduced by 3.94% from 2005 levels, compared with a target of 4%, and alternative fuel consumption increased 17.4%, above the target of 10% (DOE, 2008b).

Unfortunately, however, these numbers do not tell the whole story. Notably, no agencies reported compliance rates with the requirement to use only alternative fuel in AFVs. Despite the lack of data for 2007, the U.S. Government Accountability Office (GAO) concluded that fleets continued to fuel their AFVs largely with gasoline, based on data from previous years. For example, in 2006 alternative fuel was used in vehicles only 2.13% of the time (GAO, 2008). Further, of the 120,000-odd AFVs in the federal fleet, over 60% were waivered in 2007 because alternative fuels were unavailable at their locations (DOE, 2008b). Despite high AFV acquisition compliance rates, it is clear that the main objective of all federal AFV policies – to significantly reduce federal fleet consumption of petroleum fuel – is still not being achieved.

One factor contributing to this problem – in addition to the difficulty caused by having multiple requirements – is the lack of structured guidance provided by the government to assist agencies with fleet planning. In a 2006 study, Michael Helwig examined reasons for the lack of compliance described above and found that most agencies lack an effective methodology for developing strategies to achieve the goals of EPAct 1992 and associated executive orders. His research demonstrated that use of optimization models could improve the efficiency of compliance strategies for federal agencies, allowing them to achieve increased compliance rates without additional cost (Helwig, 2006). The study also revealed that fleet managers often face conflicting objectives, making it difficult to determine optimal compliance strategies. Helwig demonstrated that any one of at least 29 different formulations could be used to generate optimal strategies depending on the particular goals being pursued. At the conclusion of his research, Helwig recommended that follow-on work be undertaken using multi-criteria decision making (MCDM) methods