



Modeling GHG Emission Reduction Policies in Support of AB32 Using ENERGY 2020

Glen Wood – ICF International
Jeff Amlin – Systematic Solutions, Inc. (SSI)

November 4, 2009

Outline of Presentation

1. Reference Projection
2. Policies Modeled
3. Policy Modeling Results

Project Overview

- Goal:
 - *Provide the ARB with the modeling capability to analyze policy options for reducing greenhouse gas emissions across all sectors of the California economy. This capability is required for the ARB to fulfill its legislative mandate under AB 32, which requires that the ARB implement a program that reduces the State's GHG emissions to 1990 levels by 2020.*

- Key Tasks
 - Update Reference Case to reflect recent economic downturn
 - Incorporate current/approved Model policies specified by the ARB
 - Model impacts of key Complementary Policies and potential Cap-and-Trade configurations
 - Sensitivity cases

Reference Projection

Reference Projection

Key policies and assumptions included:

- ❖ AEO 2009 Reference Price forecast
- ❖ Economic forecast including downturn
- ❖ 2007 EISA requirements
 - ❖ CAFÉ provisions (for other states)
 - ❖ Biofuels mandate (for other states)
- ❖ RPS requirements for all states modeled
- ❖ RPS for CA at 20% of electricity sales
- ❖ Heavy Duty Vehicle Efficiency
- ❖ Marine efficiency

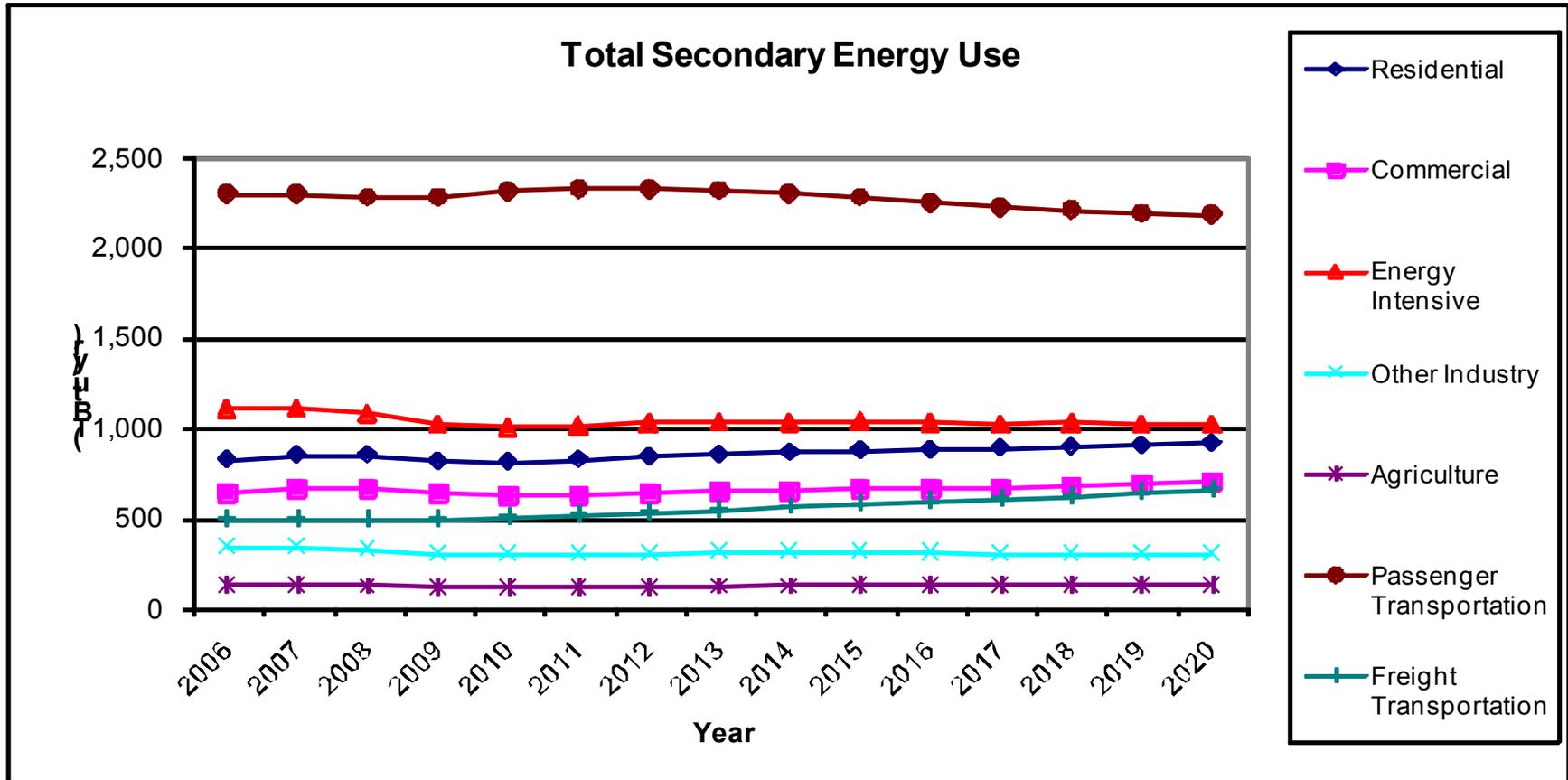
Reference Projection – Policies Included

Policy	Region	Goal
2007 EISA	All states	New vehicles reach 35.5 mpg by 2020 under EISA CAFÉ provisions.
Pavley Vehicle Standard	CA only	35.5 mpg in 2016. Replaces EISA above
Low Carbon Fuel Standard	CA only	10% reduction in carbon content of fuel by 2020 replaces EISA above
Renewable Portfolio Standard	All states that have an RPS	California 20% attainment

Summary of Reference Case

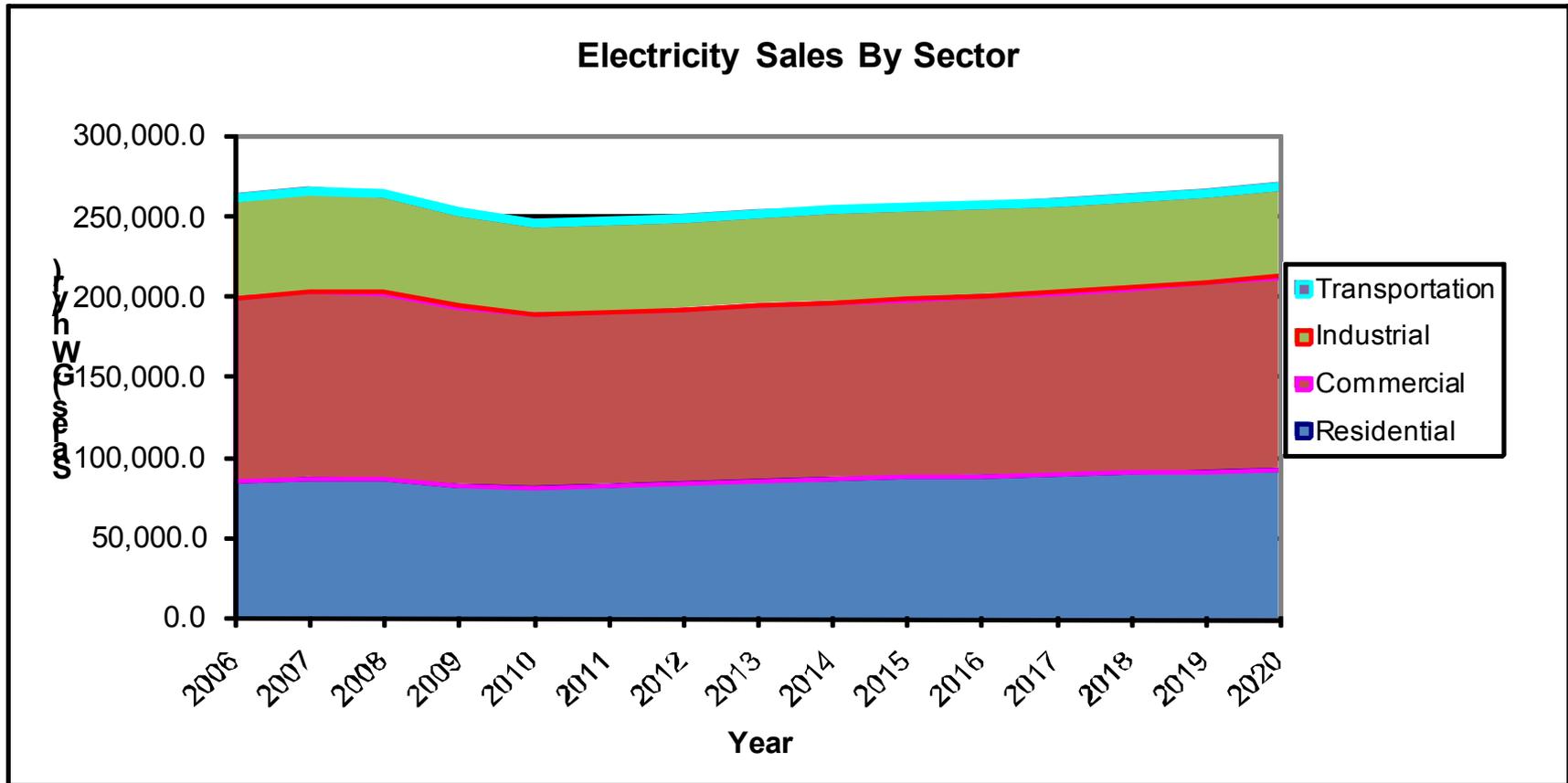
- Economic output and emissions in 2020 lower than in initial (2008) modeling
- Growth in Gross Output averaged 3.1% growth (2007 to 2020) in prior Reference Case compared to 2.7% in updated 2009 model.
- Total emissions in 2020 for CA approximately 508 Mt CO₂e including power imports.
 - lower than in earlier (2008) modeling due to economic and price changes and inclusion of different policies.
- Limited emissions growth (~21 Mt) between 2007 and 2020.
- Graphs which follow show pattern of change & emissions by source/sector in new Reference Case.

Reference Case – Secondary Energy (as of 29 Sept)



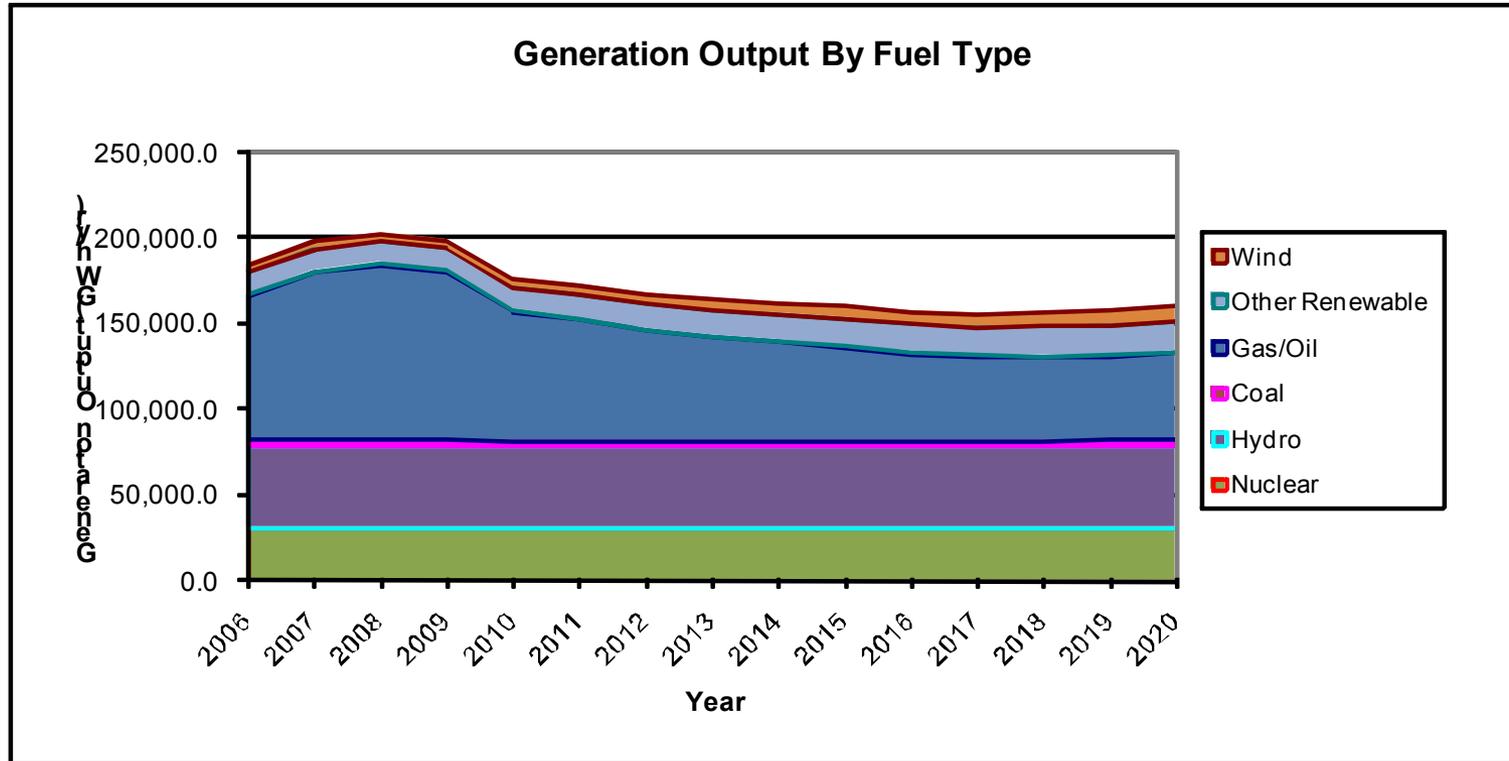
- Total secondary energy use grows by 0.1% per year to 2020
- Transportation and industry energy use decline.

Reference Case - Electricity Demand



- Total electricity sales increase by average of 0.2% per year to 2020.
- Electricity sales decline in 2009 to 2011 period then continue growth.

Reference Projection – Power Sector



- Wind and renewables increase to meet RPS requirements
- Fossil generation (gas/oil/coal) decline from 45% of in-state generation in 2006 to 32% in 2020.
- Imports decline over period from 30% of sales to about 22% by 2020.

Reference Projection – Transportation

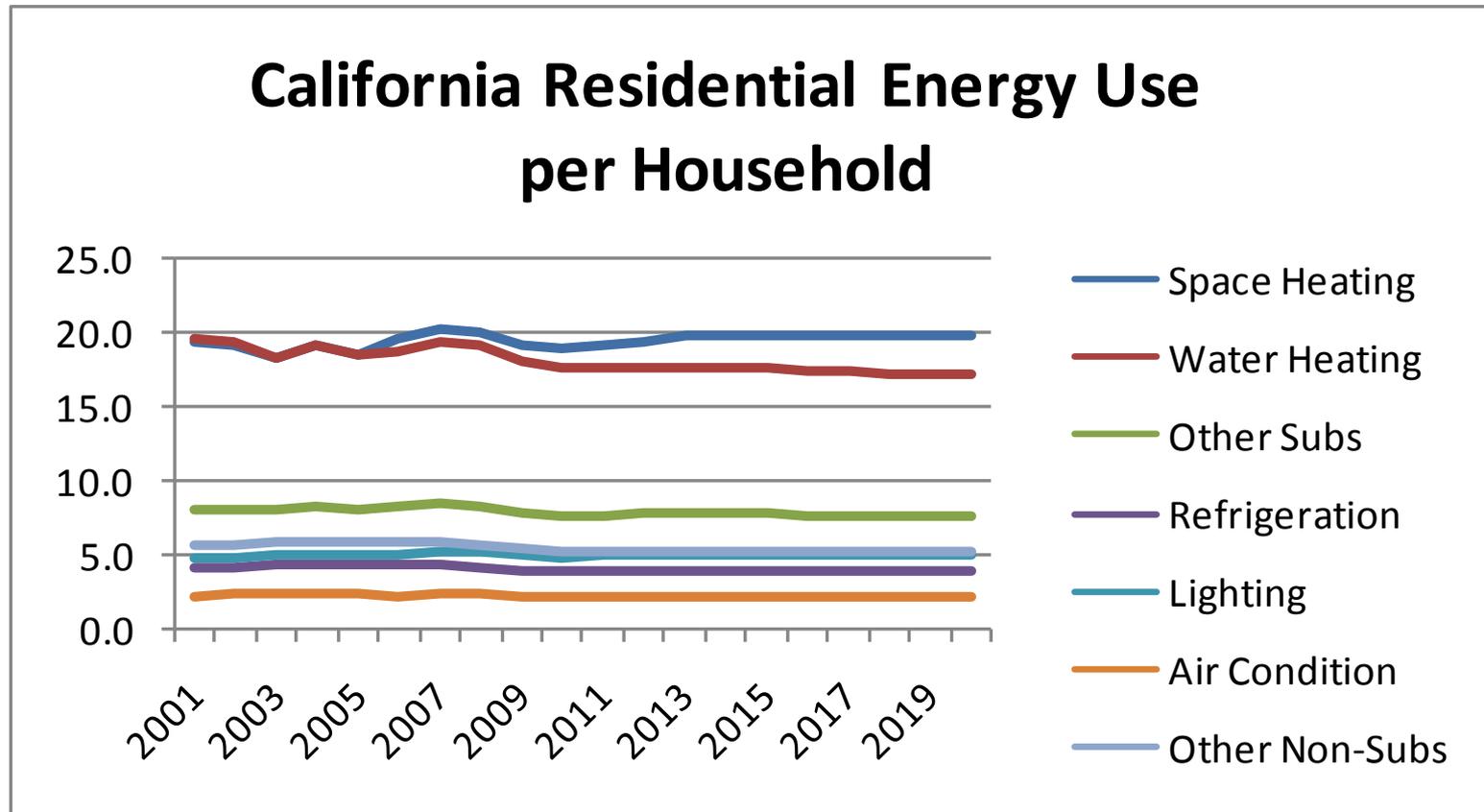
Marginal Vehicle Efficiency (miles/gallon)					
	2006	2012	2015	2020	Avg. Annual Growth Rate 2006-2020
Light Gasoline	24.2	32.4	38.9	42.6	4.1%
Medium Gasoline	24.2	32.4	38.9	42.6	4.1%
Heavy Gasoline	17.3	21.7	25.1	26.5	3.1%
Heavy Diesel	17.3	21.5	24.8	26.2	3.0%
Fleet Average (In-Use Vehicles)	21.4	28.6	33.9	36.6	3.9%

Renewable Shares	2006	2012	2015	2020	Difference 2006-2020
Renewable Percentage	12.6%	15.4%	17.7%	20.2%	7.5%
Ethanol/Gasoline	3.8%	8.4%	11.7%	15.0%	11.3%
Biodiesel/Diesel	0.0%	9.5%	19.1%	35.0%	35.0%

- New vehicle efficiency increases to meet targets under Pavley.
- Ethanol and biodiesel increase as a share of total fuel to meet LCFS.
- Passenger VMT grows by about 2% per year.
- Freight VMT rises by 2.7% per year (2006 to 2020).
- Some shift to larger vehicles as efficiency improvements reduce cost of driving (1-1.5% shift 2006 to 2020 to larger vehicles).

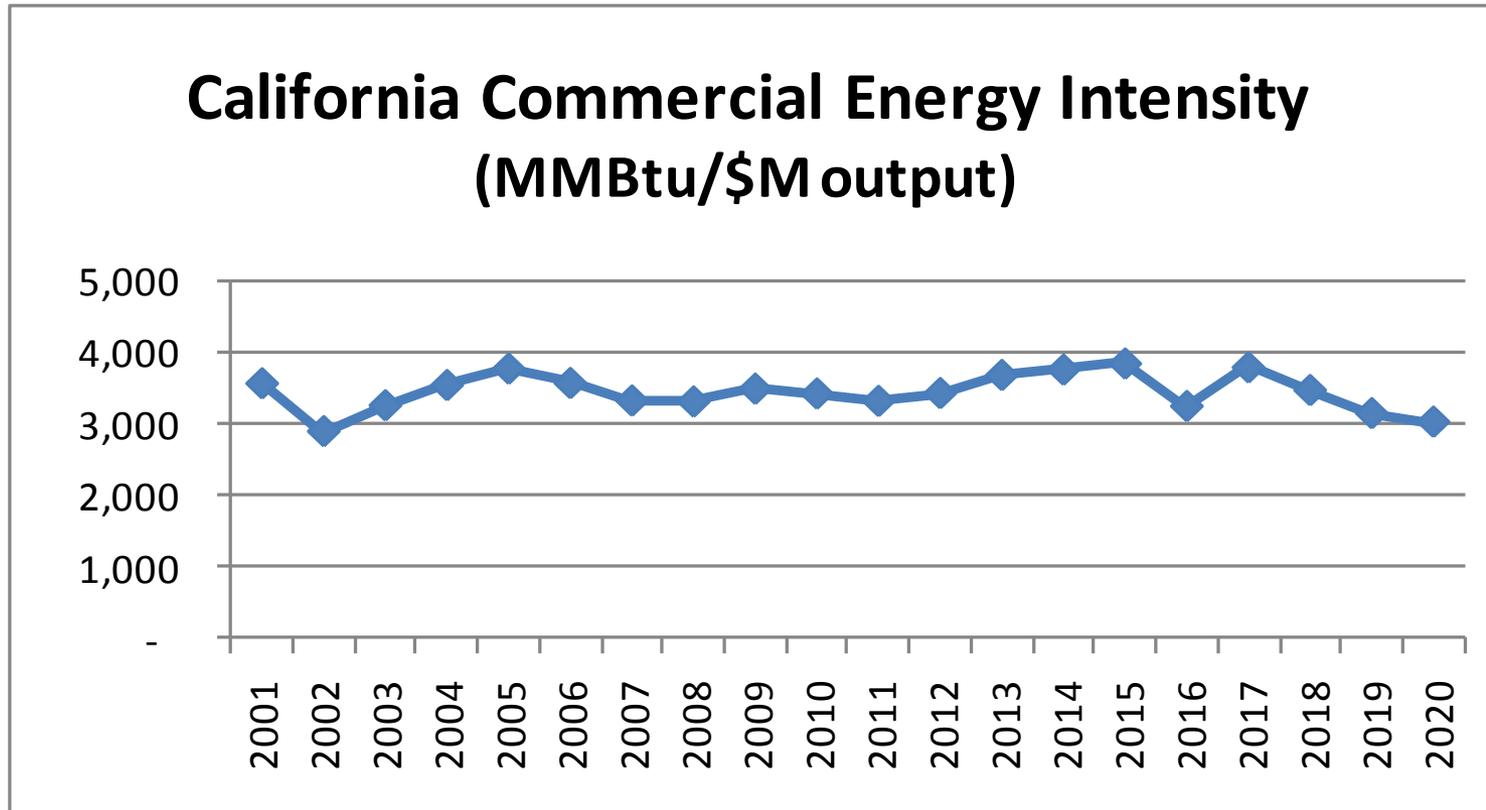
Change in Energy Intensity

➤ Reference Case projection - California.



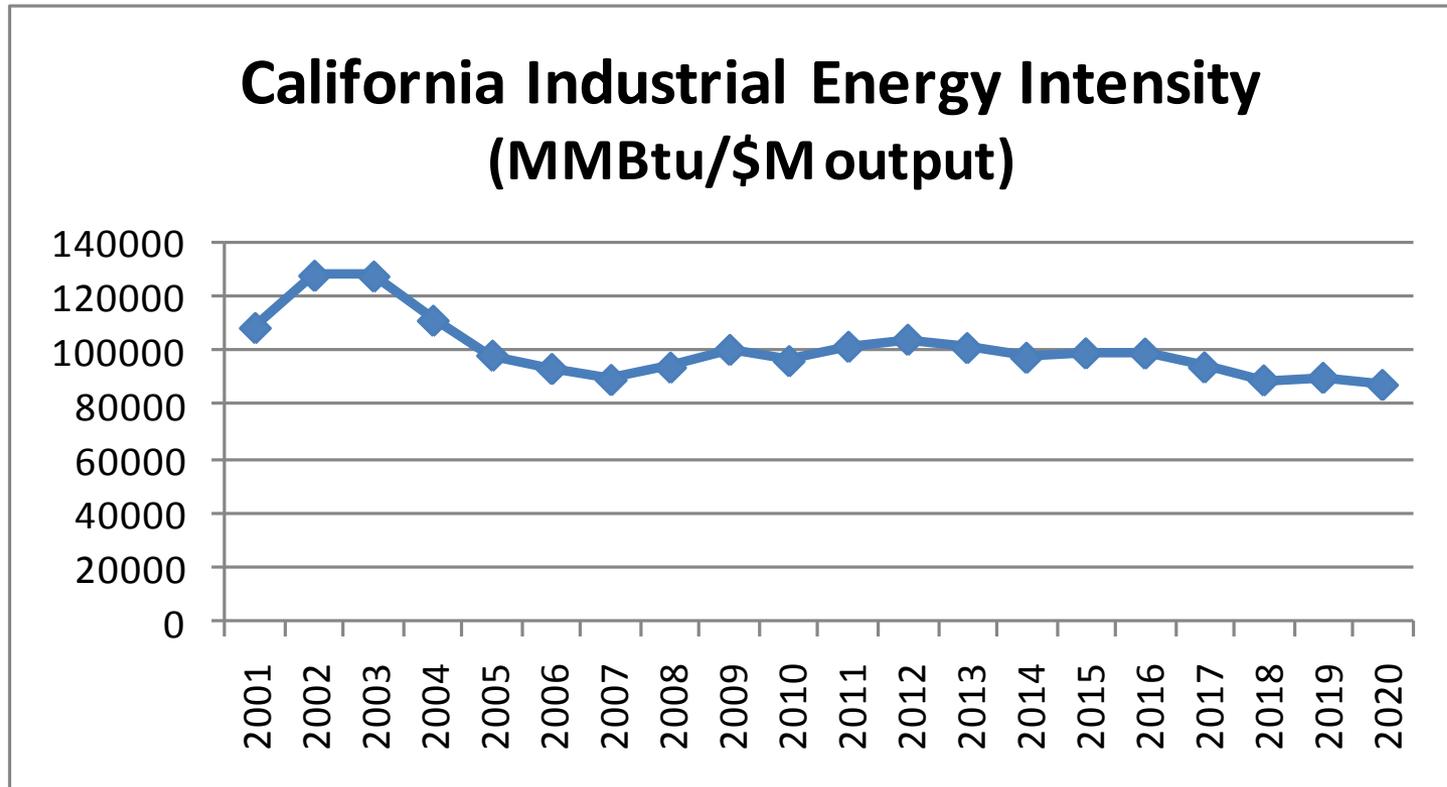
Change in Energy Intensity

- Reference Case projection - California



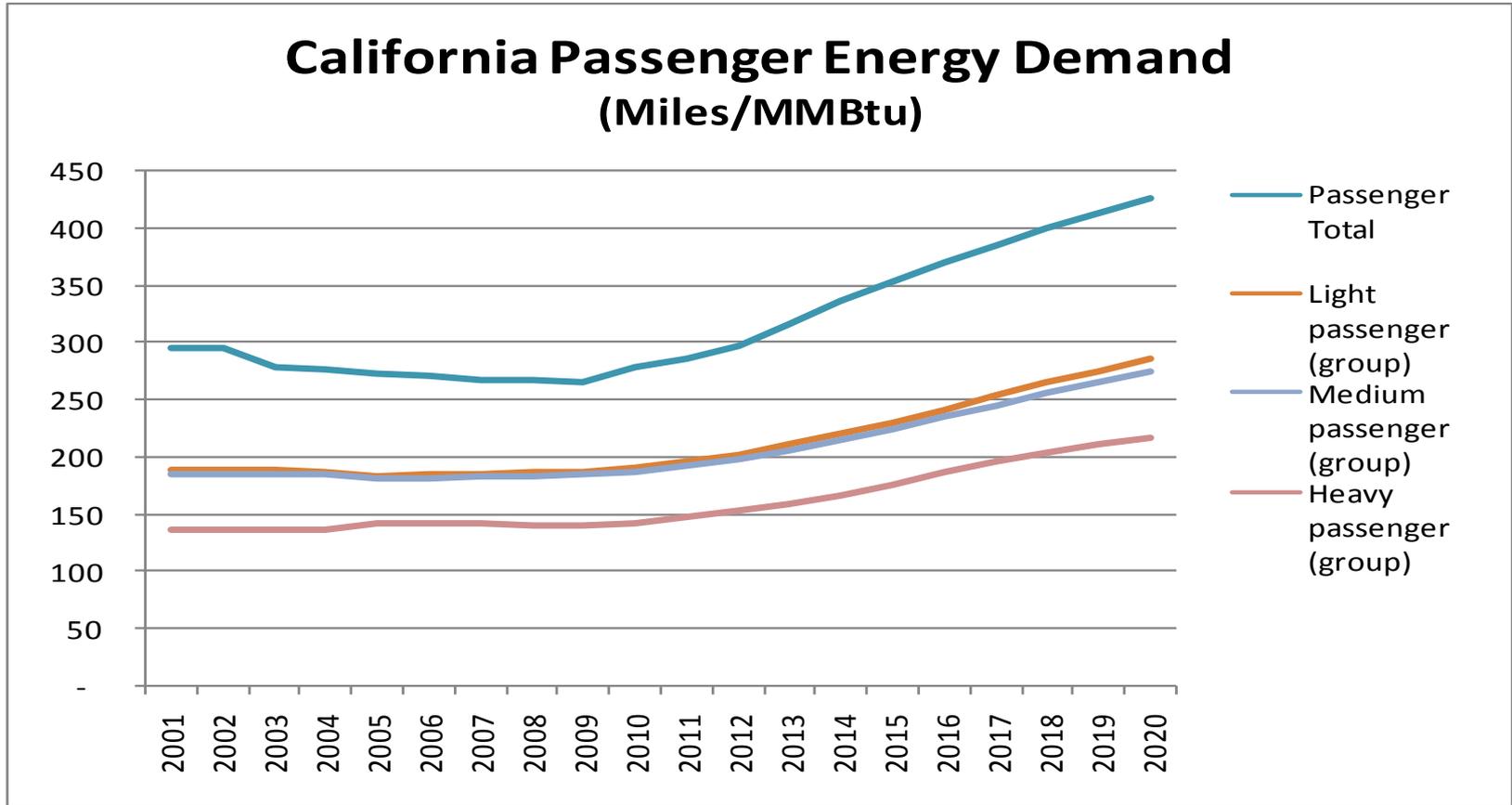
Change in Energy Intensity

- Reference Case projection - California.

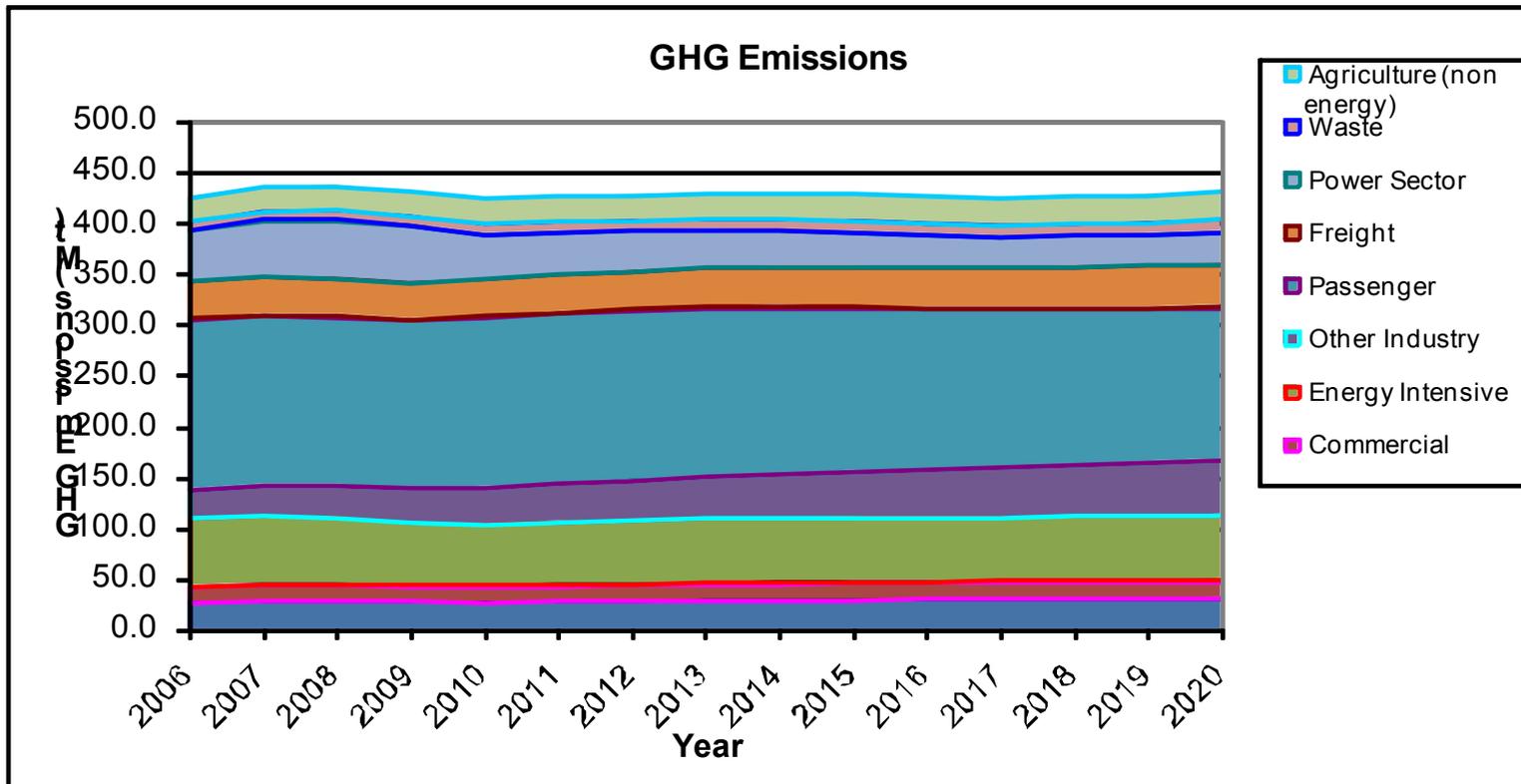


Change in Energy Intensity

➤ Reference Case – California.



Reference Projection – GHG Emissions



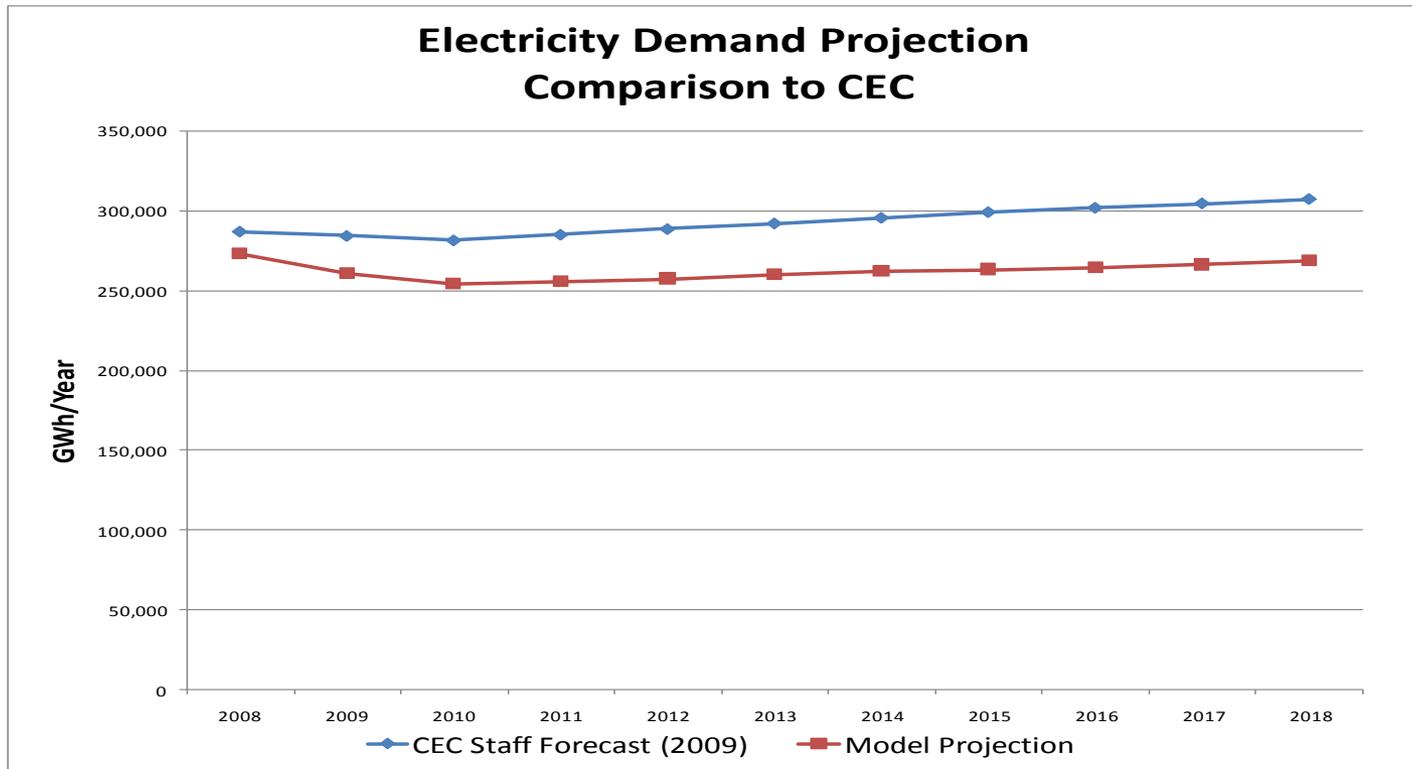
- GHG emissions (excluding power imports) rise slightly (5.4Mt) by 2020; growing on average by 0.1% per year.
- In-state power sector, passenger transportation and energy intensive industry emissions decline over period.

Reference Projection – GHG Emissions

GHG Emissions (Mt)	2006	2012	2015	2020	Avg. Annual Growth Rate 2006-2020
Residential	27.9	29.0	30.2	31.6	0.9%
Commercial	14.1	15.3	16.0	16.7	1.3%
Energy Intensive	67.7	63.1	64.1	64.1	-0.4%
Other Industry	27.9	38.7	44.6	54.2	4.9%
Passenger	167.5	168.2	162.1	150.7	-0.8%
Freight	37.9	38.9	40.5	42.8	0.9%
Power Sector	49.3	39.1	34.2	31.5	-3.1%
Waste	9.8	10.9	11.5	12.4	1.7%
Agriculture (non energy)	23.6	25.0	25.7	27.0	1.0%
Total	425.7	428.2	428.8	431.1	0.1%

➤ Emissions increase in all sectors except energy intensive industry, passenger transportation and power sector.

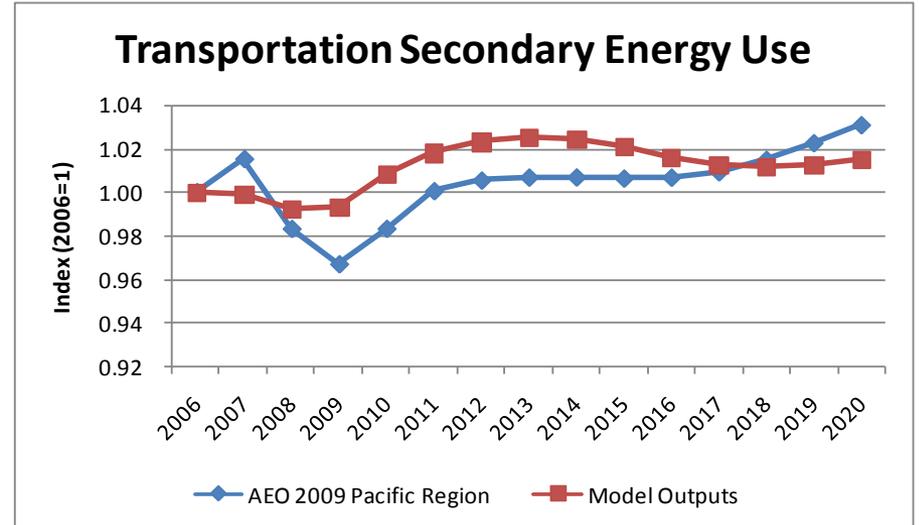
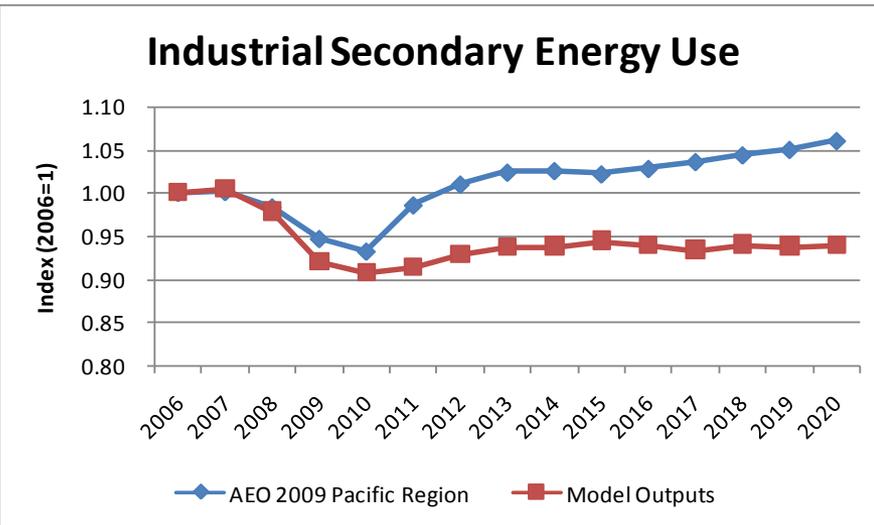
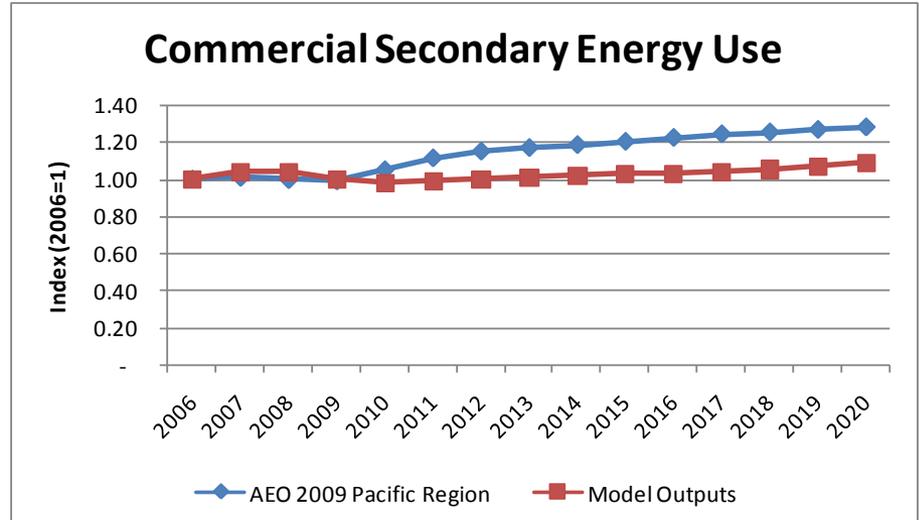
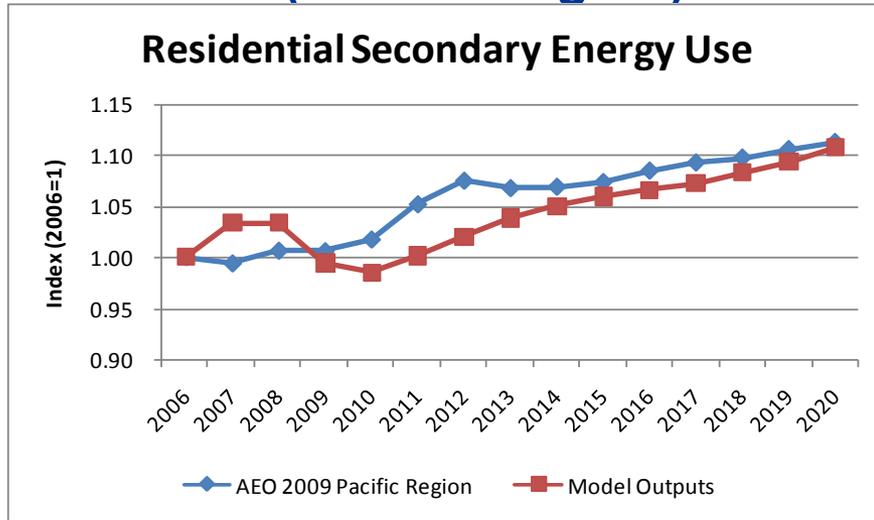
Comparison to Other Projections:



- Electricity demand projection lower than latest CEC staff projection – reflecting less optimistic economic projection.
- Gross output for California projected to increase by 33% (2007 to 2020)
- Rest of Western Electricity Coordinating Council (WECC) grows more quickly – expanding by 43% over same period.

Comparison with Other Projections

AEO 2009 (Pacific Region)



Policies Modeled

Complementary Policies Modeled

Policy	Region	Goal
Pavley Vehicle Standards II	California	42.5 mpg average new vehicle efficiency by 2020.
Renewable Portfolio Standard	California specific increase	20%-33% attainment
Energy efficiency	California	<ul style="list-style-type: none"> • 10% in electricity use in 2020 or about a 1% per year reduction in electricity consumption. • 4% of projected natural gas use in 2020.
Combined Heat and Power	California	Increase CHP use by 30,000 GWh

Complementary Policies Modeled

Policy	Region	Goal
VMT Reduction Measure		VMT decrease of 4% by 2020
Heavy Duty Vehicle Efficiency	CA Only	<p>Increase in Freight Ground end use efficiency to reflect Smart Way Truck Efficiency (~1.4 MMT reduction)</p> <p>Establish Medium and Heavy Duty Vehicle Hybrids as a Technology (~0.5 MMT reduction)</p>
Ship Electrification at Ports	CA Only	On-shore electricity used in place of diesel engines (~0.2 MMT)

Policies Modeled – Cap & Trade

- **Region**
 - California
- **Covered GHG Pollutants**
 - CO₂, CH₄, N₂O, SF₆, PFC, and HFC
- **2020 Goal**
 - 14% below 2006 base emissions (Target of 427 MMT in 2020)
- **Covered Sectors:**
 - **2012-2014 - Narrow Scope:**
 - Electricity and Industrials emitting >25,000 MT CO₂E
 - **2015-2020 - Broad Scope**
 - Narrow Scope plus transportation fuels, commercial and residential fuels and small industrial.
- *Note - Consistent with WCI Phase 3 Main Cap and Trade Case*

Policies Modeled – Cap & Trade

- **Banking**
 - Allowed without limitation
- **Allowance Allocation** for Electricity generation (two cases)
 1. 100% Auction
 2. 0% Auction
- **Offsets - Two cases**

(based on 100% auction allocation scheme for offset cases)

 1. No offsets
 2. With offsets at 49% of reduction from base at some price

Policy Modeling Results

Policy Modeling Results: C&T Case

Relative to the Reference Case in 2020:

- Secondary energy use declines by 5.4%, with all sectors showing a decrease from Reference levels.
- Passenger transportation energy use declines by >6%.
- Electricity sales decline by over 20% due to increase in self-generation (30,000 GWh) and increase in energy efficiency (10% reduction in electricity use).
- Renewable energy sources provide 33% of in-state generation and imports.

Note that results are still preliminary

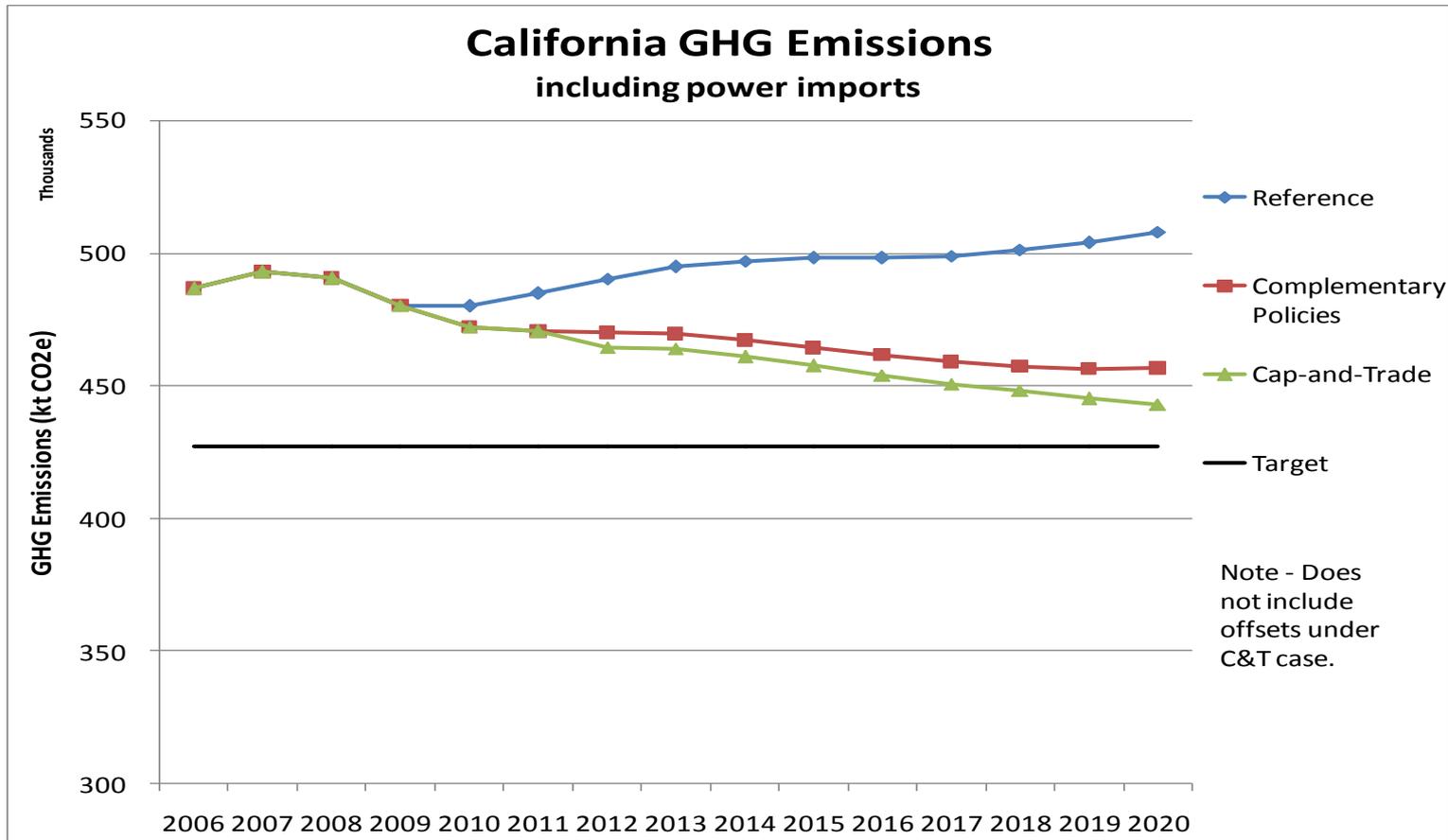
Policy Modeling Results: C&T Case

- Electricity prices rise by 7% for commercial and residential customers; higher increase for industry.
- Impacts on actual Fuel Expenditures are mitigated by the reduction in energy consumption due to efficiency gains
- Fuel expenditures decline by about 6% for residential and commercial customers and up to 15% for industry. Average for all sectors – 7% decline in energy costs.
- Energy prices rise by 4-5% for natural gas, 2-3% for oil and over 25% for coal as carbon costs are added.

Policy Modeling Results: C&T Case

- Carbon allowance prices
 - \$9/tonne in 2012
 - \$5/tonne in 2015
 - \$8/tonne in 2020.
- No permits banked.
- Bulk of permits sold are from electric utility sector
- Other manufacturing and industrial generators are largest purchasers of permits.

Policy Modeling Results:



- Emissions fall by almost 65 Mt from Reference in C&T case.
- 80% of reduction comes from Complementary Policies

Contact Information:

Jeff Amlin

President

SSI

jeffamlin@energy2020.com

Phone (937) 767-1873

Glen Wood

Senior Manager

ICF International

gwood@icfi.com

Phone (416) 341-8952