Renewable Diesel Scenario Analysis

Algae

Biodiesel

Biomass-to-Diesel

Non Esterified Renewable Diesel

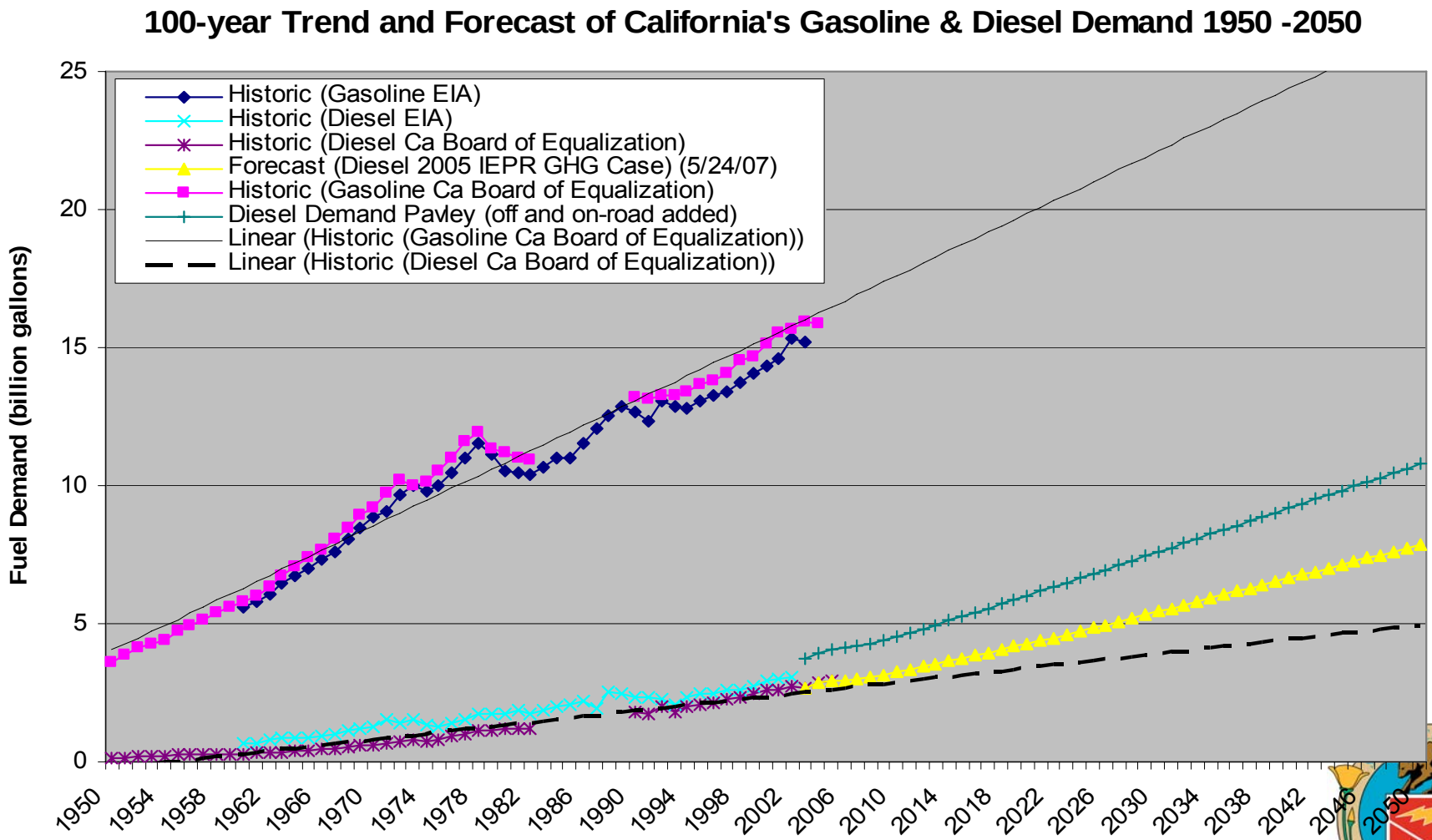
Gary Yowell

May 31, 2007

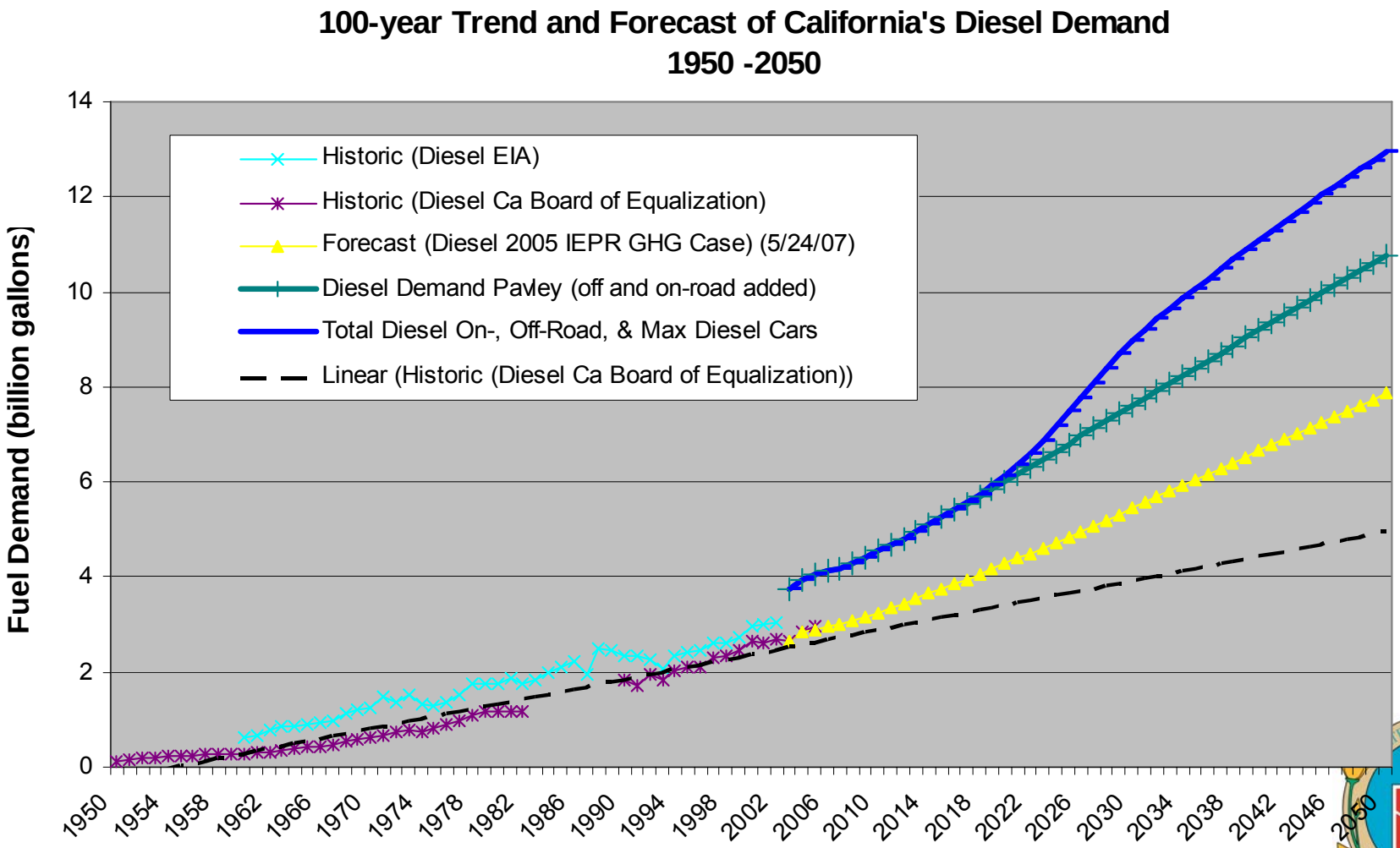
Key Issues

- Diesel Demand
- Crude Oil Price
- Renewable Diesel Supply (volume and timing)
  - Imports (serving Biodiesel and NERD)
  - Domestics (serving Biodiesel and NERD)
  - Unconventional (Algae, BTL, Thermal Depolymerization – with unconventional feeds)
- Projected Response to Incentives/Mandates
  - 0.50-$2.00/gallon

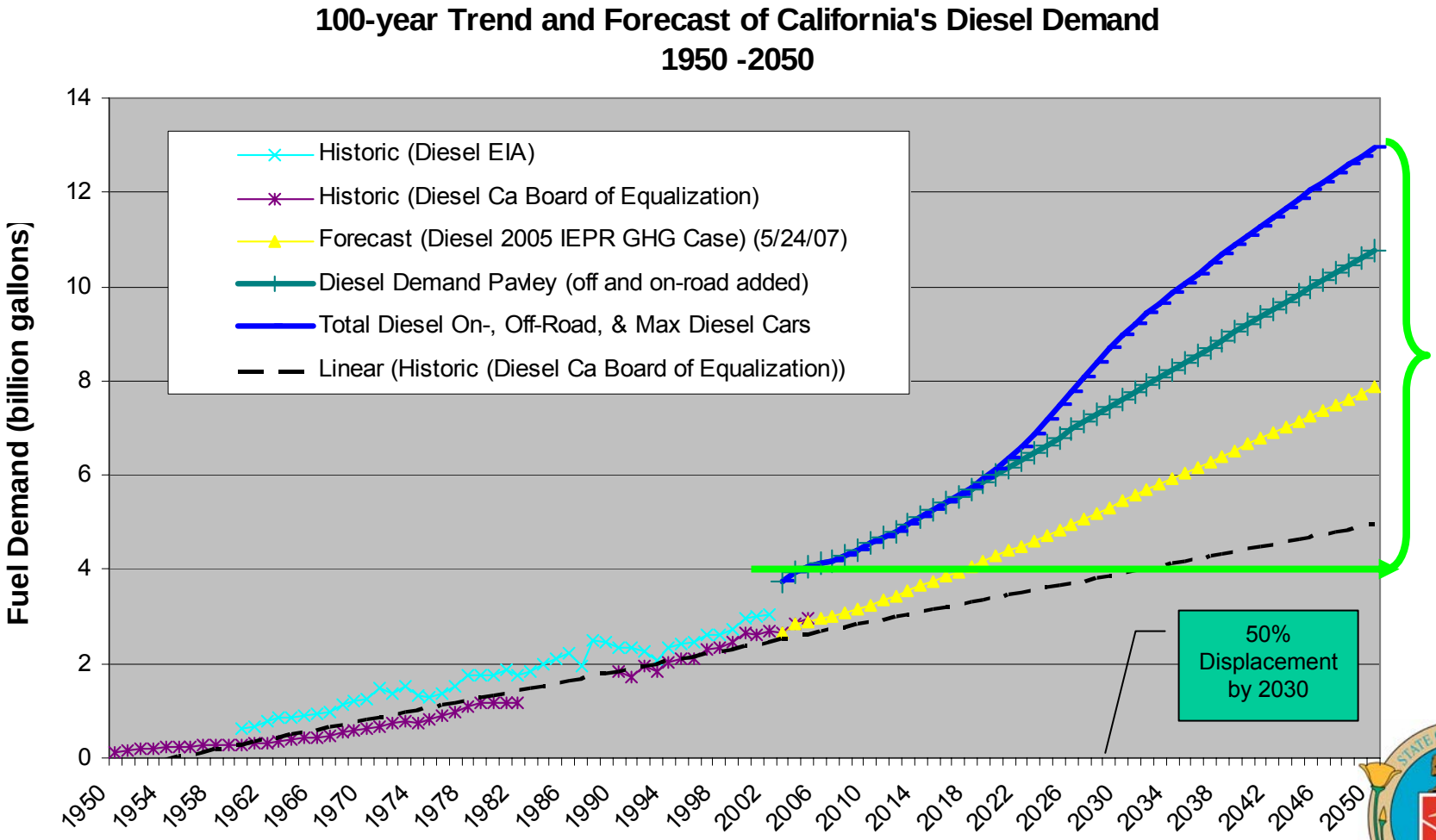
California's Fuel Demand is Strong and Steady



Diesel Demand



Opportunity for Alternative Fuels to Displace 60% Before Impacting Current Levels



Three Crude Oil Price Scenario

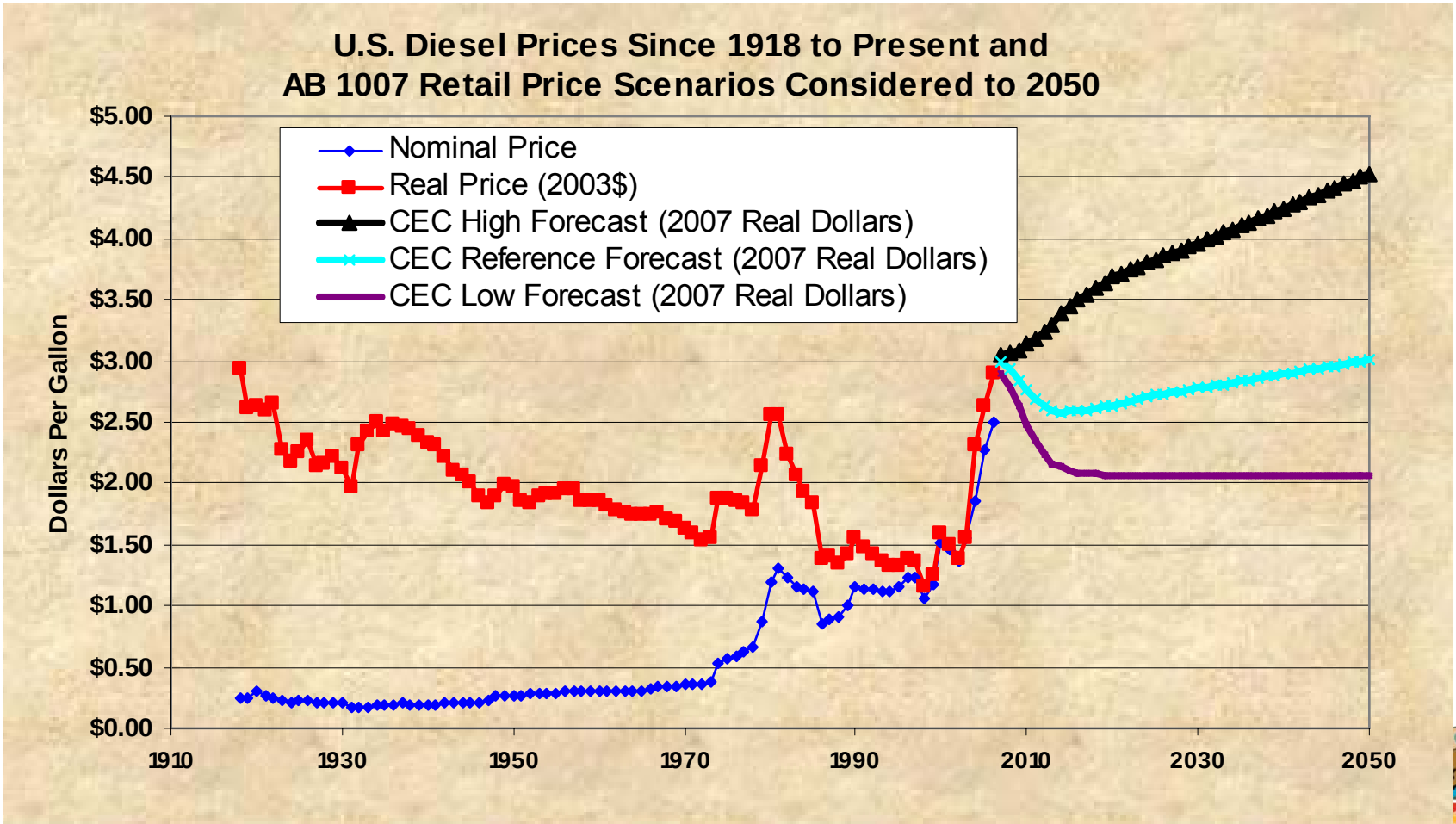
Crude Oil Price Scenario	2007	2012	2017	2022	2030	2050
High	63	70	83	90	99	121
Reference	63	49	48	51	55	64
Low	63	37	31	31	31	31

Prices are dollars per barrel, in constant 2007 dollars

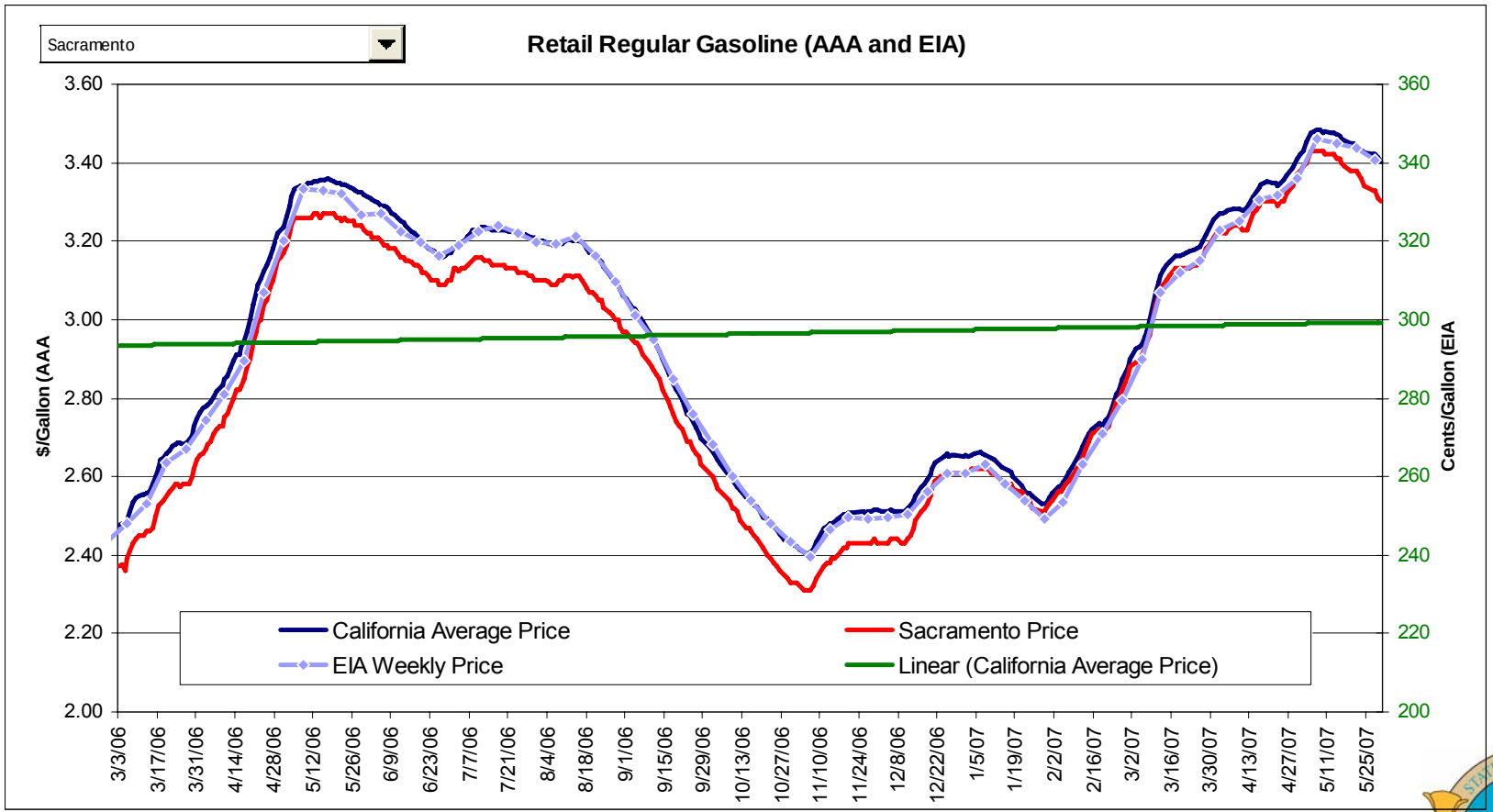
Staff Linear Extrapolated EIA values to 2050

Source: 2007 EIA AEO

Retail Diesel Price Scenarios

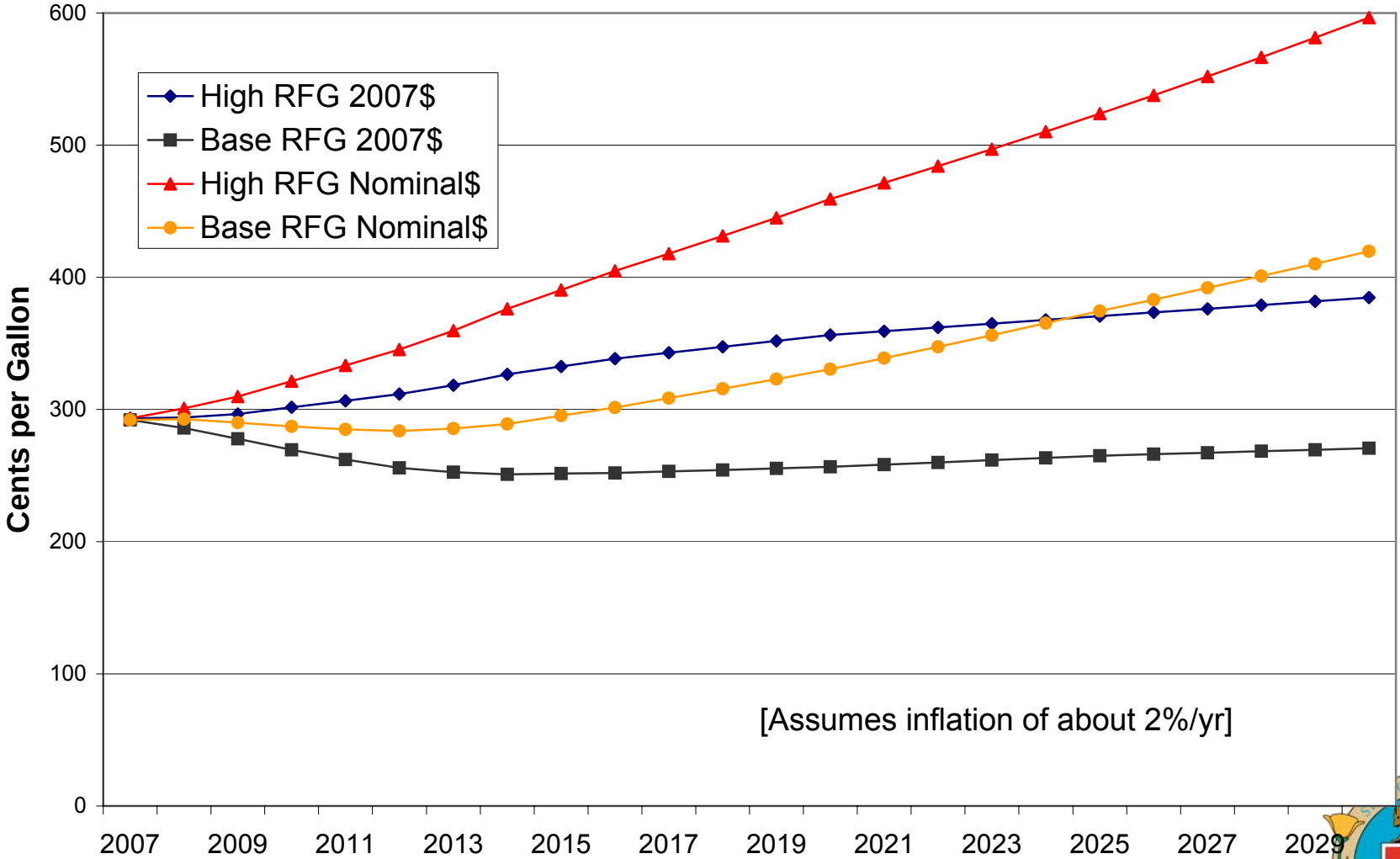


Average Gasoline Prices over the last 12-months

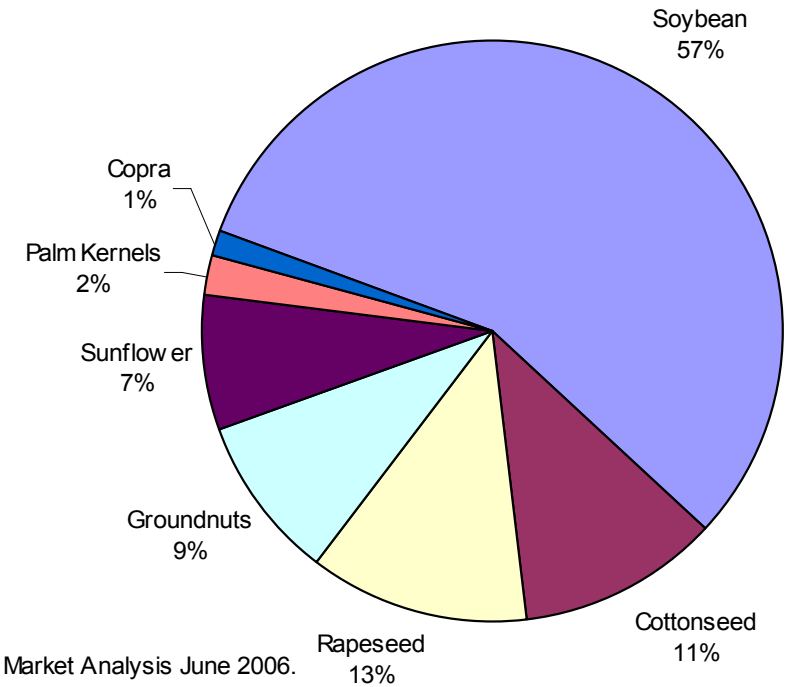


High and Middle Case Gasoline Price Forecasts

Annual Average Prices for Regular-Grade in Constant & Nominal Terms



Supply Context



Source: Food Outlook Global Market Analysis June 2006.

This production is serving food, cosmetic and other markets.

Palm production @ 9 billion gallons and growing

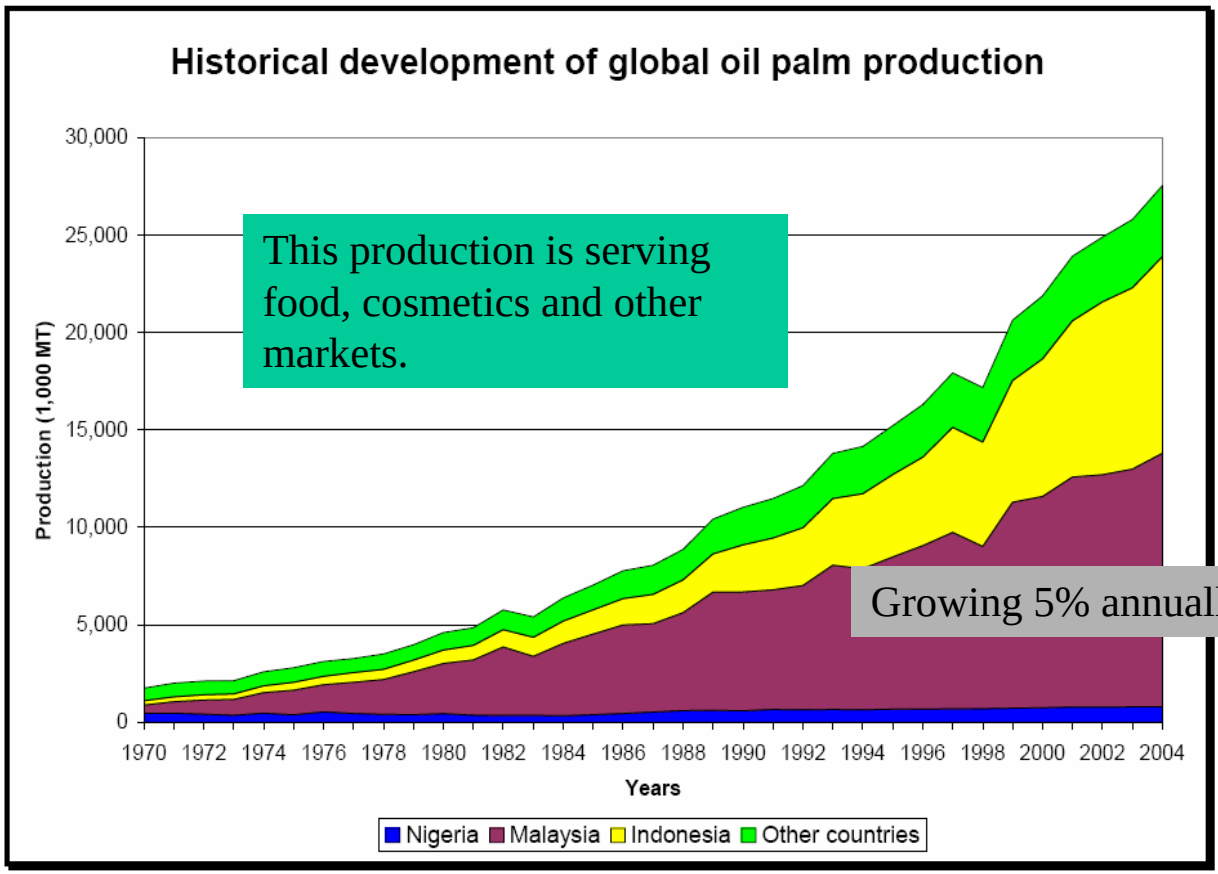
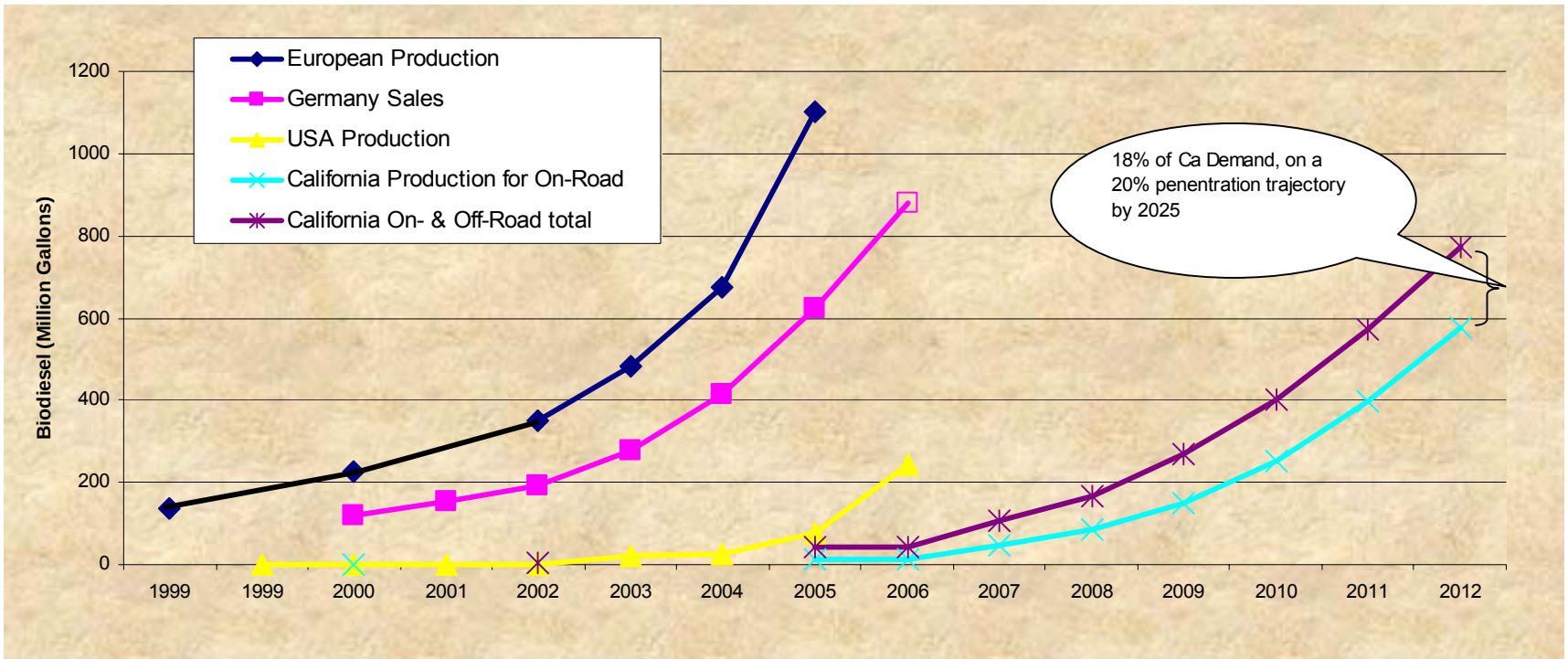


Figure 1. Historical development of the global palm oil production 1970-2004

Supply - Biodiesel Production Trends

(In Million Gallons)



Sources: European Biodiesel Board, National Biodiesel Board, Commission Staff Phone Survey of Biodiesel Production,

Greenhouse Gas Emissions

- Biodiesel 50 % GHG Reduction
- RenDiesel 70-85 % GHG Reduction
- BTL 70-85% GHG Reduction

- Low Carbon Fuel Standard:
  - B20 Biodiesel Blends
  - RD15 NERD Blends

Scenario Analysis – Baseline

- Less than 4-6% of Ca demand is met with Renewable Diesel
  - Existing Federal Incentive Remains
  - No additional Research to advanced Algae, or BTL Plants
- Low Carbon Fuel Standard Baseline
  - 15% NERD & Biodiesel blends
  - Biodiesel is generally use up to B5 although B20 should be feasible with a B20 ASTM adoption

Alternative Scenarios

- State production incentives/or mandated cost of: 50,1.00, 1.50, $2.00/gallon
- $50 & $500 R&D for unconventional feedstock processes (Algae, BTL)
- 10-year off-take contracts for “unconventional” plants (non-esterified Plants, Algae, BTL, Thermal Conversion)
- Favorable tax credits for in-state renewable plants
- Facilitate siting petroleum infrastructure port facilities, & bulk storage
  - Pulls Renewables into Ca market
  - Accelerate plants, and volume.

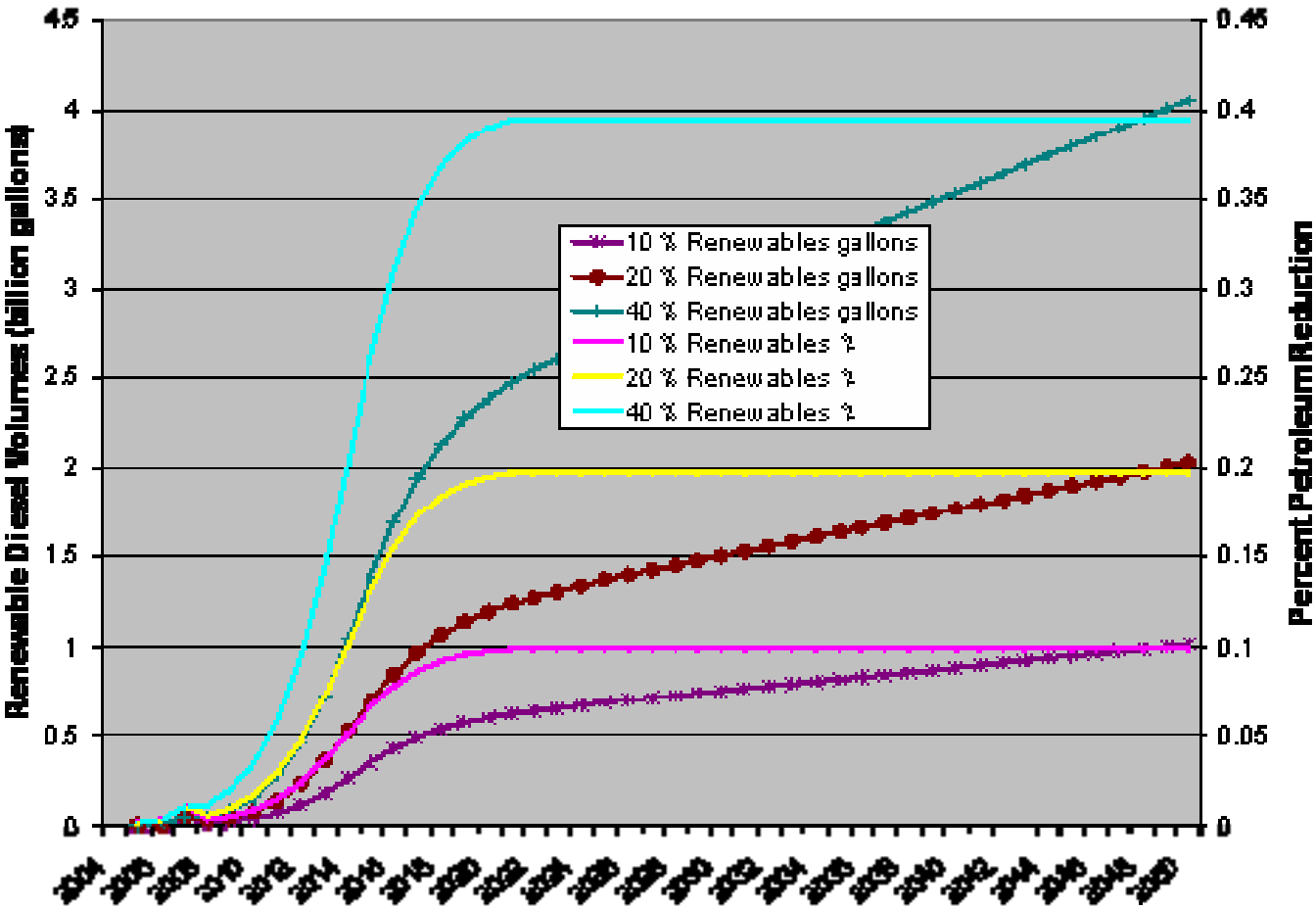
Market Supply Responses to Incentives or Mandates

Table 2. Maximum Renewable Diesel Penetrations after 20-30 years in Response to Varying Incentives or Mandated Cost

Existing Federal Incentive	Additional Incentive ($ / gallon)	Total Incentive ($ / gallon)	Low	Reference	High
$1.00	0	$1.00	4%	5%	6%
$1.00	60¢	$1.60	8%	11%	14%
$1.00	$1.00	$2.00	14%	20%	24%
$1.00	$1.50	$2.50	22%	31%	38%
$1.00	$2.00	$3.00	30%	44%	52%

% of Ca Demand

Fig 5 Renewable Diesel Volumes



Scenario Model Analytics

- Constructed for AB 1007 Criteria
- XTL and Renewable Diesels use same backbone - projected diesel demand vs. % displacement
- Percent of XTL supply – Incentives
- ∑ Cost (Consumer, Gov, Fuel Prices, Fuel energy impacts)
- Emissions, Petroleum Reduction Cost effectiveness is quantified to 2050

Cost Effectiveness Results

@ 20% Renewable Diesel Blend with $1.00 additional cost/gallon

Cumulative Years	Consumer's Incremental Expense (billion $)	Gov't Tx Revenue Expense (billion $s)	Gov Incentives Expense (billion $s)	Total Gov Expense (billion $s)	Petroleum Reduction (billions)	Alt Fuels Demand (billions)
2007 to 2012	0.00	0.00	0.97	0.97	0.49	0.21
2007 to 2017	0.00	0.00	7.22	7.22	3.61	0.89
2007 to 2022	0.00	0.00	18.22	18.22	9.11	1.21
2007 to 2030	0.00	0.00	41.63	41.63	20.82	1.67
2007 to 2050	0.00	0.00	125.20	125.20	62.60	2.44

NOTE: Positive Numbers are Reductions, Negative Numbers are Increases

Cost Effectiveness Analysis ($s per ton reduction)

Cumulative Years	Petroleum Reduction	NOx	CO	NMOG	Toxics	Particulate Matter	GHGs
2007 to 2012	2.000	-2,925,230	268,173	-9,317,599	-1,845,561,967	3,424,927	179
2007 to 2017	2.000	-51,598,929	2,003,386	-64,008,689	-1,880,942,645	24,263,768	183
2007 to 2022	2.000	91,503,140	5,112,691	-142,774,934	-1,884,337,897	56,673,938	183
2007 to 2030	2.000	45,239,677	11,953,493	-261,371,871	-1,885,592,937	111,680,338	183
2007 to 2050	2.000	35,826,152	39,237,628	-459,910,342	-1,886,245,838	225,346,201	183

Emissions & Petroleum Reduction

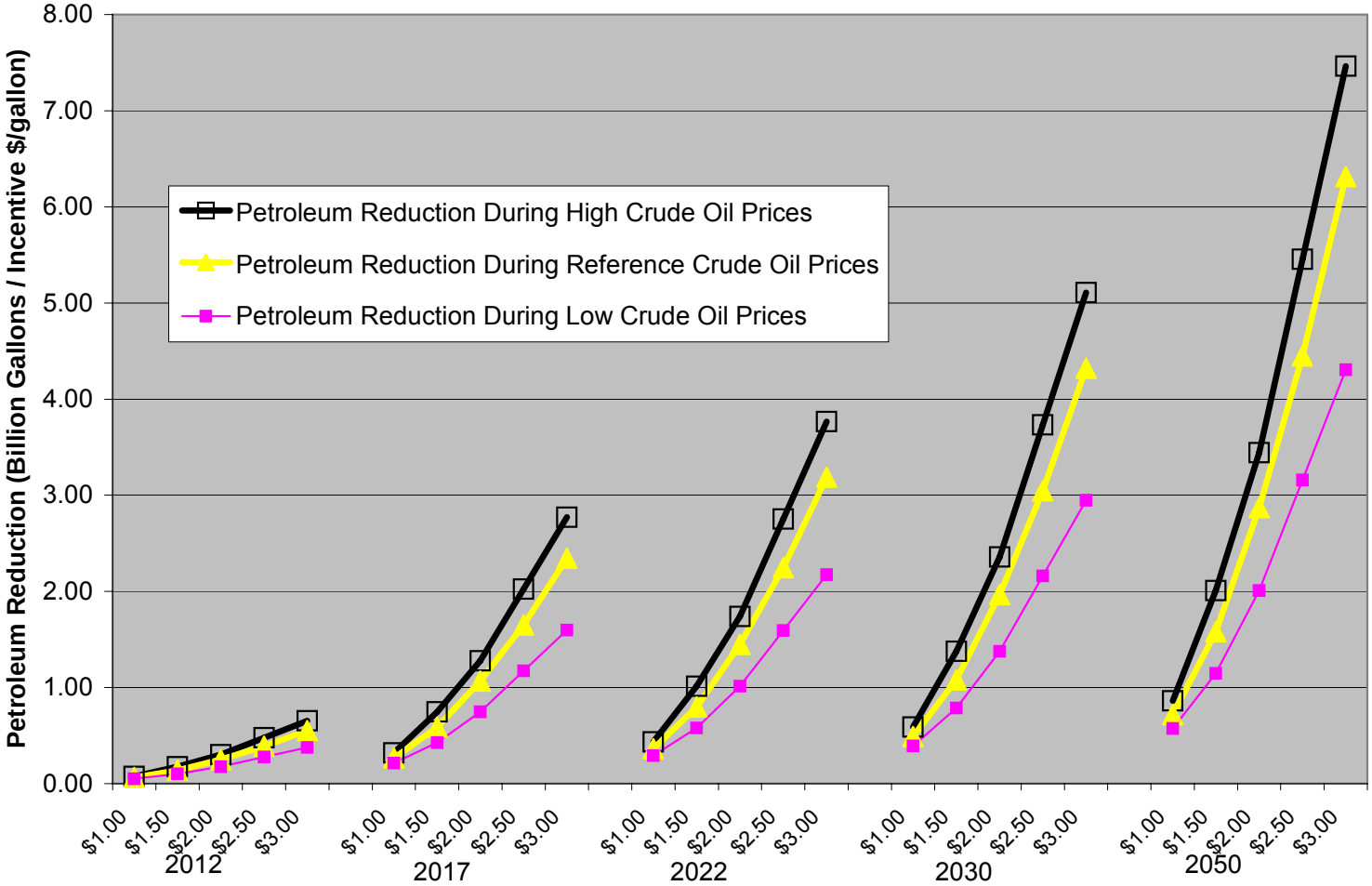
Based on 2005 IEPR Emission Analysis To Be Updated ASAP

15% Renewable Diesel Blend

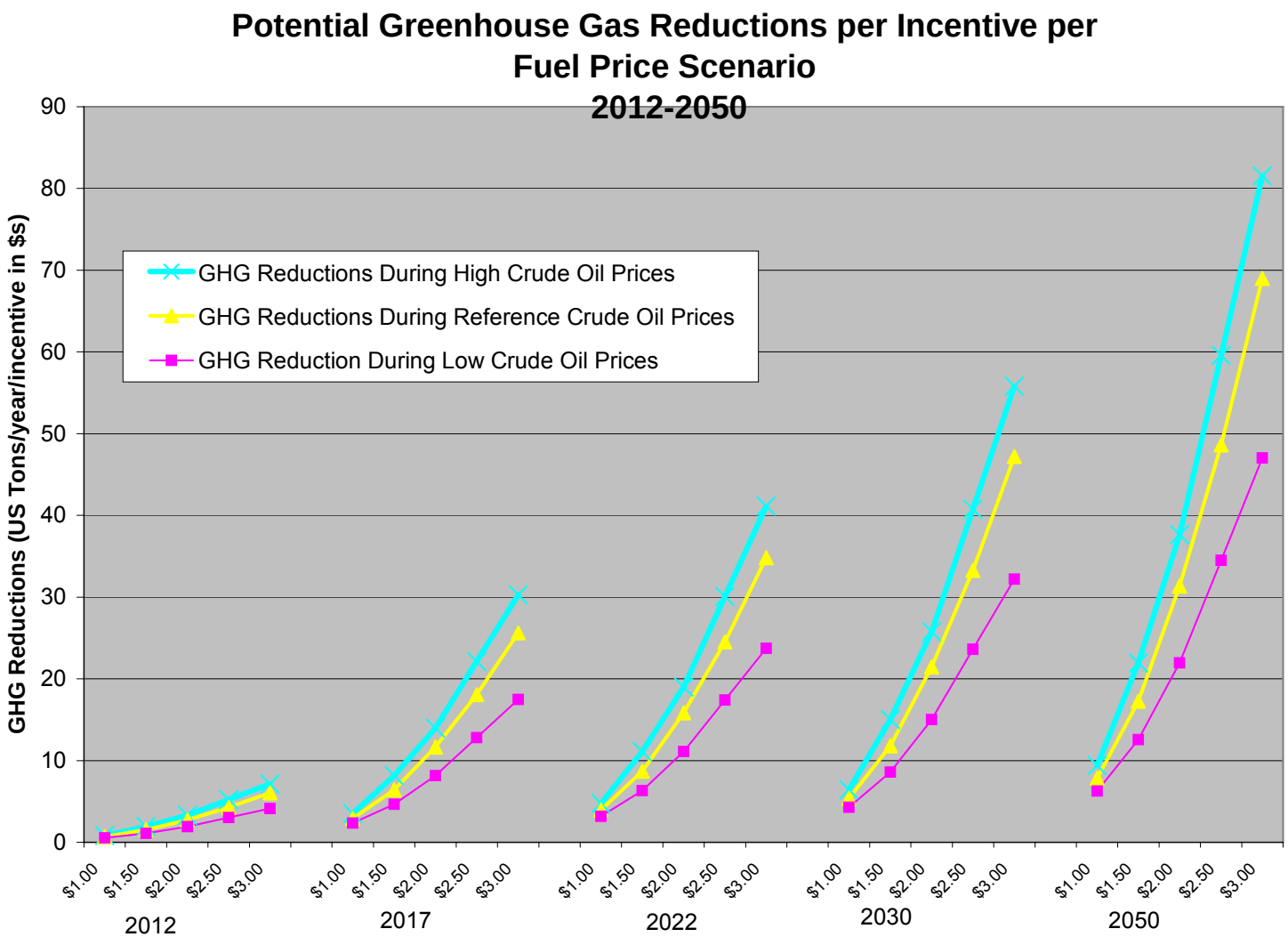
	Emission Reductions (in tons/year)						
Single Year	NOx	CO	NMOG	Toxics	Particulate Matter	GHGs	Petroleum Reduction (billion gallons)
2012	10	-1	0	0	1	1,733,854	0.159
2017	41	-5	-2	-1	3	7,293,559	0.668
2022	56	-6	-2	-1	4	9,888,819	0.905
2030	77	-9	-3	-1	5	13,662,852	1.251
2050	113	-13	-5	-2	8	20,006,245	1.832

Results Petroleum Reduction

Potential Petroleum Reductions per Incentive per Fuel Price Scenario
2012-2050



GHG Reductions 80% GHG Benefit Assumed



Staff Recommended Actions

- Lack of bulk storage sufficient to receive Renewable Diesel shipments (and XTL diesel) from abroad and keep bulk segregated
  - Improved Permitting Process,
  - Legislature empower the Energy Commission to Oversee and facilitate the permitting process (at ports and inland)
- **Limited Market Demand for Renewable Diesels**
  - Low Carbon Fuel Standard – implementing the standard in a way that pulls Renewable diesels into market.
  - Need a 5% mandate to get infrastructure established
  - Use Incentives to move beyond 5%

Continued Staff Recommendations

- **Limited In-State Renewable diesel Production.**
  - The State Legislature should establish “Floor” price protection up to 25 cents per gallon excise tax exemption for Renewable diesel fuels
  - Floor is indexed on a composite of palm, canola and soy oil and Diesel Rack prices
  - Subsidy cost funded via a 0.1 cent per gallon tax per diesel gallon sold
  - Must require that the fuel be sold in California

Continued Staff Recommendations

- Now is the time to develop sustainable Biofuel production policy (guidelines) for in-state and foreign Biofuel supplies
  - Will the Low Carbon Fuel Process result in a GHG Certification?
  - Welcome comments and suggested language that staff could include into our staff recommendations.

Current Storage

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Westway Terminal

- Port of LA
- 25MM gal
  - 6MM+ dedicated to biodiesel
  - 1MM+ gallons of Ethanol Storage
  - could be expanded to support more an/or higher percentage of renewable diesel and ethanol storage
  - Close proximity to major oil refineries and Kindermorgan Carson facility
- City of LA closing down to make way for park within 18 months
- Losing this storage would make it more difficult for the state to achieve its biofuel objectives for the next 3 year
- Industry recommends delaying closing 3-5 years until replacement facility is built

New Storage

- Targets to meet renewable diesel growth
  - Expect 6-8 turns year for the storage
  - Takes 3-4 years to build with permitting
  - To support 1B gallons within 5 years, CA needs at least 150MM gals to 200MM gals of new storage
- What the market needs
  - Developers of storage need to fast track permitting process to help cut one year off process
  - Storage needs to be planned now to get ahead of the demand curve as proposed
  - Storage needs to be near pipelines with rail, truck and ship (at least 30k MT dead tonnage)

Comments - Suggestions