

Recent Trends in California Energy Generation Research & Development

presented by
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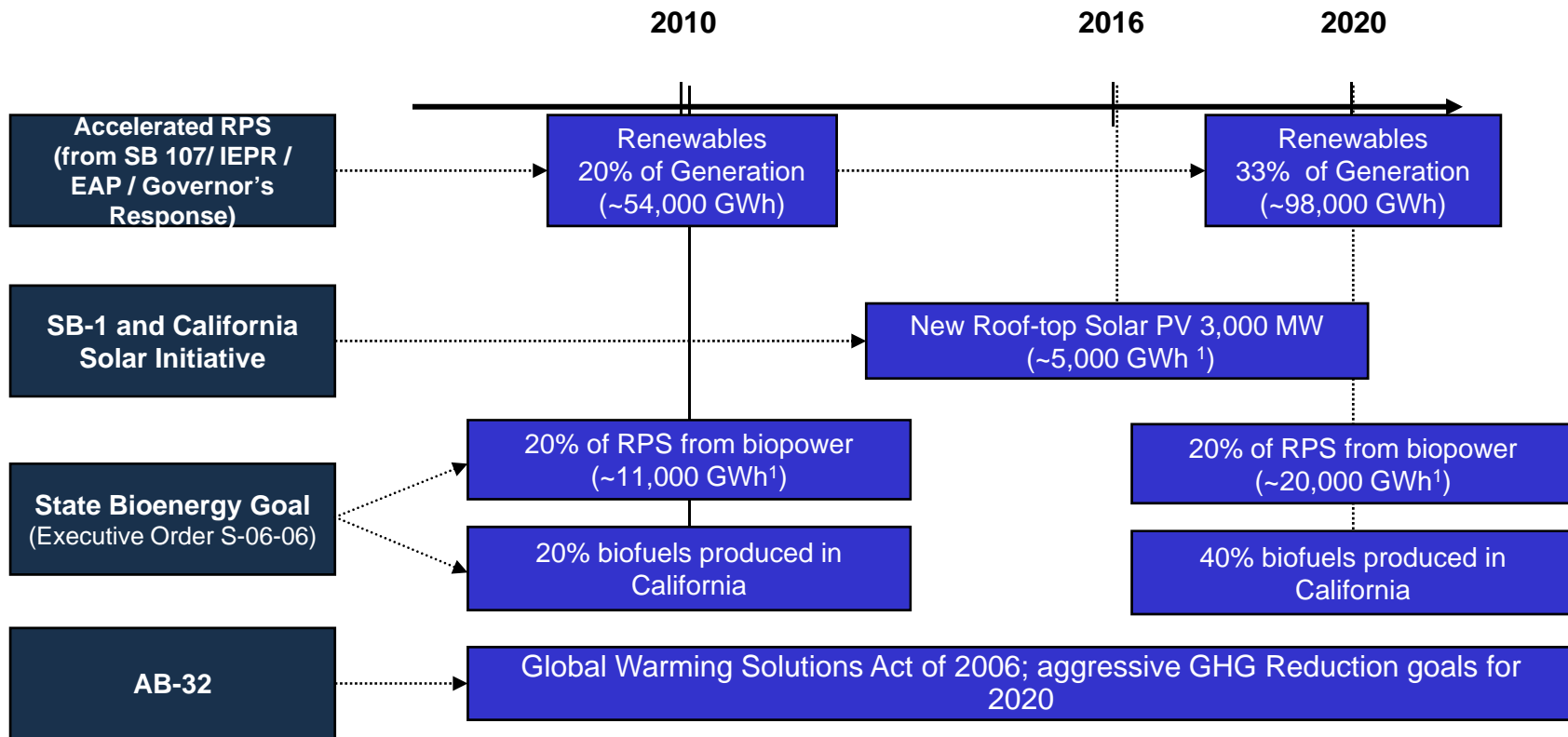


Outline

- Where are we at?
Policy, Legislative, Use
- Where do we need to go?
- What are we doing to get there?
Partners, Portfolio, Collaboratives
- What new things do we need to do?
- Summary

Policy Context

Key Renewable Energy Policy Impacting California



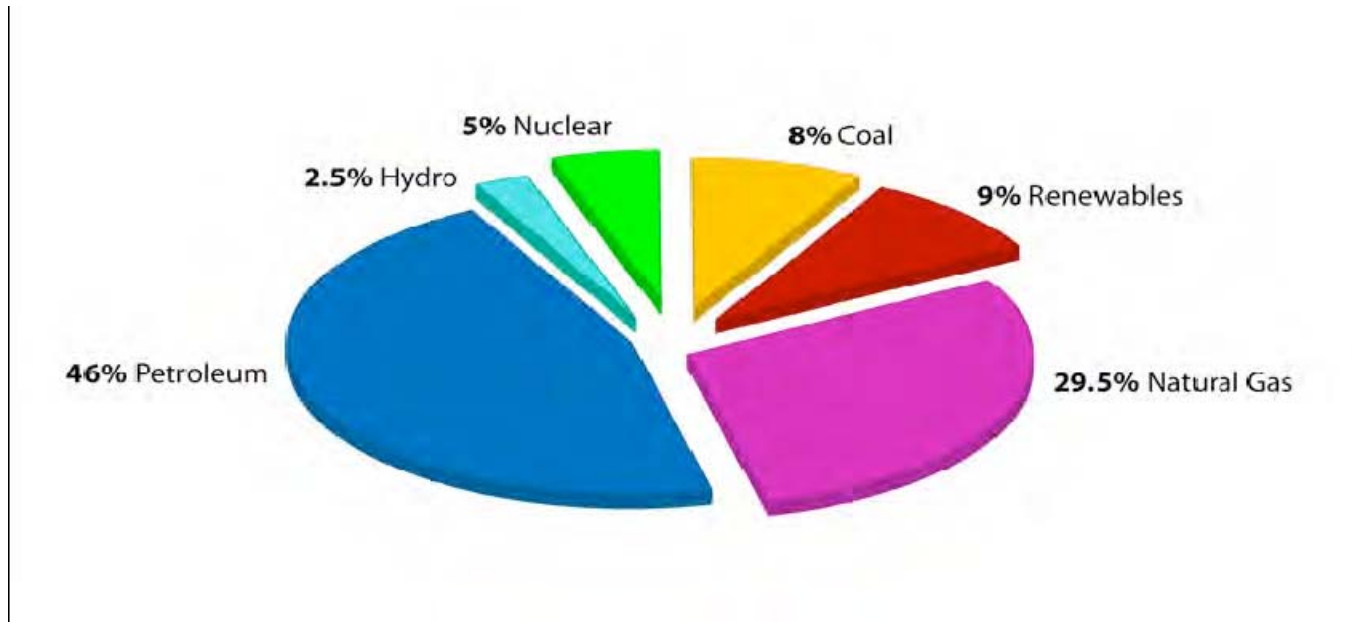
1. Assumed capacity factors are 20% for residential and commercial solar PV and 90% for biopower.

Legislative Context

- SB 1250 (2006) reauthorized PIER and renewable energy incentive programs.
- “develop and help bring to market, energy technologies that provide increased environmental benefits, greater system reliability, and lower system costs”
 - “Advanced **transportation** technologies that reduce air pollution and greenhouse gas emissions beyond applicable standards, and that benefit electricity and natural gas ratepayers.”
 - “Increased energy **efficiency** in buildings, appliances, lighting, and other applications beyond applicable standards, and that benefit electric utility customers.”
 - “**Advanced electricity generation** technologies that exceed applicable standards to increase reductions in greenhouse gas emissions from electricity generation, and that benefit electric utility customers.”
 - “Advanced electricity technologies that reduce or eliminate consumption of water or other finite resources, increase use of **renewable energy** resources, or improve **transmission or distribution** of electricity generated from renewable energy resources.”

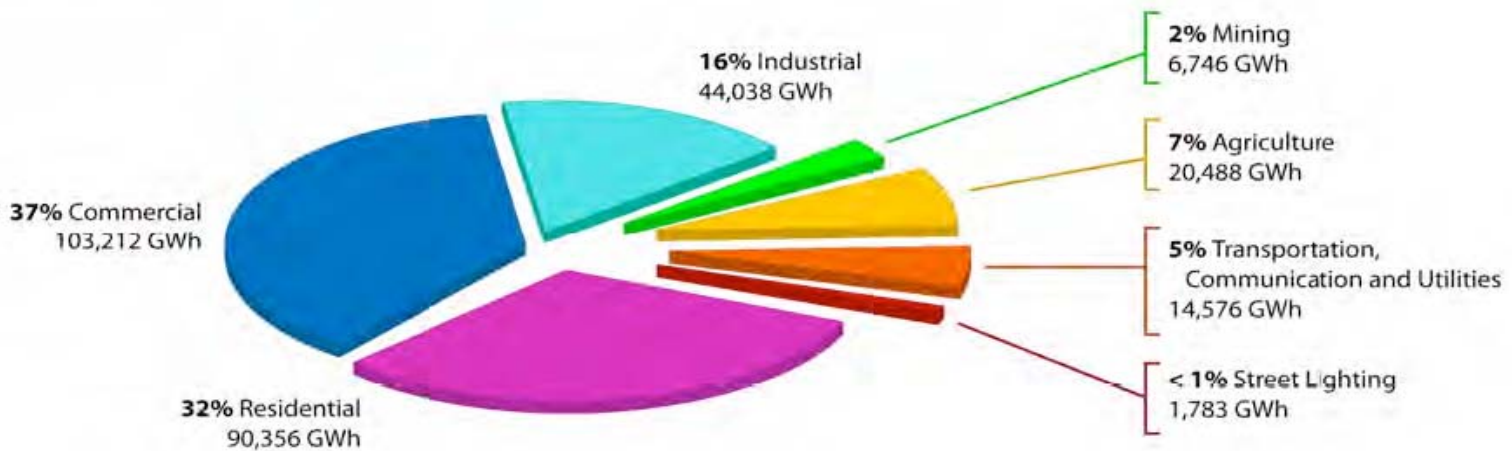
Where are we at?

- Energy from renewables vs. total



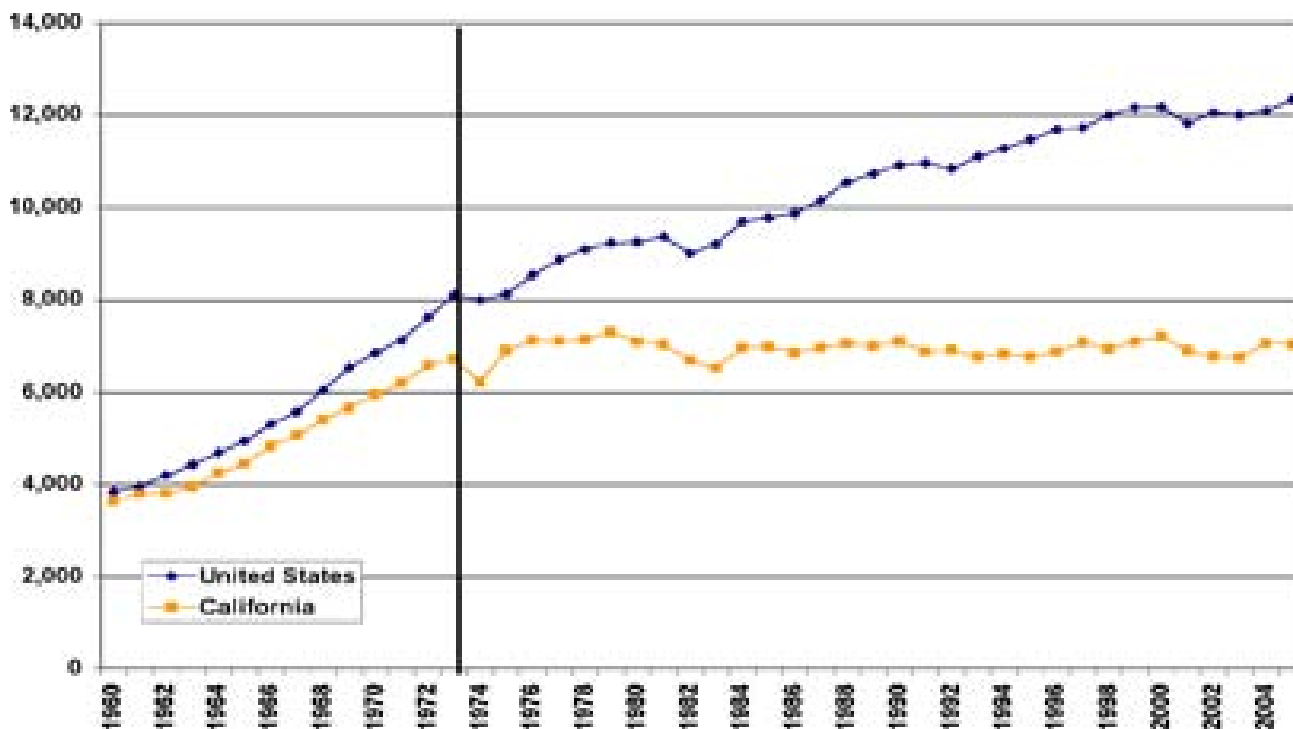
Where are we at?

- Electricity Consumption by Sector, 2006



Where are we at?

- Per Capita Electricity Sales, kW-hrs/person

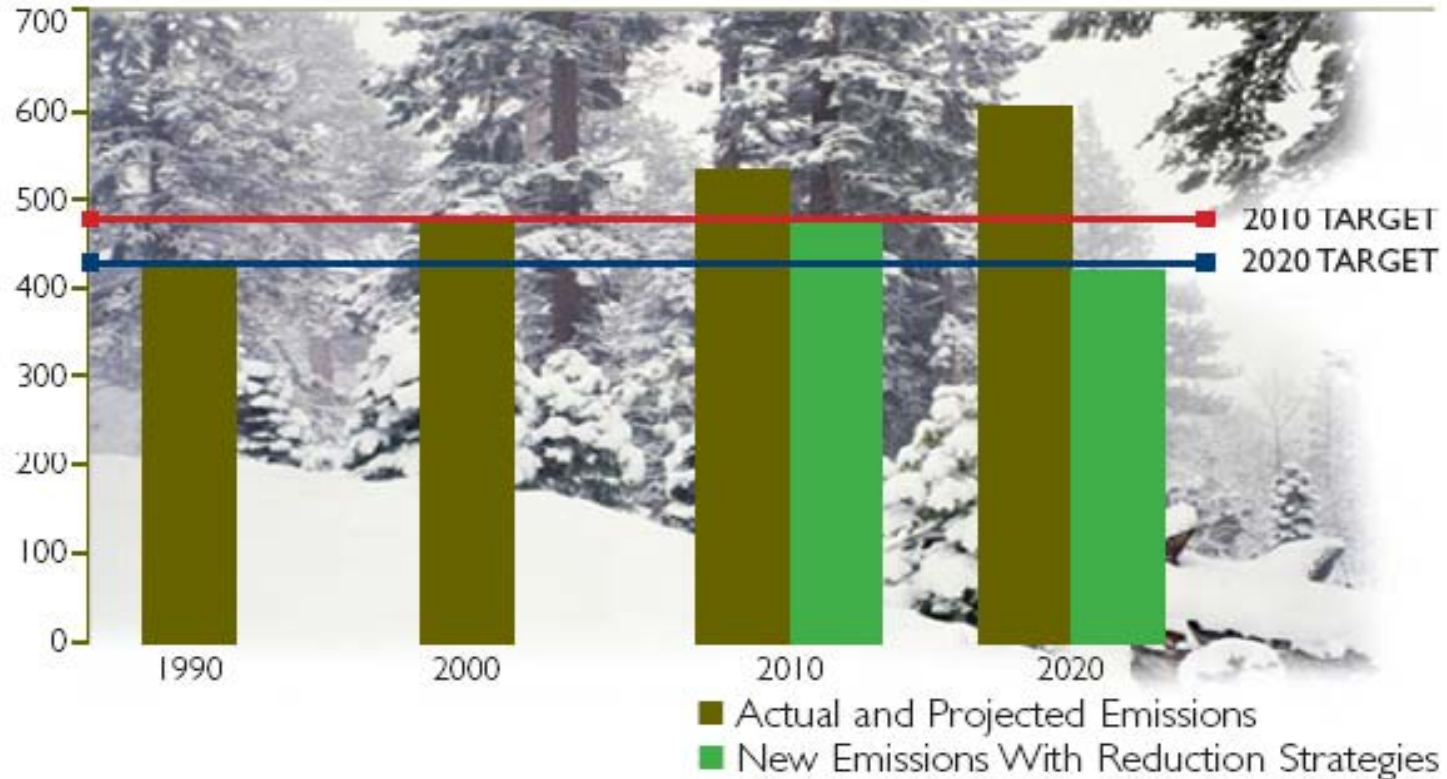


Where are we at?

- Energy Use by Sector, 2006

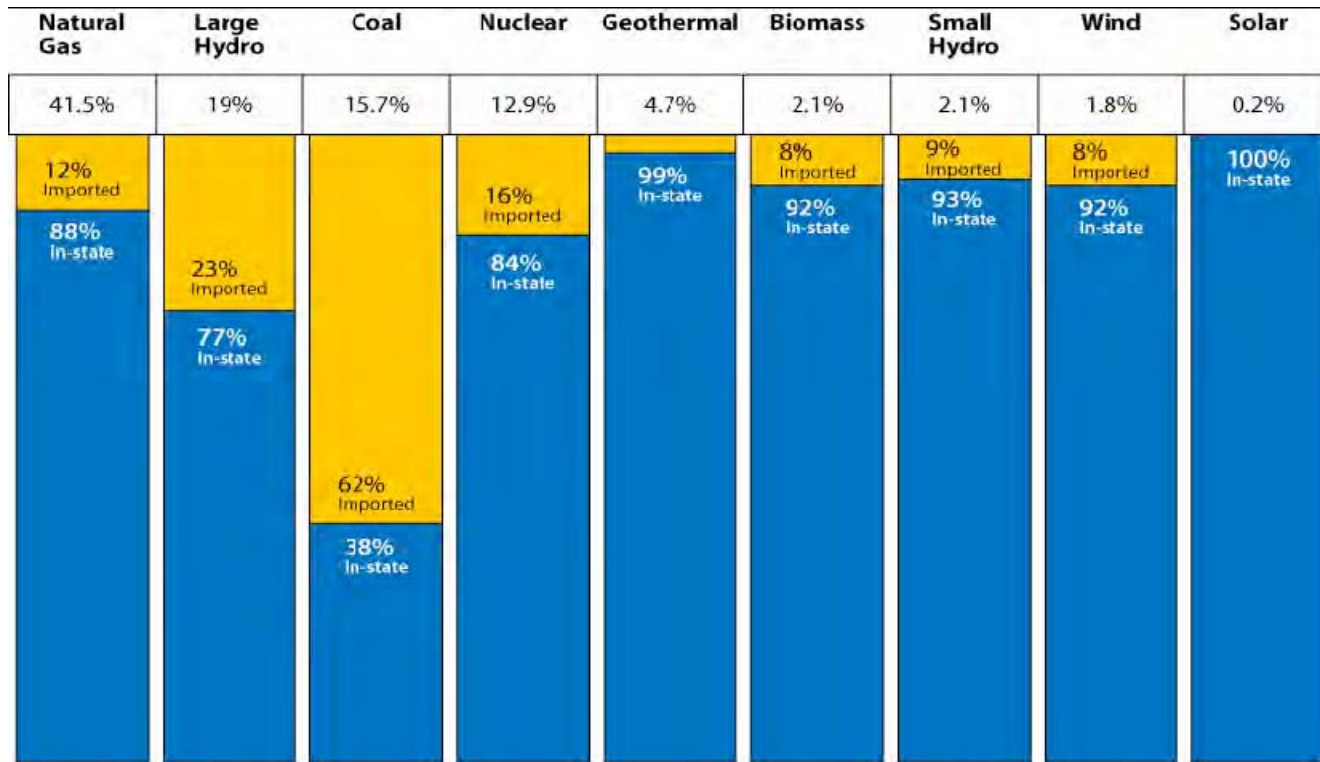


Greenhouse Gas Emissions



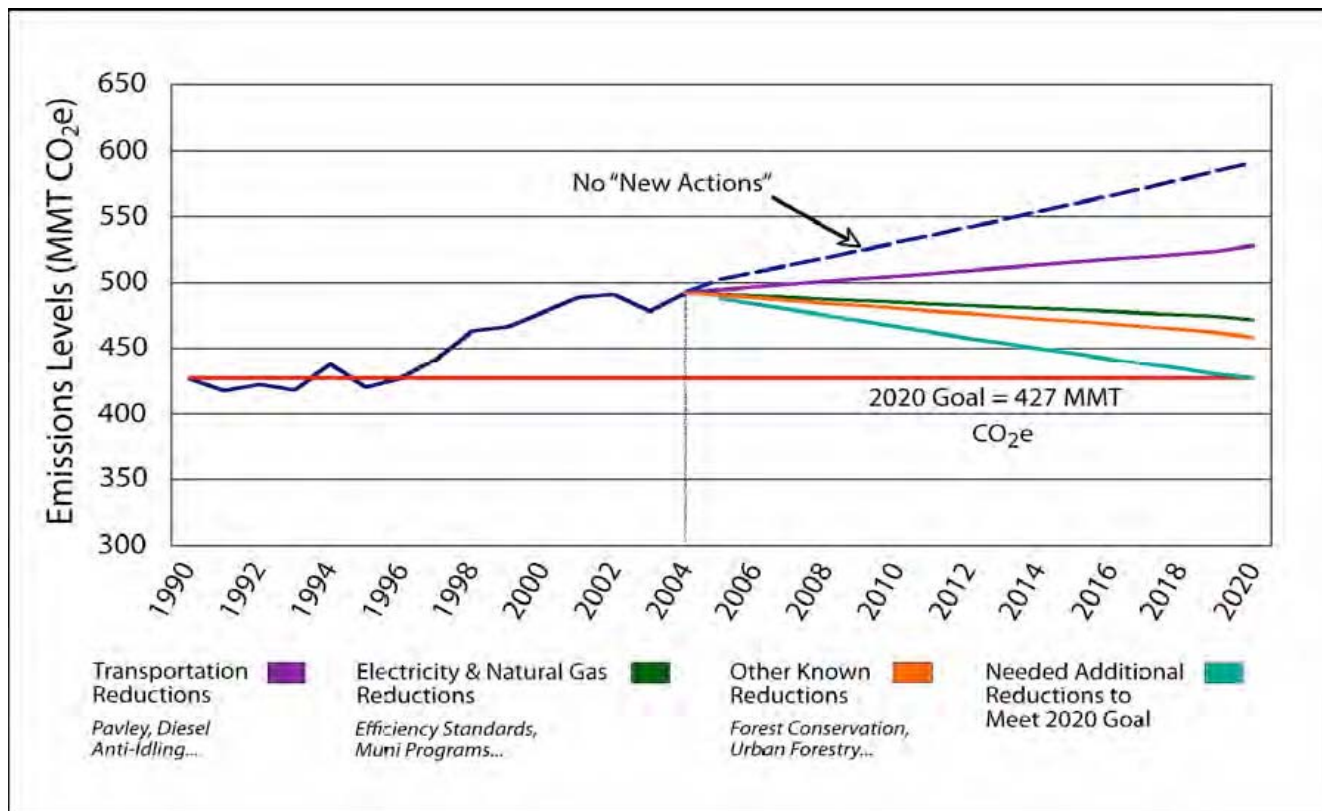
Where are we at?

- Renewable energy in use



Where do we need to go?

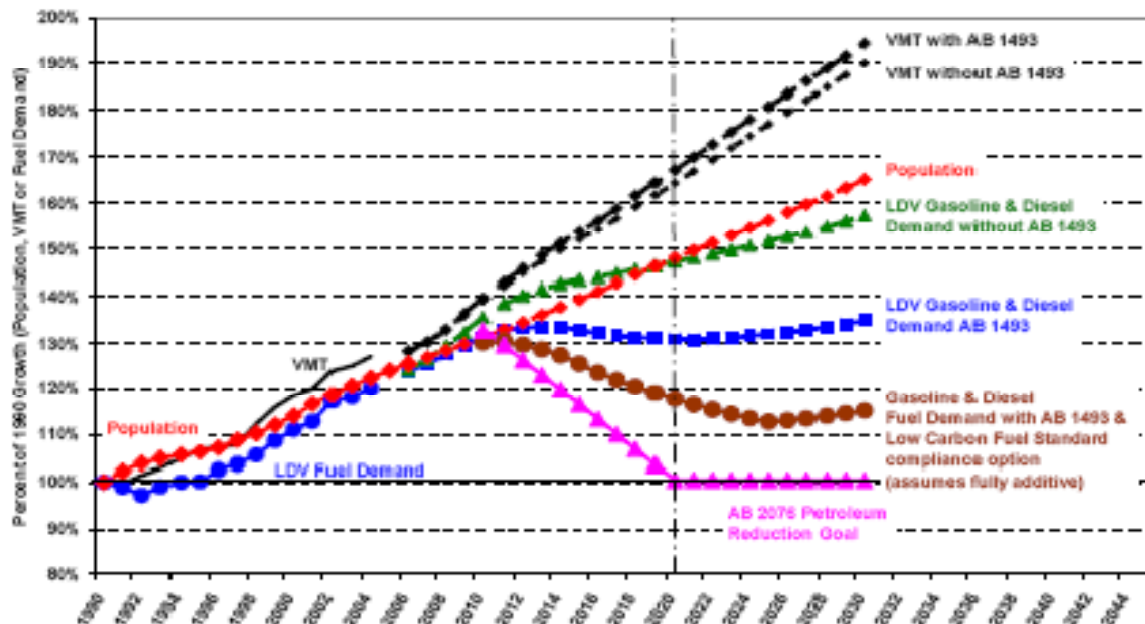
- AB 32



Where do we need to go?

- Petroleum reduction

Historical and Projected Population, Vehicle Miles Traveled (VMT) and Fuel Demand, with and without AB 1493 and Including Low Carbon Fuel Standard (LCFS) (all values scaled to 100% in 1990, AB 32 Goal for 2020)



Source: California Energy Commission

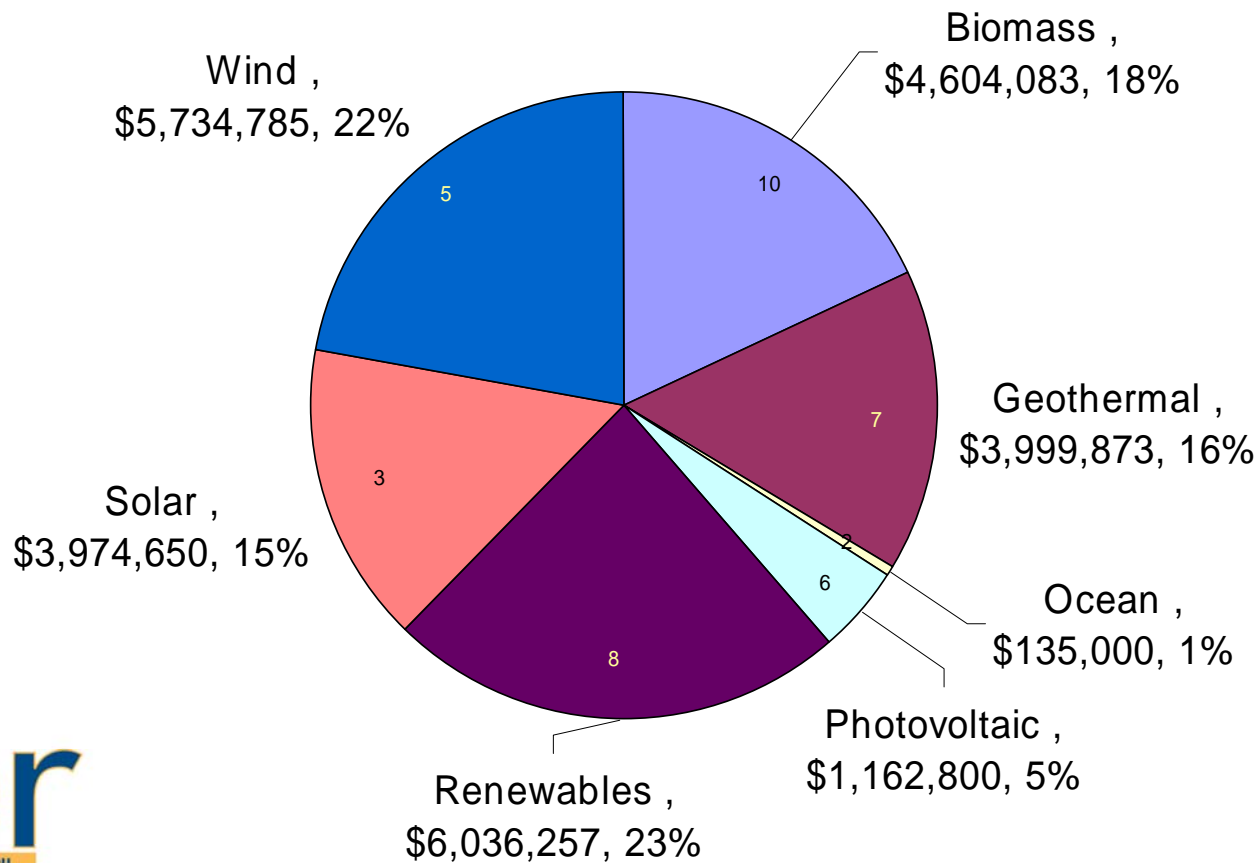
Partners

- State Agencies
 - California Public Utilities Commission
 - California Independent System Operator
 - California Air Resources Board
- Investor Owned Utilities
 - Pacific Gas & Electric Company
 - San Diego Electric & Gas Company
 - Southern California Edison
- Collaboratives
 - California Biomass Collaborative – UC Davis
 - California Geothermal Collaborative – Lawrence Livermore Laboratory
 - California Solar Collaborative – to be determined
 - California Wind Energy Collaborative – UC Davis

Project Portfolio – 03/07

Renewables Projects - Active

41 Projects, \$25.6 Million



Selected Project: Biomass



Project Title: Dairy Power Production Program

Contractor: Western United Resource Development, Inc.

Project Manager: Ghasem Edalati

PIER Funding: \$6,822,620

Status: Phase I complete:

- 10 systems awarded (8 Buydown and 2 Incentive) ~ generating 2.5 MW total
- 5 Covered lagoons and 5 plug flow digesters
- Lactating cows range from 245 to 7931
- Dairy manure or mixture of dairy manure with cheese wastewater, creamery wastewater, and food processing wastewater

Selected Project: Biomass



Project Title: 250 kW Microturbine

Using Landfill Gas

Contractor: SCS Engineers

Project Manager: Prab Sethi

PIER Funding: \$450,000

Status: Completed, 2007

Results:

- Modified natural gas microturbine to accept landfill gas
- Installed microturbine and balance of plant
- Performed a seven-day reliability test
- Completed 12-month demonstration test since June 23, 2005
- Tested over 10,000 hours of operation with NOx emissions of 0.265 lb/MWh and availability higher than 90%

Selected Project: Solar

Project Title: Tracking the Sun for High Value Grid Electricity

Contractor: PowerLight

Project Manager: Golam Kibrya

PIER Funding: \$1,214,389

Status: Completed January, 2007

Results:

- Tracker life cycle cost reduced by 29%
- Cycle time (design to installation) reduced by 58%
- Material waste stream reduced by 20%
- Three commercial systems installed in CA in 2006



Selected Project: Wind

Title: Intermittency Analysis Project

Contractor: CWEC

Project Manager: Dora Yen

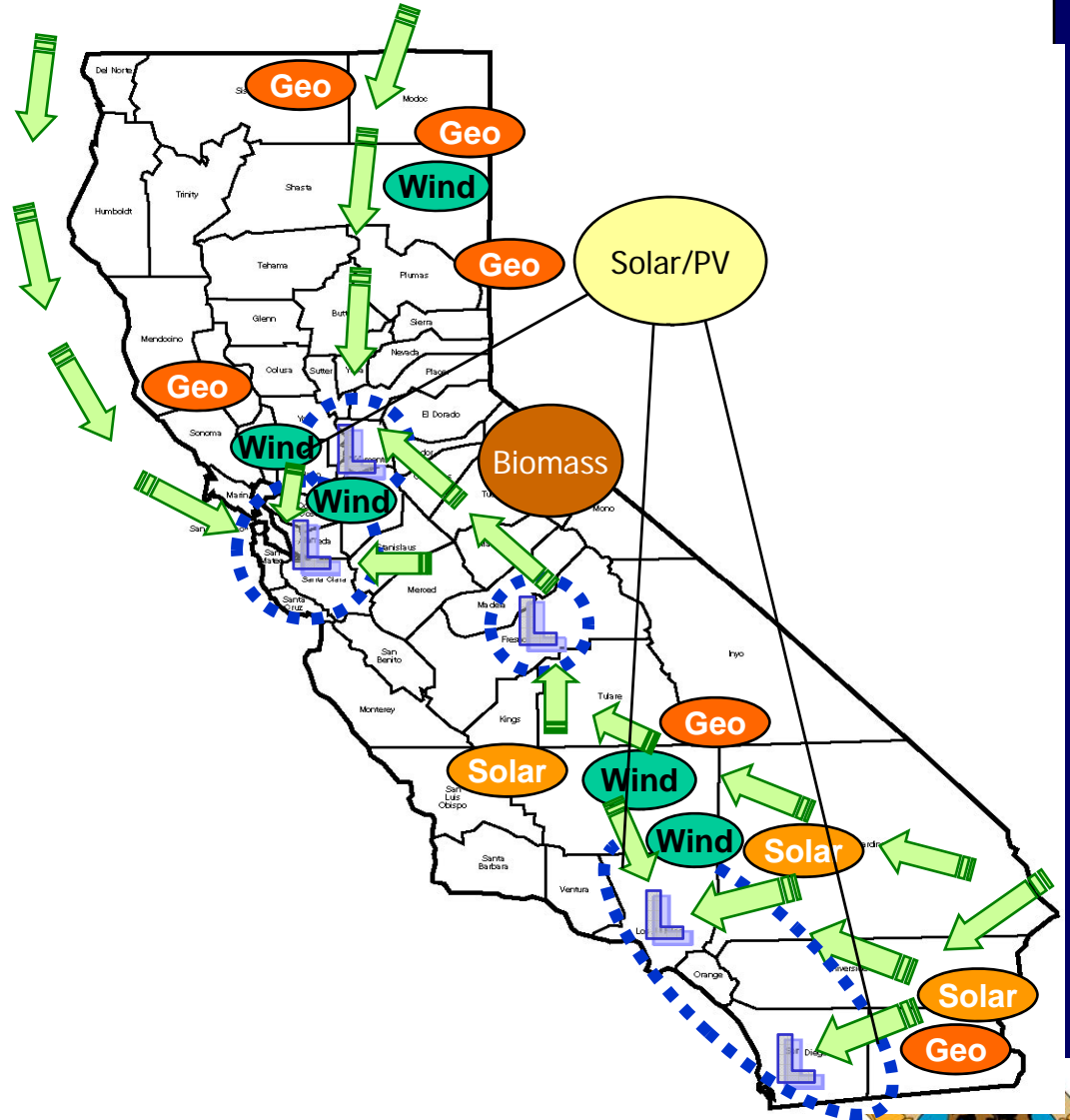
PIER Funding: \$1,342,179

Status: Complete: Reports posted

Scope:

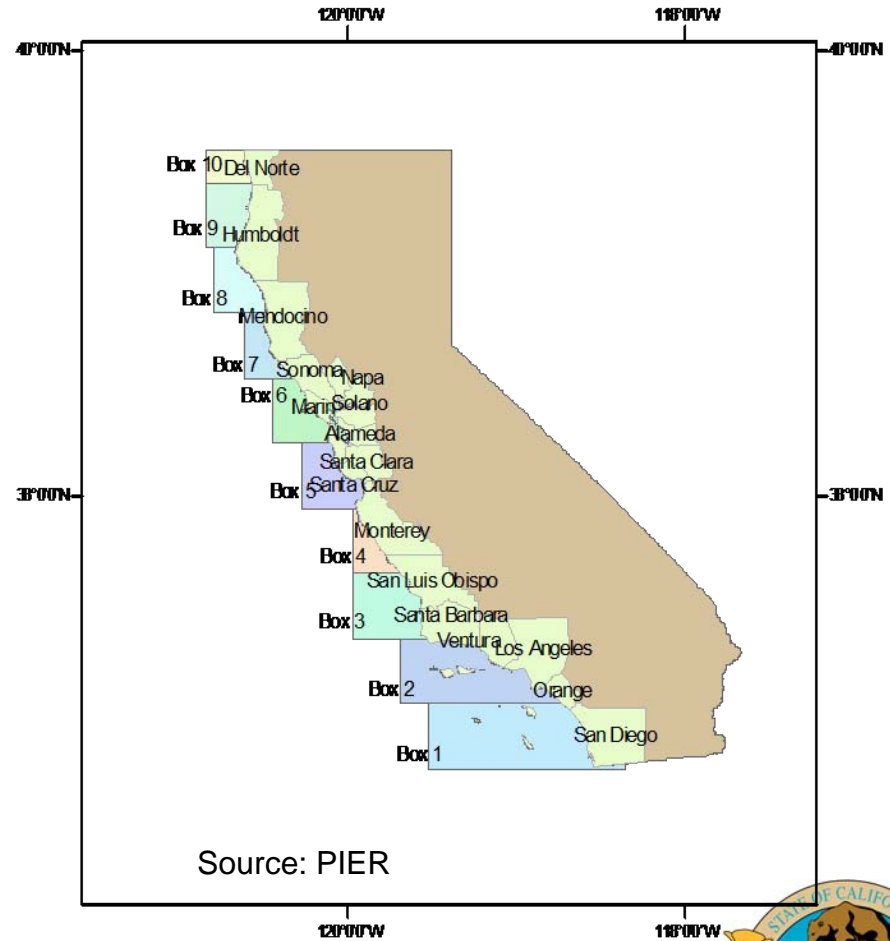
- Impact of Past, Present & Future Wind Technologies on Transmission & Operation Report
- Four Study Scenarios
 - 2006 Base Case
 - 2010 Tehachapi with 3,000MW of wind in Tehachapi
 - 2010 Accelerated Case: theoretical “stepping-stone” case for building to 2020 alternatives
 - 2020 Case – 33% penetration
- Lessons Learned from the International Experience - Europe and Asia

Possible Future Transmission Corridors in California



PIER Wave Energy R&D

- Funded and refined California Wave Energy Resource Assessment
- Waters off the California coast were broken into 10 – one degree latitude cells
- Draft report is complete and in publication process – expect posting to the CEC website soon
- Now co-funding wave energy environmental knowledge gaps white paper, building on existing body of research of wave resources and wave energy conversion technologies
- Wave energy proposals are now eligible for funding under the Energy Innovations Small Grant Program



Community Choice Aggregation in California

- AB 117 allows cities, counties and joint powers agencies to “aggregate customers load” for the purpose of procuring electricity.
- Investor owned utilities customers have the right to “opt out” and be served by the IOU, and the IOU continues to provide transmission, distribution metering, billing, and other regulated services.
- The California Public Utilities Commission has established rules, procedures and schedules for interactions between Community Choice Aggregators and IOUs.
- The California Energy Commission and the Local Government Commission are supporting feasibility assessments by pilot communities (Palm Springs and San Luis Obispo) and the development of implementation guidelines and templates.

Collaboratives

- Statewide collaboration of government, industry, environmental groups, and educational institutions. Sponsored by the Energy Commission and other agency and industry partners, the collaboratives work to enhance the sustainable management and development of renewable energy in California for the production of renewable energy and products.



- Each receives approximately \$400,000 from the Energy Commission annually.
- A fourth collaborative, the Solar Energy Collaborative, is in the formation stage.
- The four Collaboratives are being brought under the oversight of the California Institute for Energy and the Environment, CIEE, to achieve economies in administration.

Collaboratives

- Strong emphasis on collaborations:
 - ❑ Avoid duplication/builds on past work/ensures relevance
 - ❑ Regular coordination with IOUs via the Emerging Technology Coordinating Council and Transmission Program Advisory Committee
 - ❑ State Agency Partnerships (CARB, CPUC, CEC T-24, DGS/DOF, CDF, CFA, CalEPA, IWMB)
 - ❑ Market Partnerships (California builders, Collaborative for High Performance Schools, California Commissioning Collaborative, major equipment manufacturers)
 - ❑ Use California Capabilities (Universities, National Laboratories, High Technology Companies)
 - ❑ Leverage/complement Federal Investments – Photovoltaics, Biomass, Smart Grid, Efficiency

Recent Solicitations

- Biomass
 - PIER Funding: \$1 M
 - Target: Bio-Power RD&D related to forestry wastes
 - Status: 5 proposals received and qualified for evaluation
- Geothermal
 - GRDA Funding: \$5.8 M
 - Target: Unrestricted
 - Target Release Date: Available
 - Pre-Applications Due: November 16, 2007
- Solar
 - PIER Funding: \$2 M
 - Target: PV Grid Integration, End Use and Market Support Innovation
 - Applications Due: February 8, 2008
- Wind
 - PIER Funding: \$1.65 M
 - Target: Feasibility and Analysis: Wind-Storage-Enhanced Technologies for the Grid
 - Applications Due: February 13, 2008

Upcoming Solicitations

- Combined Heat & Power

- PIER Funding: \$1.5 million
- Target:
- Applications under review?

- Stationary Engine

- PIER Funding: \$1 million
- Target: transportation engine technology with stationary applications
- Target Release Date: ?

Summary

- Increasingly dynamic legislative, policy and budgetary context
- Renewable technologies will alter and need to be adapted to new and overlapping deployment venues
- Need to transfer project successes to the market.
- Research and development roadmaps under development with a goal to settle on strategies for all technology areas by early 2008
- Looking forward to close collaboration with Collaboratives and California IOUs

Thank You!

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