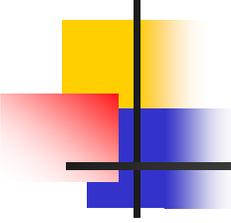


Activity Trends for Key Emission Sources in California's San Joaquin Valley, 1970-2030

Presented by:
Stephen B. Reid
Sonoma Technology, Inc.
Petaluma, CA

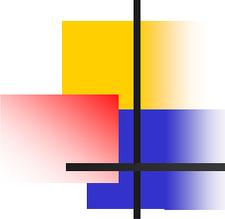
U.S. EPA 16th Annual Emission Inventory
Conference
Raleigh, NC
May 16, 2007





Outline

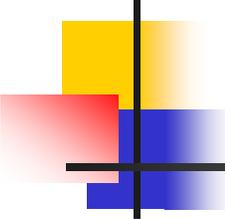
- Background
- Project Overview
- Preview of Key Findings
- Methodologies and Results
- Summary of Results
- Questions & Discussion



Background (1 of 3)

Emission Projections:

- Support future-year air quality modeling efforts and control strategy assessments
- Are often generated by tools that rely on economic activity forecasts
 - Employment
 - Earnings
 - Product output



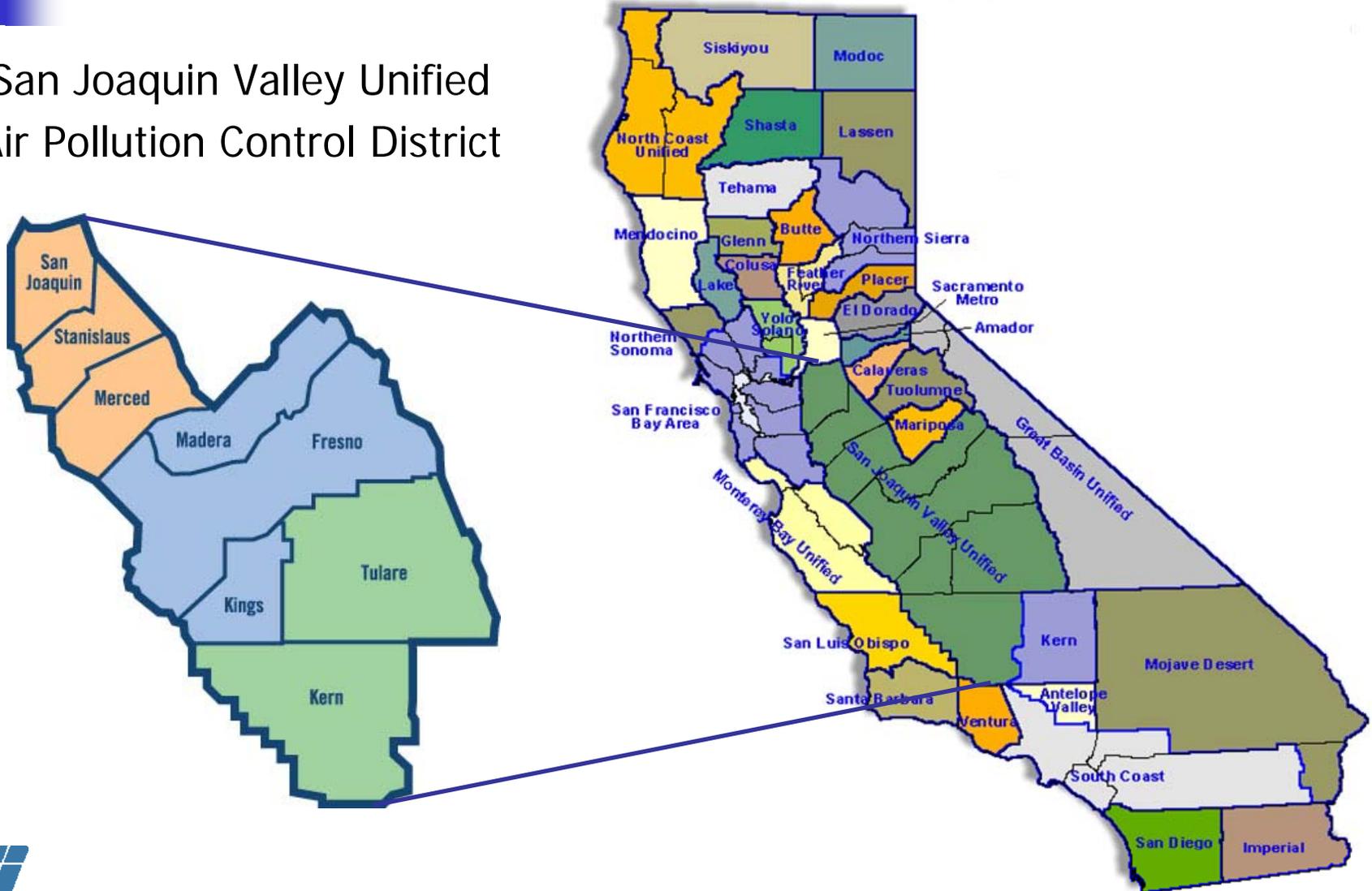
Background (2 of 3)

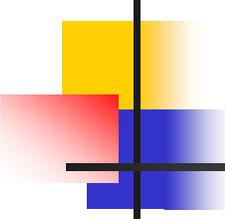
Emission Projection Tools:

- Emission Growth Analysis System (EGAS)
 - Regional Economic Models, Inc. (REMI) model
 - Department of Energy (DOE) energy consumption forecasts
- California Emission Forecasting System (CEFS)
 - REMI economic models for California counties
 - More detailed analysis of 50 high priority sources
 - Input from individual air districts

Background (3 of 3)

San Joaquin Valley Unified
Air Pollution Control District

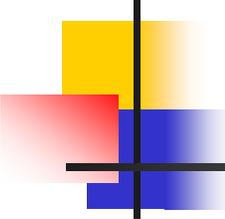




Project Overview (1 of 2)

Scope of work:

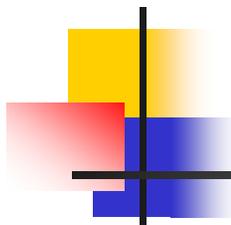
- Review and assess default CEFS growth surrogate assignments for selected sources:
 - Civilian Aircraft
 - Locomotives
 - Petroleum refineries
 - Oil & Gas Production
 - Cogeneration
 - Foam manufacturing
 - Wine production
 - Port of Stockton
- Select an appropriate growth surrogate for each source category



Project Overview (2 of 2)

Scope of work:

- Develop county-level growth surrogate activity data for the years 1970-2030 in the following increments:
 - Every 5 years for 1970 to 1995
 - Every year for 1990 to 2020
 - Every five years for 2020 to 2030
 - Oil & Gas Production
- Submit the resulting activity data to ARB for incorporation into CEFS



Preview of Findings

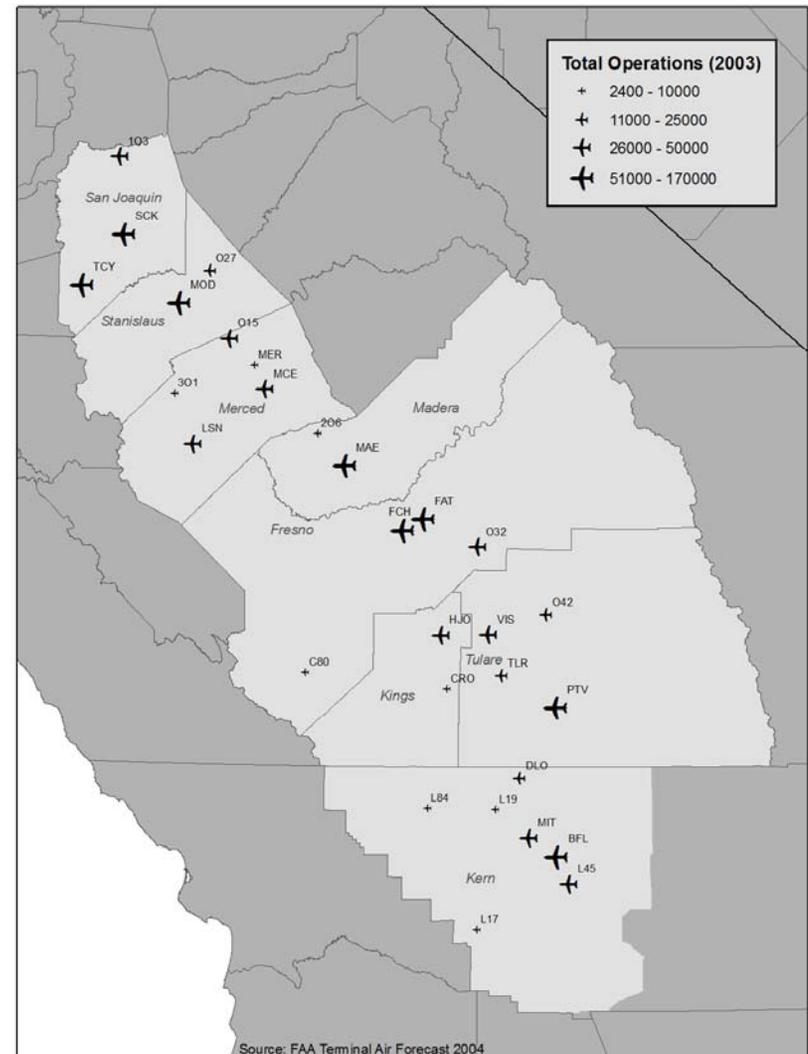
Comparison of CEFS and STI growth activity data

Source Category	CEFS Activity Data			STI Activity Data			% Change	
	2002	2020	Units	2002	2020	Units	CEFS	STI
Civilian Aircraft	639,088	752,720	Annual aircraft operations	1,147,801	1,232,009	Annual aircraft operations	17.8%	7.3%
Locomotives	1.315	1.734	Unitless growth factors (based on freight shipments)	31,025,545	37,679,351	Gallons of fuel	31.9%	21.4%
Petroleum Refining (Kern County)	1	1	Unitless (no growth)	115,000	126,300	Barrels per day	0.0%	9.8%
Oil Production	2.09E+08	1.76E+08	Million barrels	206187005	107960406	Million barrels	-15.8%	-47.6%
Natural Gas Production	1.98E+08	2.39E+08	Million cubic feet	217691826	119284563	Million cubic feet	20.9%	-45.2%
Cogeneration (Kern County)	0.902	1.216	Output in the oil and gas extraction sector (billions of 1992 dollars)	3240.5	3600.2	Cogeneration capacity (megawatts)	34.8%	11.1%

Civilian Aircraft (1 of 3)

SJV Airports:

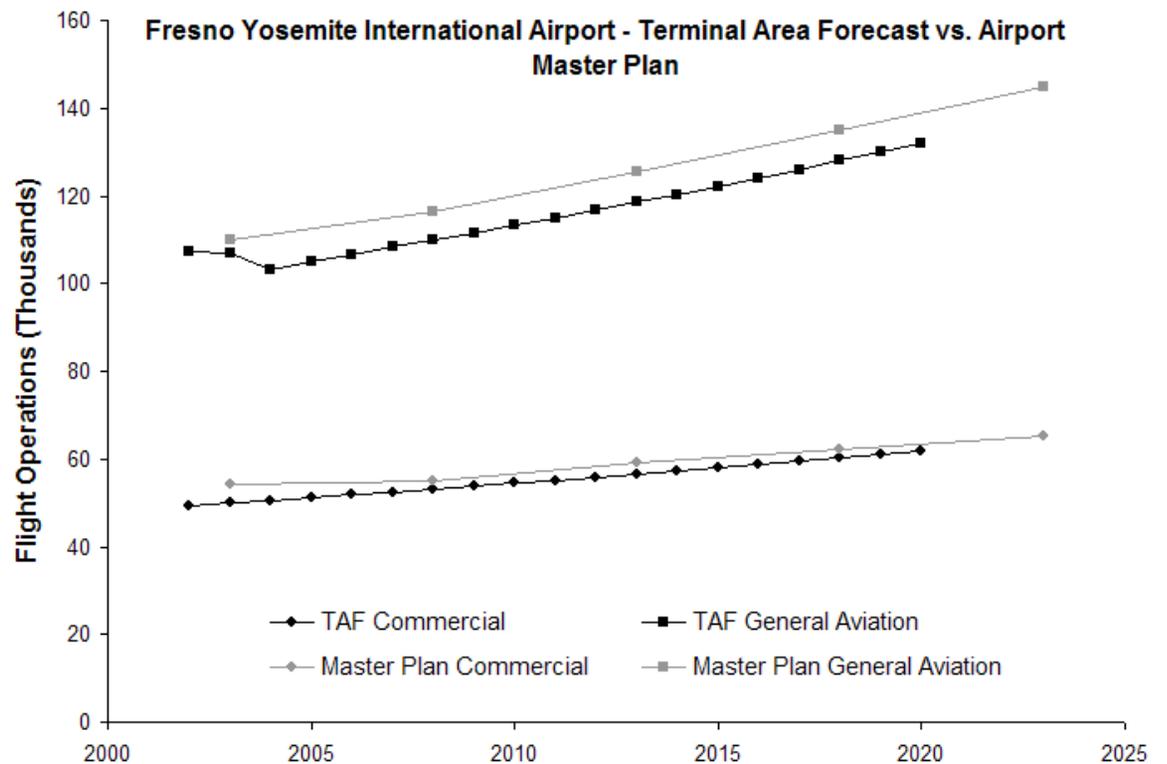
- 126 non-military facilities
- 29 airports included in FAA's Terminal Air Forecasts (TAF)
- 2004 TAF includes historical activity back to 1976 and forecasted activity to 2020
- 84% of civilian air traffic in the SJV occurs at one of the 29 airports covered by TAF



Civilian Aircraft (2 of 3)

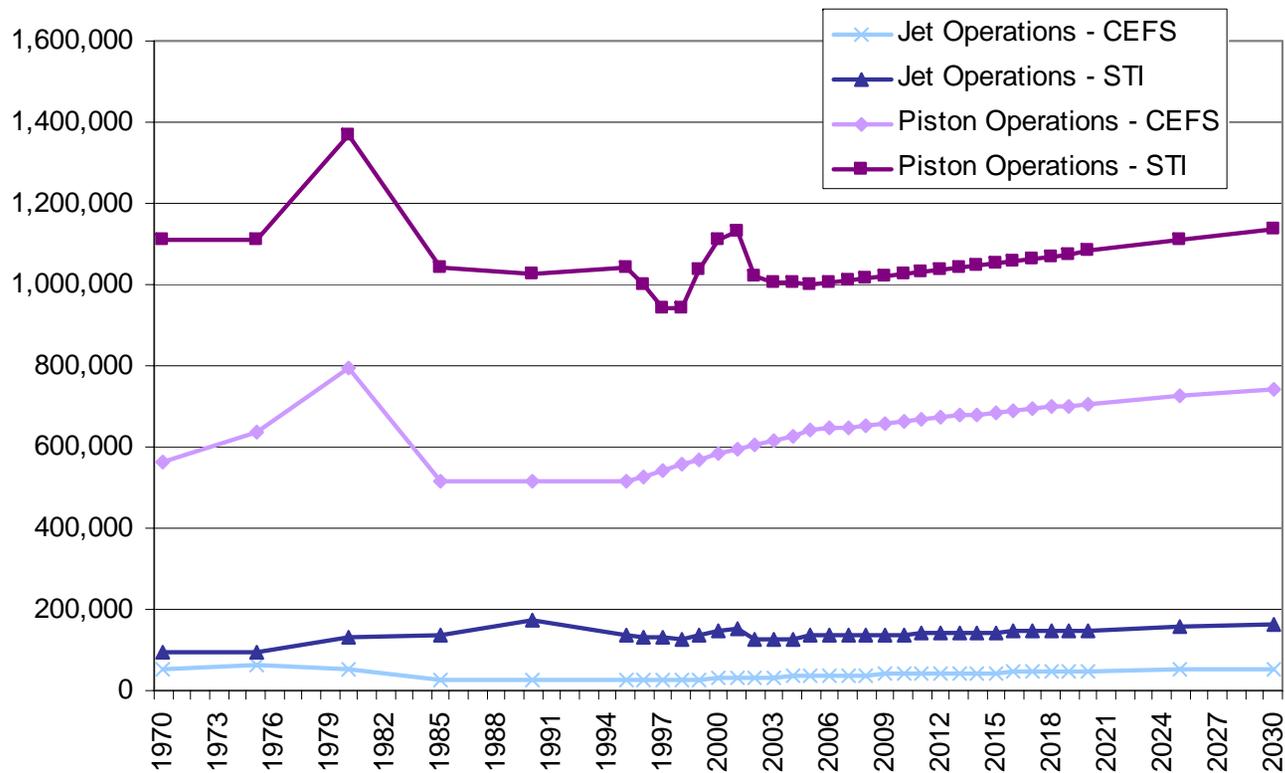
Fresno Yosemite International Airport:

- Largest in SJV
- Published Master Plan Update in 2005
- Plan data and TAF data agree within 8% and have similar growth rates
- Plan data used for this study



Civilian Aircraft (3 of 3)

Comparison of CEFS and STI aircraft data



Locomotives (1 of 4)

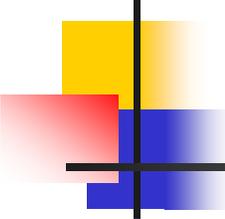
SJV Rail Lines:

- 2 Class I railroads - Burlington Northern Sante Fe (BNSF) and Union Pacific (UPRR)
- Several Class III railroads
- Amtrak (passenger)

California locomotive fuel consumption – annual average for 2001-2003

Railroad Type	Fuel Consumption (10 ⁶ gallons)	Percentage
Class I	193.8	89.1%
Passenger	20.4	9.4%
Class III	3.3	1.5%

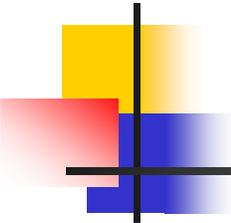




Locomotives (2 of 4)

Fuel Consumption Surrogate

- County-level fuel consumption data available from BNSF for 1999-2004 and for UPRR for 2003
- Bureau of Transportation Statistics (BTS) fuel consumption data for Class I railroads used for historical years back to 1970
- For future years (2005-2030), forecasted growth in economic sectors that dominated rail freight shipments were used to represent growth in rail fuel consumption
- Amtrak projections based on route expansion plans



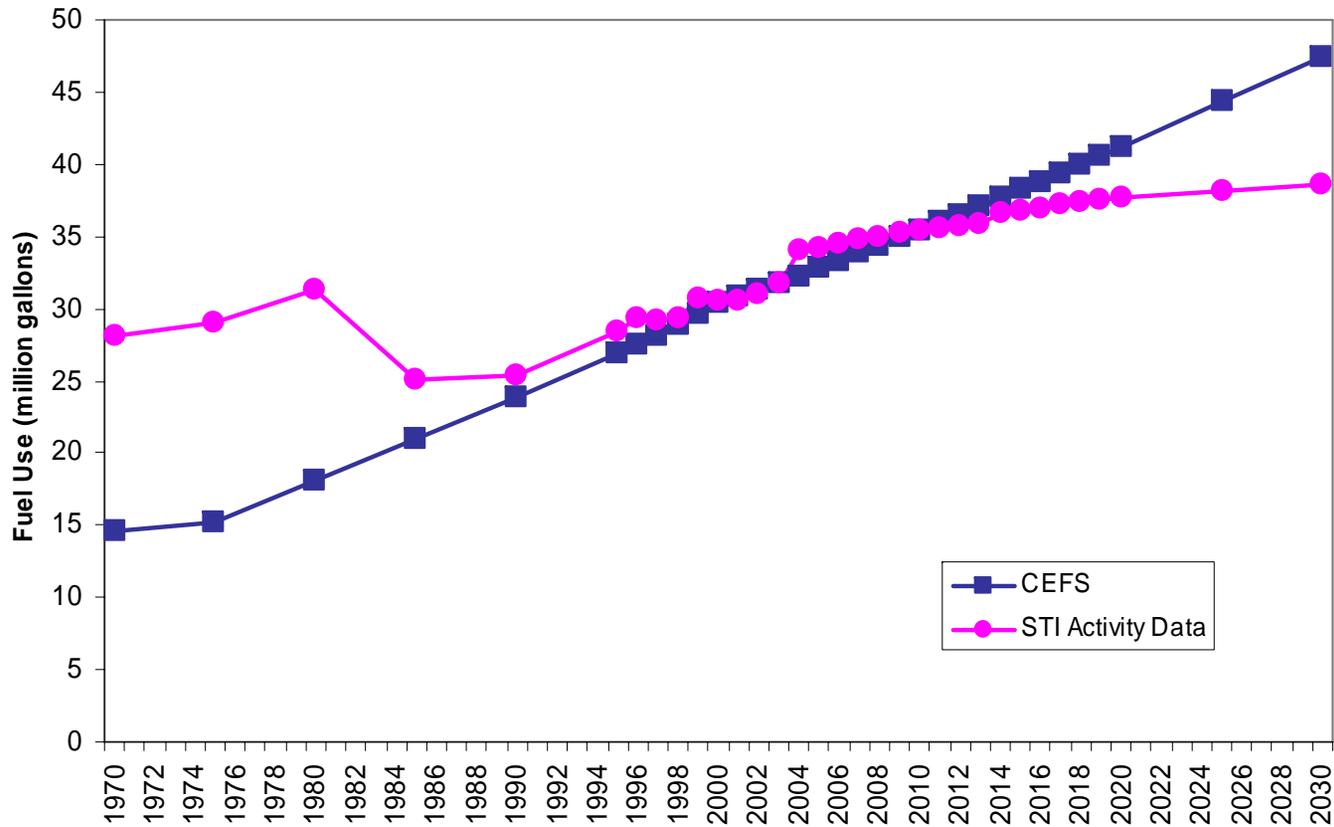
Locomotives (3 of 4)

California rail cargo shipments by economic sector

Economic Sector	Commodity	2004 Ton-miles (%)	Source of Activity Forecasts
Manufacturing	<i>Other prepared food stuffs, fats, and oils</i>	28.50%	Sector employment data from the California Dept. of Transportation 2002-2020 Economic Forecast
	<i>Non-metallic minerals</i>	11.10%	
	<i>Wood products</i>	9.40%	
	<i>Articles of base metal</i>	7.50%	
	<i>Alcoholic beverages</i>	7.20%	
	<i>Milled grain products and bakery products</i>	6.20%	
	Total manufacturing	69.90%	
Petroleum Refining	Coal and petroleum products	16.30%	California Energy Commission (CEC) refining capacity forecasts
Agriculture	Agricultural products	13.80%	Irrigated acreage forecasts from the California Dept. of Water Resources; agricultural transport trends from the Nisei Farmer's League

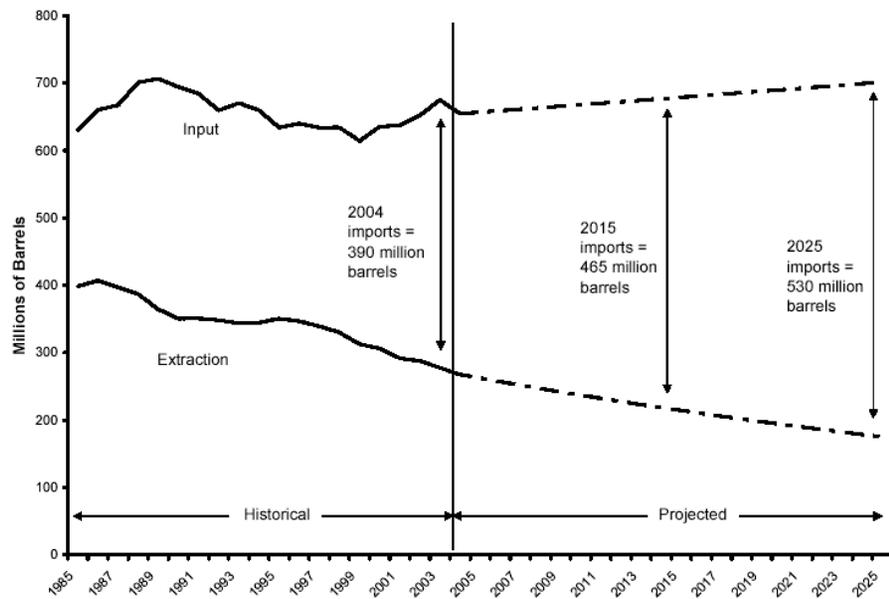
Locomotives (4 of 4)

Comparison of CEFS and STI line-haul fuel consumption data



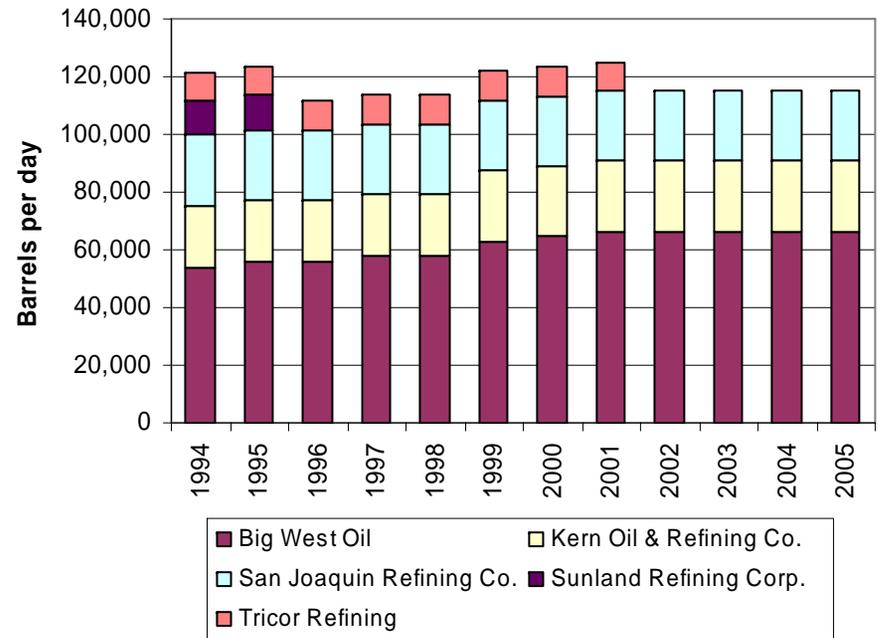
Petroleum Refining (1 of 2)

California refinery inputs, 1985-2025



Source for historical data: Energy Commission PIIRA Database

SJV refinery capacity, 1994-2005

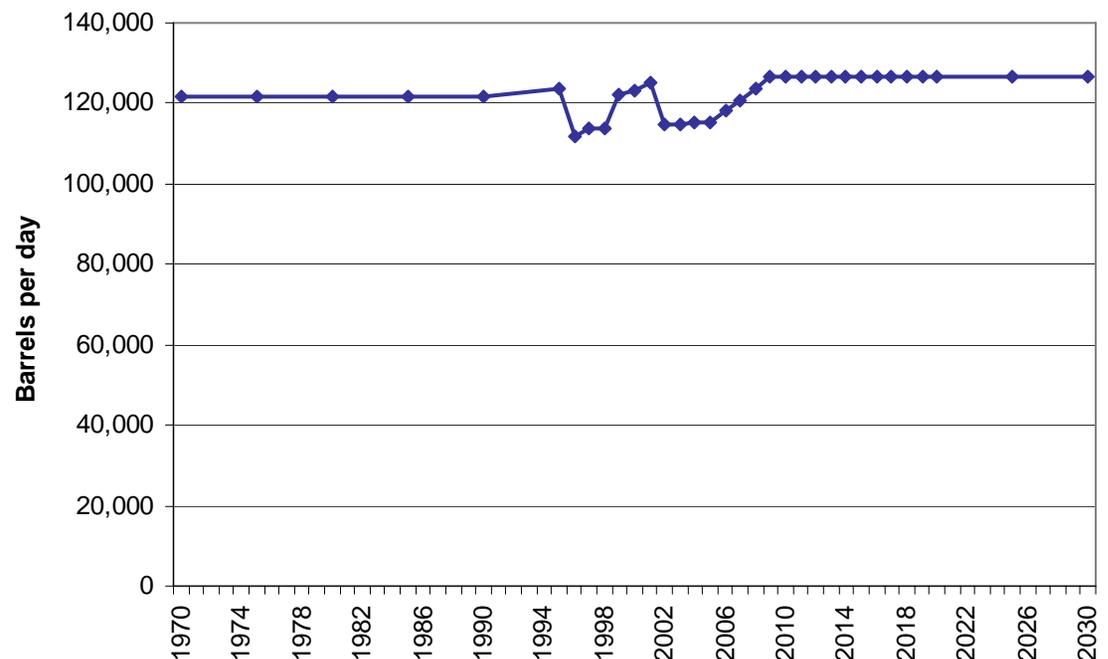


Petroleum Refining (2 of 2)

SJV Refineries:

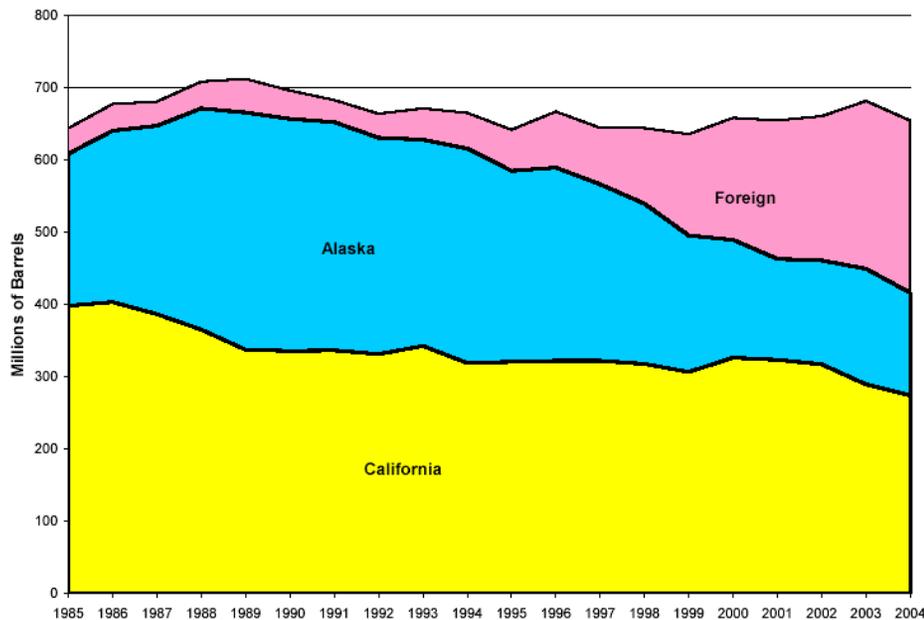
- Currently operating at capacity
- Big West facility undergoing expansion
 - 17% capacity increase
 - 2 to 4 year process
- Other refineries expected to remain at current capacity

SJV refinery capacity, 1970-2030



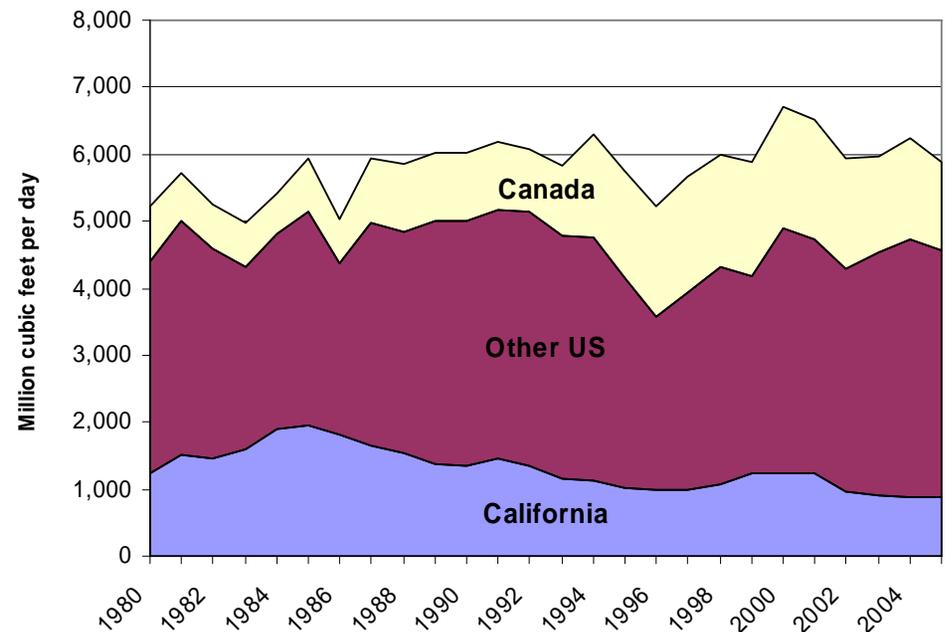
Oil & Gas Production (1 of 3)

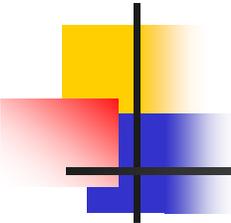
California crude oil receipts by source from 1985 to 2004



Source: Energy Commission PIIRA Database

California natural gas sources from 1980 to 2004





Oil & Gas Production (2 of 3)

CEFS Forecasts

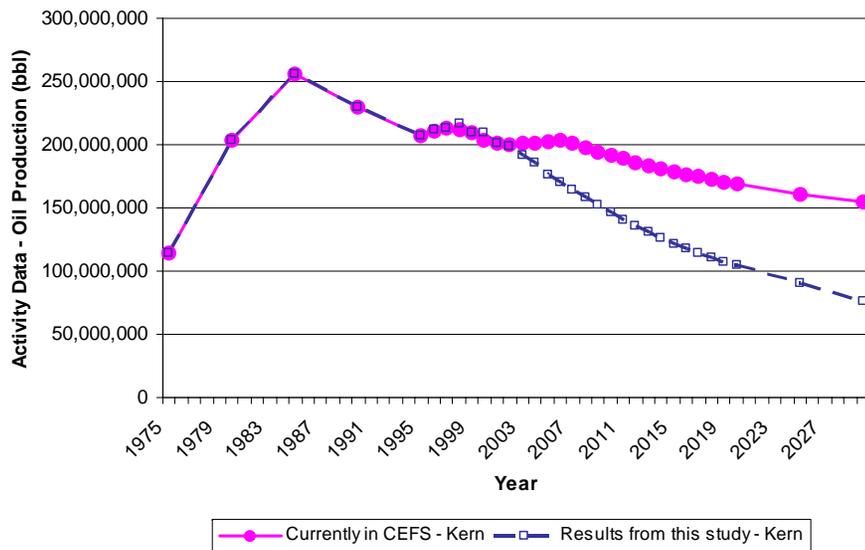
- Oil production tied to REMI employment in the crude petroleum/natural gas sector and pipeline sector
- Natural gas production tied to California Energy Commission (CEC) forecasts and REMI employment in the gas utilities and crude petroleum/natural gas sectors

Replaced with 2005 CEC forecasts based on:

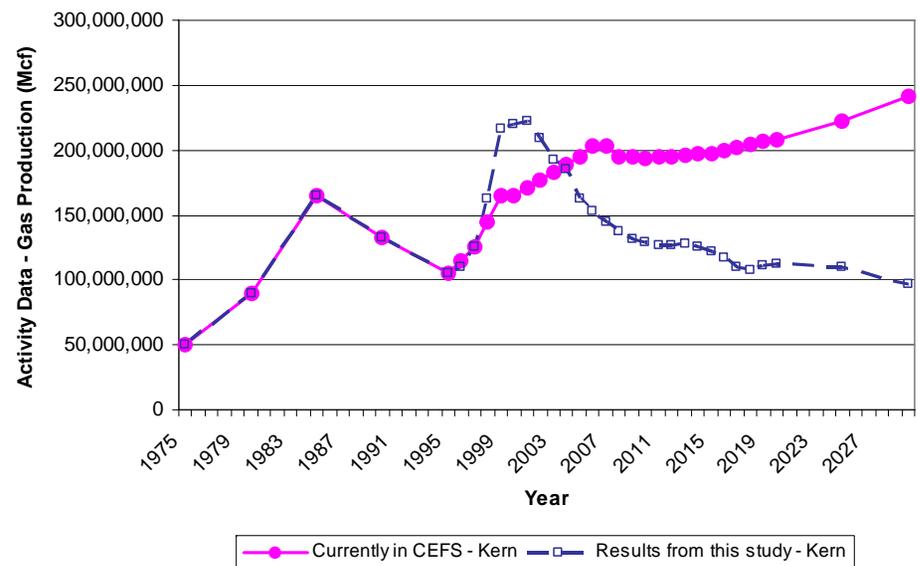
- Future fuel consumption demand estimates
- Estimates of oil and natural gas reserves in California
- Anticipated fuel prices

Oil & Gas Production (3 of 3)

Comparison of CEFS and STI oil production data



Comparison of CEFS and STI natural gas production data

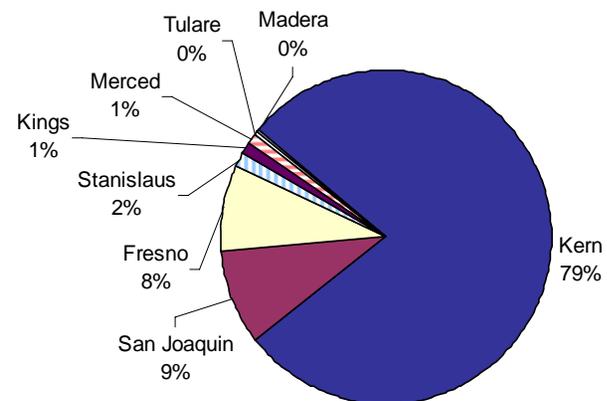
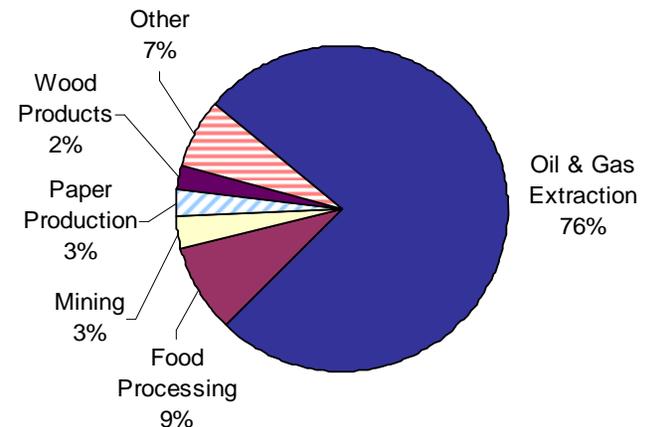


Cogeneration (1 of 3)

Background:

- On-site electrical generation at energy-intensive industries or institutions
- Thermal by-products captured for process or space heating; known as “combined heat and power” (CHP)
- In the SJV, 76% of cogeneration capacity used for oil and gas extraction

2004 SJV cogeneration capacity by industry and county

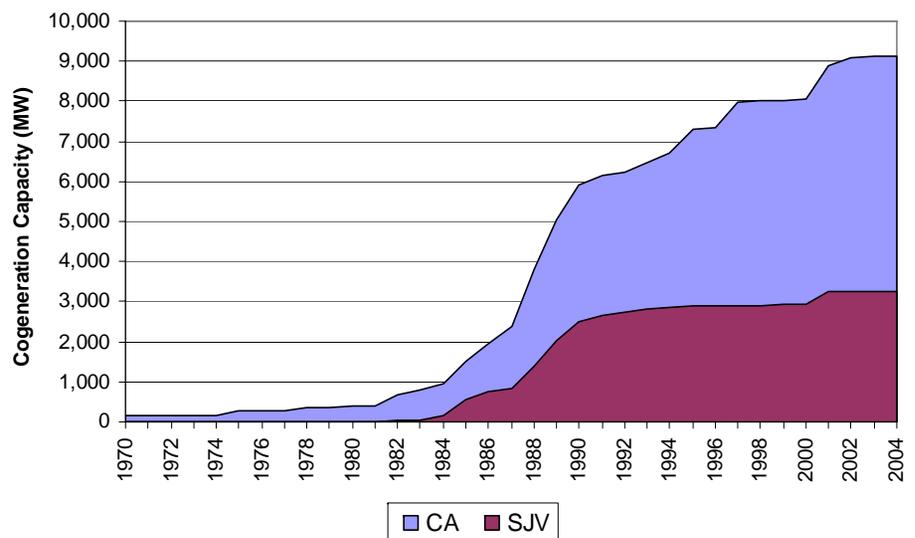


Cogeneration (2 of 3)

Activity Data:

- County-level cogeneration capacity in megawatts (MW) selected as growth surrogate
- Historical capacity data available from Energy and Environmental Analysis (EEA) CHP installation database
- Forecasts available from a 2005 CEC study on statewide cogeneration market potential

Historical cogeneration capacity data
1970-2004

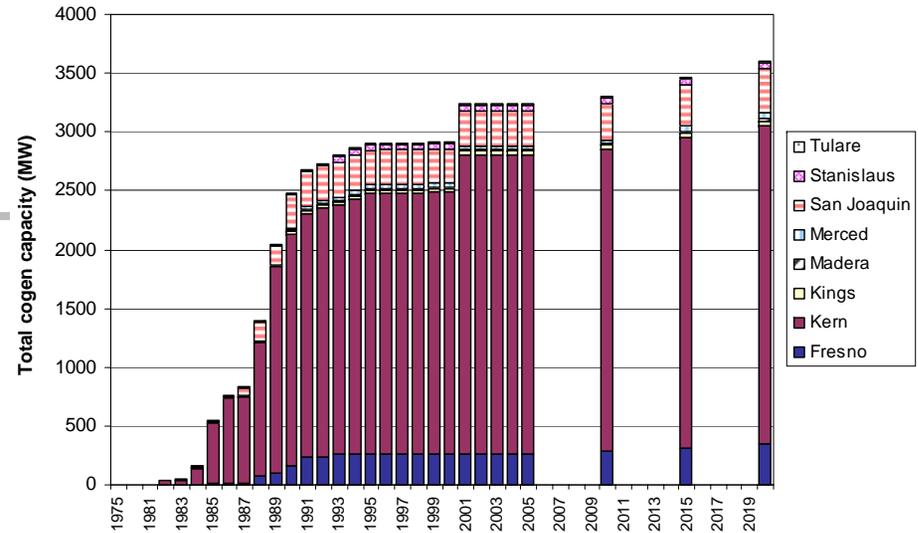


Cogeneration

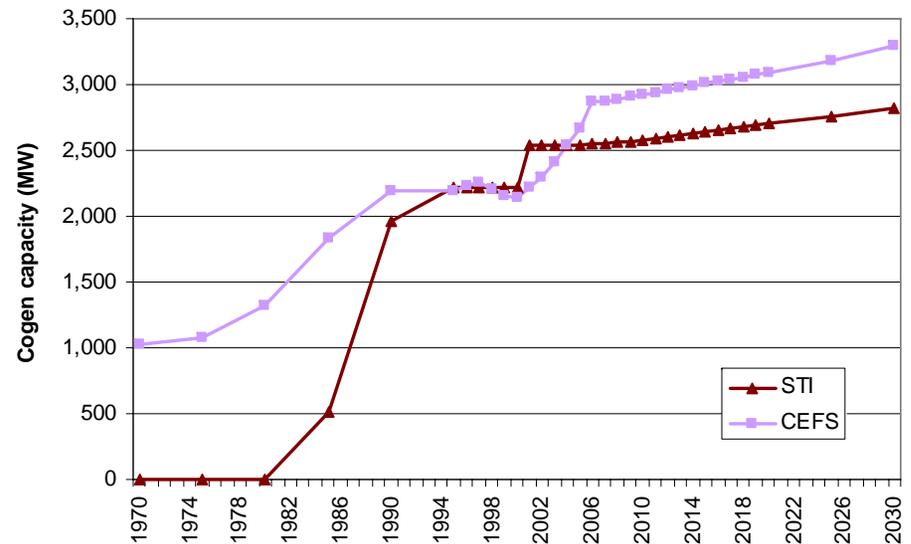
(3 of 3)

Capacity Forecasts:

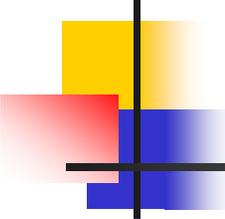
- By utility service region for 2010, 2015 and 2020
- Apportioned to SJV and individual counties based on 2004 data
- By 2020, 1966 MW increase in statewide capacity; 357 MW increase in SJV
- County-level estimates for 2005 to 2020 extrapolated out to 2030



SJV cogeneration capacity by county, 1975-2020



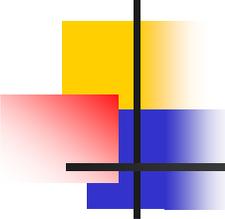
Comparison of STI and CEFS cogeneration activity trends for Kern County



Summary of Results (1 of 2)

Selected growth surrogates by source category

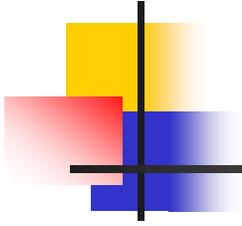
Source Category	Growth Surrogate	Surrogate Description/Units	Data Sources
Civilian Aircraft	Aircraft operations	Landing, take-off, or touch-and-go	Individual airports, Federal Aviation Administration (FAA) Terminal Area Forecasts (TAF), Bureau of Transportation Statistics (BTS) Air Carrier Summary database
Locomotives	Locomotive fuel consumption	Gallons consumed by line-haul and switching engines	Individual railroads, BTS freight and fuel consumption data, BTS Commodity Flow Survey, California Department of Transportation economic forecasts
Petroleum Refineries	Refinery capacity	Barrels of fuel produced	Individual refineries, California Department of Conservation Division of Oil, Gas, and Geothermal Resources (DOGGR) historical refinery capacity data
Oil Production	Crude oil production	Barrels of crude oil produced	DOGGR historical production data, California Energy Commission (CEC) forecasts
Natural Gas Production	Natural gas production	Million cubic feet of gas produced	
Cogeneration	Electrical generation capacity	Megawatts	Energy and Environmental Analysis, Inc. (EEA) cogeneration capacity database, CEC forecasts



Summary of Results (2 of 2)

Comparison of CEFS and STI growth activity data

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Questions and Discussion

