The Energy Policy Act of 1992 and Executive Order 13149: Proposed Compliance Strategies and Process Improvements for Federal Agencies

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Applicable Statutes/Executive Orders

- The Energy Policy Act of 1992 (EPAct)
- Executive Order 13149 (2000)
- National Defense Authorization Act of 2002 (NDAA 2002)

Alternative Fuel Vehicle (AFV)

- Capable of using alternative fuel
  - Methanol, ethanol, other alcohols
  - Propane, Natural Gas
  - Hydrogen, Electricity, Biodiesel**
- "Dedicated" or "Dual-fuel"
  - "Bi-fuel" – 2 distinct tanks
  - "Flex-fuel" – single tank

Ethanol

- Feedstock: Corn, wheat barley, grasses
- Energy: 1gal ethanol = 0.72 gal gasoline
- Often used as an additive to gas
- 85% or above Ethanol blends = “alternative fuels” under EPAct
- Some emission reductions (CO and NOx)
- Corrosive
- Engine calibration and fuel system issues

Natural Gas

- Primarily Methane (CH4)
- CO, NOx, CO2 down 90, 60 and 35%
- 3,000 or 3,600 psi typically
- Incremental vehicle costs: $1,000s
- CNG commercial grade outlet $0.25M to 0.5M or more
- 0.1% of total gasoline demand in 2003
- Performance and maintenance issues generally not a problem

Biodiesel

- From vegetable oils or animal fats
- 20% biodiesel mix common (B20)
- B20: Less CO_2, PM, CO, SO_2, more NOx
- Manufactured domestically
- Good lubricity properties
- Is a solvent
- Generally slightly more expensive
- Cold start issues

MTBE

- Synthetic oxygenate to increase combustion efficiency
- Possible carcinogen
- Ethanol may replace MTBE

Other Fuels/Vehicle types

- Methanol (from natural gas typically)
- Electric (ZEVs)
- HEVs
- LPG (Propane)
  - Still a few LPG AFVs in the federal fleet
- Fuel cell vehicles

Agency “X” Compliance Strategy

- 100 new vehicles: need 75 credits

- One strategy:

50 conventional vehicles	0
10 “dedicated” vehicles	20
40 bi-fuel vehicles	40
6,750 gal biodiesel	15
Total credits	75

EPAct: What's Broken

- Agencies are gaming the system – acquiring AFVs without using alternative fuel
  - Does nothing to support the intent of EPAct
  - Poor stewards of tax money
  - Failure to take advantage of environmental benefits of AFVs

- **Failure to develop an acquisition strategy that takes full advantage of an agency's limited resources**

Agencies “doing extremely well” with EPAct Compliance

Agency	2004 EPAct compliance %	% time alt. fuel used in AFVs	petroleum reduction %
DoD Army	99	0.8	(16.8)
DoD Navy	100	9.1	13.9
DoD AF	96	9.9	5.3
USPS	79	5.4	0.2
DOE	99	21	1.8
Interior	106	64.3	1.8
DoD USMC	243	21.4	27.5
HHS	60	34	10
NASA	198	27.6	15.3
EPA	83	15	17.7
State	110	20.7	1.2
Treasury	2480	16.3	20.1

Other Agencies

Agency	2004 EPAct compliance %	% time alt. fuel used in AFVs	petroleum reduction %
Agriculture	95	7	8.6
VA	24	1.5	(12.3)
DOT	29	10.1	11.7
Labor	19	---	(2.5)
Commerce	46	10.3	(51.9)
Justice	86	21.7	17
CIA	8	1	---
GSA	91	12	52
EOP	29	76.8	69.6
HUD	---	0.4	15.8

Why can't/won't federal agencies comply with EPAct and/or E.O. 13149?

- Too expensive
- Can't track alternative fuel use
- Little alternative fuel infrastructure
- Nobody watching
  - Earthjustice

Conventional fuel infrastructure

Alternative Fuel Stations

Alternative fuel Infrastructure

http://www.gao.gov/new.items/d02810t.pdf, accessed 3/29/06

Federal Agency Guidance

- DOE Guidance
  - Promulgated on DOE's web site
  - "Federal Fleet Strategy Development Supplement"
  - DOE Compliance Strategy
- DoD Guidance
  - Published in 2003
- Various other compliance assistance tools

DOE's Four-Part Strategy

Strategy	Planned by 2005	2004 Actual
Biodiesel	473,745 GGE	85,000 GGE
Alt. Fuel Use	1,222,511 GGE	400,000 GGE
Fuel economy	19.5 mpg	19.1 mpg
"Fleet efficiency"	2% petroleum reduction	Unknown

1.8 % drop in petroleum consumption relative to 1999

Strategy shift, but older strategies still offered as guidelines

Problem Statement

Hypothesis: Federal agencies lack an objective, quantitative methodology for AFV acquisitions and E.O. 13149 compliance. A system of tiered models could improve the process.

Research Approach

Develop a system of IPs

- Objective functions based on fleet manager inputs, federal agency annual reports and conversations with fleet managers
- Assist with EPAct and E.O.13149 compliance
- Evaluate utility of methodology using a test agency
- Rapidly identify different EPAct compliance strategies

What Agency to Use?

- NREL suggested EPAct topic, military agency
- Navy allowed access to 2005 data
- 38% EPAct compliance in 2000, 72% in 2002, 100% in 2004, 280% in 2005
- Navy acquired 2,982 LDVs in 2005

“Covered” Fleets

- 20 or more LDVs centrally refueled
- Entity owns 50 vehicles nationally
- Metropolitan Statistical Area (MSA)
- States & alternative fuel providers are covered too, as well as federal agencies
- Feds: EOP, GSA, NASA, Agriculture, CIA, Commerce, DoD, DOE, HHS,HUD, Interior, Justice, State, DOT, Treasury, VA, EPA, USPS

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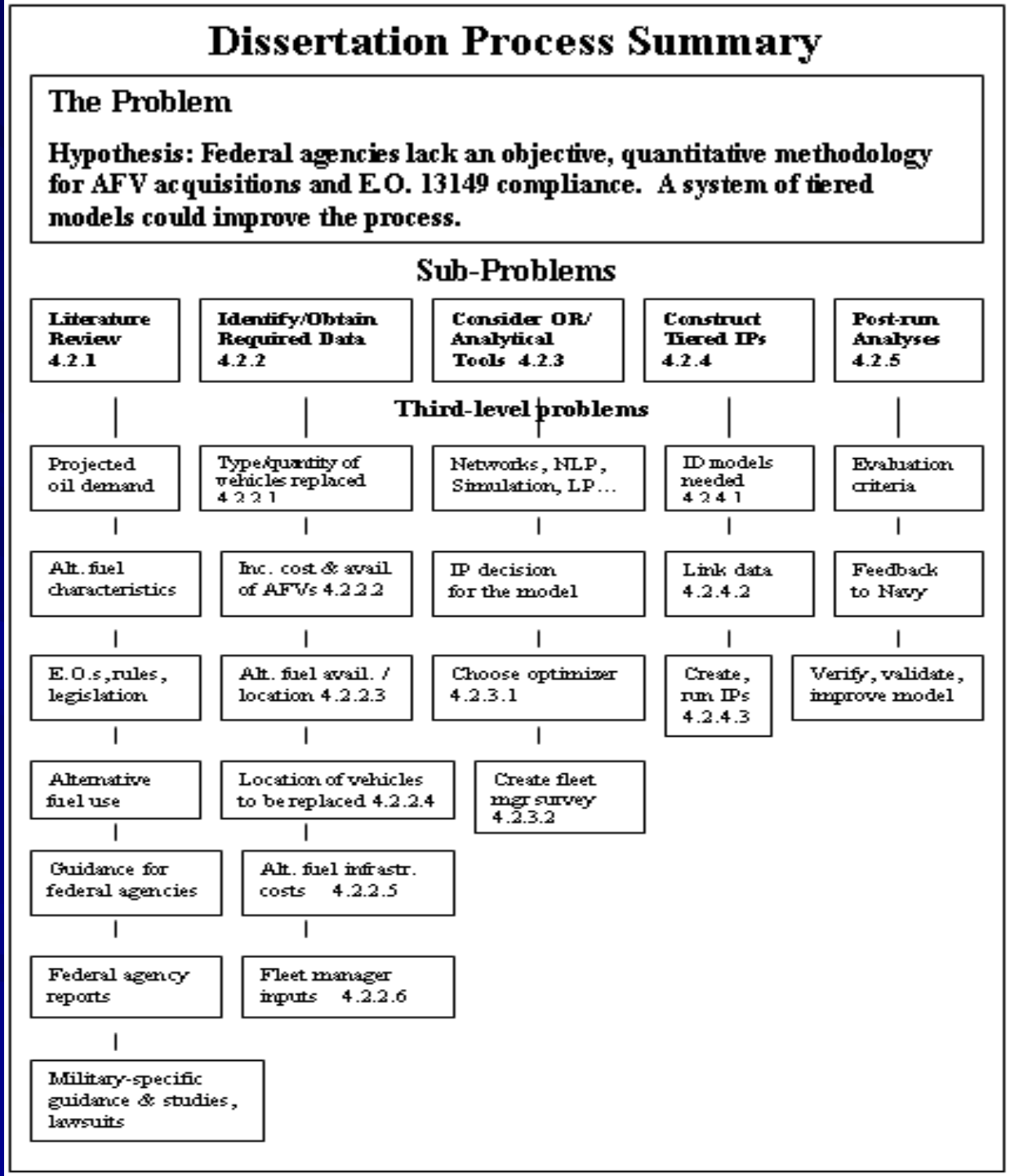

Survey Results

Respondent	1	2	3	4	5	6	7	8
Survey question								
Meet EPAct 75% requirement	1	1	1	1	1	1	1	1
Meet E.O. 13149 requirements	1	1	1	1	1	1	1	1
Reduction in dependence on foreign oil	1	1	2	1	2	2	2	1
Opportunity for infrastructure investment	1	1	4	2	1	4	4	1
Develop strategy centrally	5	1	2	2	4	1	3	1
Constrain AFV spending to a budget	3	5	3	1	2	2	1	4
Small pollution reduction due to alternative fuel use	1	1	3	1	2	2	2	1
Ability to develop a strategy quickly	3	2	3	2	3	3	2	1
Local fleet inputs	1	1	4	1	1	2	4	1
Local fleet inputs if central strategy process is available	1	1	4	1	1	2	4	2
Exceed EPAct 75% to the greatest extent possible	2	1	1	2	2	2	2	1
Acquire AFVs of one fuel type as opposed to another	2	2	1	2	3	1	2	1
AFVs actually use alternative fuel	3	1	1	1	1	1	2	1
Replacement criteria determined centrally	1	3	2	2	4	5	5	2
Acquired AFV must be located in MSA	2	1	4	2	3	2	5	1
Interested in optimization model	2	1	4	1	1	1	4	1
Other criterion	NA	NA	1	NA	NA	1	1	1

Model Construction Process

- Construct a series of IP models…
- Objective functions to be based in part on Fleet Manager inputs
- Some required components of the model
  - Outgoing vehicles/locations, potential incoming vehicles
  - Infrastructure availability
  - MSA determination by zip code
  - Zip code latitude/longitude
  - Acceptable replacements
  - Alternative fuel station construction costs
  - Potential construction sites
  - Budget, travel distances

Model variations

- Objective values
  - Maximize EPAct credits
  - Minimize cost
  - Maximize alternative fuel use
  - Maximize “Public Good”
- Variations
  - Alternative fuel infrastructure construction
  - Budget
  - 75% EPAct requirement
  - Min cost
  - HEVs
  - “Must Use” alternative fuel
  - NDAA 2002 variants (7)
  - “Public Good” variants (6)

U.S. Navy (July 2004 data for 2005)

2,368 "Reports Carryout" excerpt from GSA
- 72 Police, medical, MDV, bus, VI, PR

2,296
- 114 "Heavy" Service Utility & Stake Trucks…
2,182

1,638 Sedans
267 Vans
137 Pickups
118 SUVs
22 Other

Problem: Maximize the number of acquired AFVs that have access to alternative fuels

Subject to:

- **EPAct 75 percent acquisition requirement is met**
- **Overall budget not exceeded (includes AFV and infrastructure construction costs)**
- **Each outgoing vehicle must have an acceptable incoming replacement**
- **EPAct credit scheme (i.e. 2 credits for a dedicated AFV)**
- **A maximum distance willing to travel to an alternative fuel station is not exceeded**
- **Alternative fuel infrastructure construction options considered**
- **Alternative fuel available if a dedicated AFV is acquired**
- **Integer and non-negative constraints**

Navy 2005 actual results

LDV EPAct credits	2,162
$ spent	$1.2M*
Number of funded AF stations from AFV budget	$0
Number of AFVs/HEVs acquired	2,161/0
% AF use in AFVs	10.6%
Number of AFVs with access to alternative fuel	unknown
Public Good	negative
Number of fire trucks can buy with excess funds	0

*estimate

Selected Strategy "Winners"

Model Number		Compares favorably to Navy 2005 results	Comments
1-1	Max EPAct	EPAct credits, overall cost*	*If min cost applied
1-2	Min cost	Cost	75% still met, $ left over
2-7	Max AF use	Cost	75% still met, $ left over
2-10	Max AF use	AF use, AF construct., cost	75% still met, $ left over
3-2	Max EPAct	Cost, AF use	75% not met
4-X	(Various)	AF use, AF construct., cost	NDAA 2002 met, $
5-1	Min cost	Cost, "Agency good"	75% still met, $ left over
5-2	Max AF use	AF build/use, "Agency good"	75% still met
5-4	Max public good	Public good maximized	75% still met
5-6	Max public good	Public good maximized	No solution restrictions

Major Conclusions and Recommendations

- Any reasonable EPAct and E.O. 13149 compliance strategy must consider infrastructure construction

- OMB/GSA/DOE need to recommend optimal compliance strategies similar to those suggested in this dissertation.

- DOE must update its guidance documents containing outdated and sub-optimal strategies with poor assumptions. Same for DoD.

Major Conclusions and Recommendations Continued

- DOE needs to ensure agency annual reports are more accurate, including its own.

- Conventions like FedFleet need to ensure that workshops are available discussing true optimal strategy options similar to those suggested in this dissertation.

- Federal agencies need to adopt an EPAct/E.O. 13149 compliance strategy similar to those suggested in this dissertation.