US Energy & Environmental Policy

And California's ambitious agenda

IDEES Seminar

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Pleasure to be here

Must thank IFP for making this speaking opportunity possible

Two part agenda

First: A few words about US energy & environmental politics

Second: An overview of California's energy & environmental policies

Obama's second term

- A lot is at stake for US & Obama's legacy
- Two scenarios
  - Scenario 1: **Already a "lame duck"**
    - Domestically frustrated by Republican intransigence
    - Handicapped by budget deficit & sluggish economy
    - Increased international irrelevance among friends & foes
  - Scenario 2: **Ending with a "grand finale"**
    - US economy rebounds despite fiscal cliff & political gridlock
    - Obama takes credit for turnaround
    - US relevant & respected even if not necessarily loved
- My personal bet?

Overview

Few key areas

1. Shale gas, LNG exports & future natural gas prices
2. EPA, climate change & future of coal
3. Renewable & distributed generation
4. Energy efficiency & decline of demand growth
5. Future of nuclear energy

California

Role model or disaster waiting to happen?

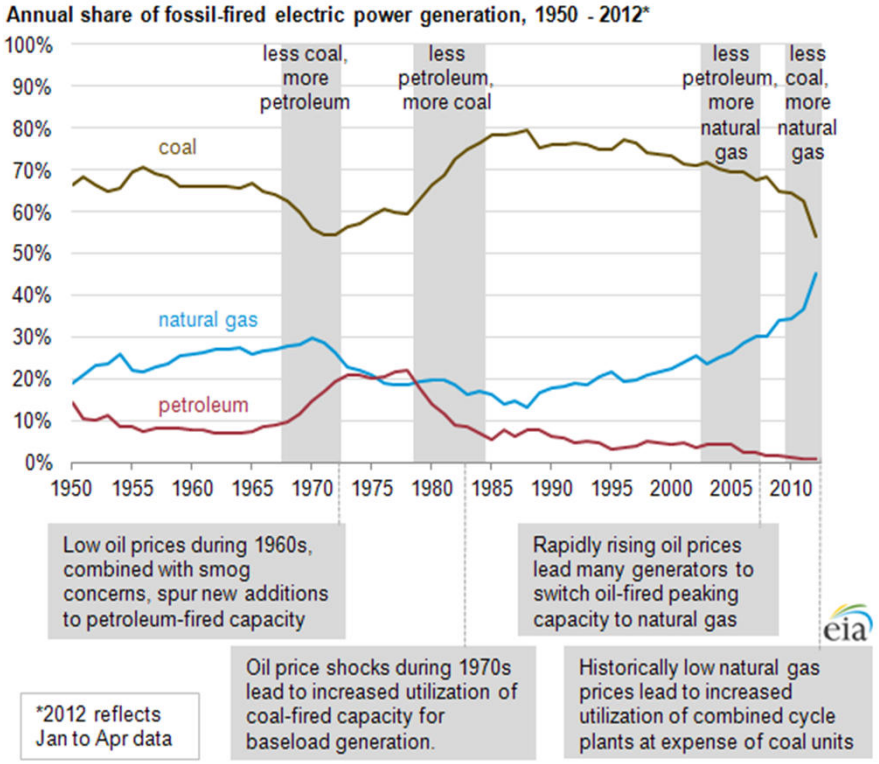
Discussion

1st: Shale gas

- Hydraulic fracturing “game changer”
  - US from net importer to exporter
  - Plentiful supplies at unprecedented low prices
  - Dash for gas pronounced in power generation sector
  - Also in transport sector
- If prices remain low, coal & nuclear “out of running”
  - Coal gained lost ground due to rising gas prices
  - Nukes can barely compete on O&M costs with gas
- Ironically, renewables not affected – so far
  - Why?
  - Renewable portfolio standards (RPS) & PTC

“Dash for gas”

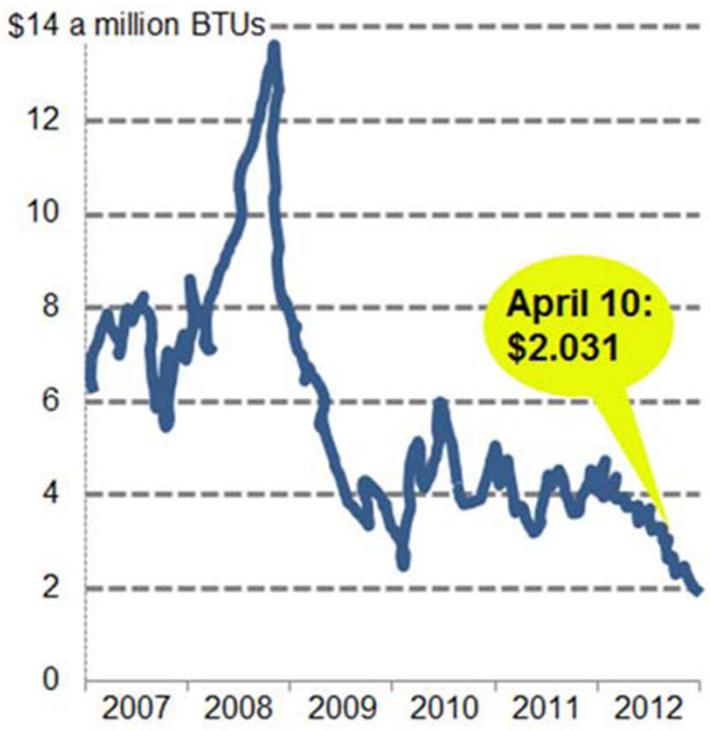
Cheap & plentiful natural gas is replacing coal in US



Source: EIA

How long will low prices last?

Price of natural gas, forward contracts, in $ per million BTUs



Source: The Wall Street Journal (11 Apr 2012) based on NYMEX trading

Future price of natural gas?

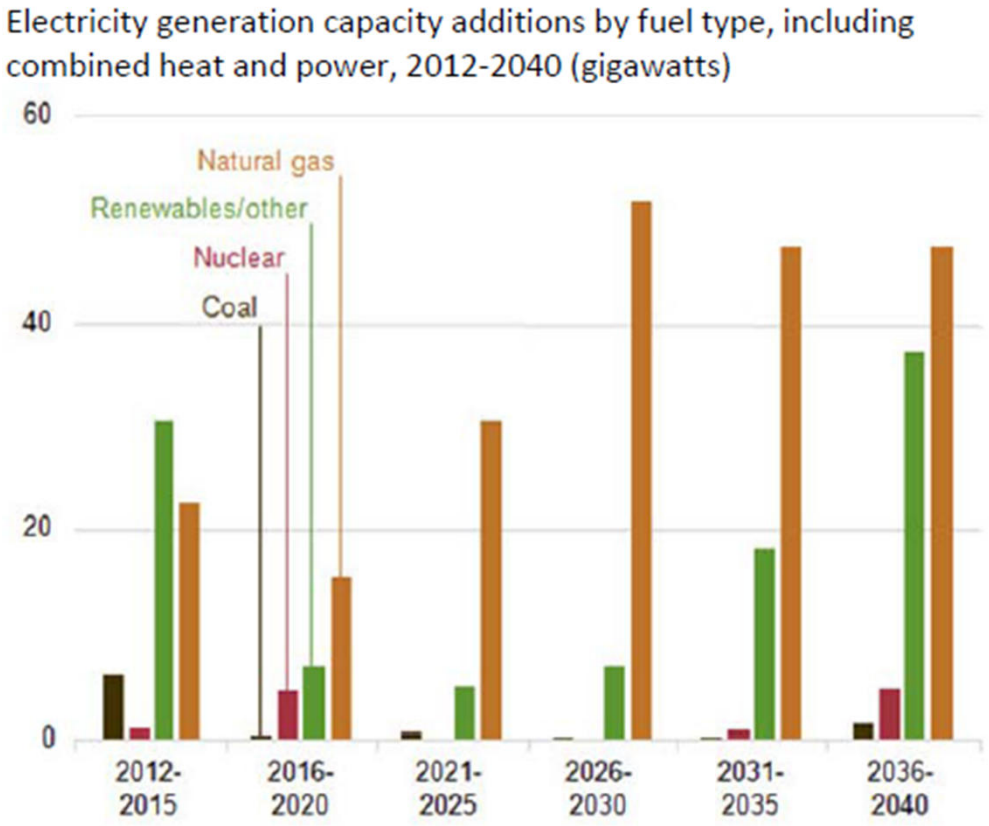
- A complex & convoluted puzzle
  - If price remains low, below $5/MMBTU
    - Dash for gas continues
    - Less incentive to drill => diminishing supply => rising prices
  - If price rises/approach $5-6/MMBTU
    - Coal gains edge over natural gas in generation
    - More incentive to drill => increased supply => falling prices
- Adding to complexities?
  - LNG exports: How many terminals, how much exported?
  - EPA restrictions on coal …
  - US economy/energy demand growth …

2nd: EPA, climate change, coal's future

- Obama can use EPA to *regulate* emissions
  - Not as effective as *legislation* passed by Congress
  - Background
    - Congress passed **Clean Air Act** in 1970s
    - US **Supreme Court** reaffirmed EPA's mandate to regulate
    - EPA's proposed rules means virtually no new coal plants
    - Pending regulations could result in "significant" retirements
  - Fate of US domestic coal hangs in balance …or does it?
    - Cheap natural gas is killing coal, not the EPA
    - Europe & Asia are happy to buy all

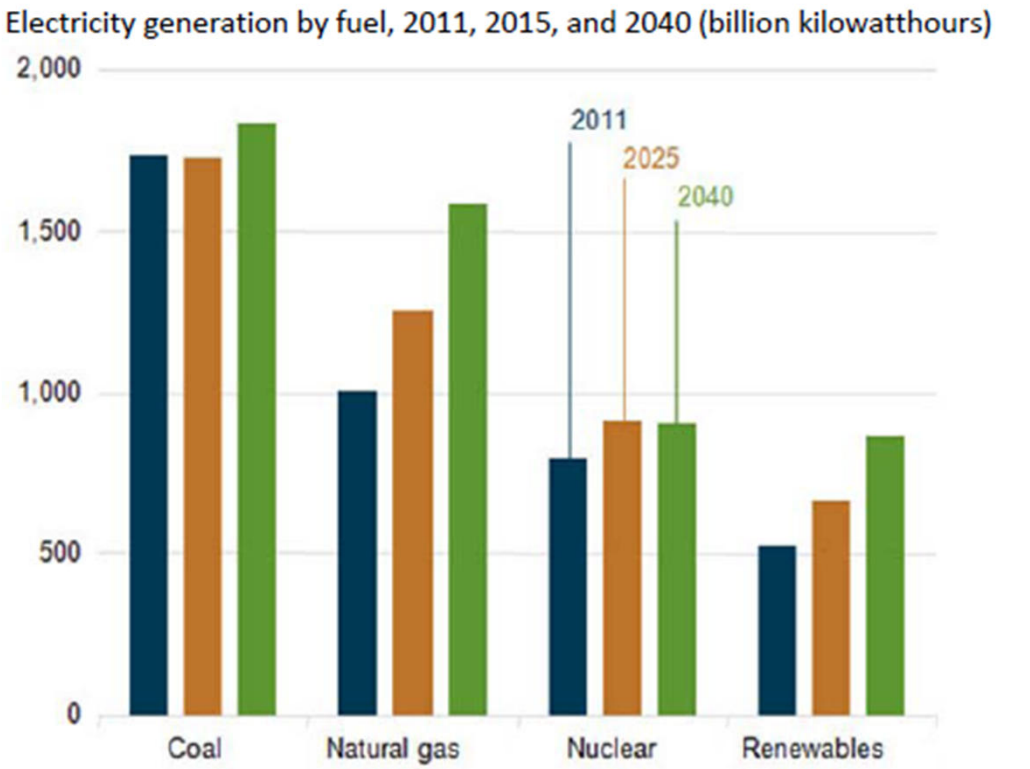
Virtually no new coal or nukes

Except for what is already in the pipeline



Renewables match nukes

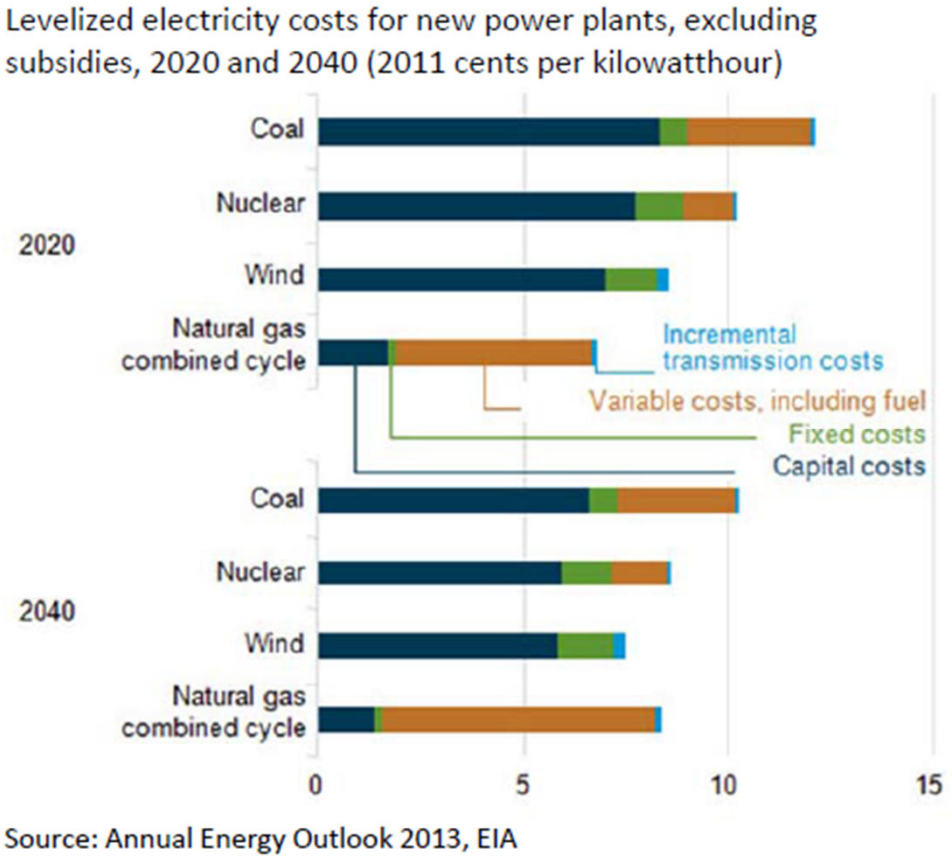
Under BAU, renewables nearly match nukes by 2040



Source: Annual Energy Outlook 2013, EIA, released in installments 15 April-2 May 2013

By 2040 wind beats all

Coal & nukes not economic



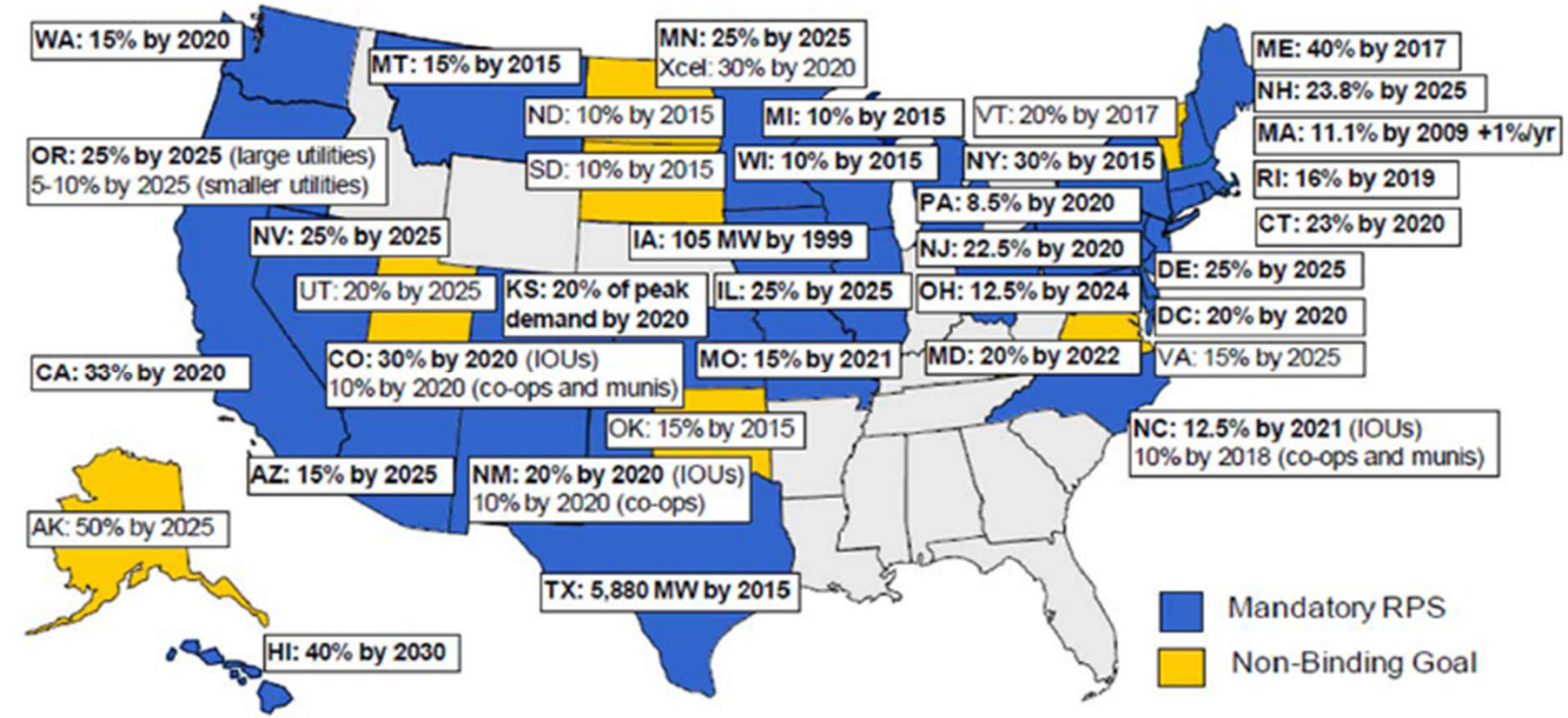
Source: Annual Energy Outlook 2013, EIA

3rd: Renewable energy

The next game changer?

- Currently no national target
  - Federal Production Tax Credit (PTC) extended
  - 30+ states have Renewable Portfolio Standards (RPS)
    - Cheap gas or not, RPS is driving demand

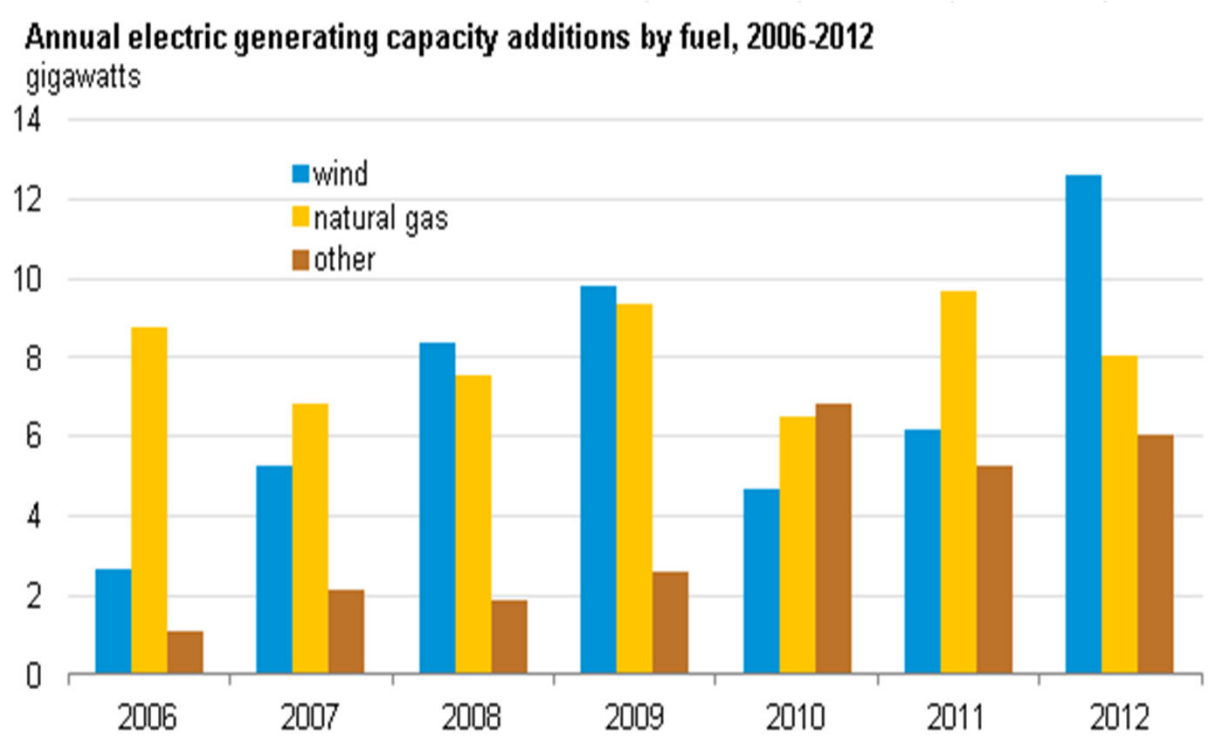
Renewable Portfolio Standards



Source: 2011 Wind Technologies Market Report, DOE

Rise of renewables

New US capacity additions, 2006-12, in GW

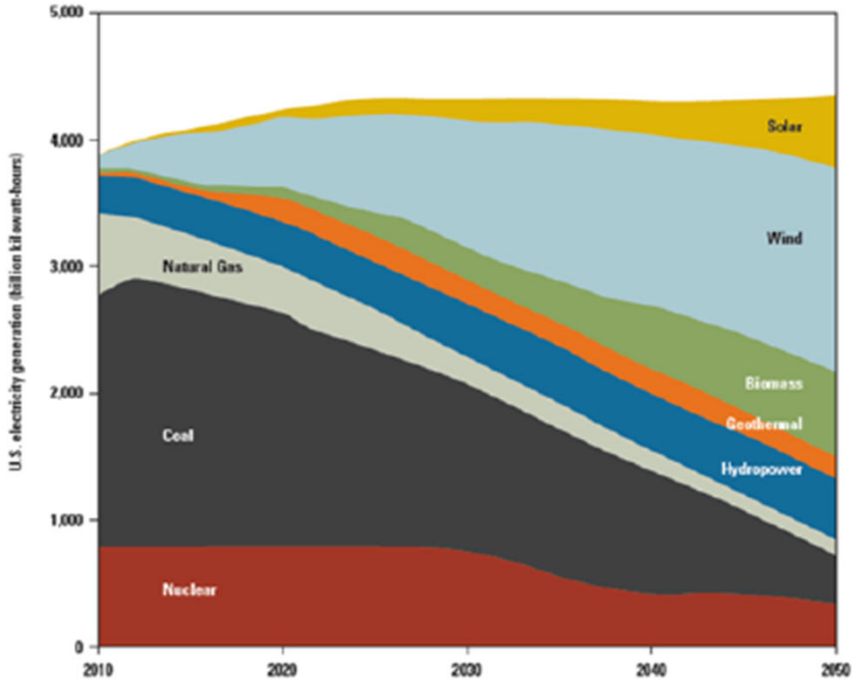


Source: Energy Information Administration, Annual Electric Generator Report, Form EIA-860

80% renewable by 2050

NREL & others agree: It is technically feasible

Renewable energy could provide 80 percent of U.S. electricity by 2050

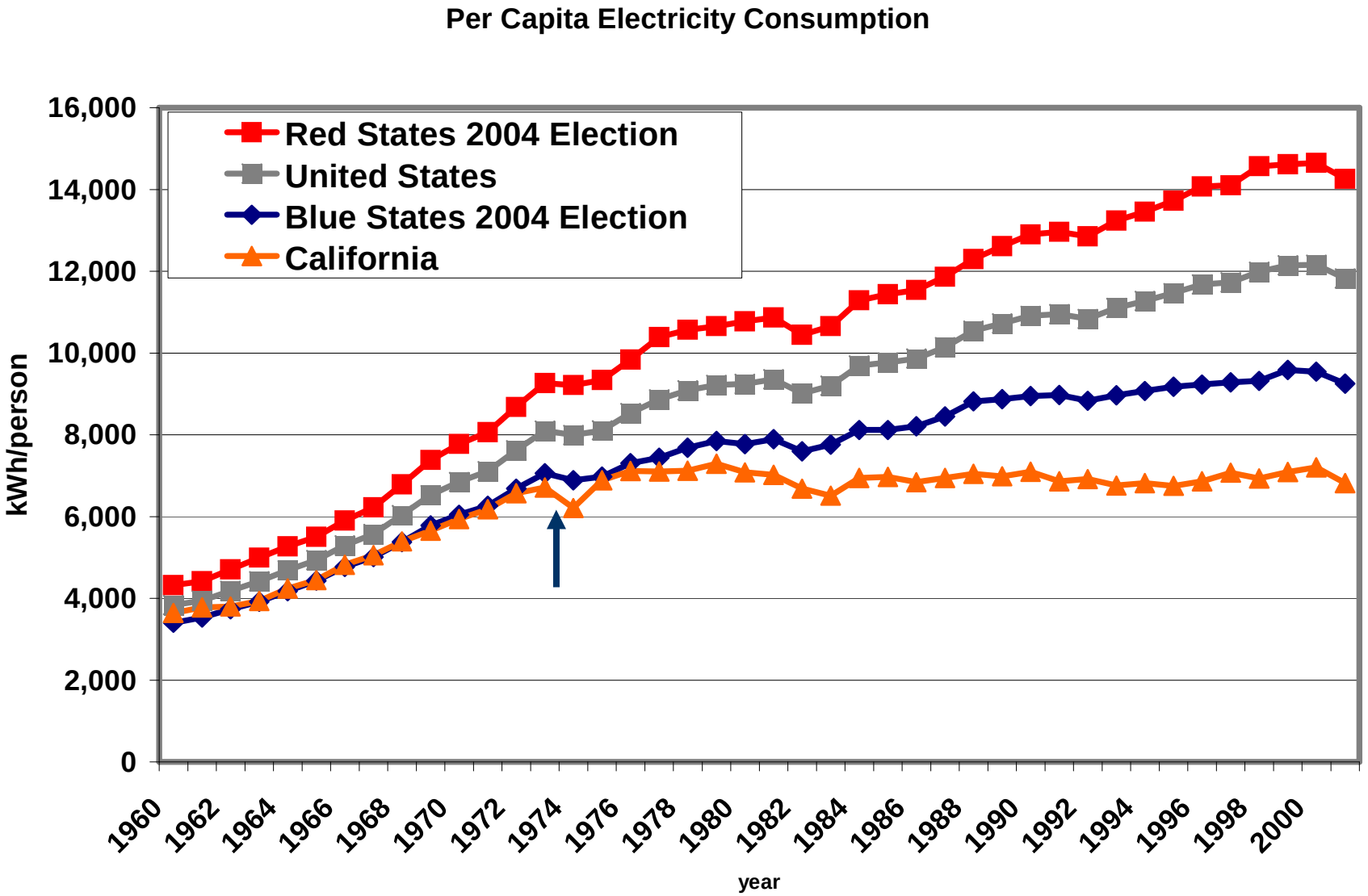


Source: Ramping up renewables, Union of Concerned Scientists, 2013

4th: Energy efficiency

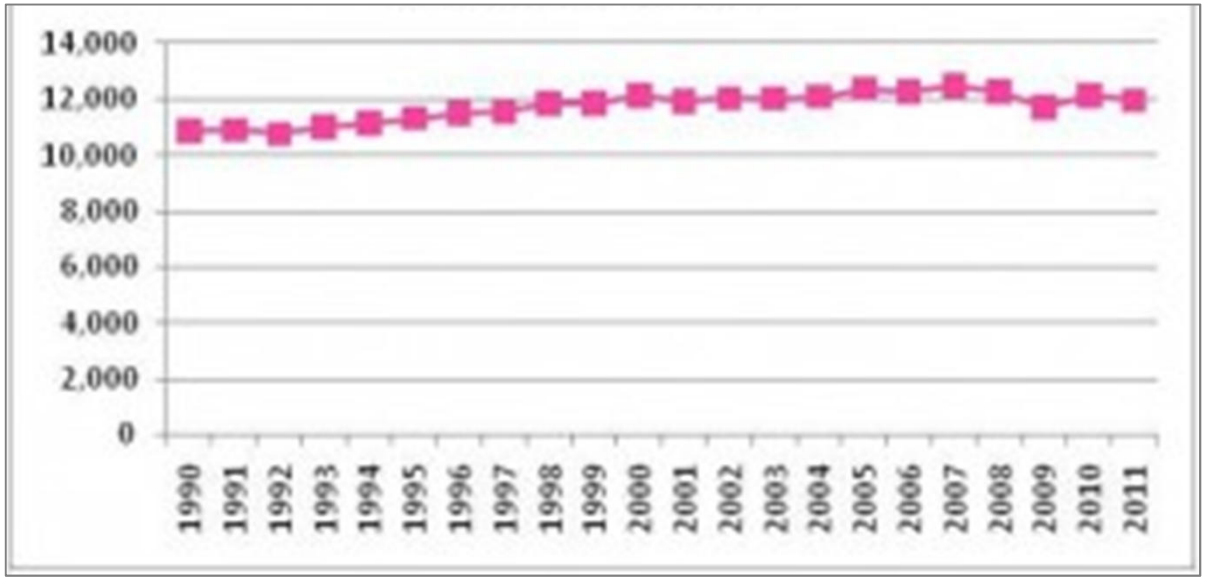
- Obama set a target at SOU in Feb 2013
- Cut energy waste in half by 2020
  - Makes a lot of sense
  - Is feasible
  - Is cost effective
  - Is the right thing to do …or is it?
    - Today in America, everything is viewed along party lines

Blue & red states



US Per Capita Elect. Consumption

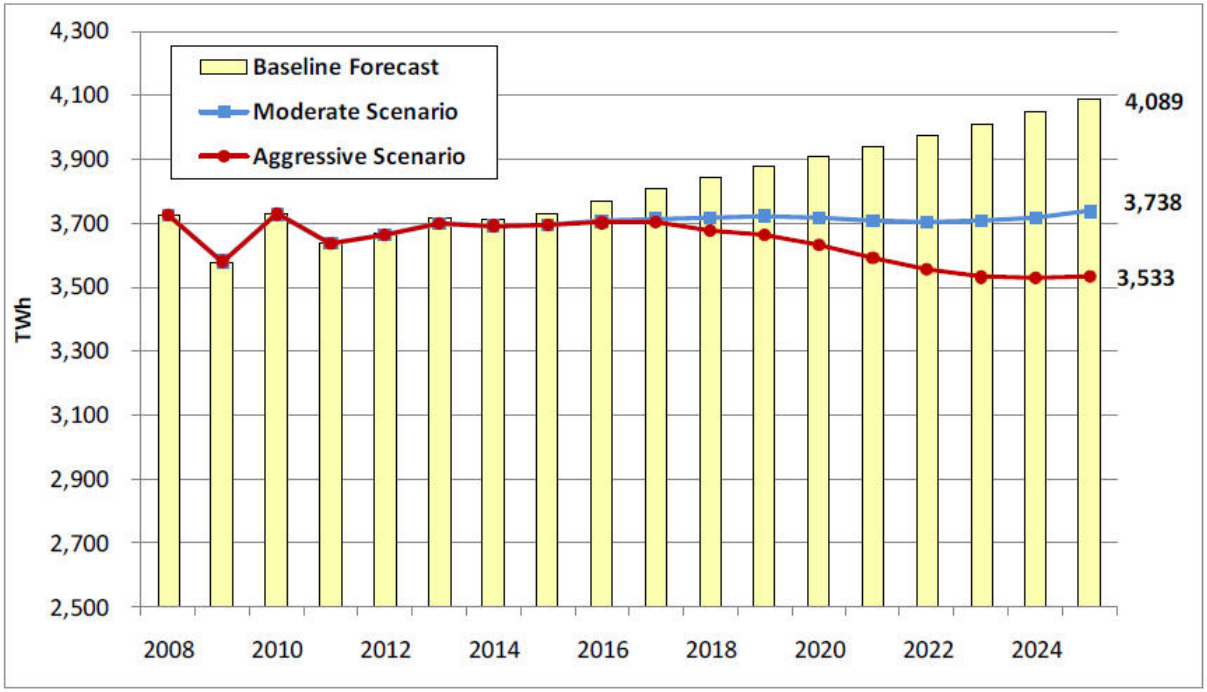
1990-2011, kWh/pp



Source: Smart Grid Watch, *How fast is U.S. electricity consumption growing?* April 6 2012

End of demand growth?

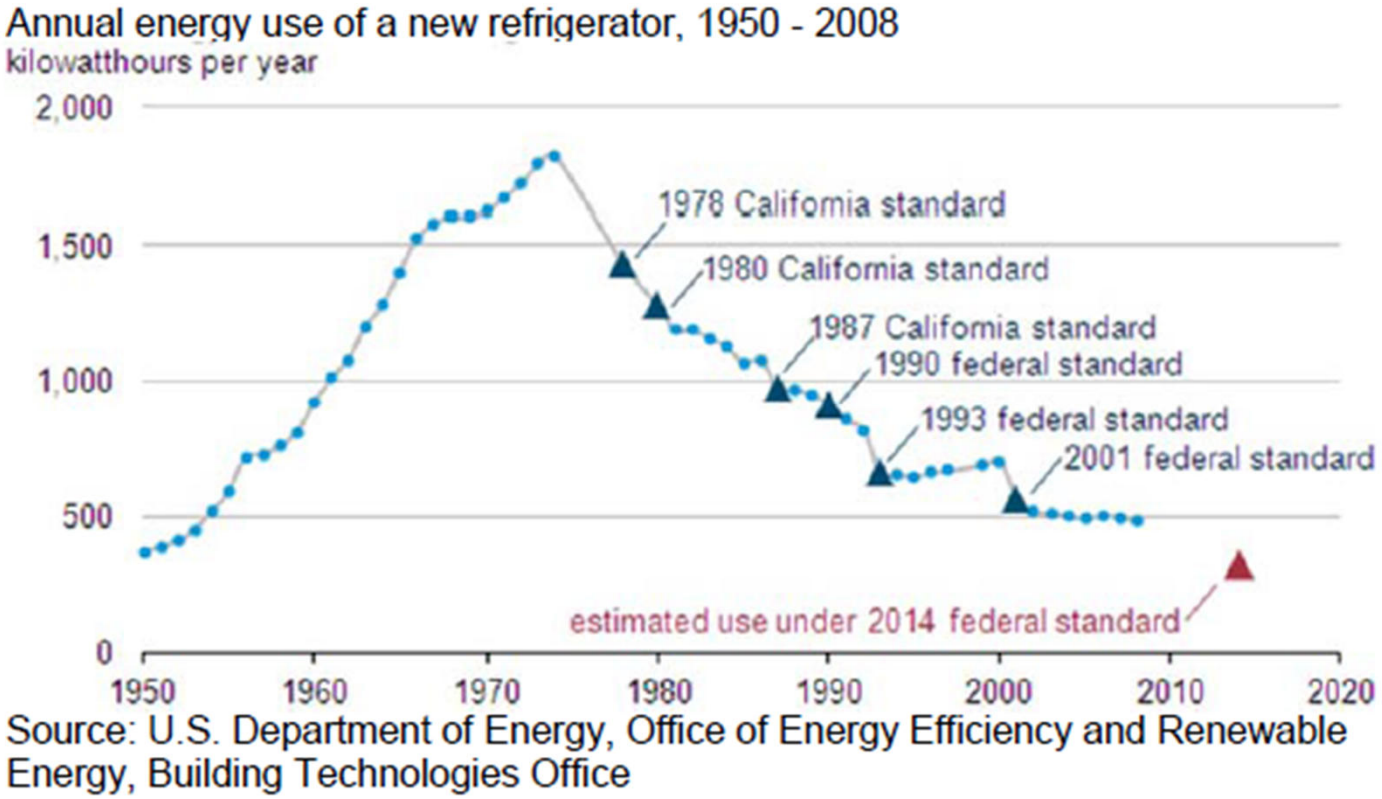
Energy efficiency "feasible & cost-effective"



Source: IEE white paper, May 2011

Getting more out of each kWhr

Avg. US refrigerator is 3 times larger yet uses less electricity



Source: U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office

Energy Efficiency:

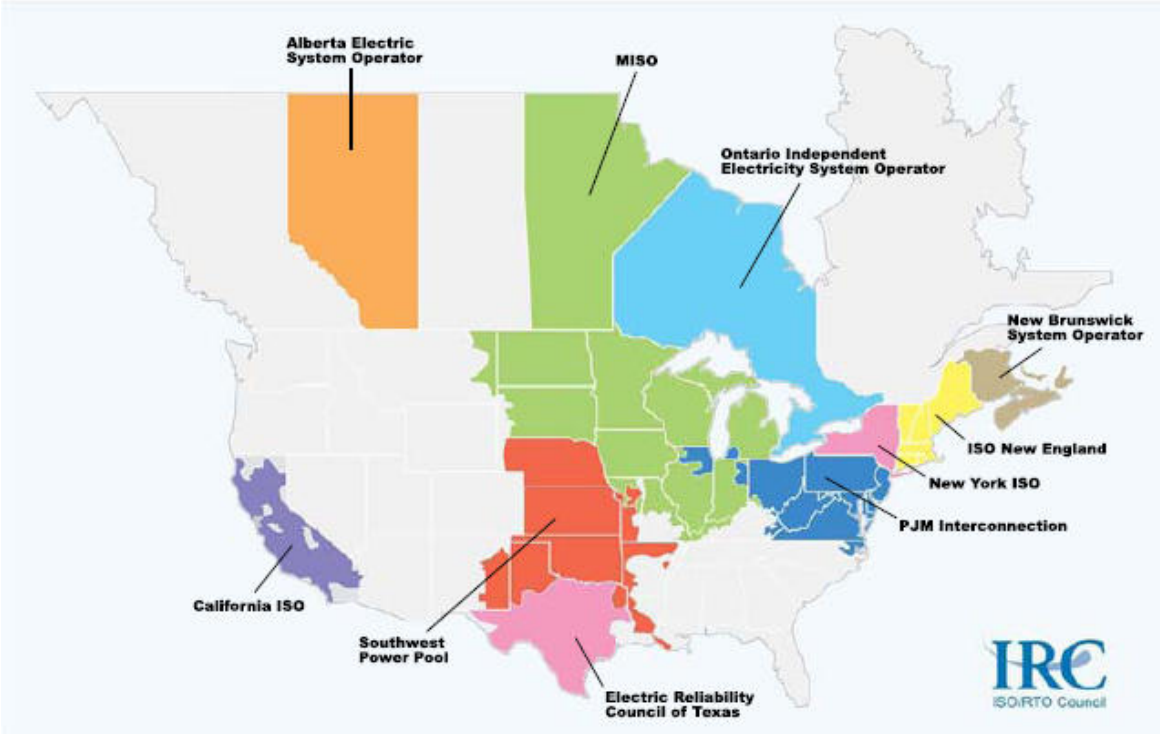
Towards the end of demand growth

5th: Nuclear energy

- US has not built new reactors in 30 years
  - Only a handful under construction
  - Only in states with no competitive markets
  - With generous federal loan guarantees
  - Plus state regulatory support
  - … and it is still an uphill battle
  - Add ownership/investment obstacles
    - NRC has rejected some proposals as not sufficiently American
  - Future of nukes may be small as in SMR

Not in competitive markets

Handful of new nuclear plants are in "protected" regions



Source: The Future of the Electric Grid, MIT, Dec 2011

Why California?

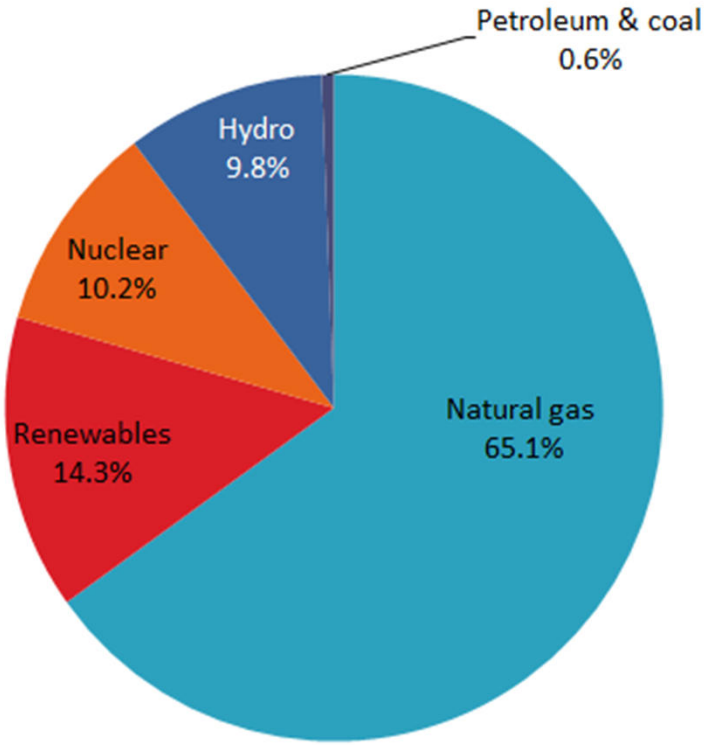
- 8th largest global economy
- Most populous state
- Leading indicator?
  - CA EPA predates federal EPA
  - CA first to introduce appliance energy efficiency standards
  - CA has most stringent building codes

What's happening in California?

- Climate
  - 2006 **Climate Bill** the only one of its kind in US
  - Reduce statewide GHG emissions to 1990 levels by 2020
- Renewables
  - 33% RPS by 2020; among the most ambitious in US
- Distributed generation & net energy metering (NEM)
  - 12 GW of DG by 2025
- Zero net energy (ZNE)
  - 2020 for new residential buildings; 2030 for commercial
- Energy efficiency
  - Leading state in manage energy consumption

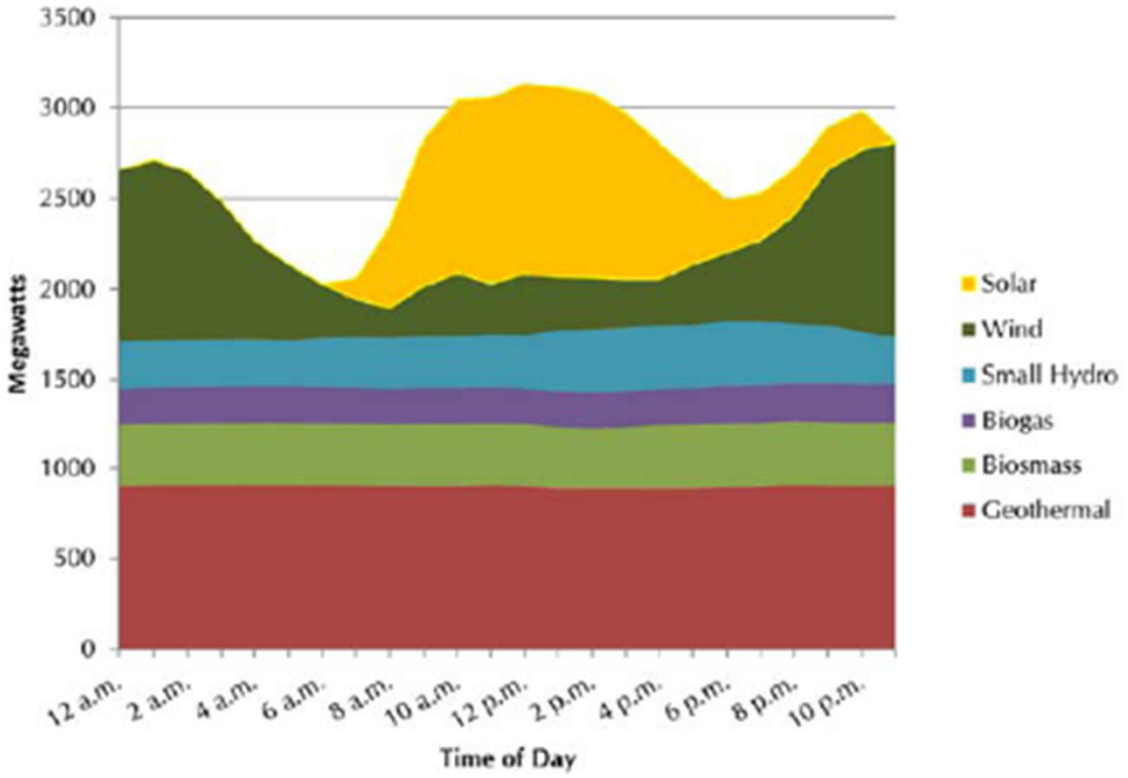
California dreaming?

Typical generation mix, low load month: Nov 2012



Source: The Wall Street Journal, 26 Feb 2013
based on data from EIA

New paradigm: Variable generation



Source: Rewiring California: Integrating agendas for energy reform, Little Hoover Commission, Dec 2012

Distributed generation

California Gov. envisions 12 GW of DG by 2025

Residential Retrofit

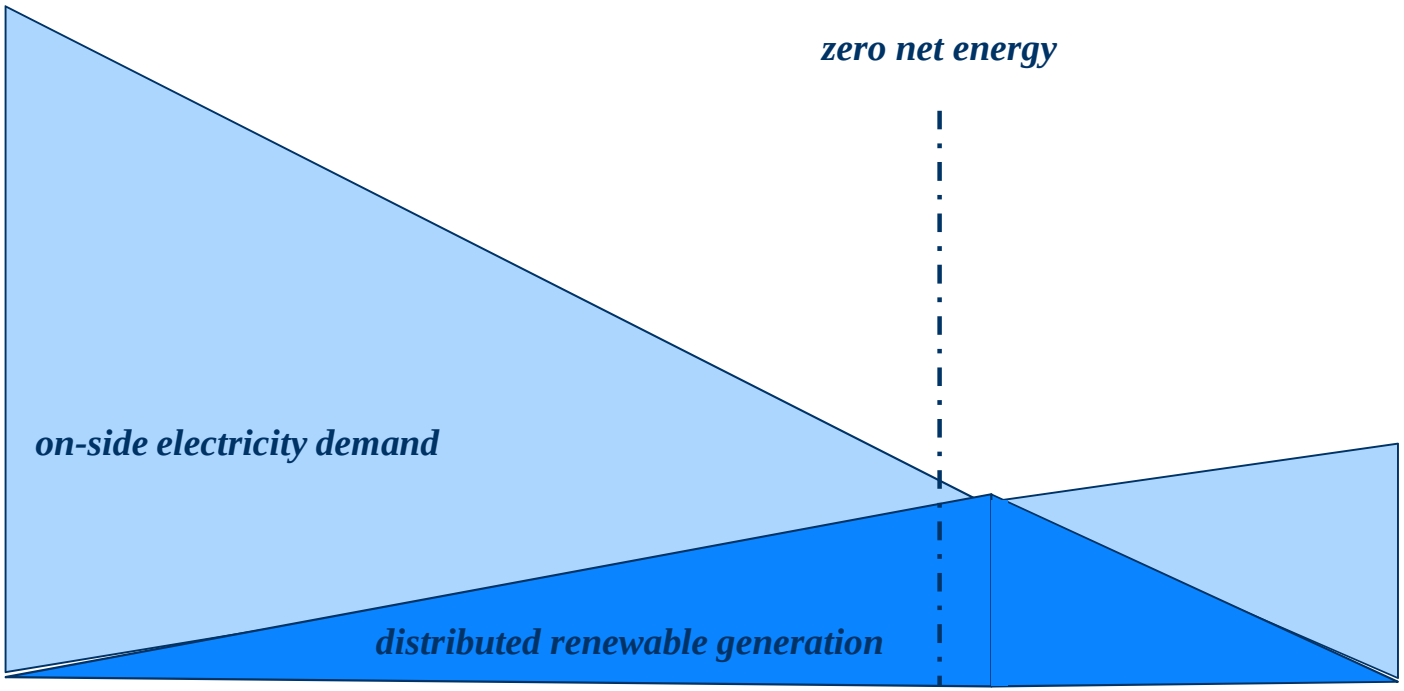
New Production Homes

Commercial & Public

Power Plants

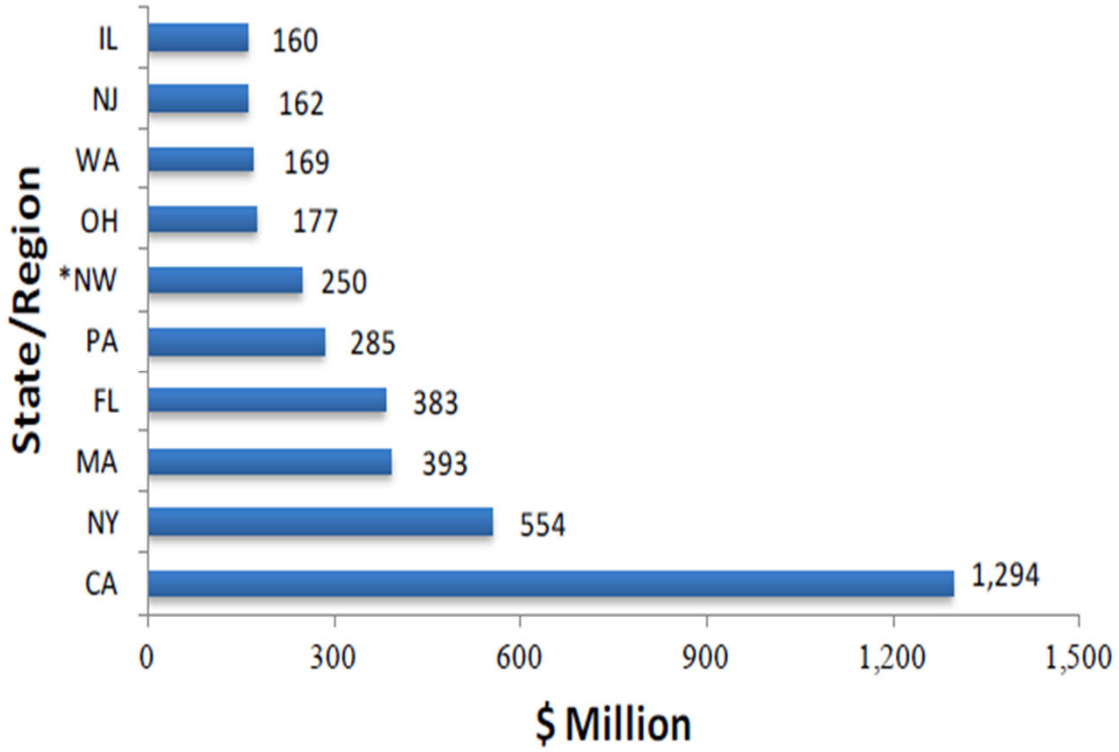
Zero Net Energy

Consuming less, while generating more



Top 10 in energy efficiency

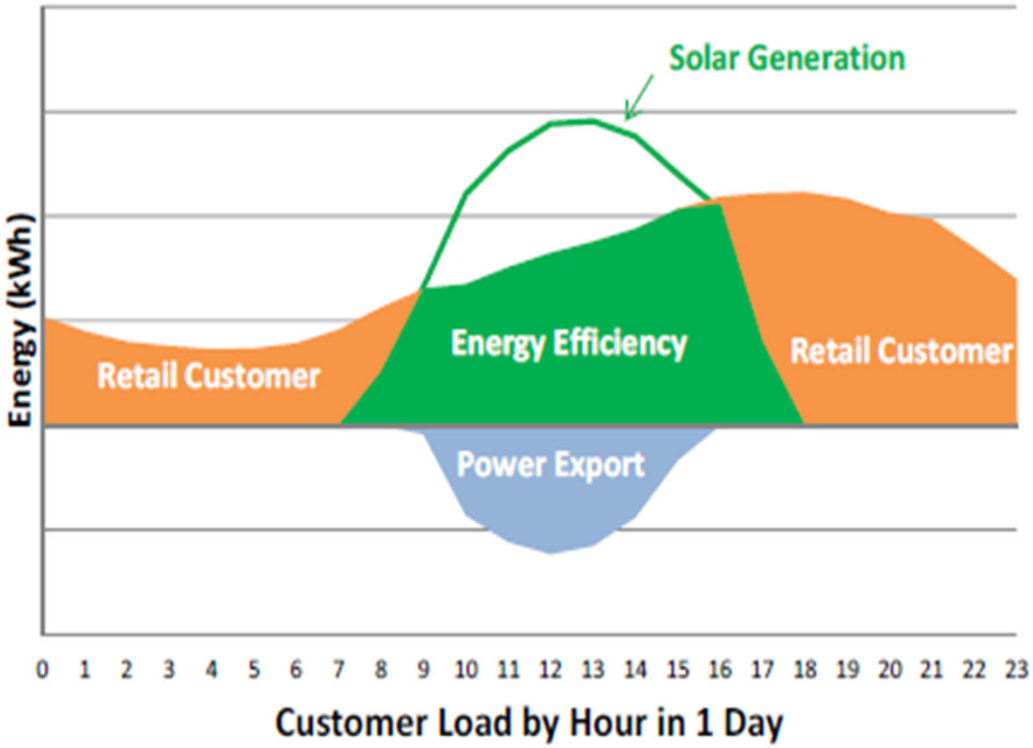
2011 EE expenditures, in $M



Source: Summary of Utility Customer-Funded Electric Efficiency Savings, Expenditures, and Budgets (2011-2012), IEE, Mar 2013

Spinning the meter backwards

Consumer with solar PV systems become “prosumers”



Source: Evaluating the benefits and costs of NEM laws in California, prepared for Vote Solar, Jan 2013

Prognosis for California

Opinions vary

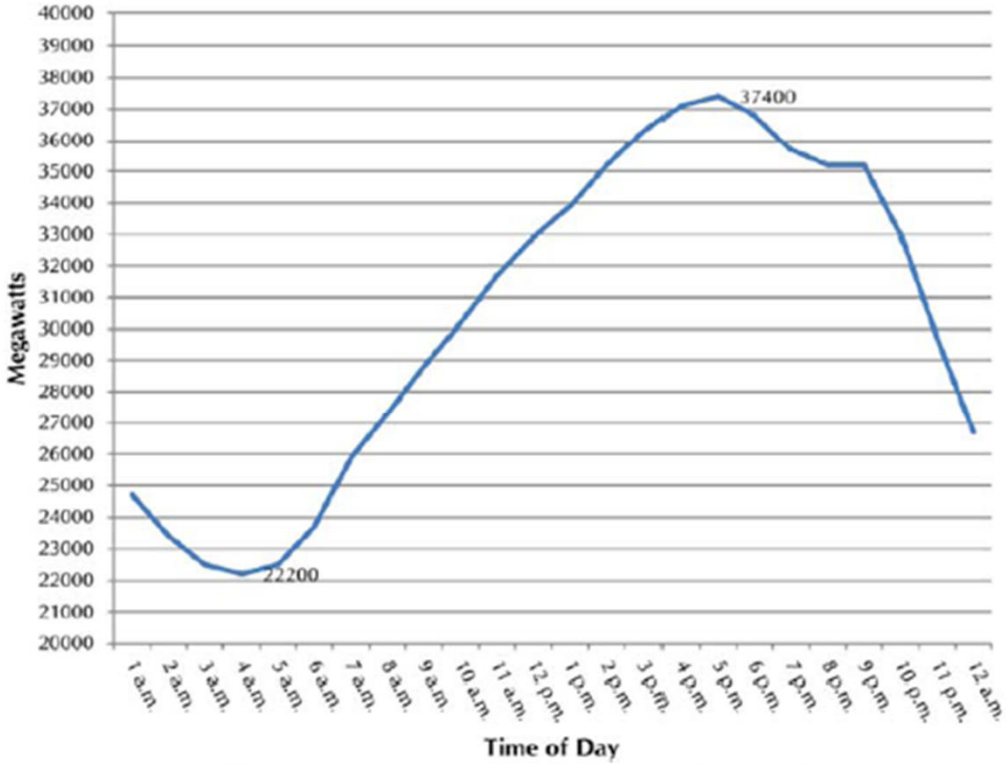
- Some see CA as a role model
  - Cleaner, greener, efficient, sustainable
- Others see it as disaster waiting to happen
  - Rising rates/costs, little or no discernible benefits
- Truth?

Questions?

- Slides available by request

Old paradigm

Typical CA demand pattern



Source: Rewiring California: Integrating agendas for energy reform, Little Hoover Commission, Dec 2012

SCE 5-tier increasing block tariff

Promotes energy efficiency, penalizes heavy users

Tier	Price cents/kWh[1]	Baseline allowance[2]
Tier 1	11.808	0-100%
Tier 2	13.741	101-130%
Tier 3	23.334	131-200%
Tier 4	26.833	201-300%
Tier 5	30.334	>300%

* Baseline allowance is determined by applicable climate zone; higher allowances apply to high temperature zones, lower for mild coastal zones

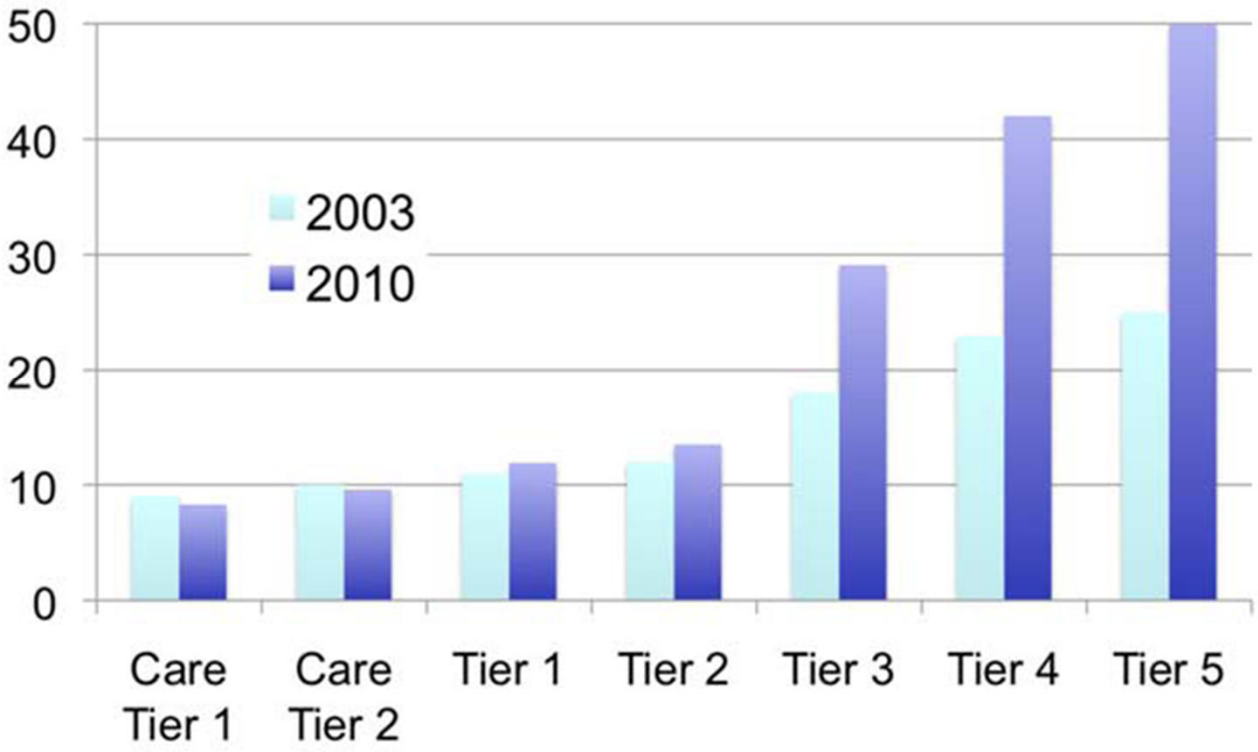
[1] For low-income customers, applicable prices for the first three tiers are 8.533, 10.668 & 18.051 cent/kWh respectively with tier 3 rate applied to all usage above 130% of baseline allowance.

[2] Link to SCE's Baseline Allocation table:
http://www.sce.com/CustomerService/billing/tiered-rates/baseline-chart-map.htm

Source: Southern California Edison Company

Top tiers: High and getting higher

5-tiered residential tariffs for PG&E*, 2003 and 2010, cents/kWh

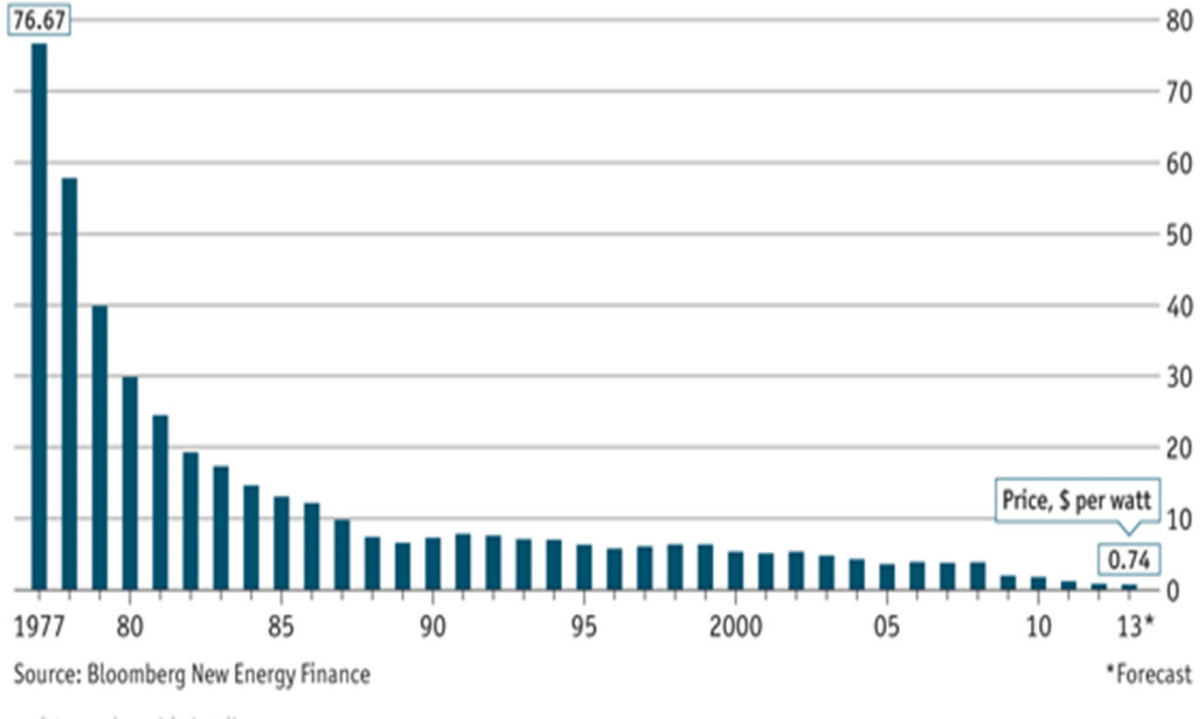


* Care Tier 1 & 2 are discounted tariffs for low-income consumers

Source: CPUC, PG&E

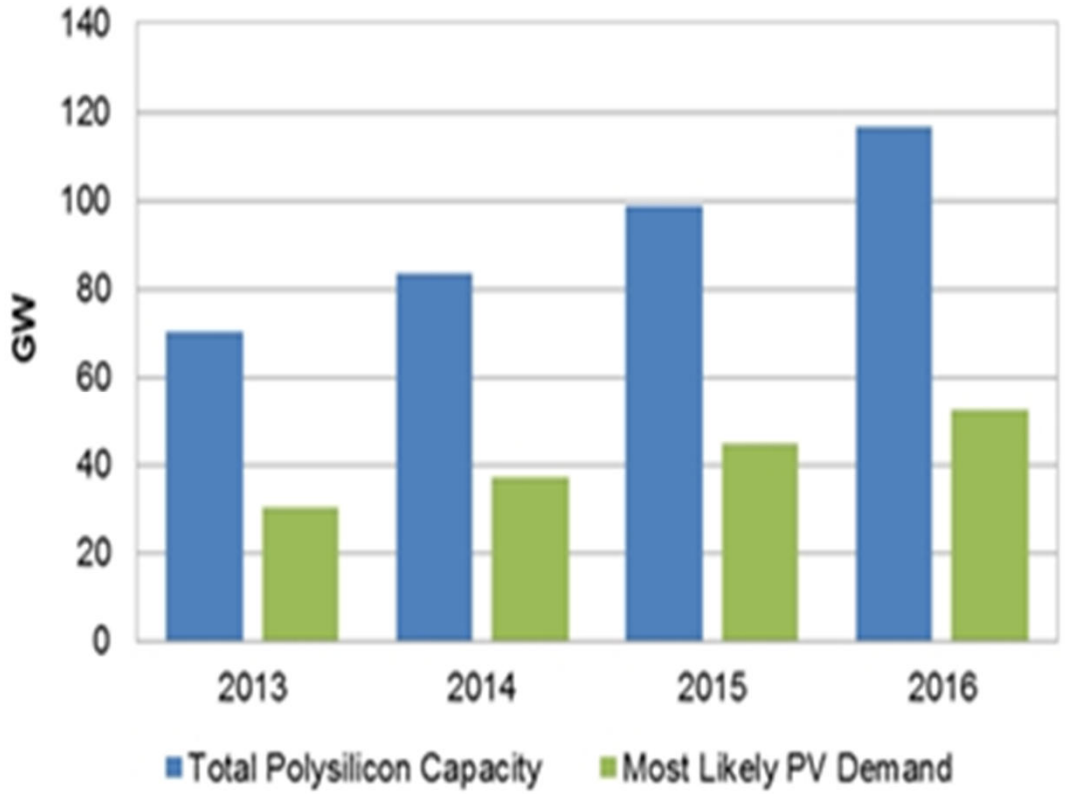
Solar PV prices keep falling

Price of solar PVs, 1977-2013, in $/W



Which way will PV prices go?

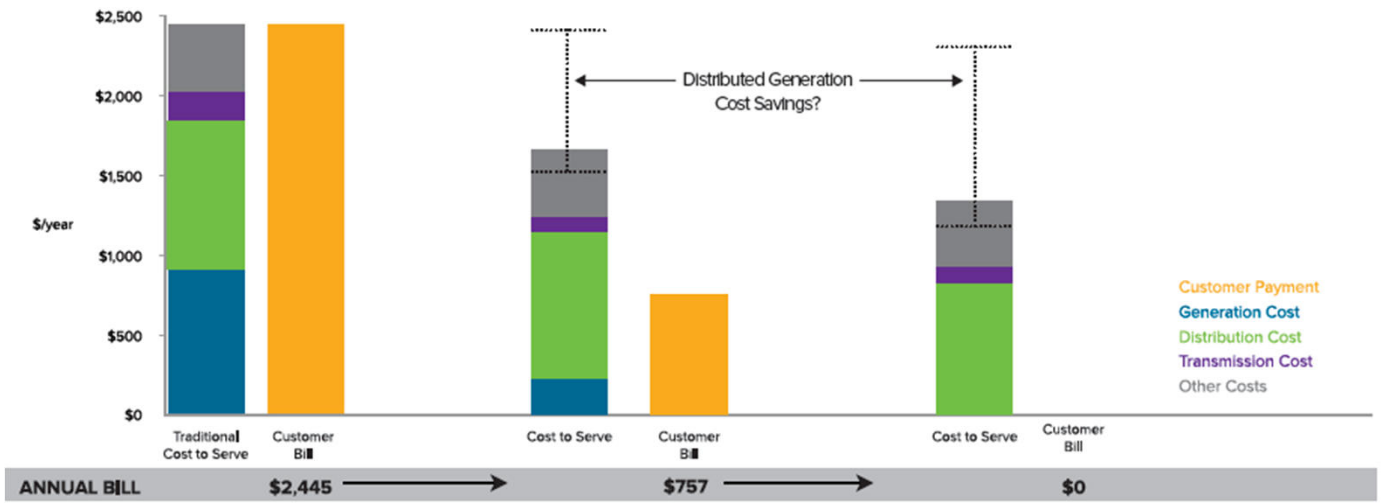
Annual global PV manufacturing cap. (blue) & demand (green), GW



Source: NPD Solarbuzz Marketbuzz 2013 Report

Vanishing bill

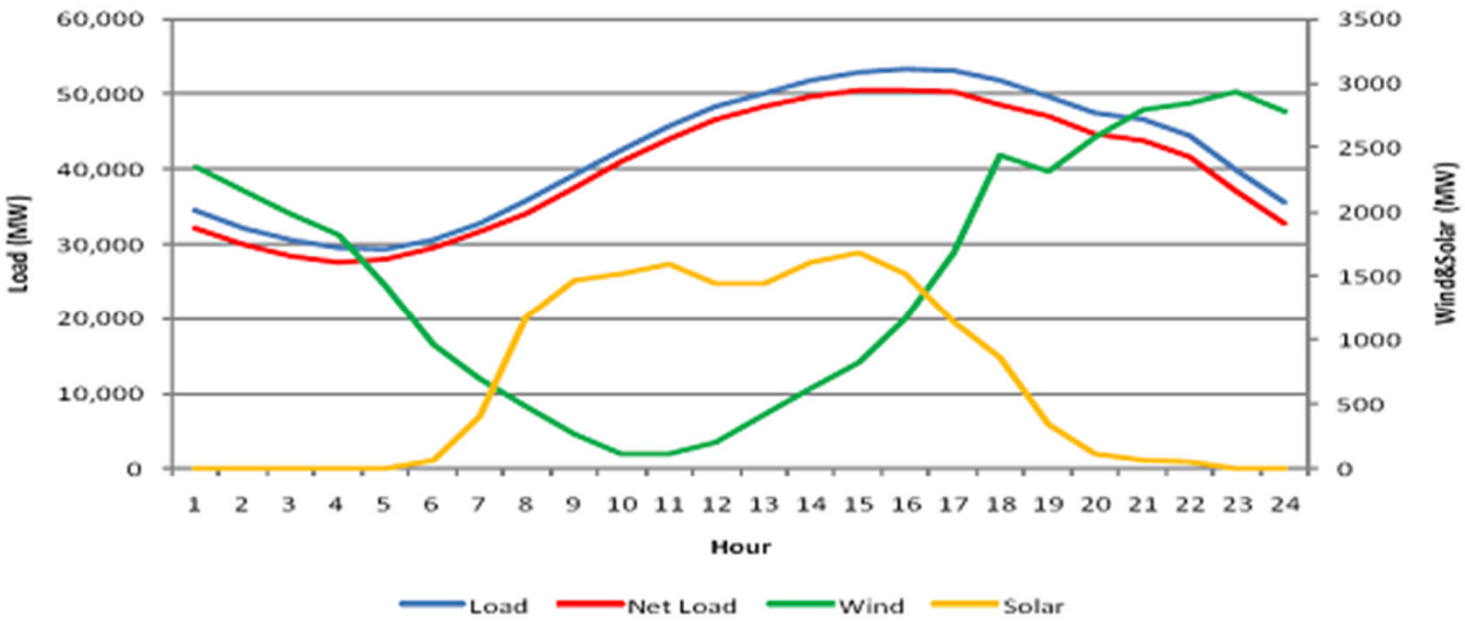
For ZNE/DG customers consumption drops but costs remain



Source: Net energy metering, RMI, Mar 2012

Balancing in real time

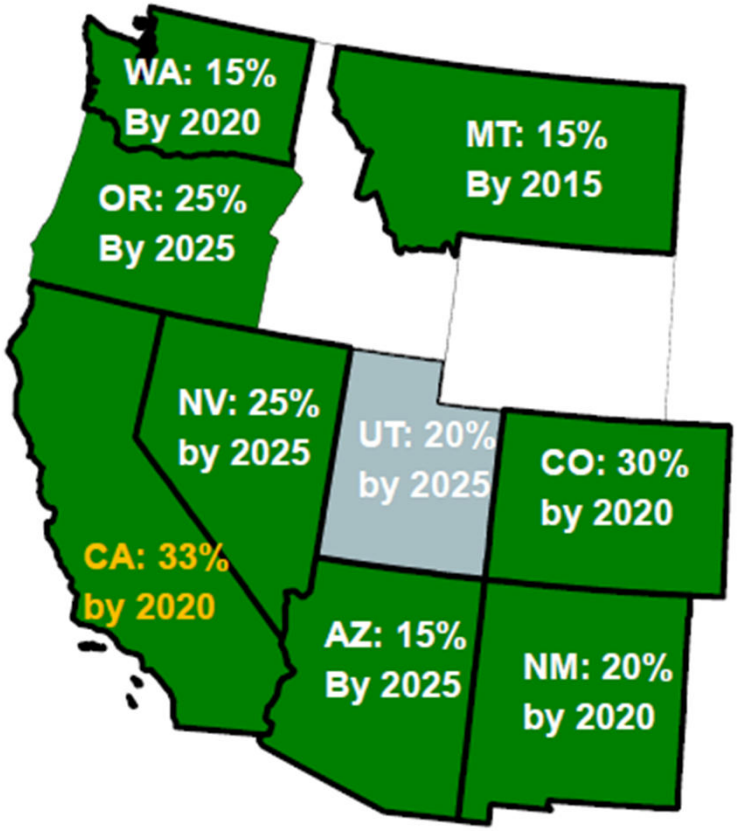
Based on simulated CA data for 25 July 2012, MW



Source:

California leads

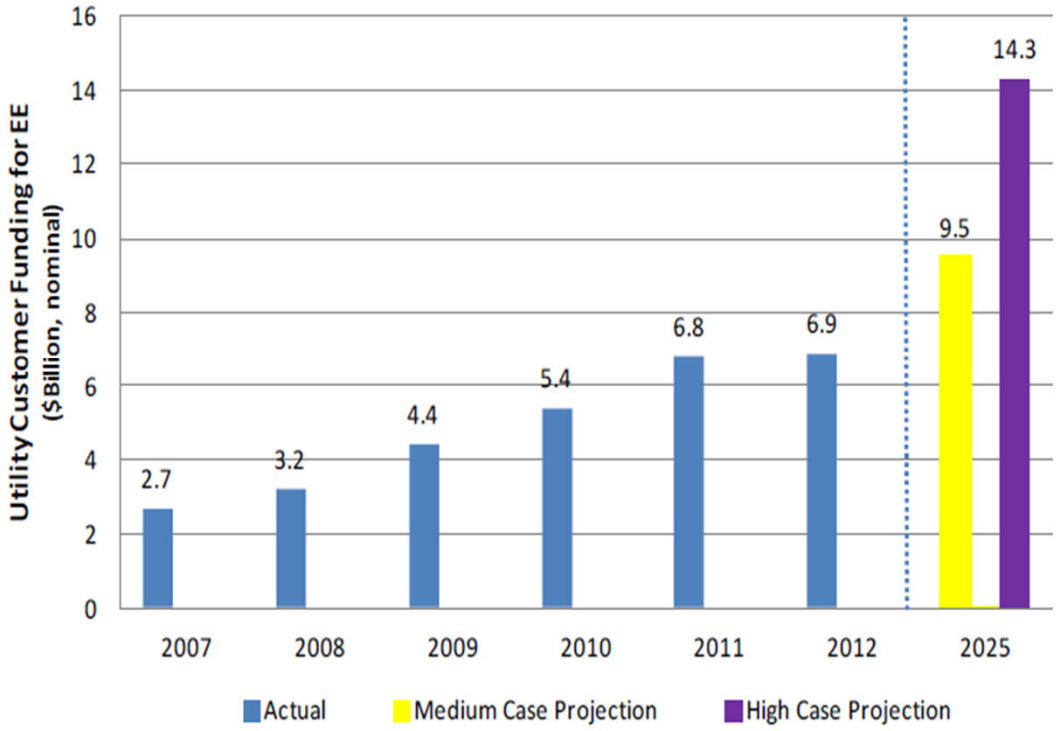
Most ambitious/earliest target, biggest market



Source: Black & Veatch

Rising EE budgets

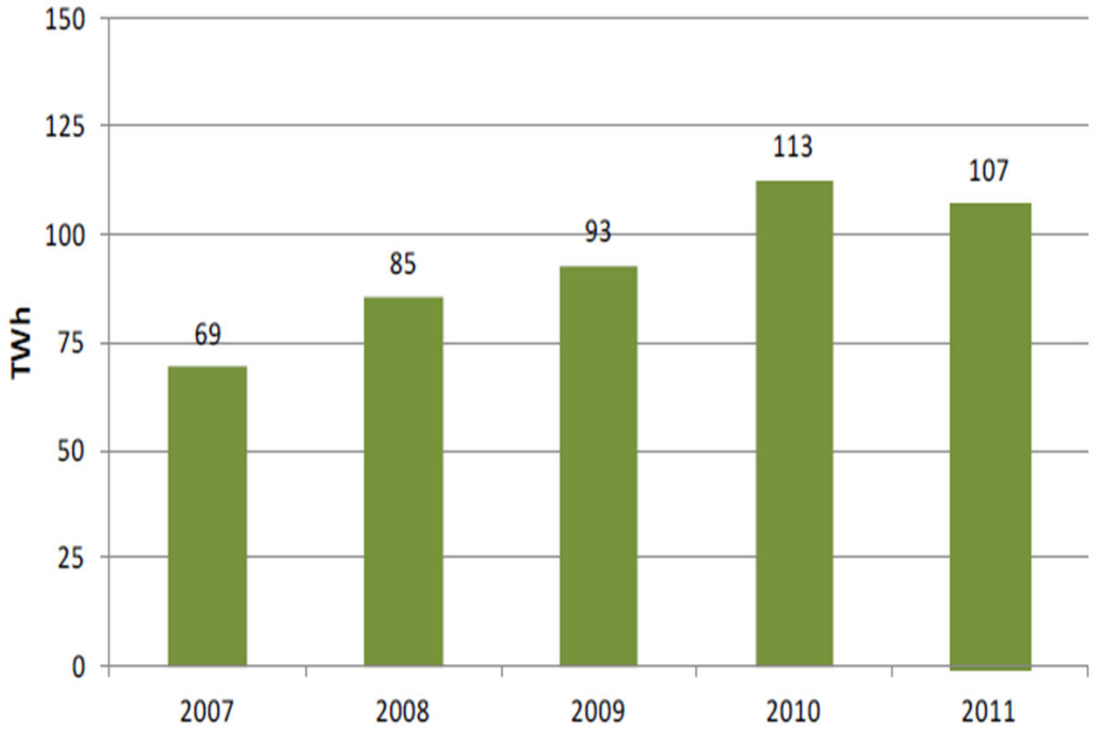
US annual customer-funded EE budget, in nominal $B



Source: Summary of Utility Customer-Funded Electric Efficiency Savings, Expenditures, and Budgets (2011-2012), IEE, Mar 2013

Negawatts: Cheap & plentiful

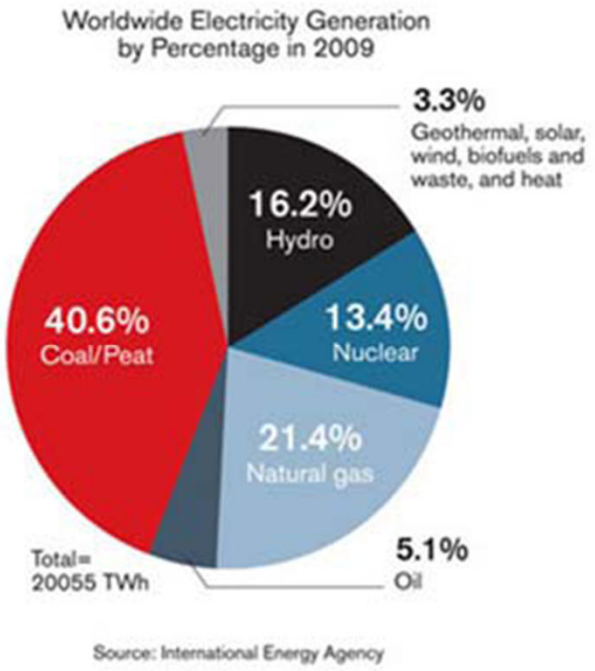
US customer-funded electricity savings, 2007-11, in TWhrs

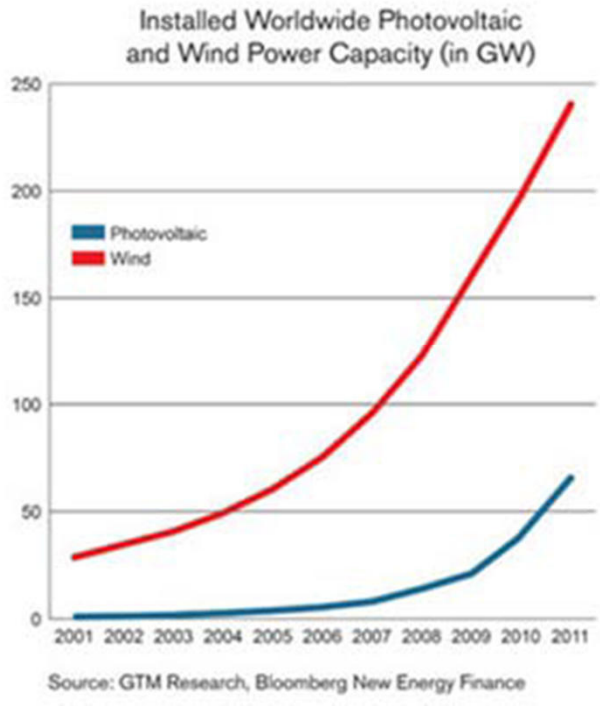


Source: Summary of Utility Customer-Funded Electric Efficiency Savings, Expenditures, and Budgets (2011-2012), IEE, Mar 2013

Renewables moving mainstream

Global wind & PV capacity exceeds 273 & 100 GW in 2012

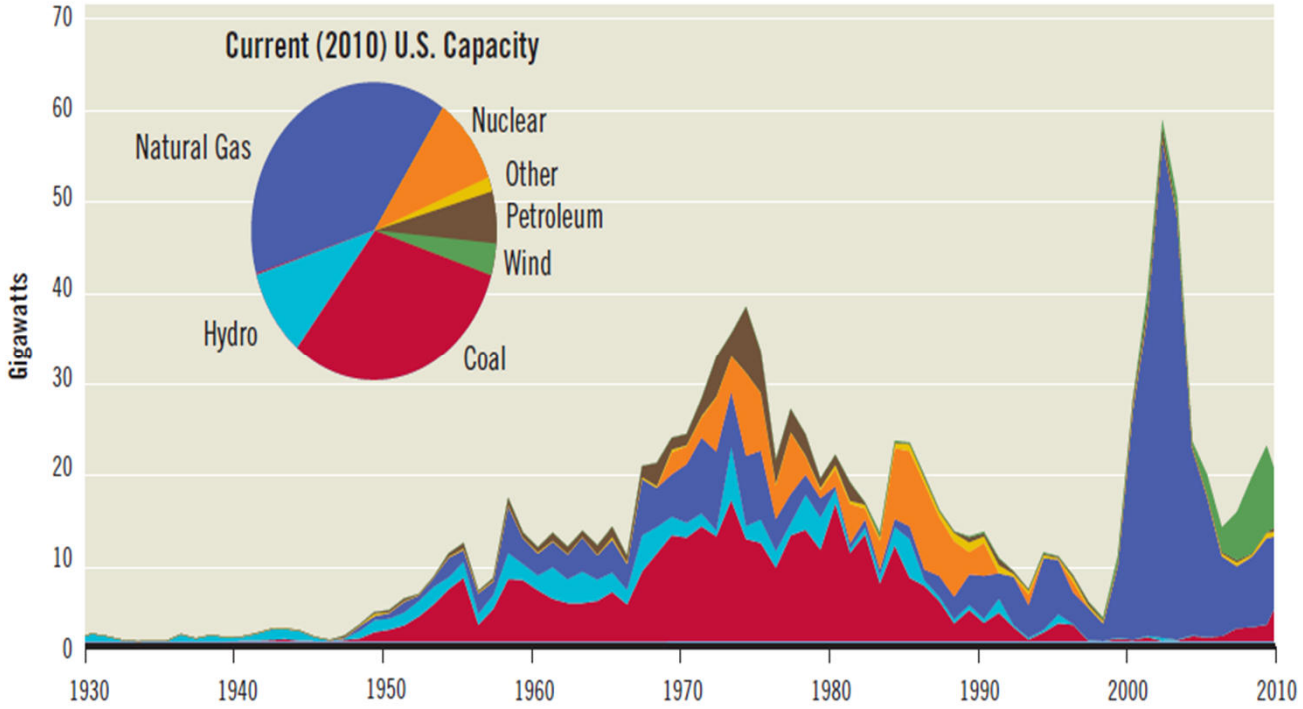




Source: IEA (left); GTM Research & Bloomberg New Energy Finance (right), reproduced from *Technology Review*

Forget coal, forget nukes

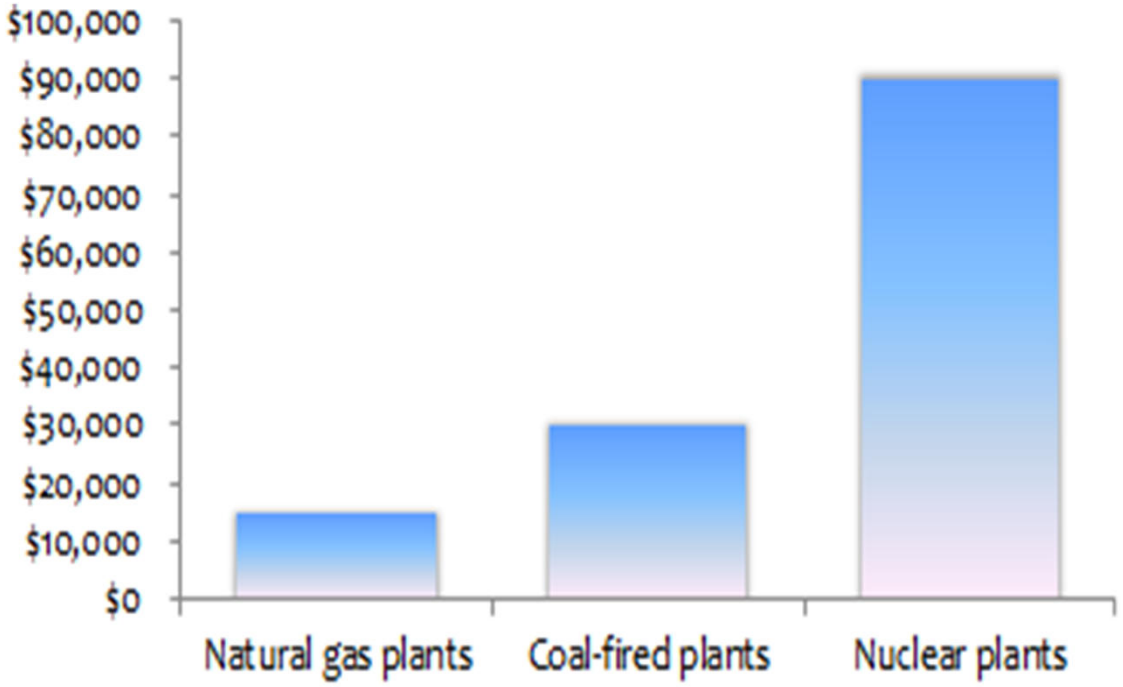
US generation capacity additions by in-service date



Source: Practicing risk-aware electricity regulation: What every state regulator needs to know, Ceres, April 2012

Nothing beats cheap gas

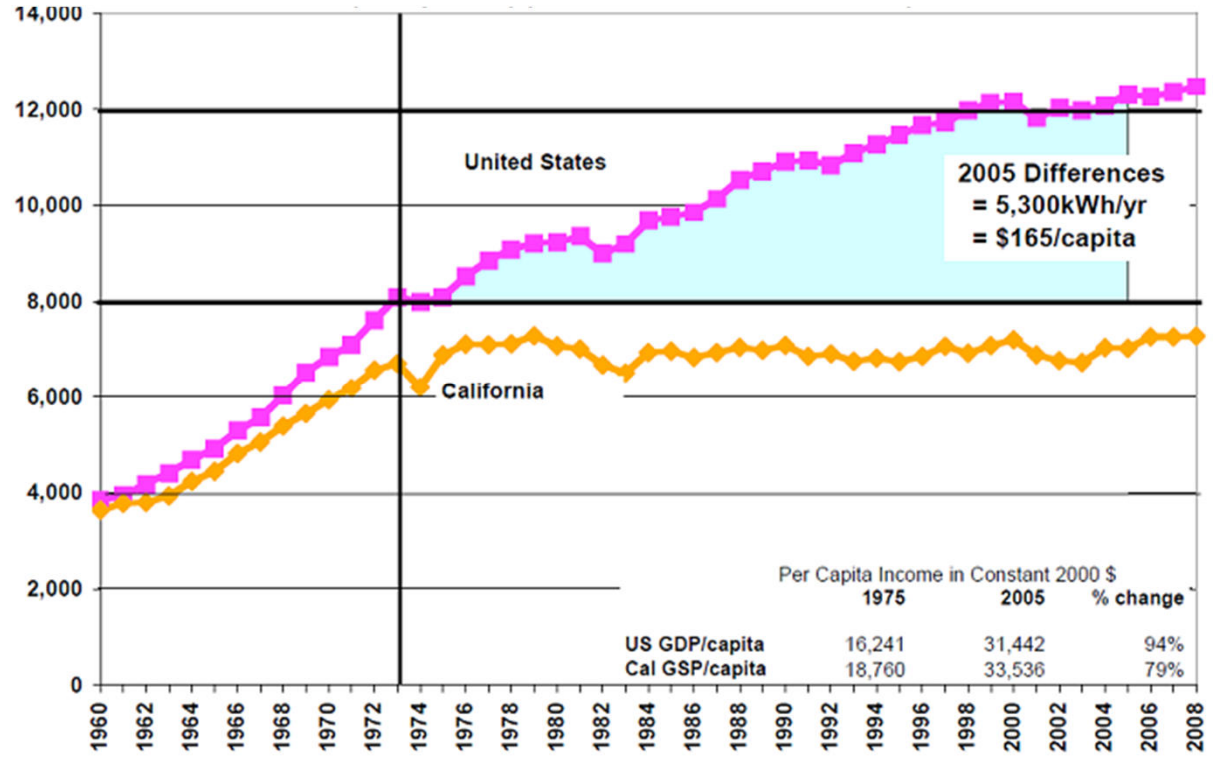
Fixed costs of operating plants in US, $/MWhr



Source: The Wall Street Journal, 30 Jan 2013 based on US estimates

California keeps it flat

Per capita electricity consumption



Source: A. Faruqui, Brattle Group, Aug 2010

Canadian tar sands/Keystone

- Background
  - Landlocked Alberta wants to export its tar sand oil
  - If not to the South, then to the West
  - Environmentalists are opposed
  - US does NOT need the oil domestically
  - Not clear who will benefit
    - Certainly NOT the environment
  - NOT a game changer
  - My personal bet?
    - Obama unlikely to oppose

In search of export markets

Existing existing Enbridge Albertan Clipper in red
TransCanada's proposed Keystone XL in green

Source: Crude oil: Forecast, markets & pipelines, CAPP, June 2011

Smart Grid

Nov 2011