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Ideas + Action for a Better City

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#GettingTo50%

50% Renewables by 2030



How Will California Get There?

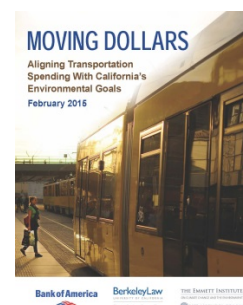
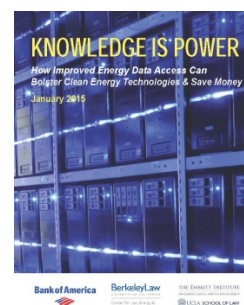
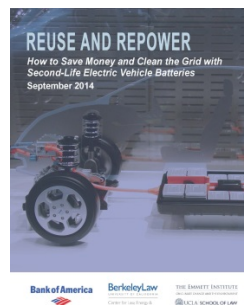
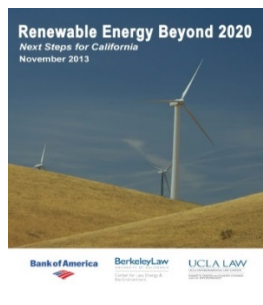
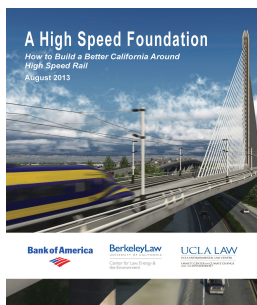
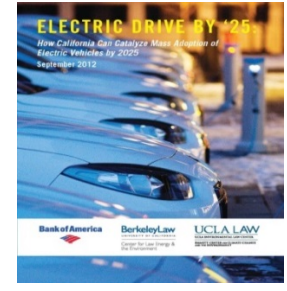
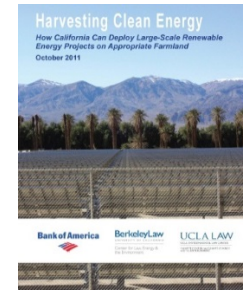
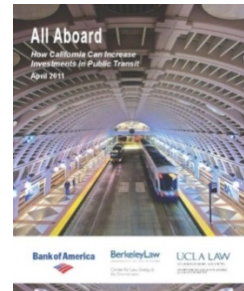
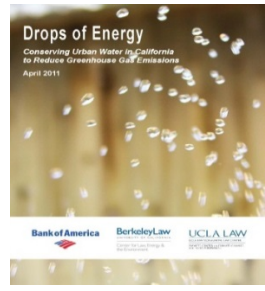
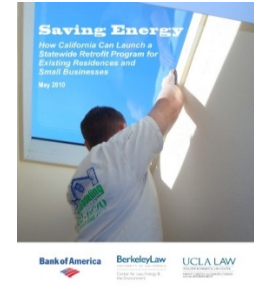
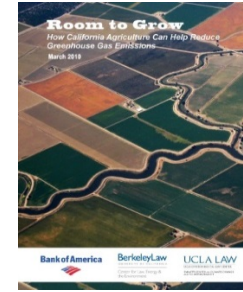
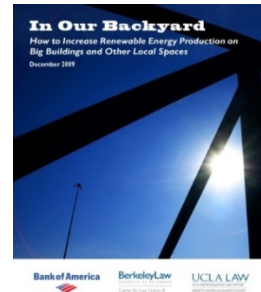
Ethan Elkind

Associate Director, Climate Change and Business Program

UC Berkeley School of Law

BerkeleyLaw
UNIVERSITY OF CALIFORNIA

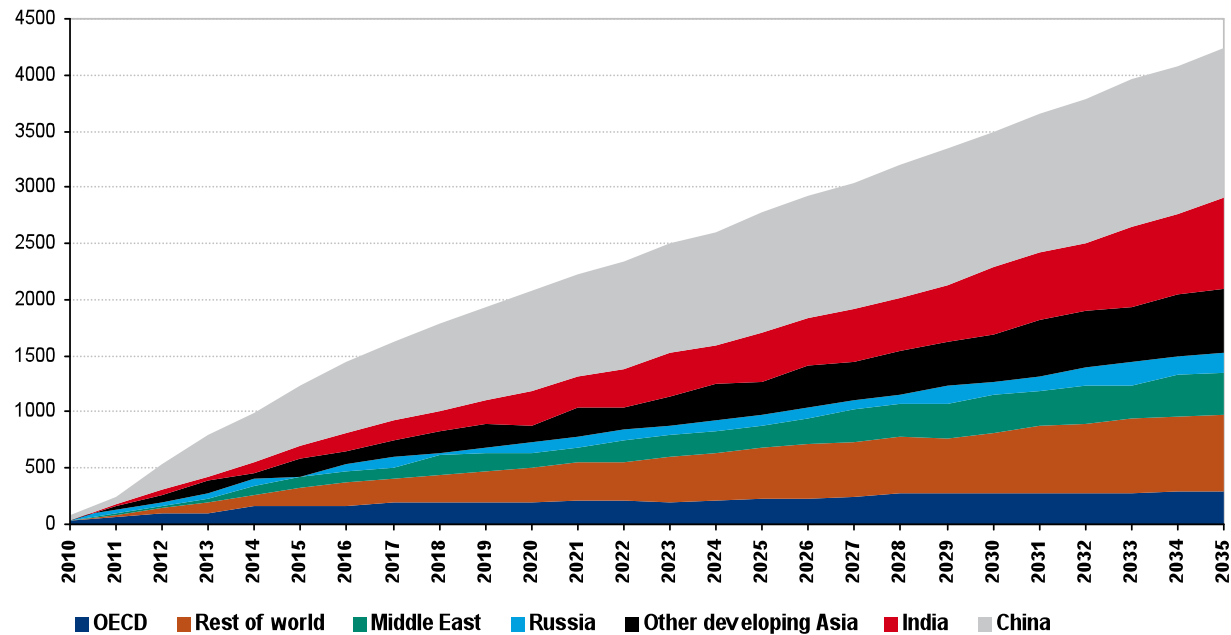
Center for Law, Energy &
the Environment



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Center for Law, Energy & the Environment

Context: Energy Demand Surge

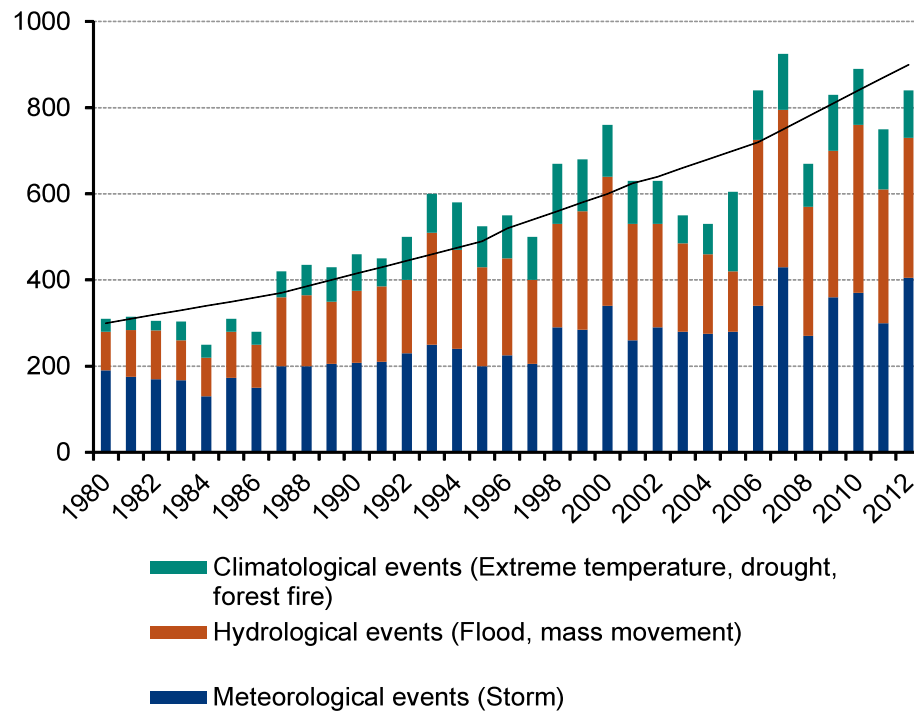
Chart 1: Global energy demand increases by one-third from 2010 to 2035 (Mtoe)



Source: EA WEO 2011, BofA Merrill Lynch Global Research

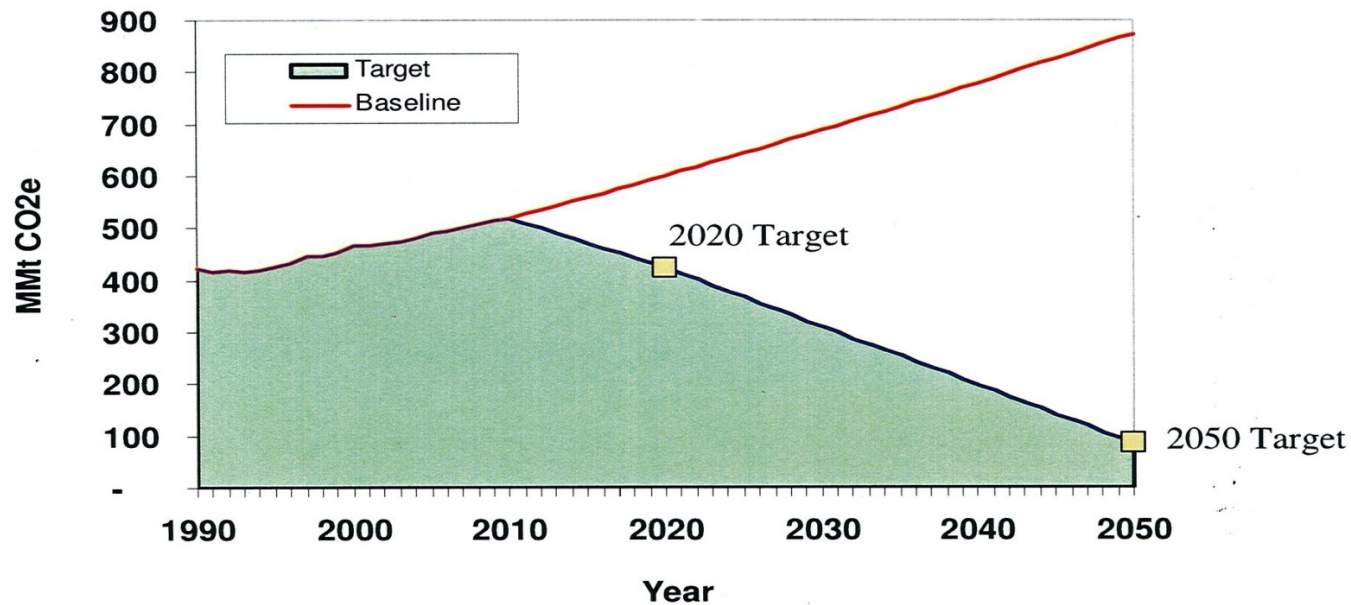
Context: More Extreme Weather

Chart 1: Weather catastrophes worldwide 1980-2012

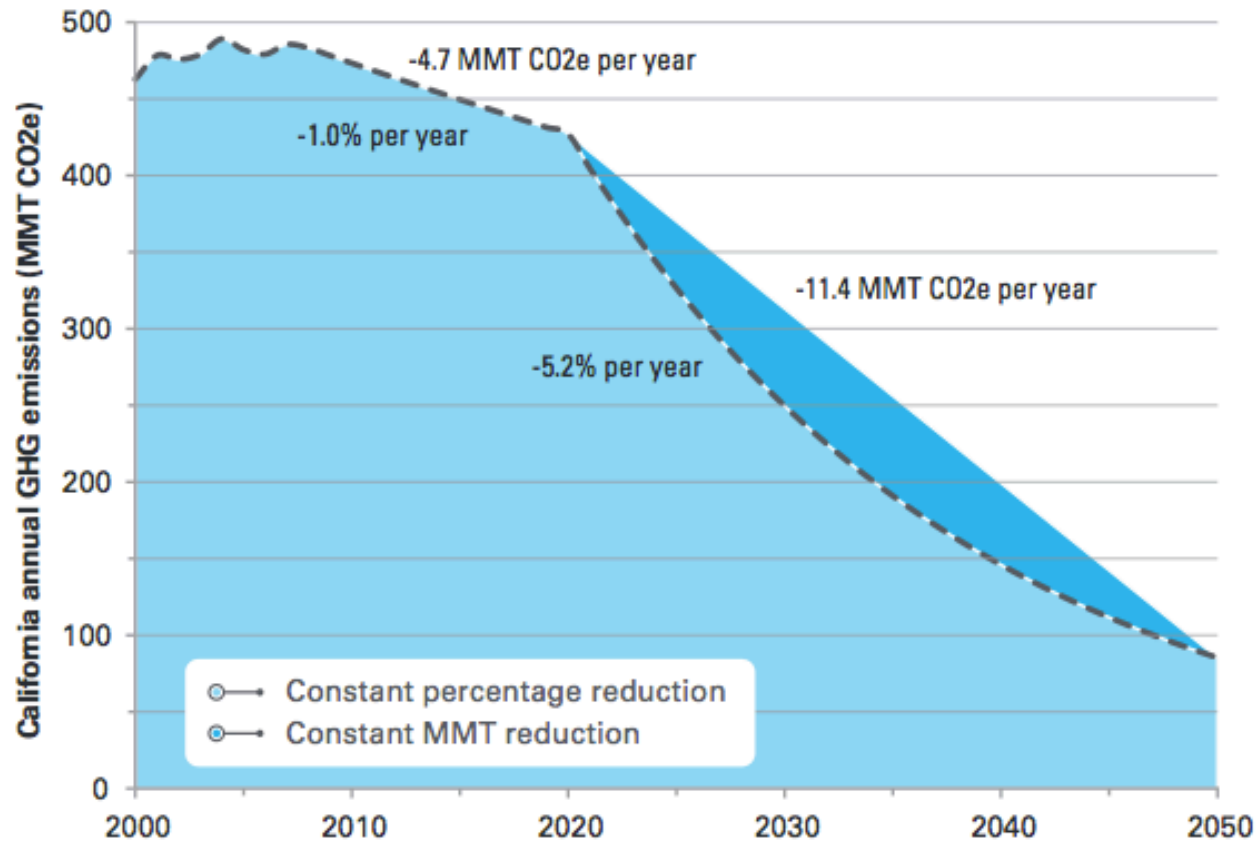


Source: Münchener Rückversicherungs-Gesellschaft, Geo Risks Research, NatCatSERVICE—As at January 2013

AB 32: 2020 & 2050 Greenhouse Gas Reduction Goals

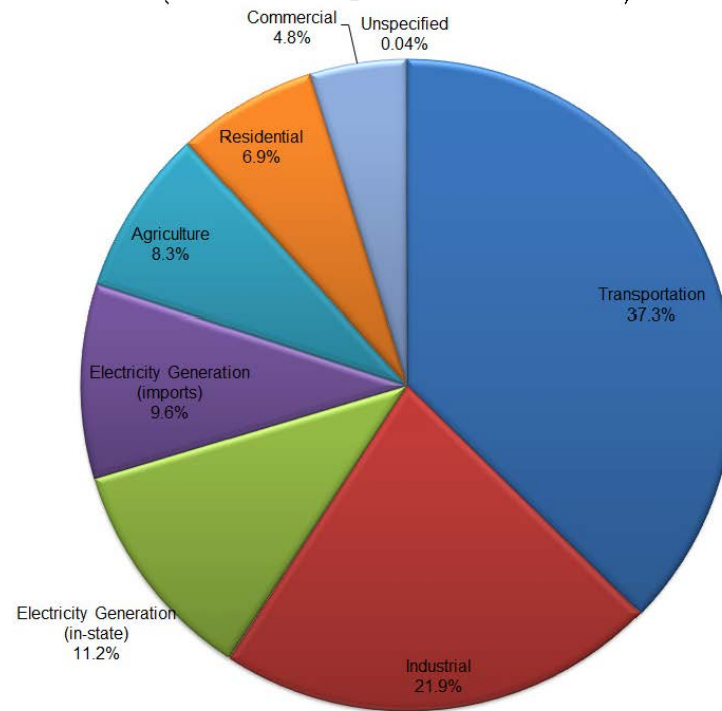


Pre-2020 and Post-2020 emissions trajectories

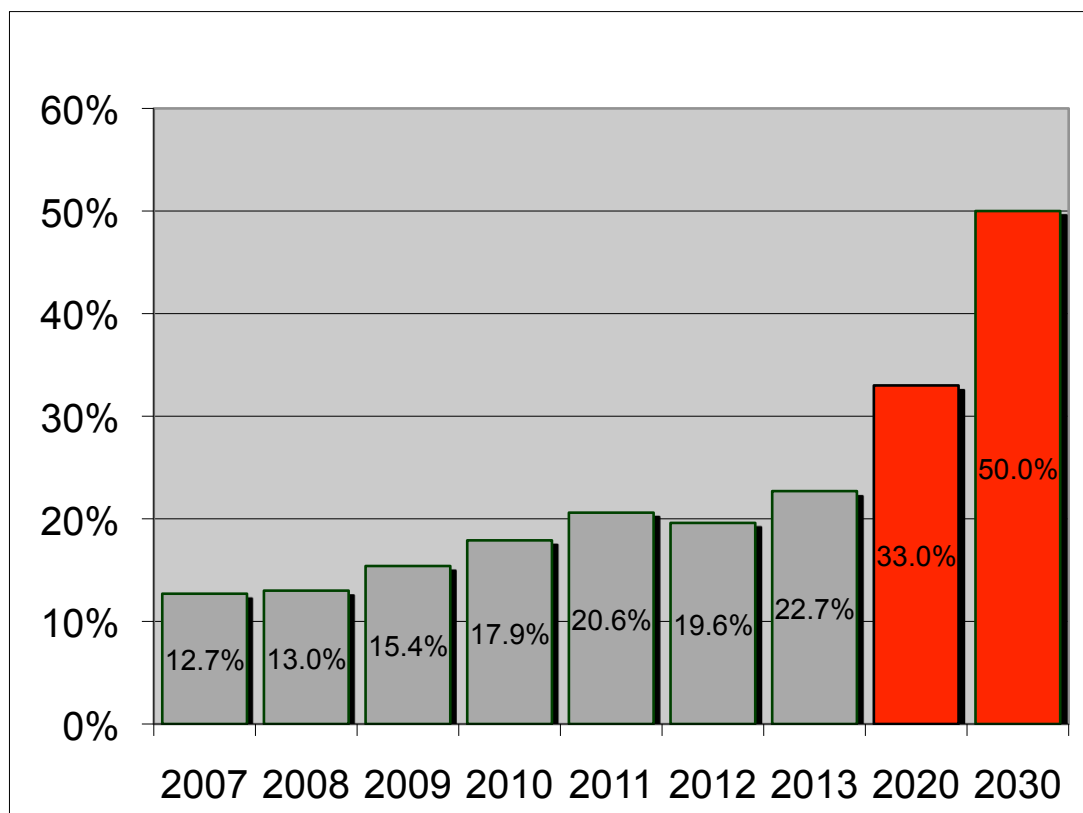


California's Carbon Footprint

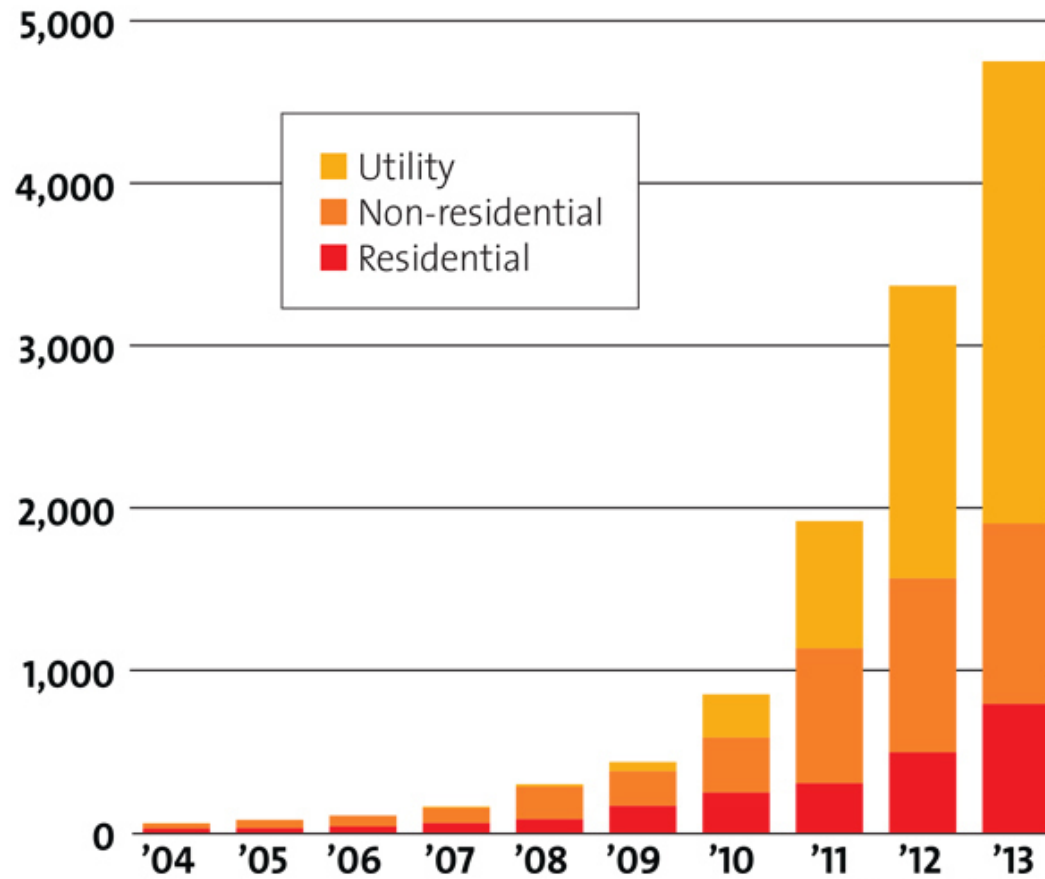
Figure 8. 2012 Greenhouse Gas Emissions by Economic Sector
(459 MMTCO₂e Gross Emissions)



SB 350: California's Renewable Push

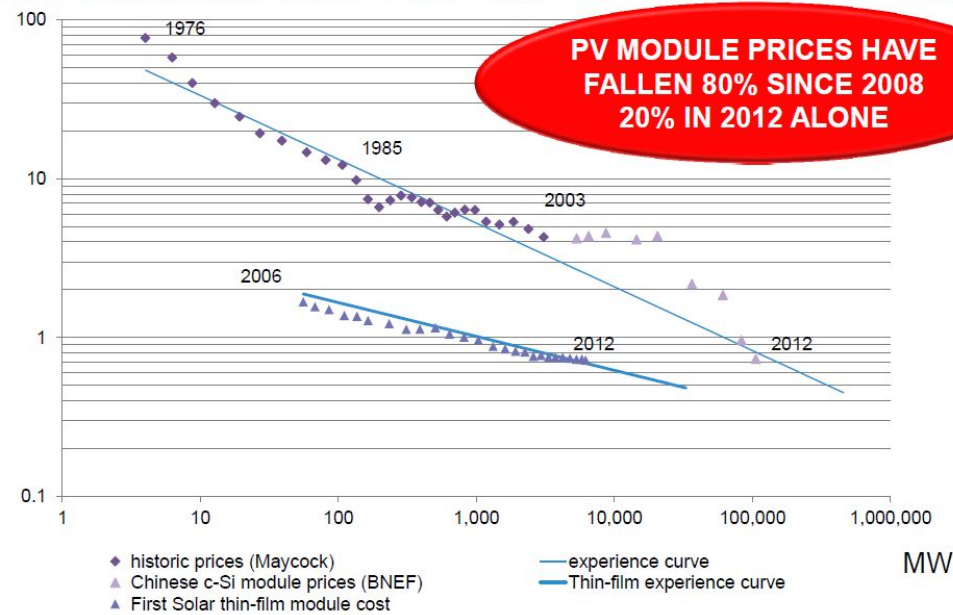


New solar installations in the United States (in megawatts)



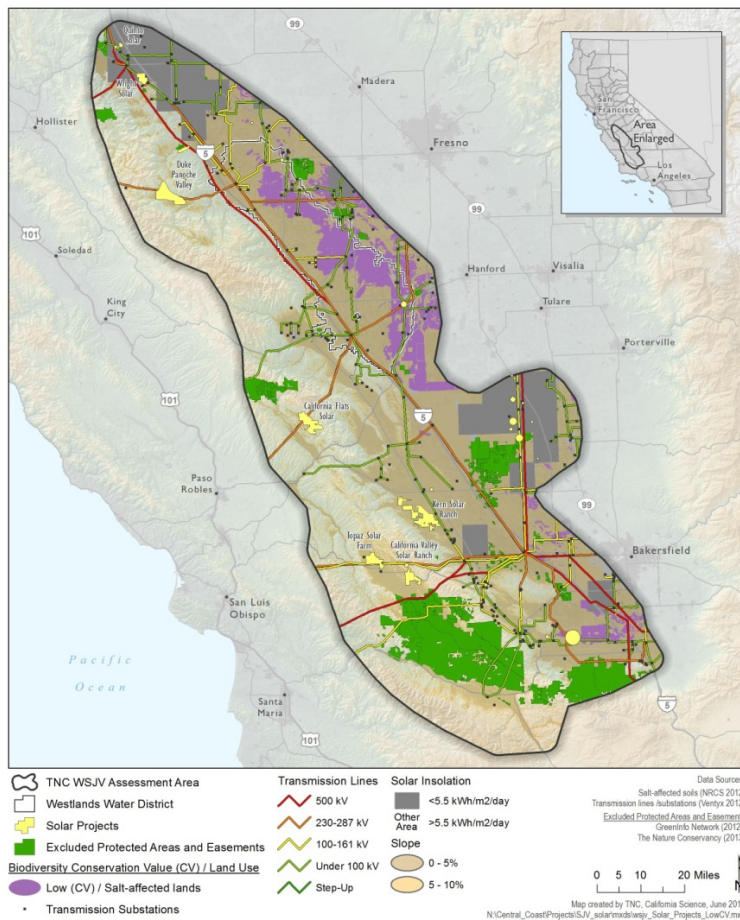
Solar Panel Price Decline

PV EXPERIENCE CURVE, 1976-2012
2012 \$/W



Note: Prices inflation indexed to US PPI.

Source: Paul Maycock, Bloomberg New Energy Finance



Getting to 50%?

Challenge #1:
Siting transmission &
new renewables

Solution:
Smart planning



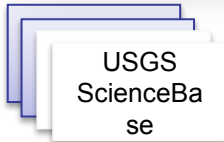
County Gateways



Data Basin



Federal Portals

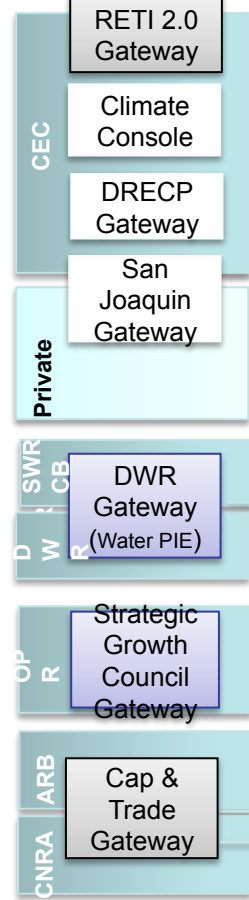


CA Geoportal



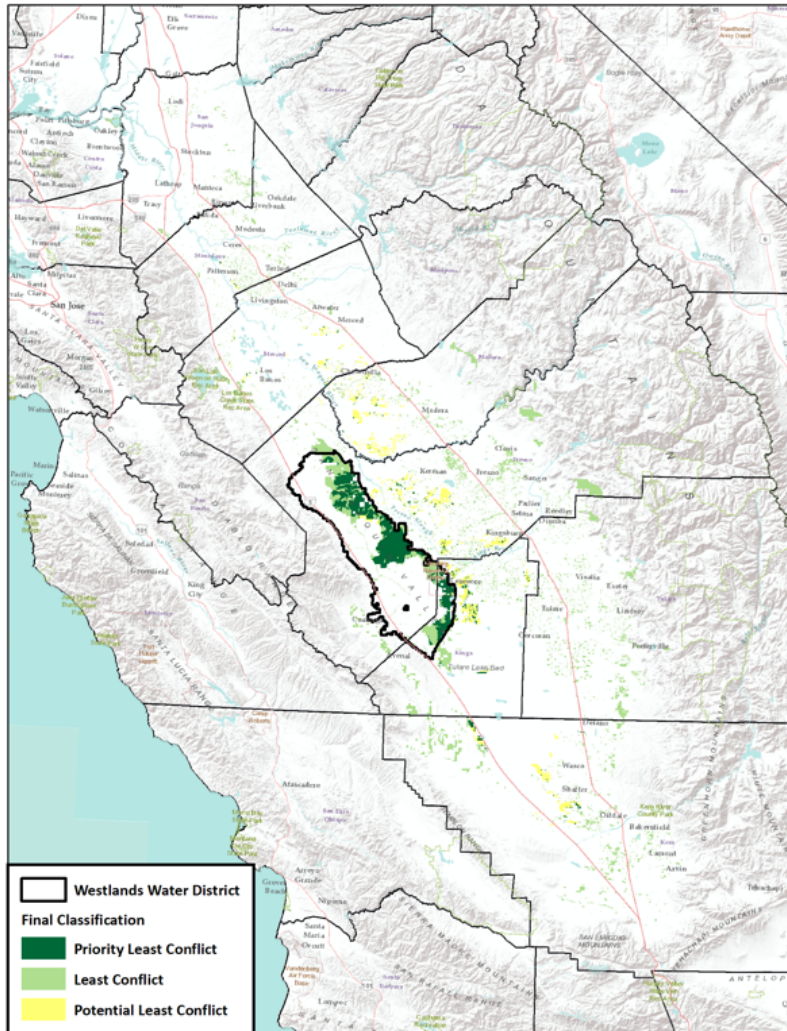
Gateway California

State Gateways



Existing and Possible Applications

- Energy Scenario Builder
- Sea level
- Mitigation and Conservation Durability
- Drought monitoring and adaptation
- County Specific Conservation Strategies
- Site Survey Analyst
- Site Mitigation Application
- San Joaquin Valley Least Conflict Solar
- San Joaquin Greenprint
- Groundwater Application
- Integrated Regional Planning Application
- SGC Grants Application
- Carbon Calculator Application
- Project Evaluation Application
- Environmental Benefits Registry



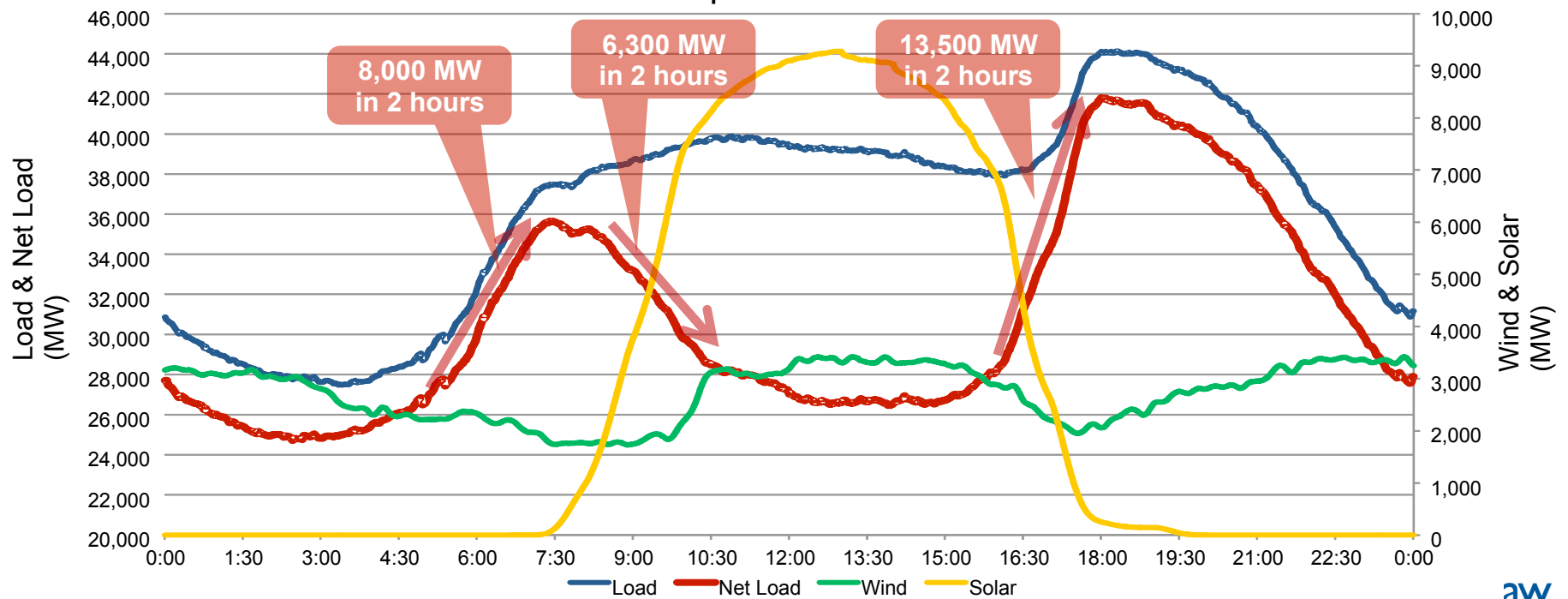
Priority Least Conflict:
~200,000 acres

Least Conflict:
~220,000 acres

Potential Least Conflict:
~125,000 acres

Challenge #2: Intermittency

Load, Wind & Solar Profiles – High Load Case
Example: winter 2020



Source: California ISO

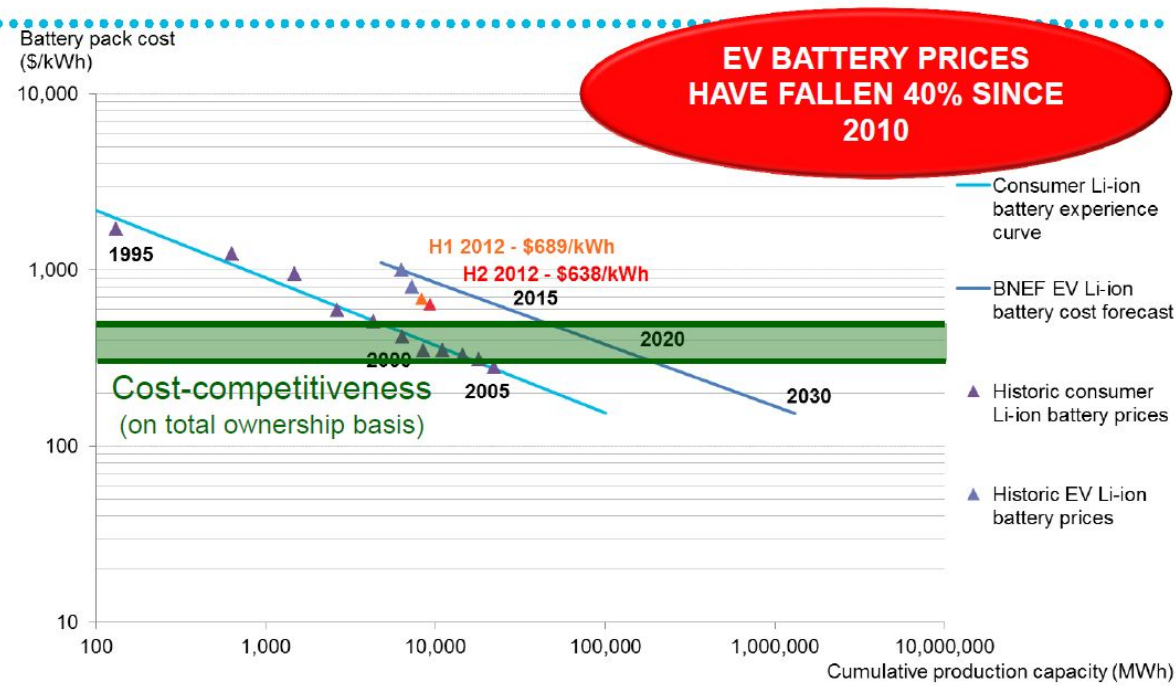
Solution #1: Energy Storage

Energy Storage Procurement Targets (in MW)

Storage Grid Domain (Point of Interconnection)	2014	2016	2018	2020	Total
Southern California Edison					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
Subtotal SCE	90	120	160	210	580
Pacific Gas and Electric					
Transmission	50	65	85	110	310
Distribution	30	40	50	65	185
Customer	10	15	25	35	85
Subtotal PG&E	90	120	160	210	580
San Diego Gas & Electric					
Transmission	10	15	22	33	80
Distribution	7	10	15	23	55
Customer	3	5	8	14	30
Subtotal SDG&E	20	30	45	70	165
Total - all 3 utilities	200	270	365	490	1,325

Battery Price Declines

LITHIUM-ION BATTERY EXPERIENCE CURVE



Source: Battery University, MIT, IIT, Bloomberg New Energy Finance

EV Batteries & Second-Life



Tesla Model S



Nissan Leaf

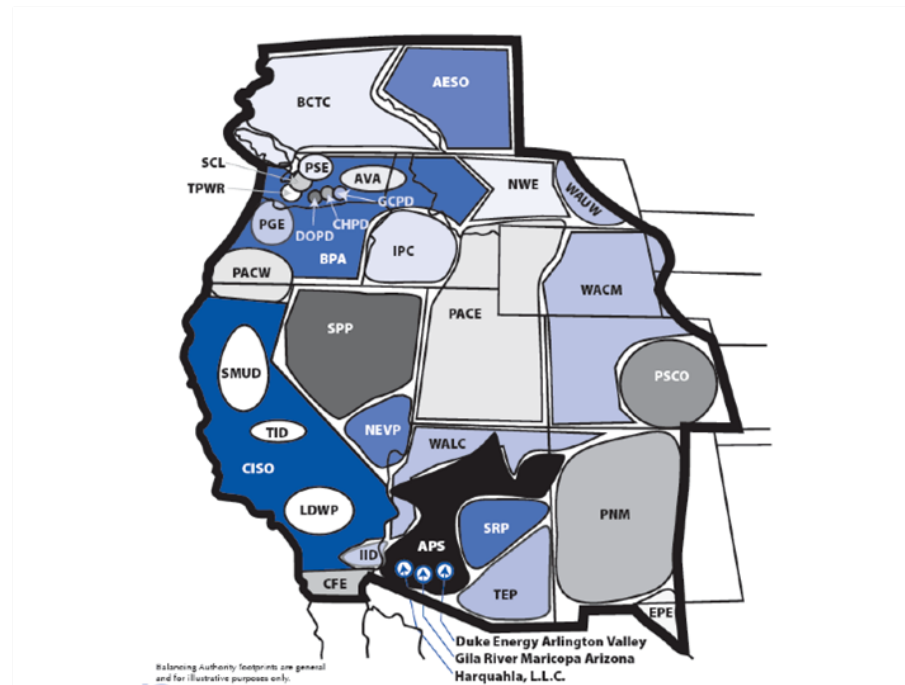


Chevy Volt

Solution #2: Demand Response

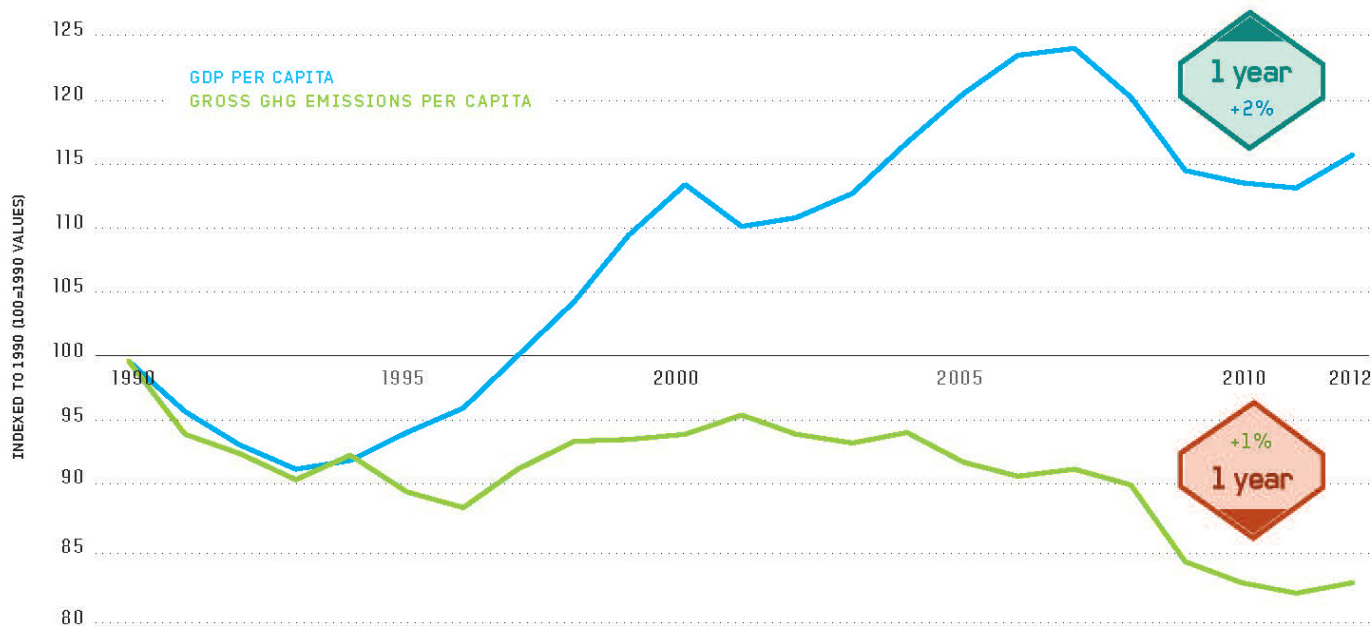


Solution #3: Western Region Energy Imbalance Market



Conclusion: GDP & GHG

FIGURE 2. GREENHOUSE GAS EMISSIONS AND GROSS DOMESTIC PRODUCT
CALIFORNIA RELATIVE TRENDS SINCE 1990 / GREENHOUSE GAS EMISSIONS (MTCO₂E) AND GDP DOLLARS, PER CAPITA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory - by Sector and Activity; Bureau of Economic Analysis, U.S. Department of Commerce; California Department of Finance. Analysis: Collaborative Economics



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Services of the San Francisco Public Utilities Commission

Getting to 50%

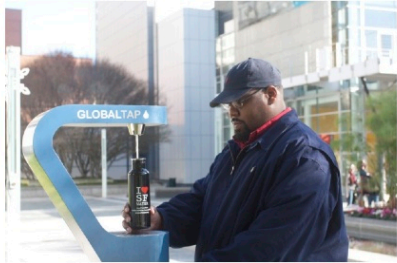
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October 20, 2015

Barbara Hale
Assistant General Manager, Power
San Francisco Public Utilities Commission



San Francisco's Provider of....



Great-tasting Hetch Hetchy tap **water**



Clean municipal **power**



Award-winning **sewer** services



Power Enterprise - Municipal Power Provider AND Community Aggregator



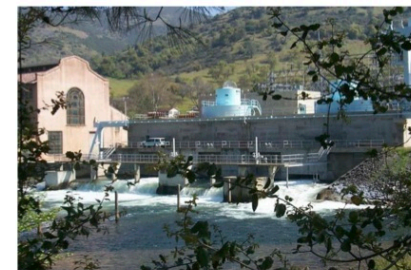
- Serving 2,260 accounts
- Generating clean hydropower, solar, and other renewables
- Providing energy efficiency services, including converting 18,500 street lights to LEDs
- Will offer 100% renewable electricity to SF residents and businesses through CleanPowerSF



SFPUC Power Facilities



Facility	MW
Kirkwood	117
Holm	165
Moccasin	103
Solar	8
Bio-methane	3



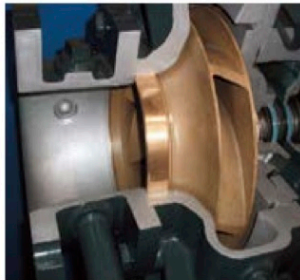


Renewable Generation

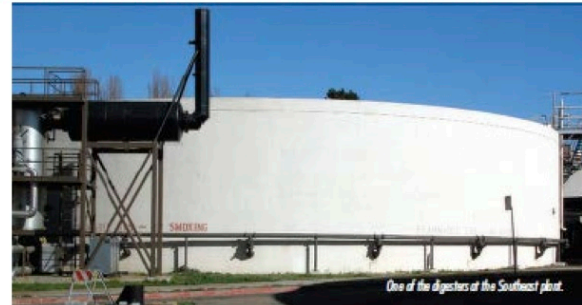
- \$26 million invested since 2002
- \$14 million planned through 2021



- Municipal solar installations



- Assessing in-city wind and in-conduit hydro



- Bio-methane cogeneration



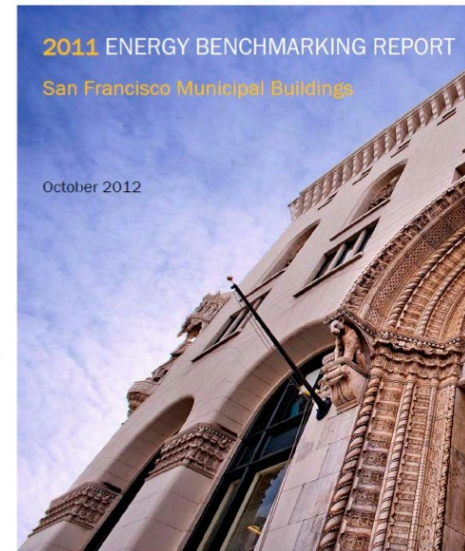
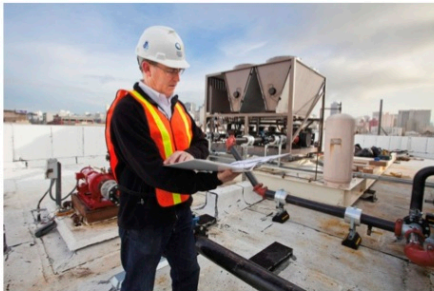
Sunset Reservoir – 5 MW Approx. \$1.6 million/year Power Purchase Agreement





Energy Efficiency

- \$43 million* spent on projects since 2002
- \$26 million planned through 2021
 - 40,000 MWh/yr electricity savings (equals 9,800 homes)
 - \$4 million/yr cost savings for municipal operations



- Energy efficiency audits and retrofits
- 2011 Energy Benchmarking Report

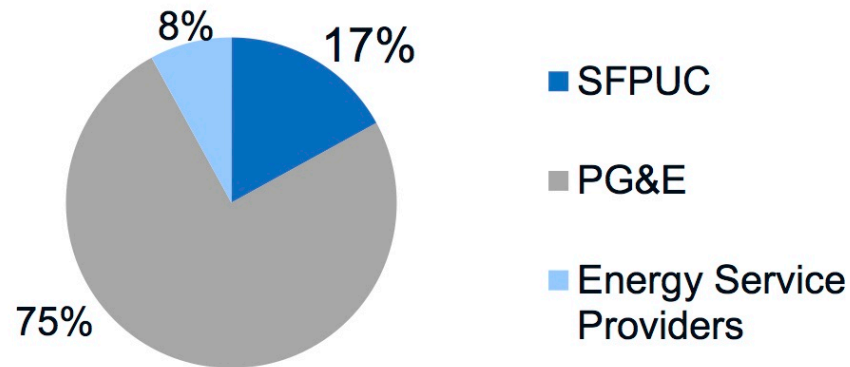


* Includes Power Enterprise and external funding 7



SFPUC Role in City Climate Policy

San Francisco Electricity Use Served by Provider



City goal: 100% GHG-free electricity by 2030 for all of San Francisco



Community Choice Aggregation

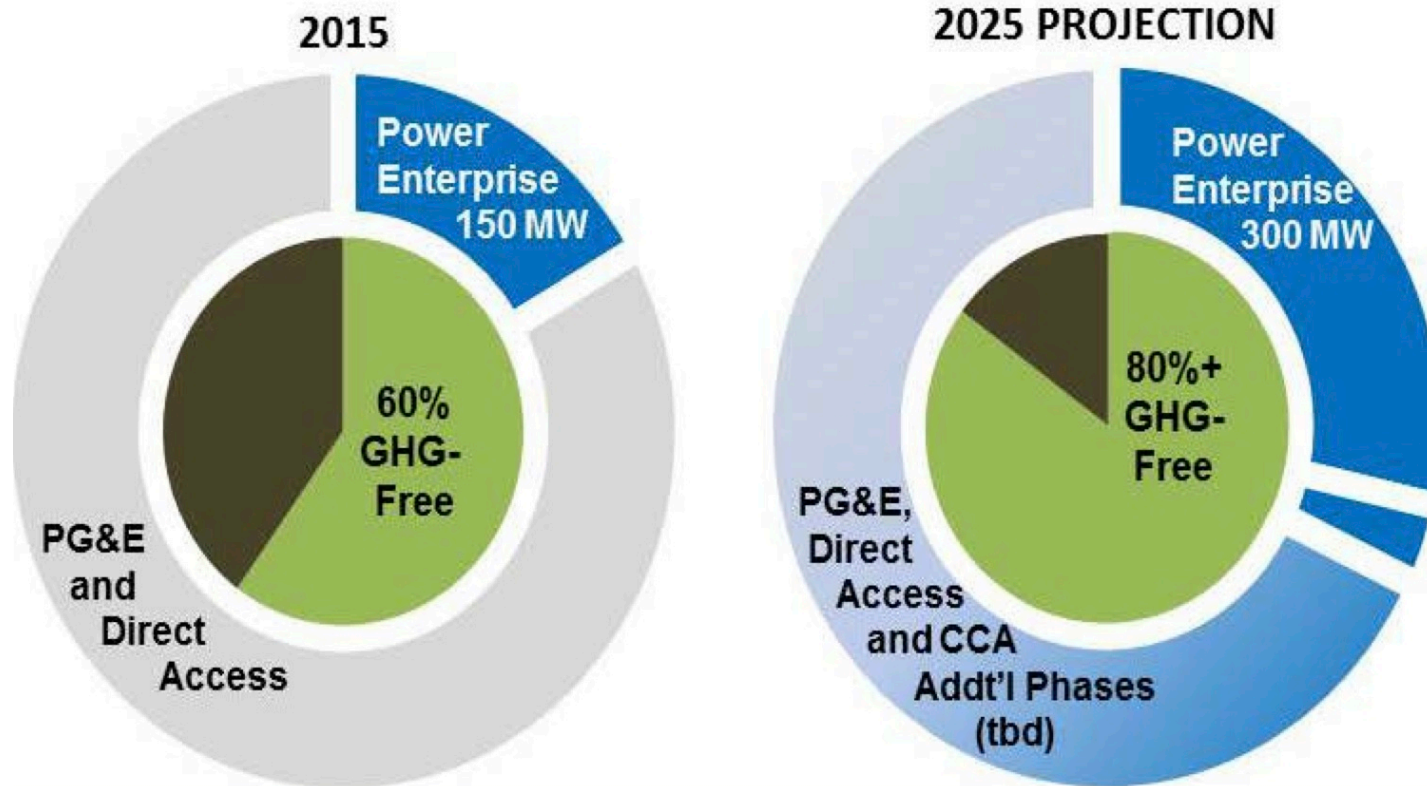
CleanPowerSF

Same Service • Cleaner Energy

- Will offer choice of 33-50% or 100% renewable electricity for San Francisco residents and businesses
- CleanPowerSF provides electricity supply; PG&E provides transmission and distribution
- First phase starts Spring 2016: 30 to 50 MW, residential and business customers
 - Pre-enroll today at cleanpowersf.org



Getting to 100% GHG-free Electricity





The Market is Changing – What’s going on out there?

- Substantial decline in conventional supply
 - Drought = Low hydroelectric production
 - SONGS retirement in 2013 removed about 2,200 MW of supply
- Yet wholesale power prices are remarkably low!
- Some utilities now reporting supply > demand





Cost-effective Customer Choices

Now – Rooftop solar, Energy Efficiency
Next – **Self-reliance**



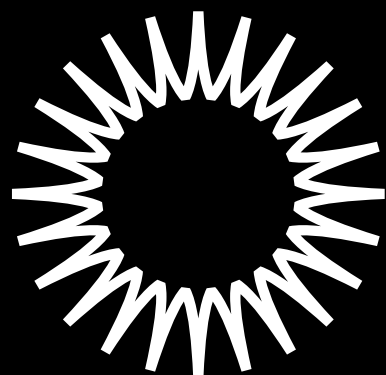


Questions



San Francisco
Water
Power
Sewer

Services of the San Francisco Public Utilities Commission



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