



06-IEP-1B
DOCKET
06-AFP-1
DATE MAY 31 2007
RECD. JUN 04 2007

Liquefied Petroleum Gas (LPG) Vehicle Fuel Plan

Presented at
***CEC-ARB Workshop on Developing a State
Plan to Increase the Use of Alternative
Transportation Fuels***
May 31, 2007

Larry Waterland
TIAX LLC
Asish Gautam, Erin Bright, Mike Trujillo
Energy Commission
Gregory McMahan
Air Resources Board

- 1 Methodology
- 2 Assumptions
- 3 Projections
- 4 Summary

- 1** Methodology
- 2 Assumptions
- 3 Projections
- 4 Summary

- Stakeholder Group
 - Propane Working Group
 - 3 full meetings Aug 2006 to Jan 2007
 - 9 one-on-one meetings
- Data Sources
 - EIA, WPGA, NPGA, AFDC
 - Group consensus
- Vehicle sales projections defined
 - WPGA: realistic and achievable
 - Assumptions decided to meet sales projections

Participating Organizations

- Western Propane and Gas Association
- Propane Education and Research Council
- Delta Liquid Energy
- IMPCO Technologies Inc
- CleanFuels USA
- Ferrellgas
- CAMPBELL-PARNELL USA
- Baytech Corp
- Schwans
- Autumn Wind Associates
- California Air Resources Board
- Roush
- ASG Renaissance
- Campbell-Parnell
- Slegers Machining & Fabricating
- ECO Fuel Systems Inc
- Accubuilt
- Technocarb Equipment
- Tesoro
- BP
- LA County Dept of Public Works
- Western States Petroleum Association

- 1 Methodology
- 2 Assumptions**
- 3 Projections
- 4 Summary

Penetration Projections

- BAU: 5,000 vehicle sales/yr in 2010 then steady
- Moderate growth: 10,000 vehicle sales/yr in 2015
- Aggressive growth: 15,000 vehicle sales/yr in 2018
- Fuel use:
 - VMT, fuel economy from CALCARS (LDVs), DOE (M/HDV) by vehicle class
- Uniform vehicle life: 10 yr
 - Vehicle population constant 10 yr after sales projection reached
 - 50,000; 100,000; 150,000 total vehicles

Target Markets

- BAU:
 - Government fleets: LDVs, M/HDVs
 - LDV fleets: Taxis
 - LDT fleets: construction, delivery, shuttle bus, agriculture
 - M/HDV fleets: shuttle bus, school bus, delivery, utility vehicles
- Moderate growth:
 - Greater BAU fleet penetration
 - Add moderate consumer penetration: full-size LDA, LDT
- Aggressive growth:
 - Moderate growth plus high penetration
 - Fleets
 - Consumer market

Growth Promoting Factors

- BAU:
 - Conversion kits remain available
 - Infrastructure growth consistent with in-use vehicle growth
 - Fuel priced at 25% discount (GGE) to conventional petroleum
 - In place incentives remain
- Moderate growth: BAU plus
 - Restructure ARB vehicle certification process
 - Adopt EPA or EU OBD II
 - Infrastructure growth rate accommodates increased vehicle sales
 - Consensus on LPG vehicle fuel specification
 - Sufficient compliant fuel available
 - Additional Federal + State government incentives
 - OEMs honor vehicle warranties for kit retrofits
 - Outreach, support, training program established and supported

Growth Promoting Factors (cont'd)

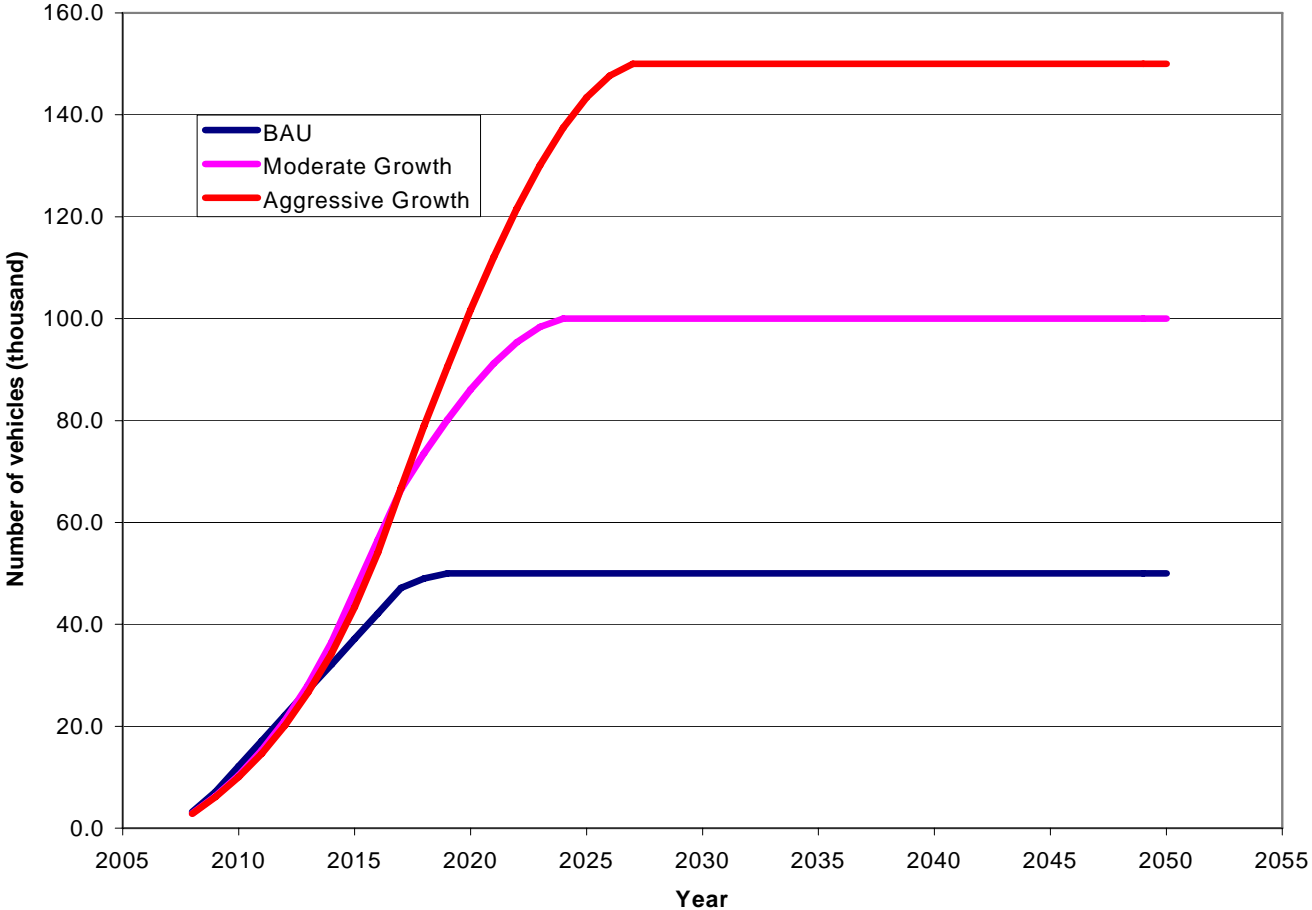
- Aggressive growth: Moderate plus
 - LPG taxed less than conventional petroleum (e.g., State excise tax exemption)
 - Federal + State government incentives increased
 - OEMs offer new **vehicles**
 - Fleet/ general consumer sees selection of vehicles

Assumed incentives

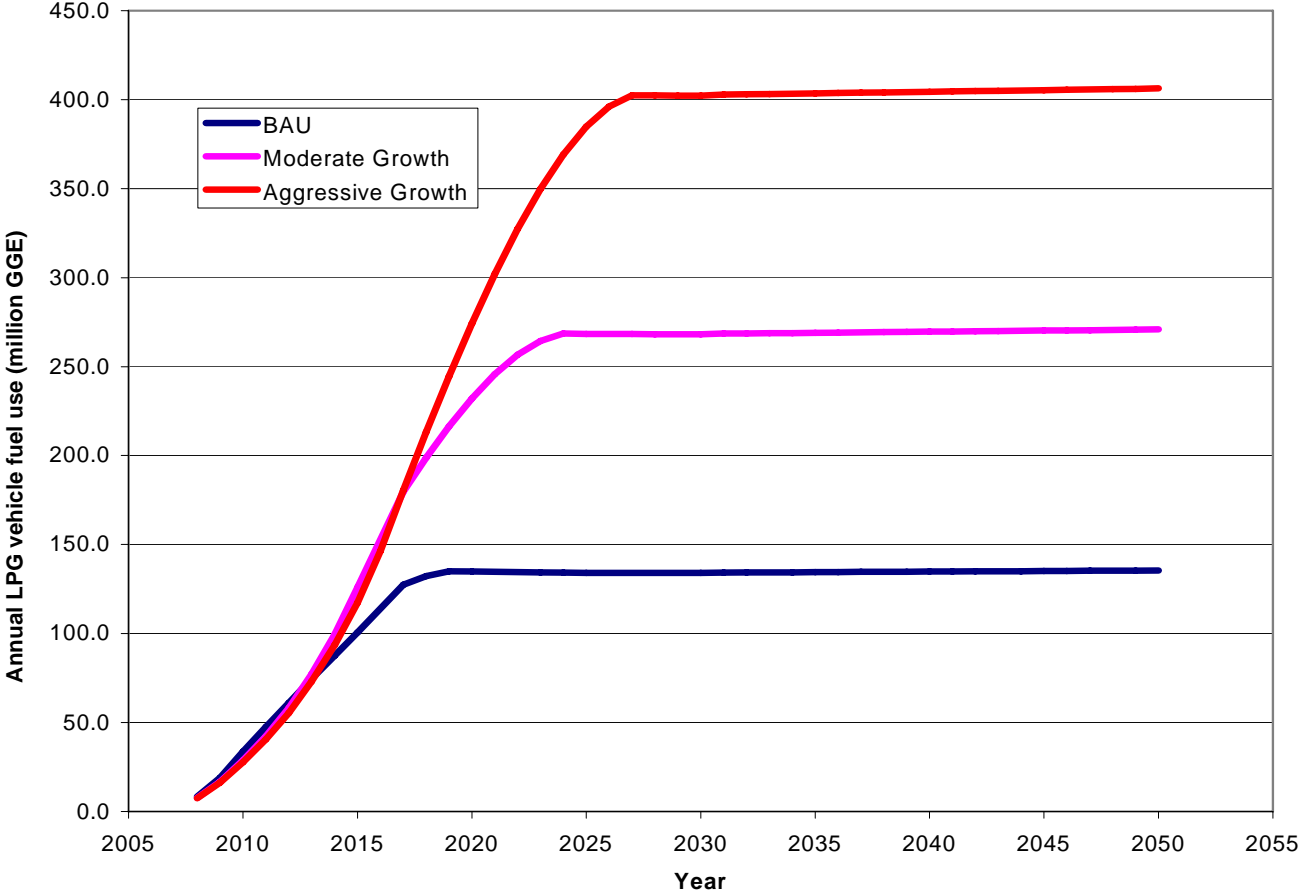
- Vehicle purchase (retrofit) incentives
 - Federal incentive: up to 40% of incremental vehicle/ retrofit cost
 - State:
 - BAU: \$1,000/vehicle through 2022
 - Moderate growth: \$1,500/vehicle through 2025
 - Aggressive growth: \$2,000/vehicle through 2025
- Refueling infrastructure, Government provides:
 - BAU 10% of infrastructure investment
 - Moderate growth 14% of infrastructure investment
 - Aggressive growth 20% of infrastructure investment
 - Federal, State equal shares

- 1 Methodology
- 2 Assumptions
- 3 Projections**
- 4 Summary

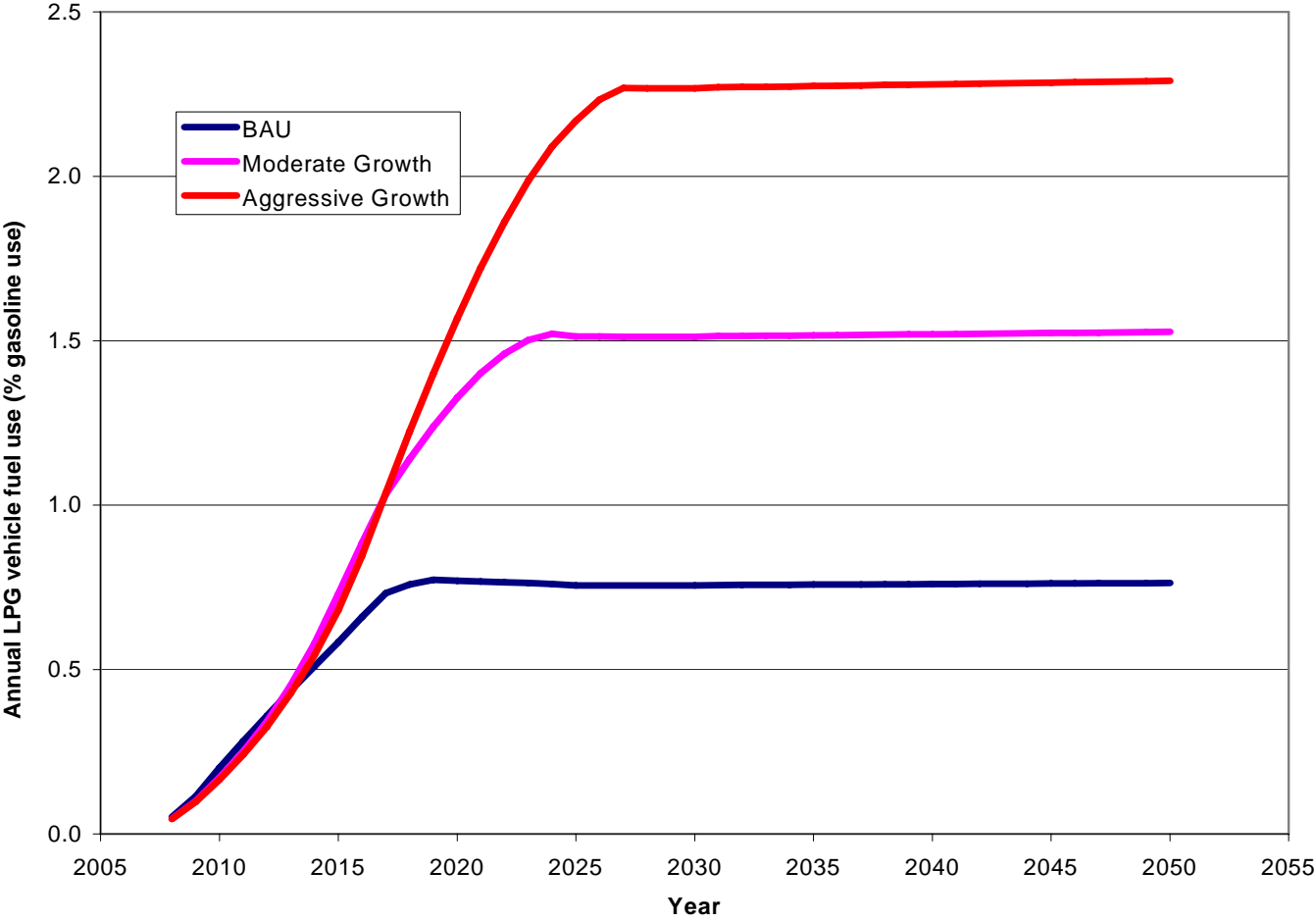
In-Use Vehicle Stock



LPG Vehicle Fuel Consumption



Gasoline Displacement



Gasoline Displacement

	2012	2017	2022	2030	2050
BAU					
Gasoline displaced (million GGE)	61	128	135	134	135
Fraction of gasoline displaced, %	0.4	0.7	0.8	0.8	0.8
Moderate Growth					
Gasoline displaced (million GGE)	58	180	257	268	271
Fraction of gasoline displaced, %	0.3	1.0	1.5	1.5	1.5
Aggressive Growth					
Gasoline displaced (million GGE)	55	181	327	402	406
Fraction of gasoline displaced, %	0.3	1.0	1.9	2.3	2.3

LPG Vehicle Fuel Plan *Projected Costs*

	BAU	Moderate Growth	Aggressive Growth
Average annual incentive cost 2008 - 2050 (1,000 \$/yr)			
State Government	6,936	12,777	18,066
Federal Government	61	767	1,365
Total Government	6,997	13,544	19,431
2012			
Average user incremental cost (\$/vehicle)	2,586	1,982	1,455
Average user annual fuel savings (\$/vehicle)	1,715	2,073	2,633
2017			
Average user incremental cost (\$/vehicle)	1,738	1,182	728
Average user annual fuel savings (\$/vehicle)	1,573	2,045	2,814
2022			
Average user incremental cost (\$/vehicle)	1,361	926	570
Average user annual fuel savings (\$/vehicle)	1,550	2,083	2,939
2030			
Average user incremental cost (\$/vehicle)	1,240	948	700
Average user annual fuel savings (\$/vehicle)	1,541	2,151	3,091
2050			
Average user incremental cost (\$/vehicle)	420	304	211
Average user annual fuel savings (\$/vehicle)	1,554	2,342	3,538

Cost Effectiveness

Costs (Savings)	BAU	Moderate Growth	Aggressive Growth
Incremental cost of vehicle and infrastructure, million \$	612	1,003	1,263
Incremental fuel costs (savings), million \$	(2,960)	(7,676)	(15,710)
Federal fuel tax costs (returns), million \$	(119)	(203)	(270)
State fuel tax costs (returns), million \$	177	304	403
Total cost (savings), million \$	(2,290)	(6,572)	(14,314)
Total LPG used, million GGE	5.12	9.47	13.32
Cost effectiveness \$/GGE	(0.45)	(0.69)	(1.07)

- 1 Methodology
- 2 Assumptions
- 3 Projections
- 4 Summary

- LPG can achieve significant petroleum fuel displacement by 2022
 - BAU: 0.8%
 - Moderate growth: 1.5%
 - Aggressive growth: 1.9% (2.3% in 2030)
- Characteristics and incentives needed:
 - BAU
 - In place incentives suffice (\$7M/yr average State)
 - Fleet sales only
 - Retrofit market
 - Moderate growth
 - Increased Federal & State incentives (\$13.5M/yr average total)
 - Inroads into consumer market
 - Aggressive growth
 - Additional Federal & State incentives (\$19.4M/yr average)
 - OEMs offer new vehicles
 - Acceptance in consumer market; selection of vehicles

- User paybacks favorable
 - BAU: <1yr by 2022
 - Moderate, aggressive growth: <1yr before or by 2012
- Cost effectiveness (\$/GGE) favorable for all scenarios, increasingly so as assumptions become more aggressive

Thank you for your Attention

Larry Waterland

TIAX LLC

waterland.larry@tiaxllc.com

408.517.1572

