

Climate Action for Sustained Growth



Analysis of ARB's Scoping Plan

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For media enquiries, please contact Morrow Cater, Cater Communications, at 415-453-0430.



Objectives

1. Estimate direct and economywide indirect impacts and identify adjustment patterns.
2. Inform stakeholders and improve visibility for policy makers.
3. Promote empirical standards for policy research and dialogue.



Summary of Findings

- Aggregate direct effects of AB32 on the economy are negligible or positive
- Innovation responses could leverage climate policy for significant growth dividends
- Participation in a national climate program will increase benefits for California
- Individual sector demand, output, and employment can change significantly
- No significant leakage is observed

How we Forecast

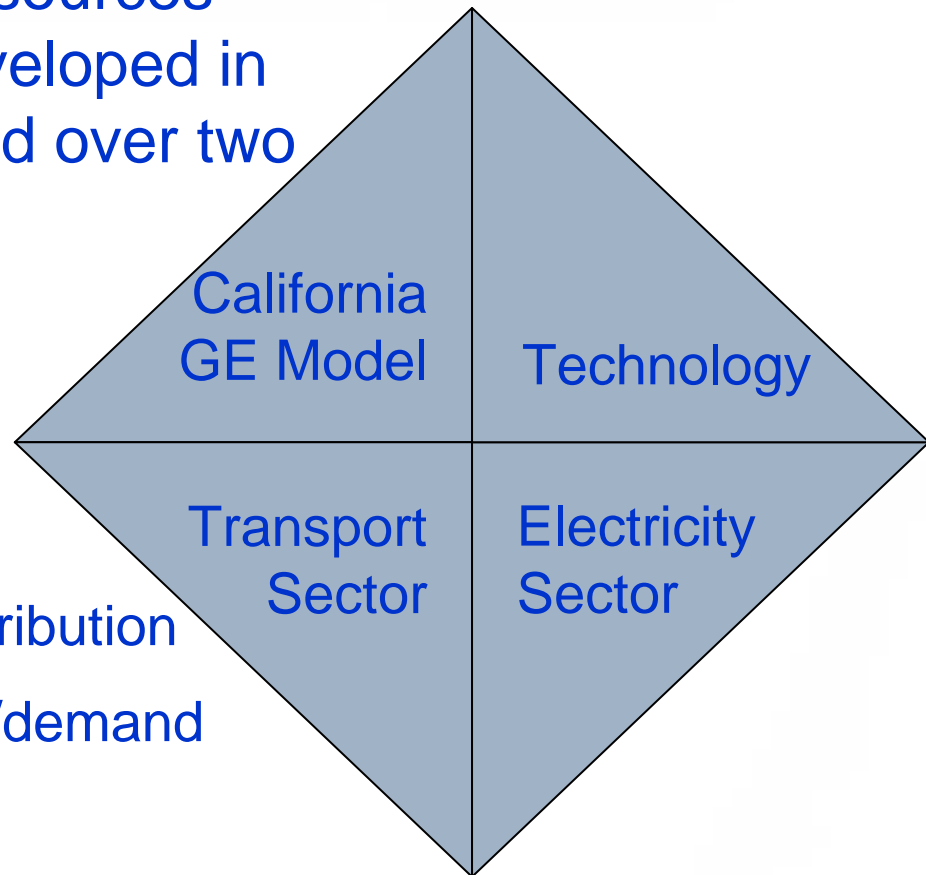
The Berkeley Energy and Resources (BEAR) model is being developed in four areas and implemented over two time horizons.

Components:

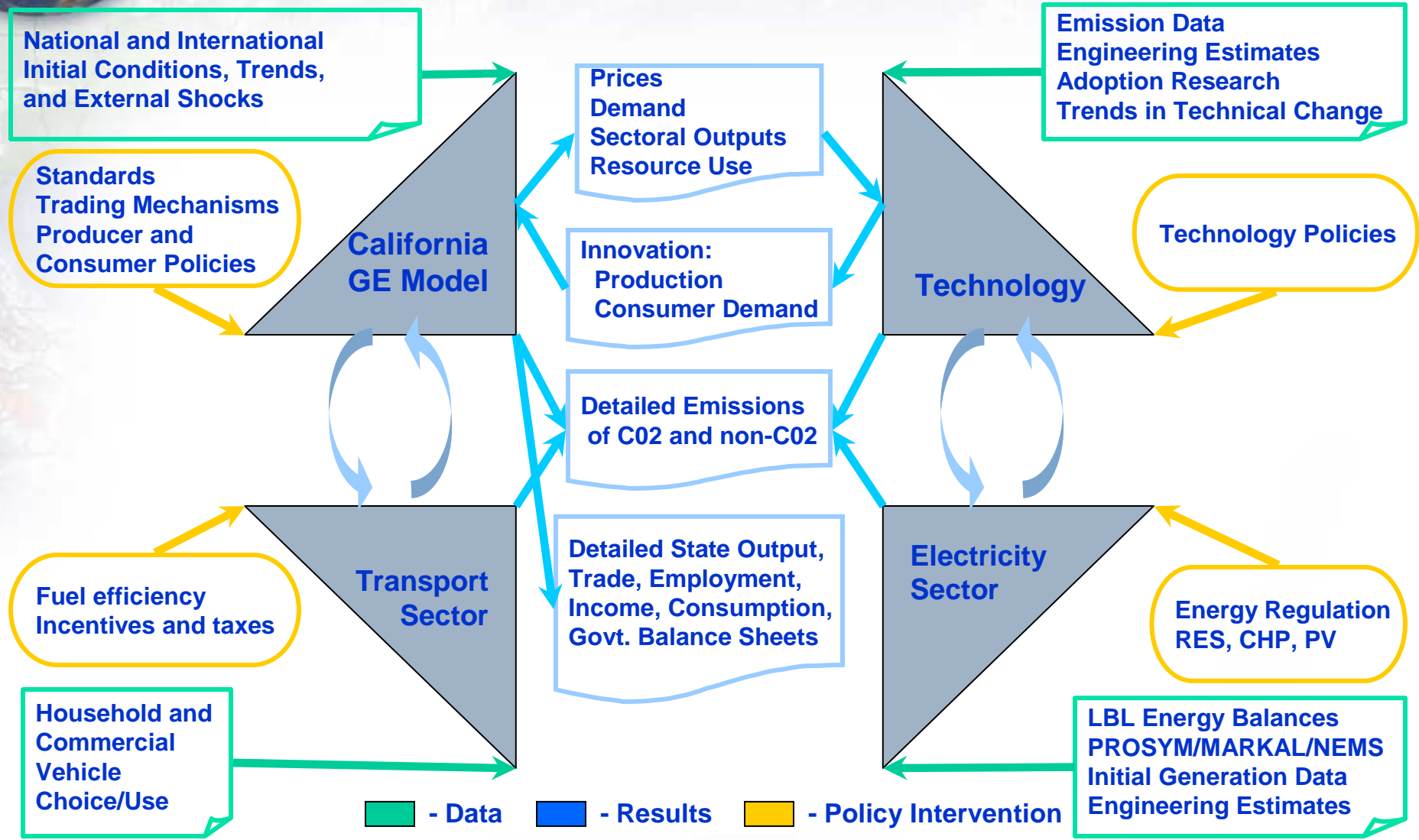
1. Core GE model
2. Technology module
3. Electricity generation/distribution
4. Transportation services/demand

Time frames:

1. Policy Horizon, 2010-2020
2. Strategic Adaptation Horizon, 2010-2050



Detailed Framework



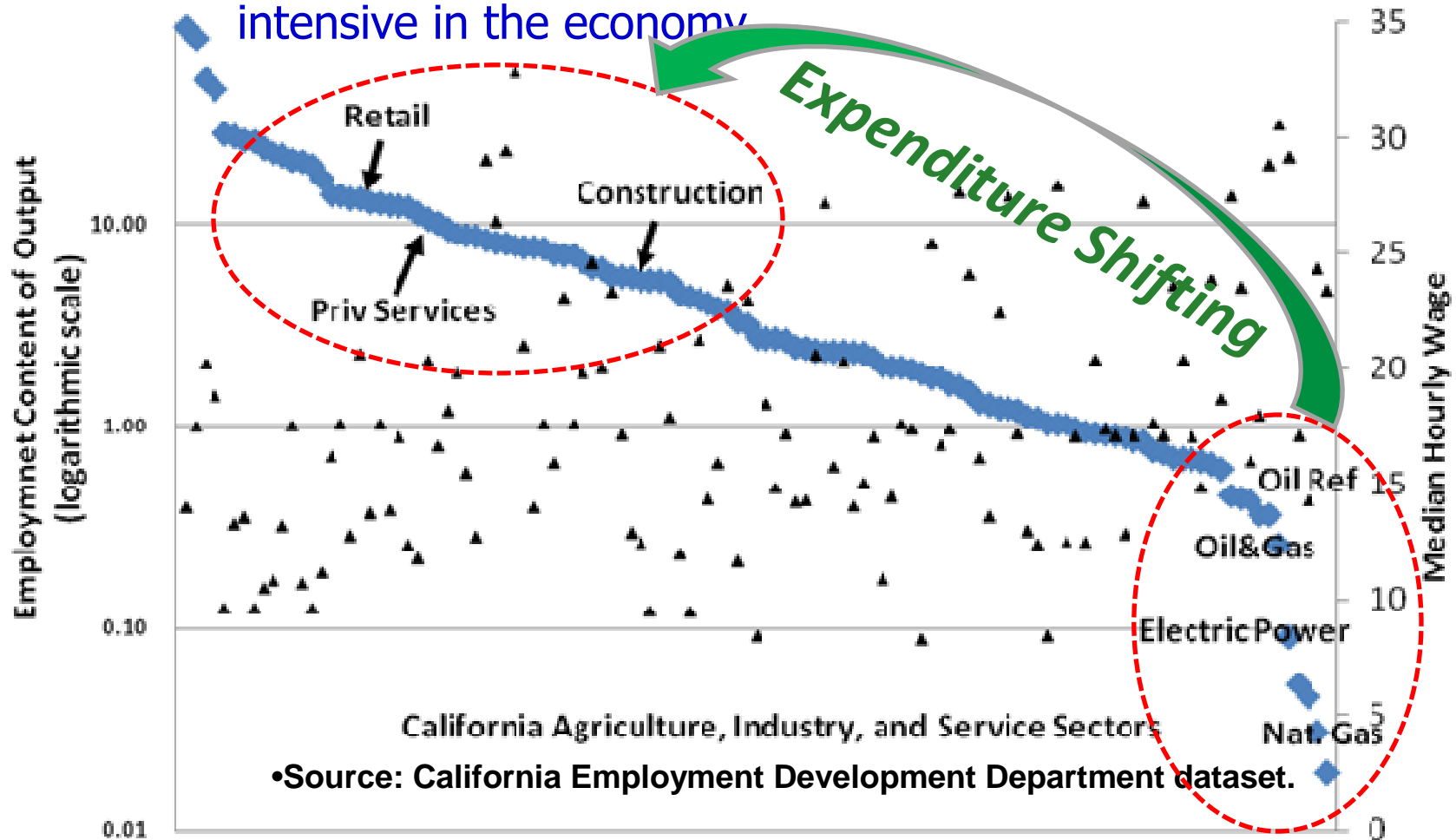


The Role of Innovation

- Innovation is the hallmark of California's superior growth experience.
- This is particularly the case with energy efficiency improvements, which have induced innovation at home and nationally, saving households over \$50 billion and creating 1.46 million additional jobs over three decades.
- To give an indication of the contribution of innovation potential, we assume California responds to AB32 with 0.4% additional energy efficiency improvements, very modest by historical standards.

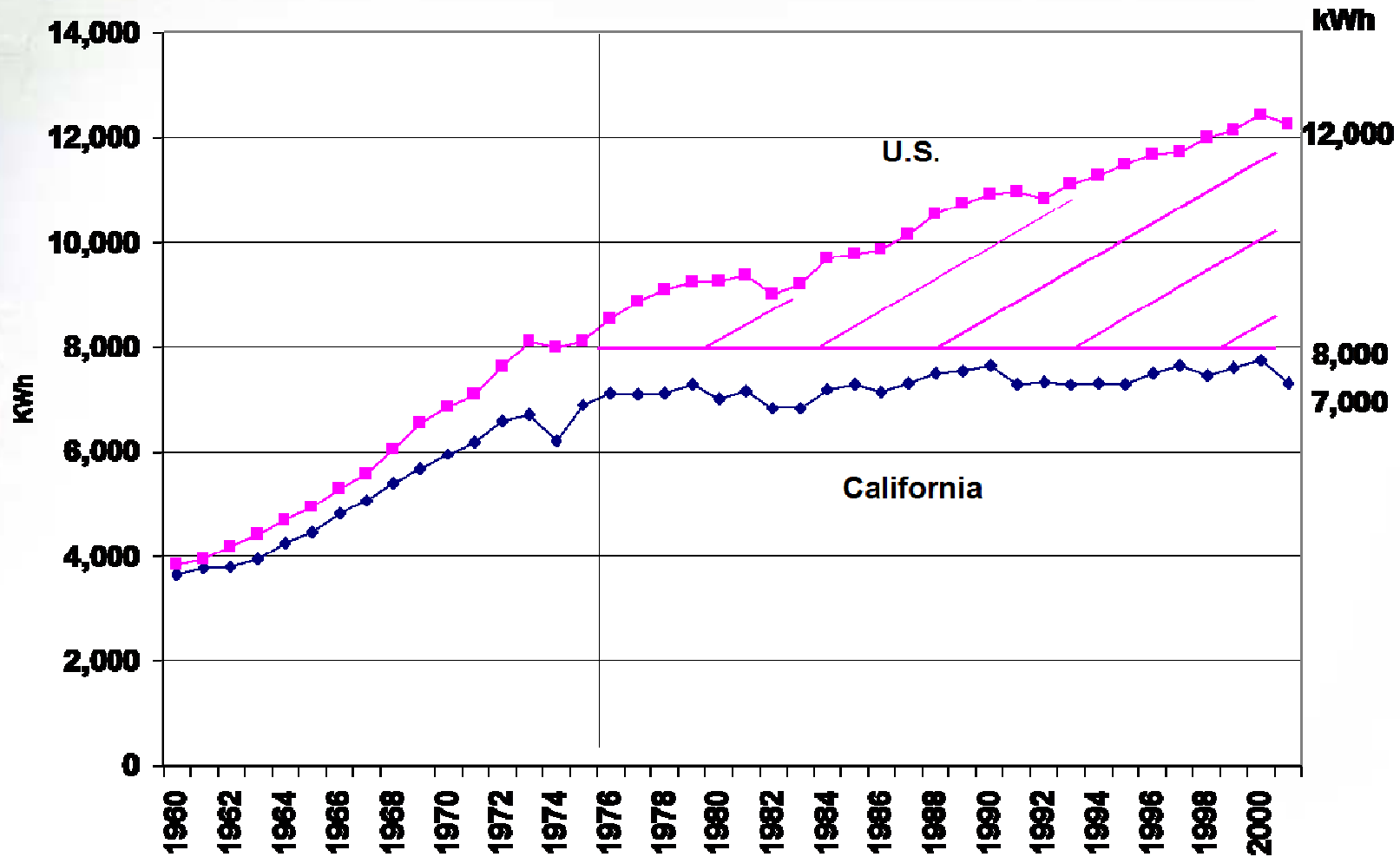
Why this works

The carbon fuel supply chain is among the least employment intensive in the economy



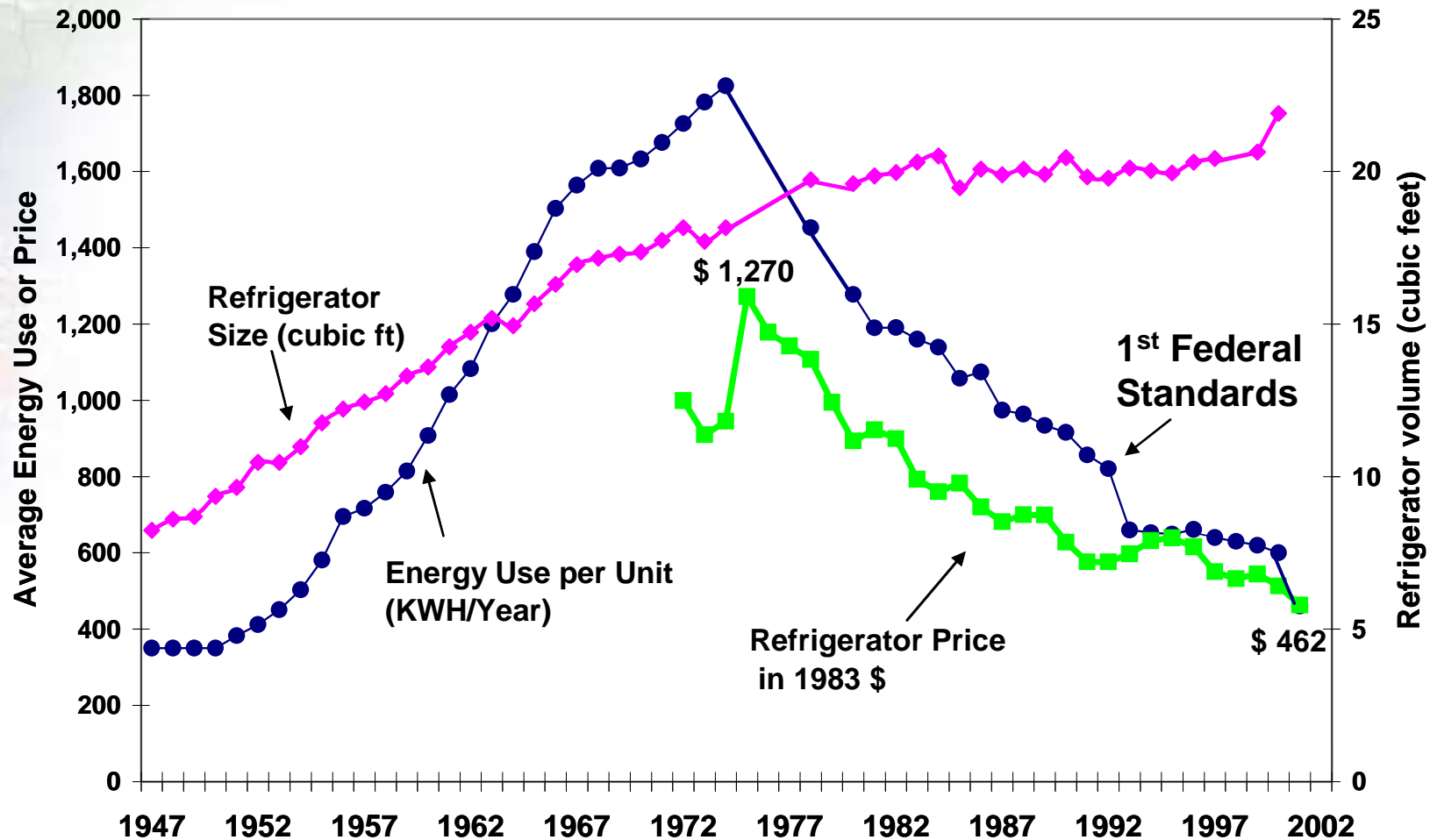
How it has worked before - I

Total Electricity Use, per capita, 1960 - 2001



How it has worked before - II

United States Refrigerator Use v. Time





California in a National Climate Program

- Because of its past accomplishments, California's marginal cost of abatement exceeds most states
- For this reason, it would be cheaper for the state to promote efficiency elsewhere through an emissions trading mechanism
- A national program would also enlarge the market for our own energy use and emission technologies



National Climate Assessment – the EAGLE Model

- The Environmental Assessment in General Equilibrium (EAGLE) model is a national GE model that captures economy/climate interactions in each of the 50 states.
- In support of policy dialogue at the national level, we conducted an assessment of the Waxman-Markey or ACES climate legislation
- Using the EAGLE model, we found California gains from participation in a national program, but still has incentives for unilateral climate action.



AB32 and Related Scenarios

	Offsets	LCFS	Pavley II	VMT Reduction	EE Standards	33% RES	CHP	Annual EE Response
ARB1	4%	Full	Full	Full	Full	Full	Full	None
ARB2	No	Full	Full	Full	Full	Full	Full	None
ARB3	4%	Half	Half	Excluded	Full	Full	Full	None
ARB4	4%	Full	Full	Full	Half	Excluded	Half	None
ARB5	4%	Half	Half	Excluded	Half	Excluded	Half	None
ARB_Cap	4%	Excluded	Excluded	Excluded	Excluded	Excluded	Excluded	None
EE1	4%	Full	Full	Full	Full	Full	Full	0.40%
WM1	Full	Full	Full	Full	Full	Full	Full	None



Results

	1	2	3	4	5	6	7	8
	ARB1	ARB2	ARB3	ARB4	ARB5	ARB_Cap	EE1	WM1
Total GHG	-14	-19	-14	-14	-14	-14	-14	-9
Household GHG	-13	-13	0	-13	0	1	-13	-8
Industry GHG	-15	-23	-24	-15	-24	-24	-15	-10
Annual GSP Growth	-0.1	-0.2	-0.3	-0.5	-0.7	-0.9	3.0	0.7
Employment	-0.1	-0.1	-0.2	-0.3	-0.4	-0.5	2.2	0.9
Permit Price	\$ 18	\$ 74	\$ 97	\$ 83	\$ 108	\$ 132	\$ 16	\$ 34
Income Per Capita (\$/yr)	-65	-72	-129	-252	-317	-417	1,389	327
Jobs (thousands)	-16	-18	-40	-56	-81	-101	397	73

Results expressed as percentage changes from year 2020 reference case levels unless otherwise indicated.



Sources of Bias in Results

- Assumptions regarding initial conditions – market failures
- No foregone damages considered – the costs of doing nothing
- Treatment of innovation potential



Conclusions

- The macroeconomic impact of AB32 will be negligible, unless
- Climate action triggers innovation responses, a potent catalyst for growth
- By creating a market to incubate the next generation of energy use and emission control technologies, California can capture national and global growth opportunities



Recommendations

- More extensive analysis of program design: permit allocation, incentive properties, welfare and multiplier effects
- More intensive analysis of likely market and technology responses
- Peer review of all research supporting substantive policy decisions



Annex

Supporting Data and Model Information



Data overview

- All economic data used in this study were obtained from official sources.
- CalEPA kindly provided a large share of technical data, and in those cases BEAR calibration is identical to EDRAM.
- For many emissions and renewable cost data, we obtained independent data.



Primary Components

The Berkeley Energy And Resource (BEAR) modeling facility stands on two legs:

1. Detailed economic and emissions data
2. A dynamic GE forecasting model

The BEAR model has been peer reviewed and its structure is summarized in an annex below and fully documented elsewhere:

http://are.berkeley.edu/~dwrh/CERES_Web/Docs/BEAR_Tech_2.0.pdf



Economic Data

California Social Accounting Matrix (2006)

An economy-wide accounting device that captures detailed income-expenditure linkages between economic institutions. An extension of input-output analysis.

- 170 sectors/commodities
- Three factor types
 - Labor (2+ occupational categories)
 - Capital
 - Land
- Households (10 by tax bracket)
- Fed, State, and Local Government (very detailed fiscal instruments, 45 currently)
- Consolidated capital account
- US and ROW trading partners



Other Data

- Employment
- Technical data (MACs, emission rates, etc.)
- Estimated structural parameters
- Trends for calibration
 - Population and other labor force composition
 - Independent macro trends (CA, US, ROW, etc.)
 - Productivity growth trends
 - Exogenous prices (energy and other commodities)
 - Baseline (“business as usual”) emissions trends



Pollution Data 1

Our primary source of activity based pollution are California and US EPA emissions inventories, with detailed (ISIC-3) pollution coefficients per unit of output for:

1. SO₂
2. NO₂
3. CO₂
4. VOC – volatile organic compounds
5. PART – suspended particulate intensity index
6. BOD – water pollution measured by biological oxygen demand
7. TSS – total suspended solids TOXAIR – airborne toxic index
8. TOXWAT – waterborne toxic index
9. TOXSOL – soil retentive toxic index
10. BIOAIR – bioaccumulative toxic metals - airborne
11. BIOWAT – bioaccumulative toxic metals - waterborne
12. BIOSOL – bioaccumulative toxic metals – soil retentive



EAGLE Overview

Environmental Assessment in General Equilibrium (EAGLE)

- Lineal Descendant of the BEAR California assessment model
- Extended to Western Climate Initiative
- Now extended to the national level, detailed each of 50 states
- Much more detailed information on economic adjustments than ADAGE, IGEM, NEMS, MARKAL, MRN, NEEM, etc.
- An economy-wide general equilibrium *forecasting* model, 2050 time horizon, forecasting annually
- Assessment including, for every state, but not limited to:
 - Economic growth projections
 - Household income deciles
 - Federal, state, and local government accounts (detailed fiscal instruments)
 - Up to 170 sectors/commodities
 - Employment by occupation
 - Tracks more non-CO2 emission categories (14)