End of demand growth?

Why such a scenario is not as far-fetched as it sounds

UNSW Seminar

19 June 2012

Sydney, Australia

Perry Sioshansi

Menlo Energy Economics

San Francisco CA

www.menloenergy.com

Thank you

Pleasure to visit UNSW again

Wish to thank Iain for the invitation

Opportunity for debate

My main message

And topic of forthcoming book

- Energy demand growth anemic
  - Can be further adjusted downward within OECD
  - Non-OECD countries will eventually reach same stage
    - More important: Demand growth can be modified/influenced
    - Feasible, cost-effective & desirable to reduce growth
- Focus on electricity
  - No growth scenario not far fetched
- Implications?

Book project

- Forthcoming Jan 2013
- Devoted to “End of Demand Growth”
- Examines EE hurdles
  - Regulatory: Incentive to sell kWhrs
  - Policy: Focus on supply, not demand
  - Pricing: Flat prices that do not include all costs
  - Behavioral: Changing consumers’ mindset
- Case studies

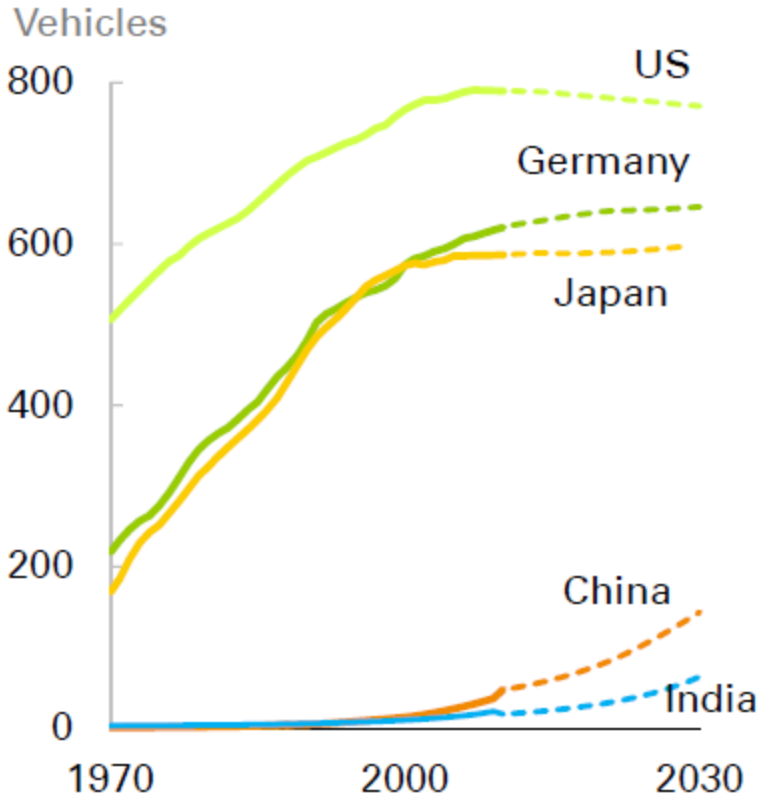
Outline

- Evidence of “demand saturation”
- Influencing demand
  - Markets or mandates?
    - Codes & Standards
    - Regulations & mandates
  - Prices & consumer behavior
- Wrap-up & discussion

1: Demand saturation?

Too many cars, not enough drivers

Vehicle ownership per 1,000 people, 1970-2030



Source: BP Energy Outlook 2030, Jan 2012

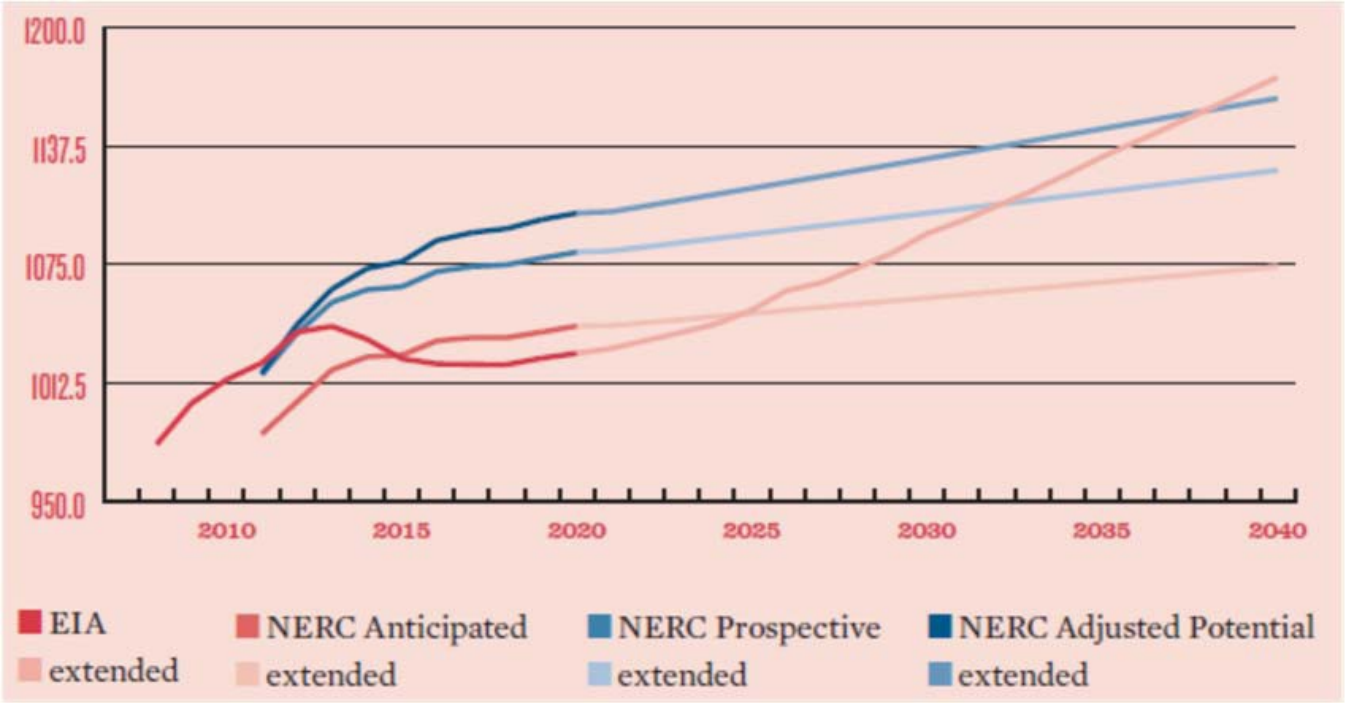
What is the evidence?

”End of demand growth”

- Consider one example
  - US petrol consumption has peaked
    - Will never reach or exceed pre 2008 levels!
    - “Unthinkable” until a few years ago
- Why?
  - US population is aging – true of all OECD
    - Older people do not drive as often or as much
  - Cars are getting more fuel efficient
    - And they can get a lot more efficient still
  - Gasoline prices rising
    - Favors more efficient cars, mass transit, shorter commutes, …

Still growing …

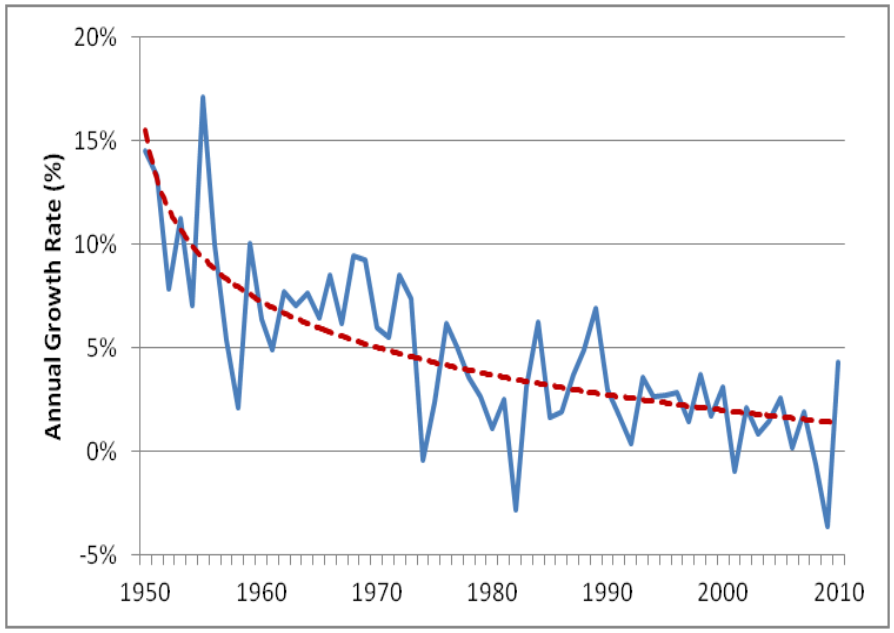
US capacity projections through 2040*, GW



* Extrapolating recent growth trends, as is essentially done here, leaves out improvements in energy efficiency, impact of higher prices, and a host of other variables that would affect projections 3 decades into the future
Source: Failure to act: The economic impact of current investment trends in electricity infrastructure, ASCE, 2012

… but at declining growth rate

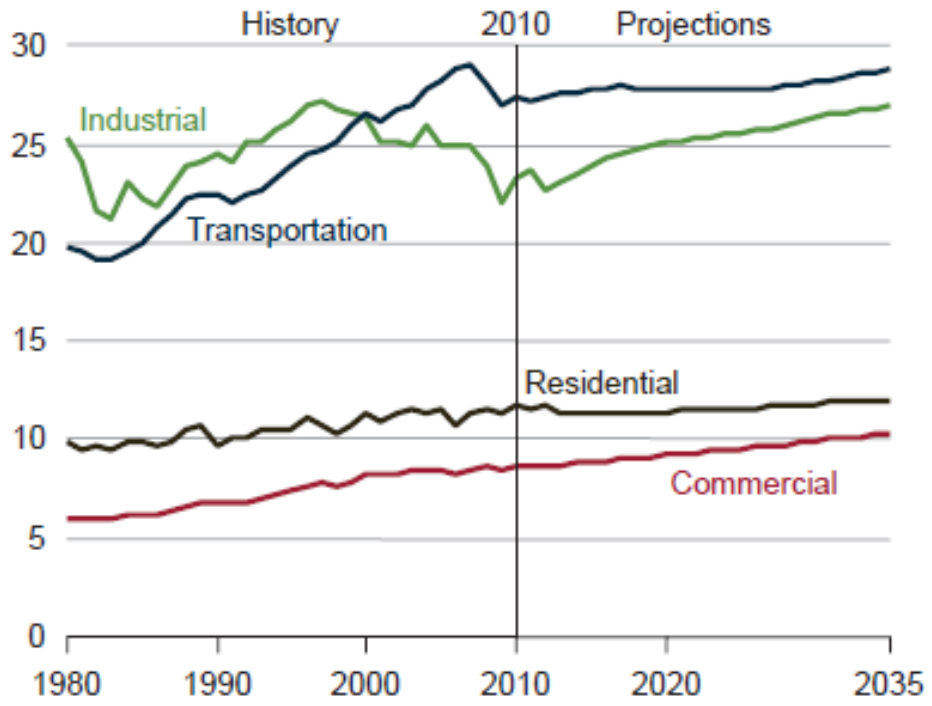
United States 1950-2010



Source: US Energy Information Administration

Flat as Kansas prairie?

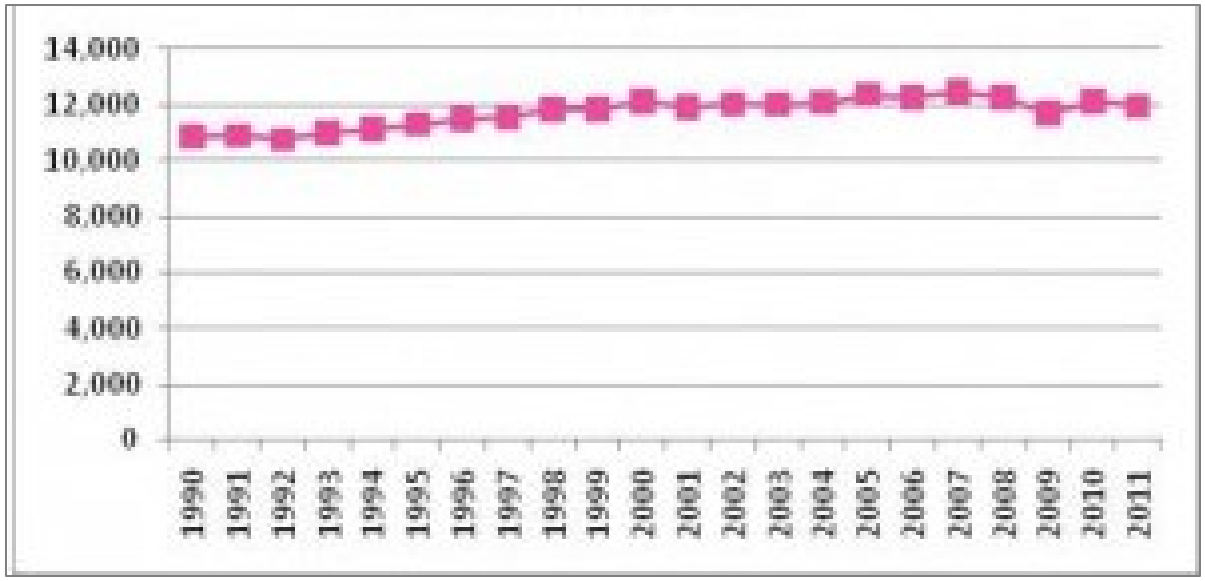
Sectoral energy consumption, Quads/yr



Source: EIA, Annual Energy Outlook 2012, Jan 2012

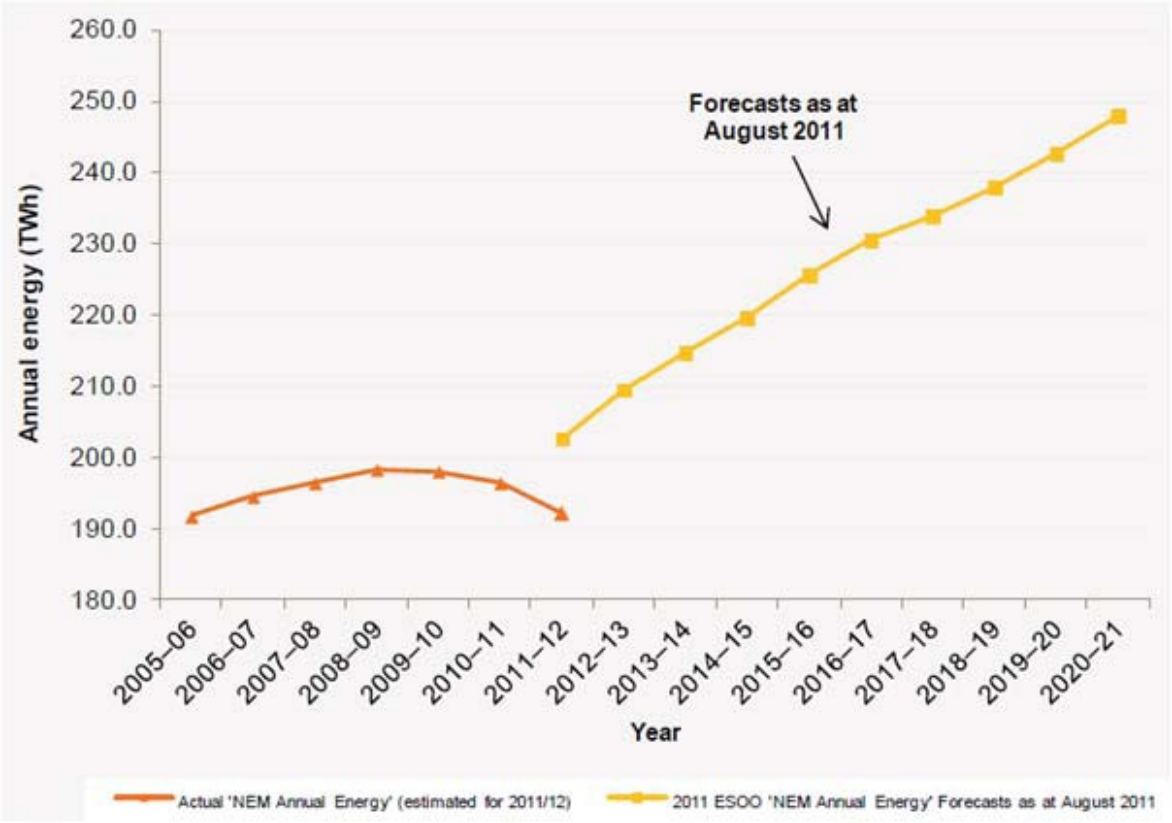
US Per Capita Elect. Consumption

1990-2011, kWh/pp



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

Where have all the kWhrs gone?



Source: AEMO, 2012

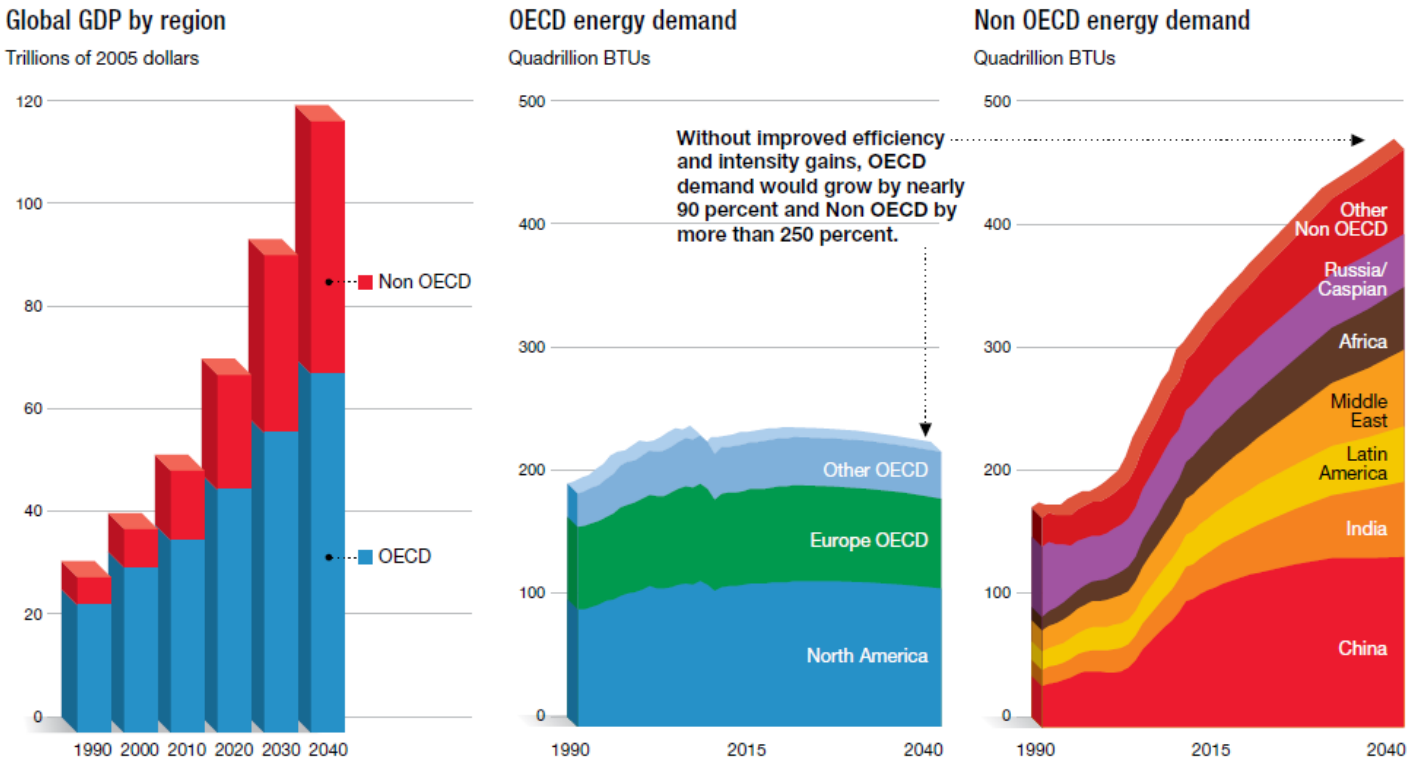
More evidence?

”End of demand growth”

- Another example
  - EU’s total energy demand will barely grow by 2030
    - BP says 4% increase in 2010-30
    - Latest predictions from BP, ExxonMobil, others consistent
- Why?
  - EU’s population is not growing much while aging
  - EU’s economy not growing as fast as it used to
  - Advances in energy efficiency > growth in GDP

OECD vs. ROW

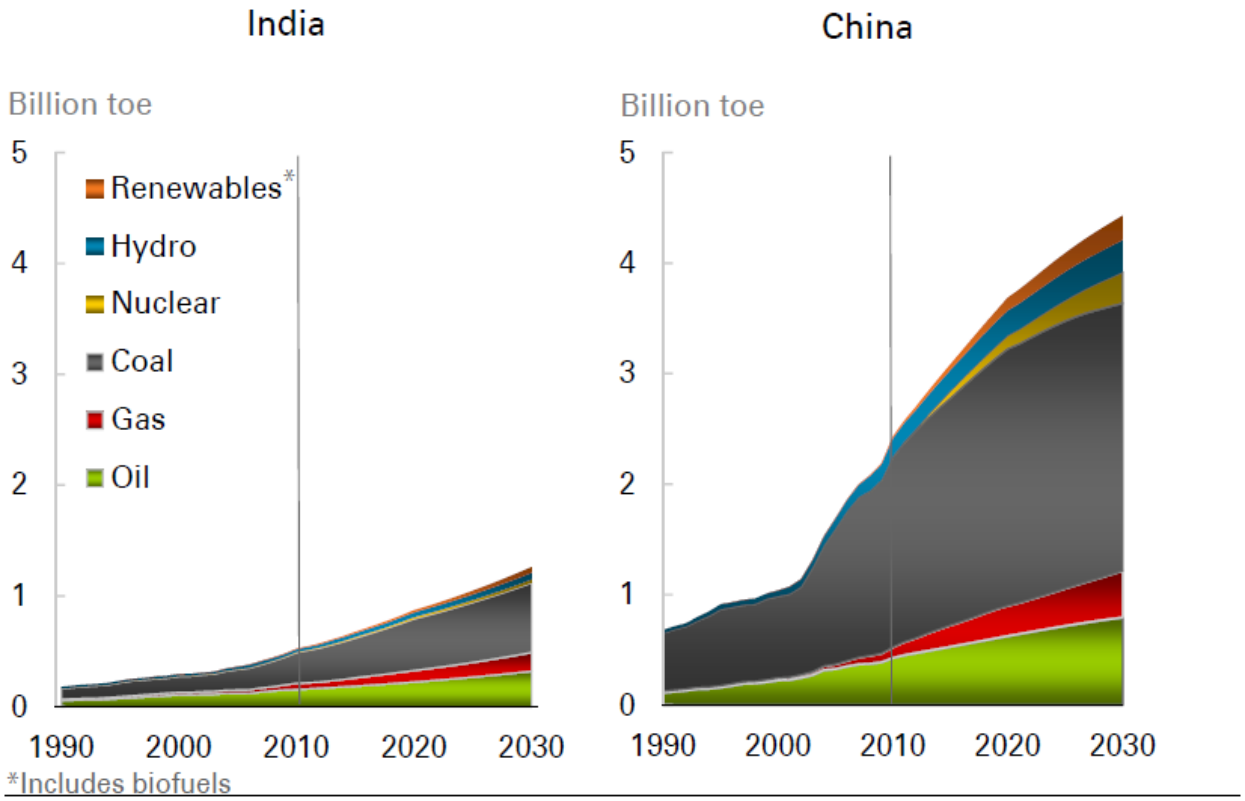
Two different worlds



Source: 2012 The Outlook for Energy: A View to 2040, ExxonMobil, Dec 2011

Chindia

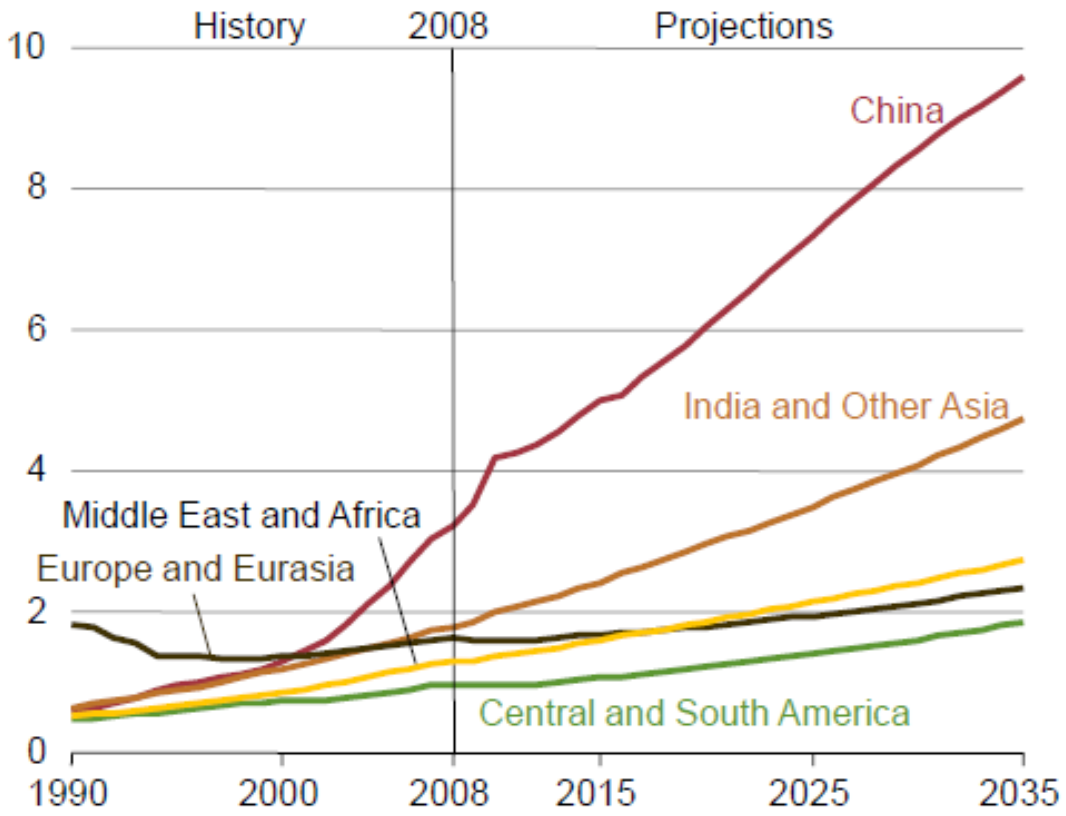
It is a different story in developing economies



Source: BP Energy Outlook 2030

High growth regions

Electricity demand growth projections, in trillion kWhrs



Source; EIA, International Energy Outlook 2011, Sept 2011

2: Influencing demand

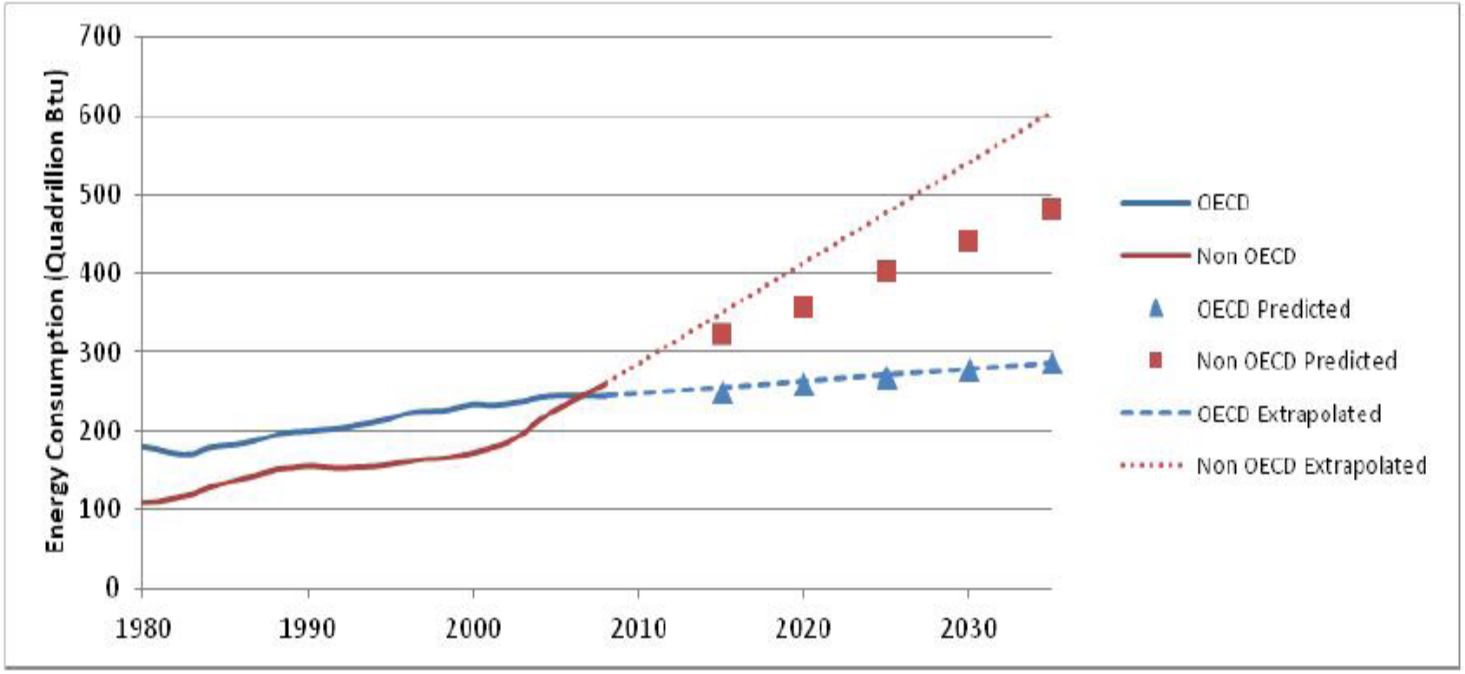
Demand drivers

What are the fundamental drivers of growth?

- Key variables
  - Economic growth derives energy demand
    - But relationship is not 1-to-1 nor pre-ordained
    - Gradual shift toward electricity
  - Population & growth in income significant drivers
    - Number of households, buildings, cars, appliances, etc. matters
    - Per capita consumption & living standards
- Policy matters
  - Govt. can shape/influence demand growth
    - Energy efficiency reduces demand
    - People want “cold beer & hot shower,” not energy per se

Future is NOT preordained

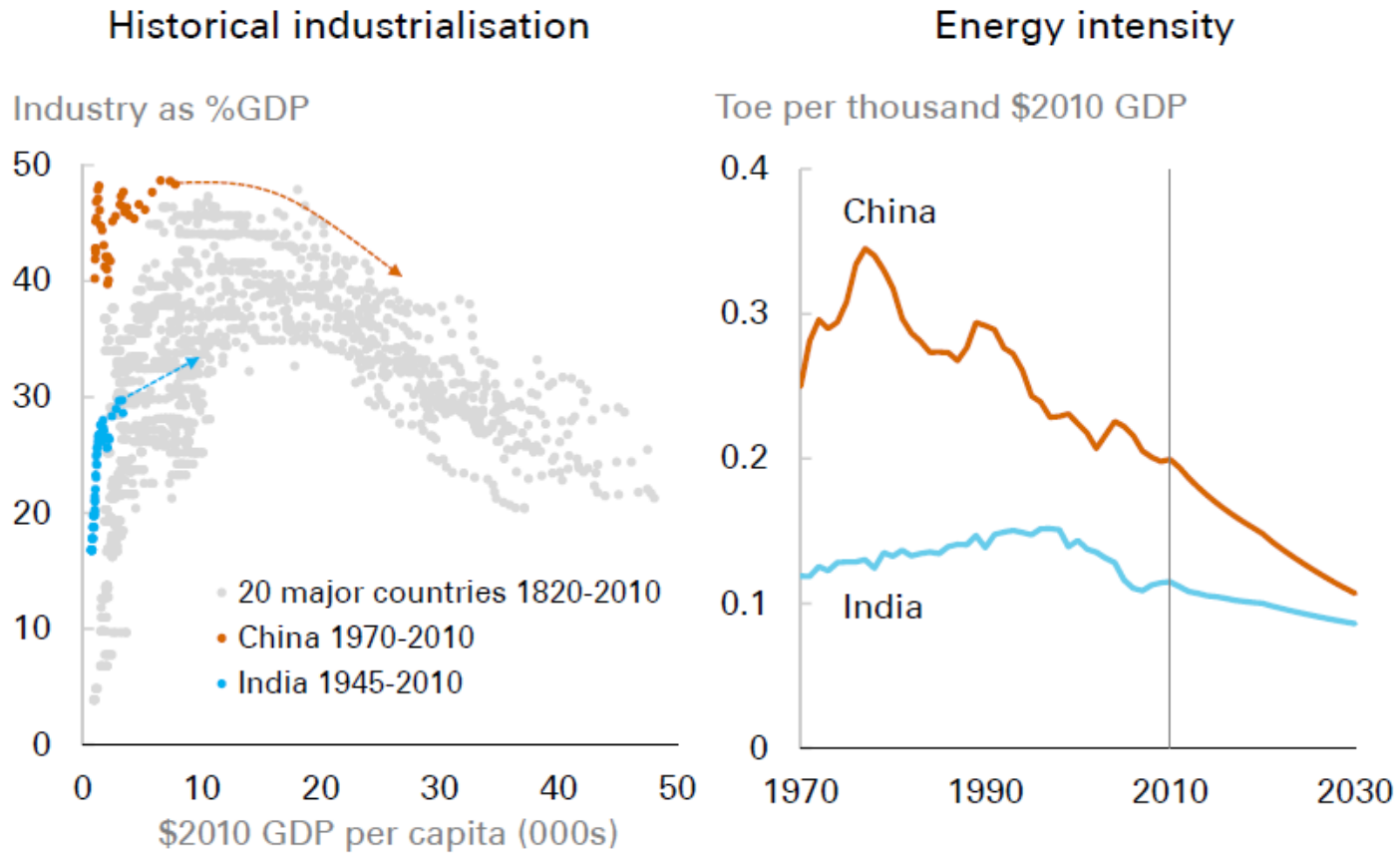
Non-OECD growth can be modified



Source:

How can we influence the trends?

Countries follow certain patterns as their economies mature



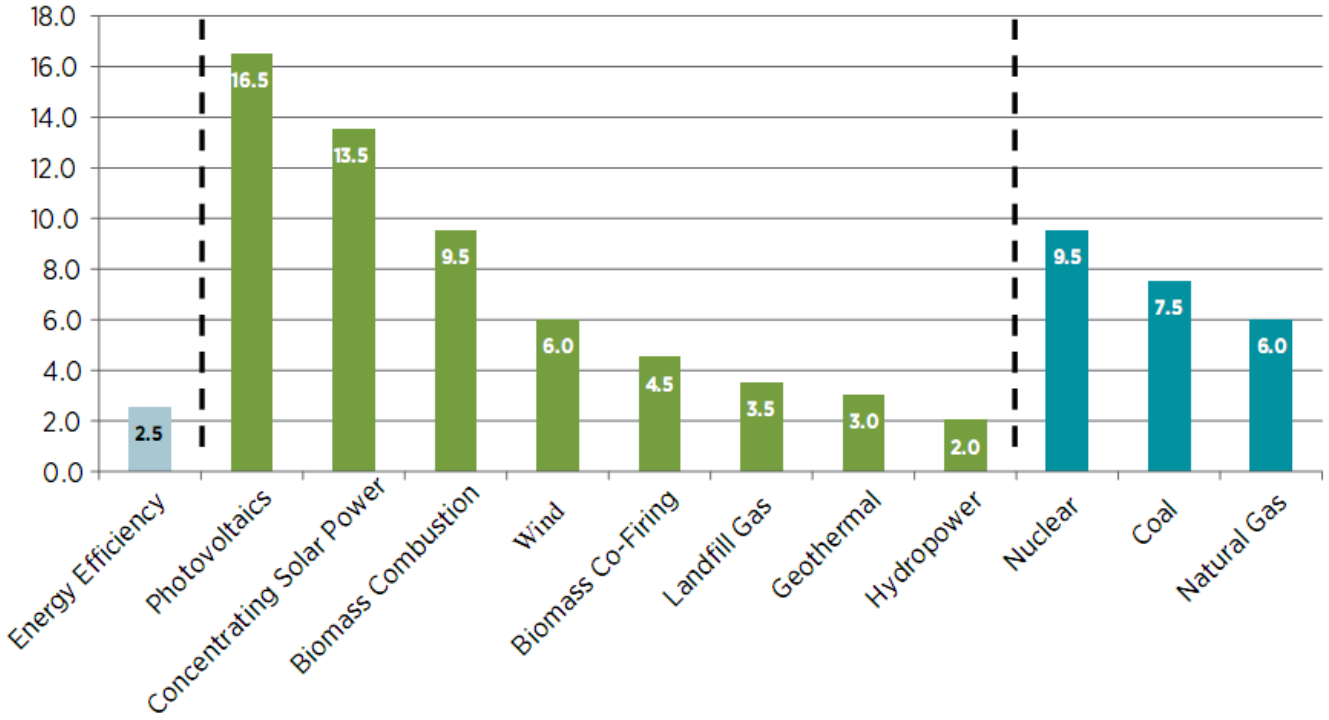
Source: BP Energy Outlook 2030

Markets or mandates

”That *is* the question’

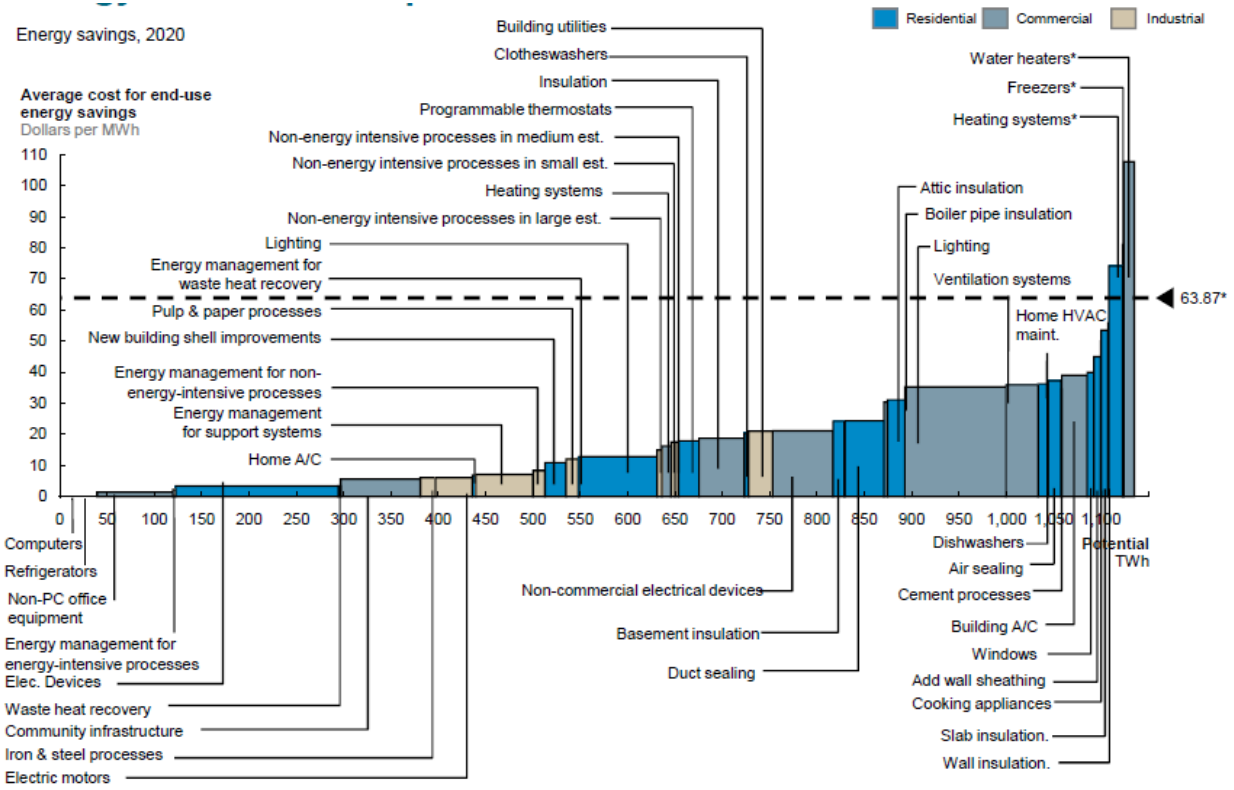
- Mandates?
  - Codes & standards
  - Regulations & incentives
- Markets?
  - Prices ….
  - … and price-induced consumer behavior

The cheapest kWh is the one you don't use



* Includes current federal & state level incentives, natural gas price is assumed at $4.50/MMBTU
Source: US Renewable Energy Quarterly Report, ACORE, Oct 2010

Opportunities abound



McKinsey's studies

Considerable scope for cost-effective savings

U.S. Greenhouse Gas Emission: How Much at What Cost (December, 2007)

- **7 leading institutions joined with McKinsey to co-sponsor**

- **Analyzed 250+ abatement opportunities across 7 sectors of the US economy** – buildings, power, transportation, industrial, waste, agriculture and forestry

Unlocking Energy Efficiency in the U.S. Economy (July, 2009)

- **12 leading institutions joined with McKinsey to co-sponsor**

- **Analyzed 675+ energy efficiency opportunities in stationary uses economy-wide (with regional breakdown)**

McKinsey's independent research identified and verified the significant potential within the U.S. to offset future energy needs (electric and natural gas) through cost-effective energy efficiency

Source: TVA/ASA Energy Efficiency Conference, Feb. 21, 2012

$1.2 trillion US gold mine

Energy efficiency offers a ***vast, low-cost energy resource*** *for the U.S. economy – but only if the nation can craft a comprehensive and innovative approach to unlock it.*

Significant and persistent barriers will need to be addressed *at multiple levels to stimulate demand for energy efficiency and manage its delivery across more than 100 million buildings and literally billions of devices.*

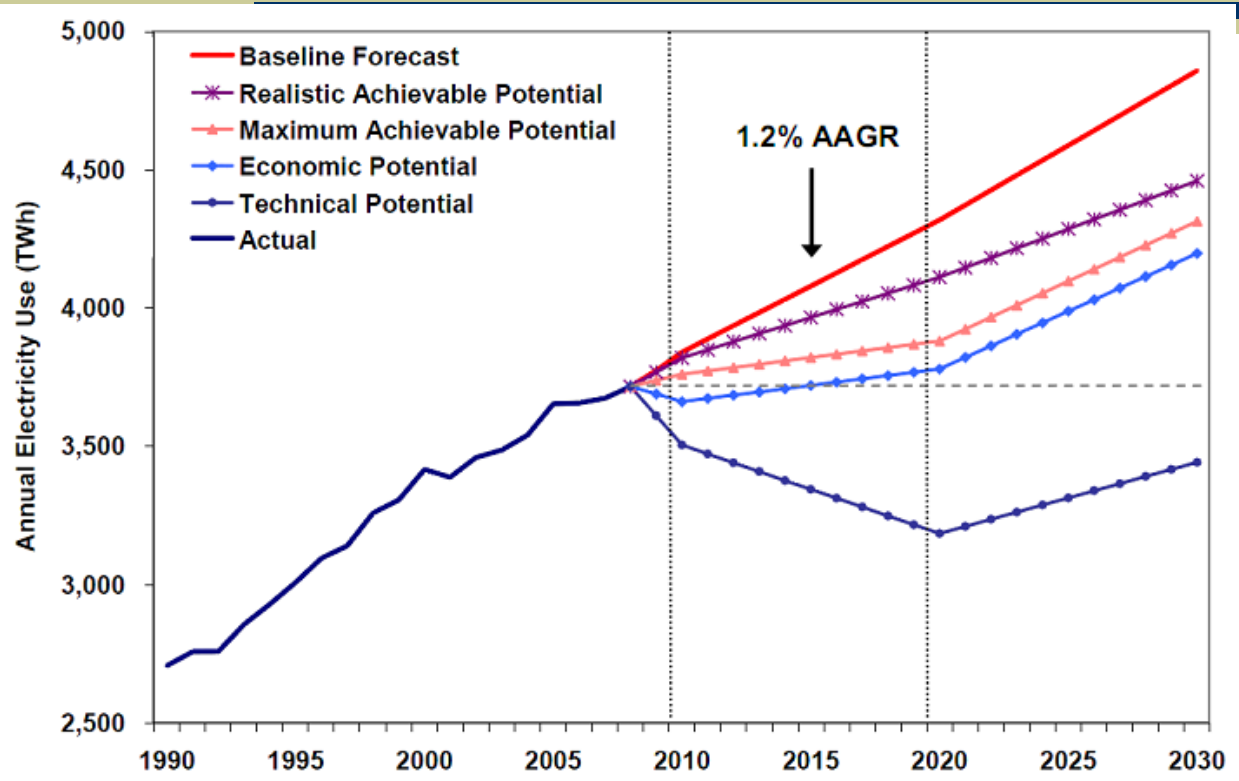
If executed at scale, a holistic approach would yield gross energy ***savings worth more than $1.2 trillion****, well above the* ***$520 billion needed for upfront investment*** *in efficiency measures (not including program costs).*

Such a program is estimated to reduce end-use energy consumption in 2020 by 9.1 quadrillion BTUs, roughly ***23 percent of projected demand.***

Source: TVA/ASA Energy Efficiency Conference, Feb. 21, 2012

664 TWh EE potential

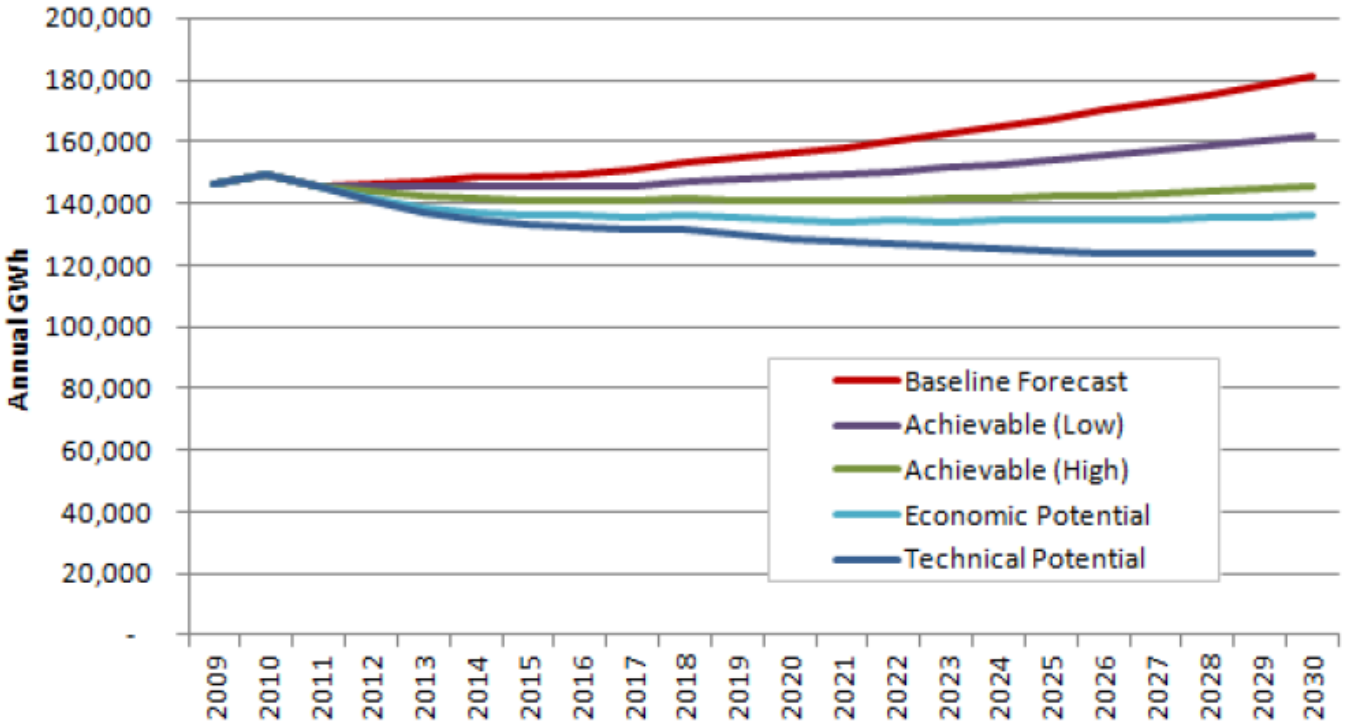
EPRI claims 14% energy reduction possible by 2030



Source: A. Faruqui, Brattle Group, Aug 2010

Declining sales?

EE potential for TVA



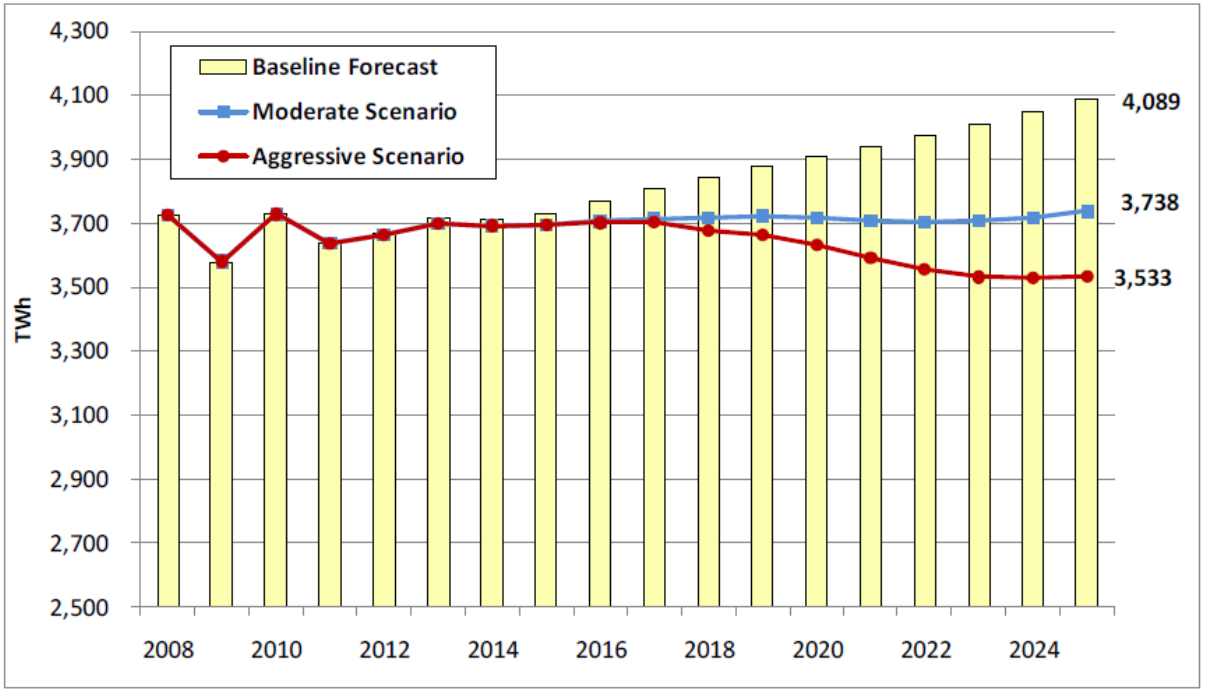
Source:

Codes & standards

Thou shall do as told, or else …

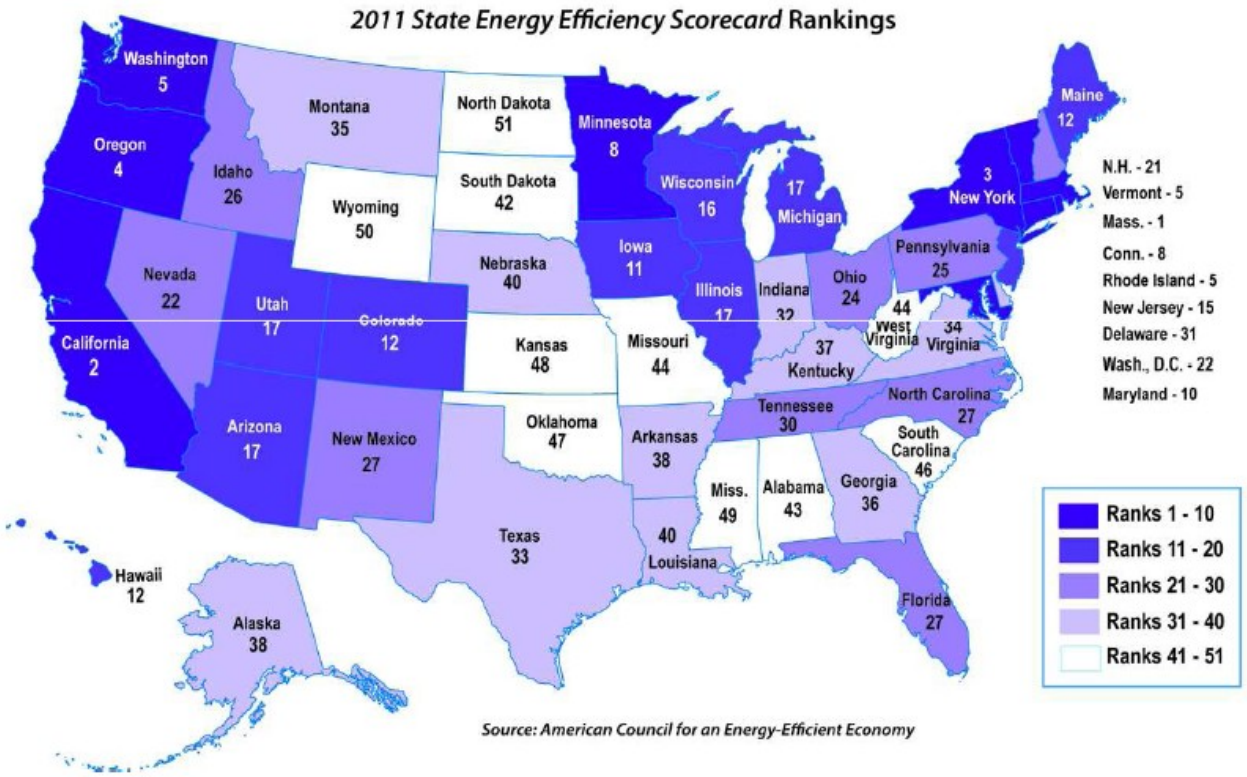
End of demand growth?

Not only feasible but cost-effective

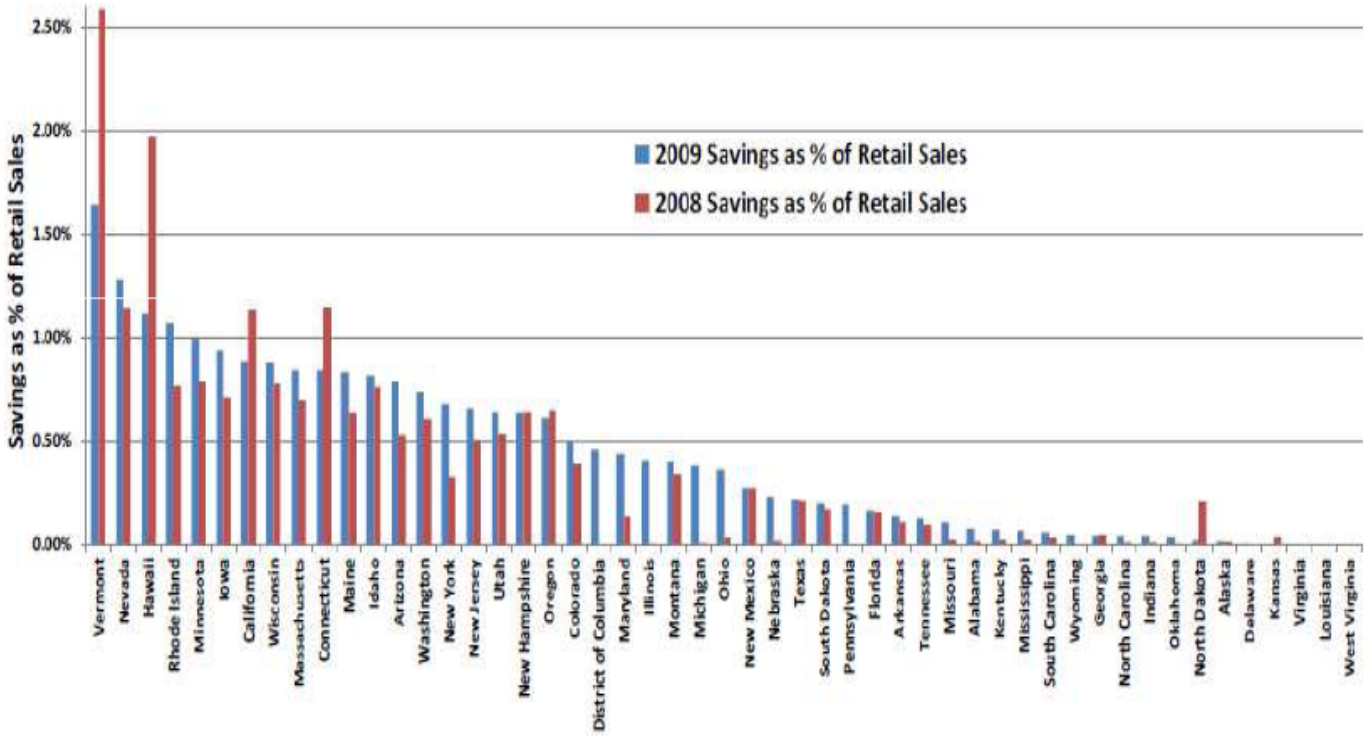


Source: IEE white paper, May 2011

Latest US EE rankings

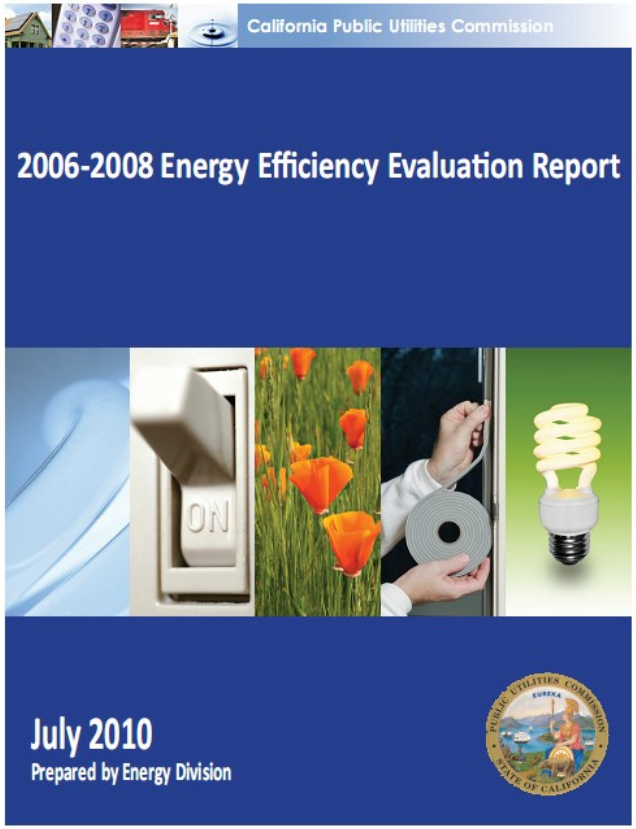


EE savings as % of retail sales



What do you get for $2.1 B?

CA IOU ratepayer investment in EE, 2006-08

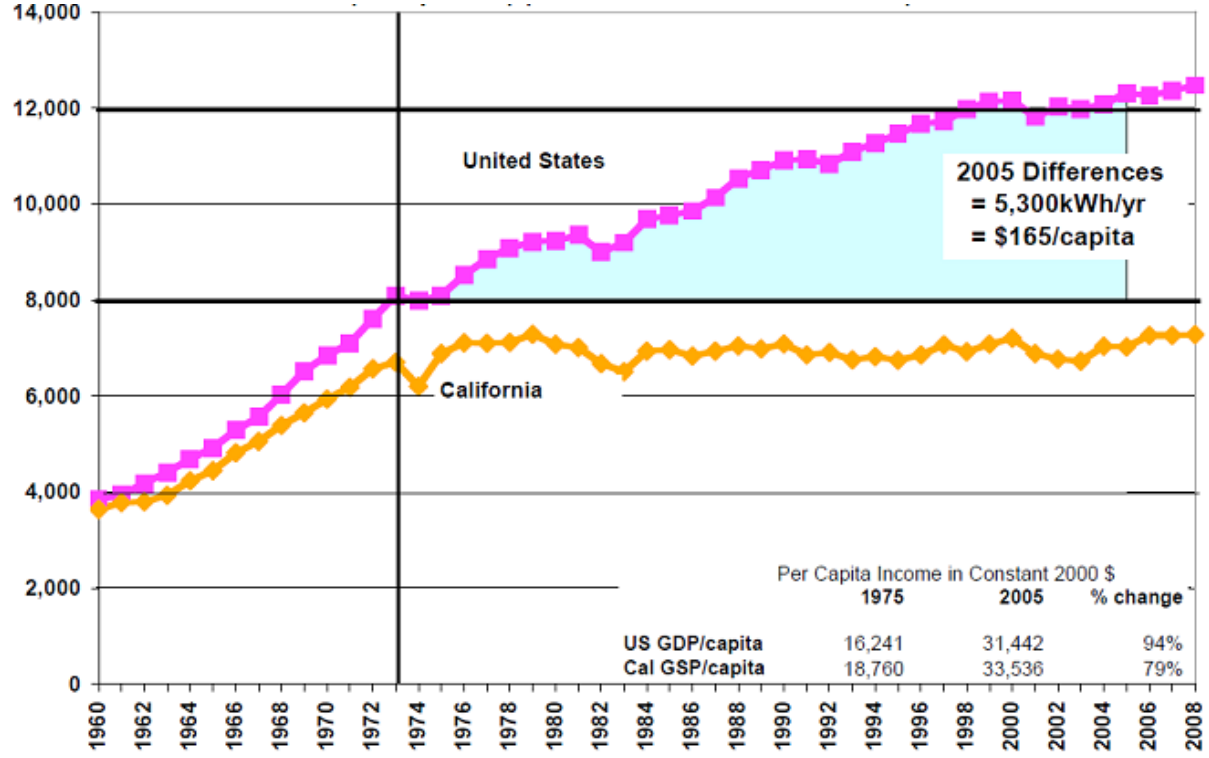


2006-8 CA Highlights

- $2.1 billion investment 2006-08
- 6,000 GWh, equivalent to 3.2% of 2008 sales
- 1,100 MW peak demand
- 4 million tons of CO2 avoided, 760,000 cars removed
- 64 million CFLs (roughly 2 per capita)
- 41 million sq ft insulation
- 1.2 million new EE appliances
- 775 MWH saving in manufacturing
- 550,000 hrs of training for 40,000 attendees
- EE campaign reached 9.5 million households

California keeps it flat

Per capita electricity consumption



Source: A. Faruqui, Brattle Group, Aug 2010

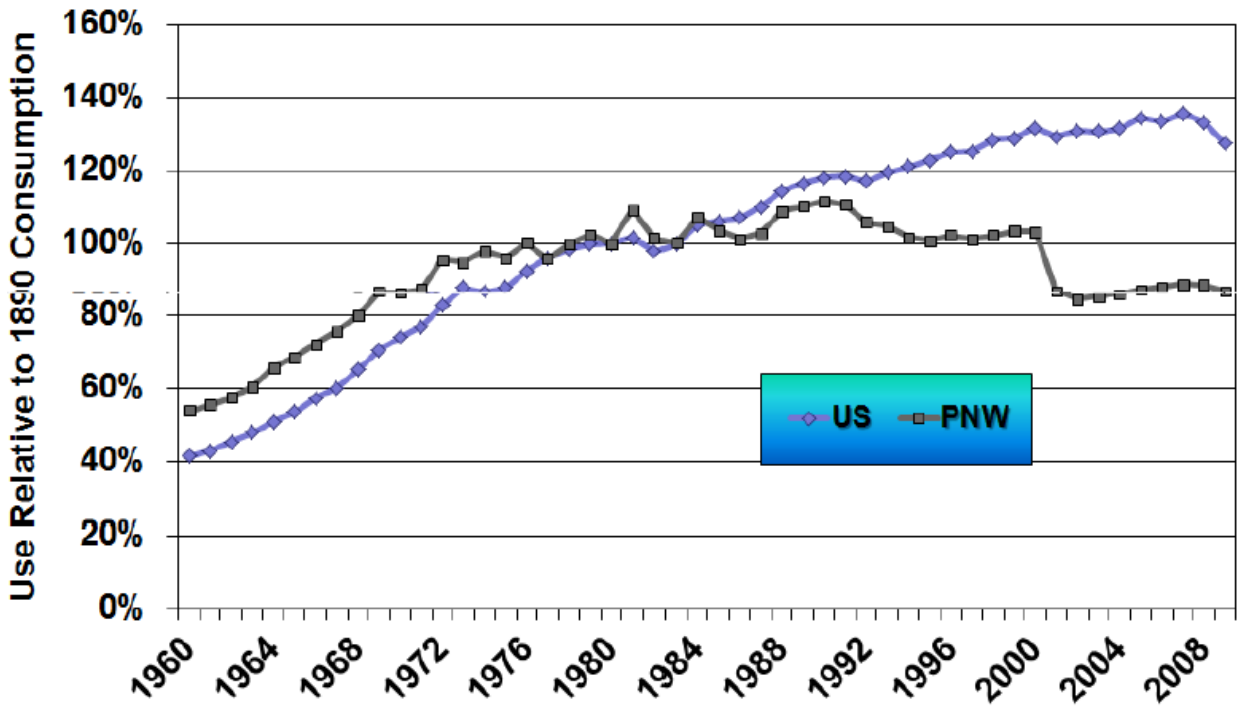
Case for standards

CEC, May 2012

- Starting 2014 avg. new homes 25% more efficient
- Non-residential buildings 30% more efficient
- Mostly through better windows, insulation, ventilation
- Extra cost of avg. new home: $2,290
  - $11/month assuming 30-yr. mortgage
- Save $27/month in lower heating, cooling & lighting costs
- Net $6,200 savings over 30 yrs.
- California to save 14 GWhrs of electricity over 30 yrs
- Eliminating 6 major power plants

PNW does it even better

Index with 1980 = 1

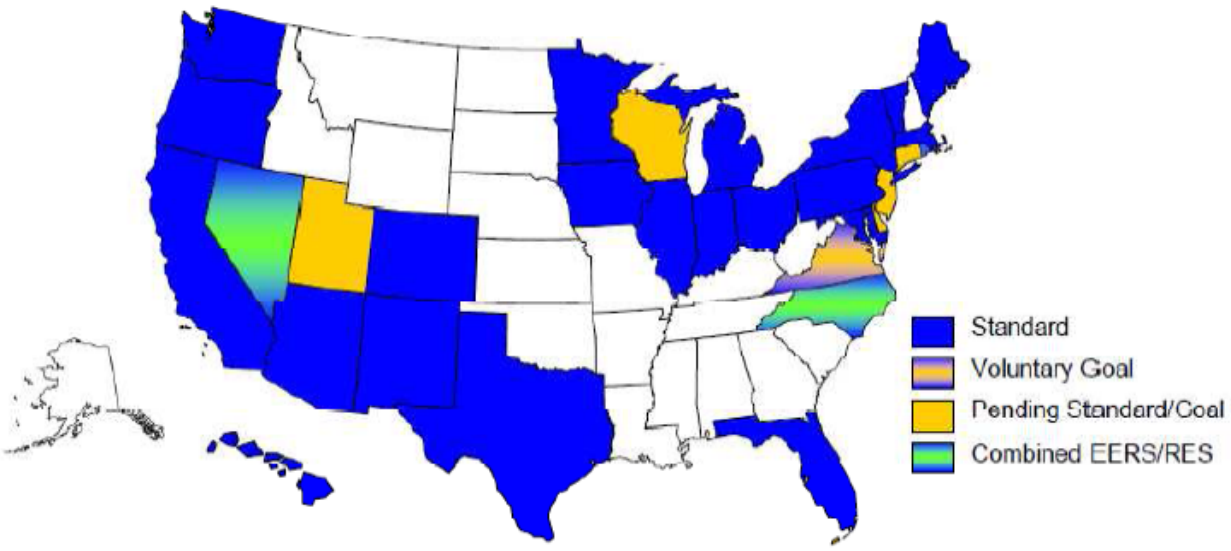


Another way to go: EERS

Impose mandatory targets similar to RPS

State Energy Efficiency Resource Standard (EERS) Activity

November 2010



Twenty-four states have enacted energy savings goals, or Energy Efficiency Resource Standards (EERS), through legislation and several states have a pending EERS

The options?

- Structural shift in economy
  - Away from energy-intensive manufacturing?
- Appliance standards
  - Lighting, HVAC, electronics, motors
- Building codes
  - Zero Net Energy concept?
- Prices
  - Smart prices to smart devices
- Consumer attitude/behavior

Regulations & incentives

Fix traditional misalignments

How do we get water to go uphill?

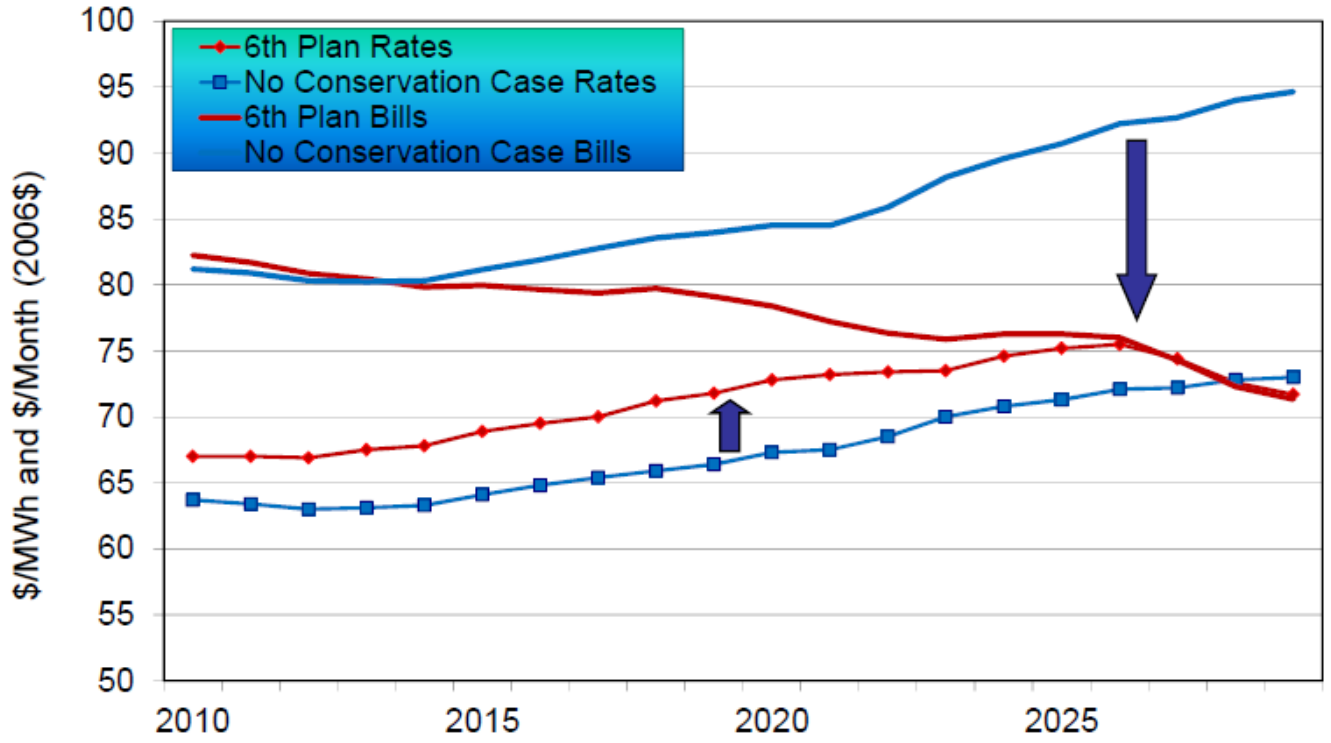
- I know of NO private utility that would say, "We're going to invest billions in customer energy efficiency measures because we believe it is the right thing to do."
- In nearly all cases, policy makers &/or regulators have had to directly intervene by introducing incentives, rewards, penalties, backed by supportive policies

Change institutional mindset

- For energy efficiency to make business sense
  - Allow full cost recovery
  - Allow recovery of lost revenues
  - Allow a reward or incentive above & beyond the above
- Even today, few states actively promote EE
  - In some cases:
    - Set mandatory targets
    - Penalty & reward

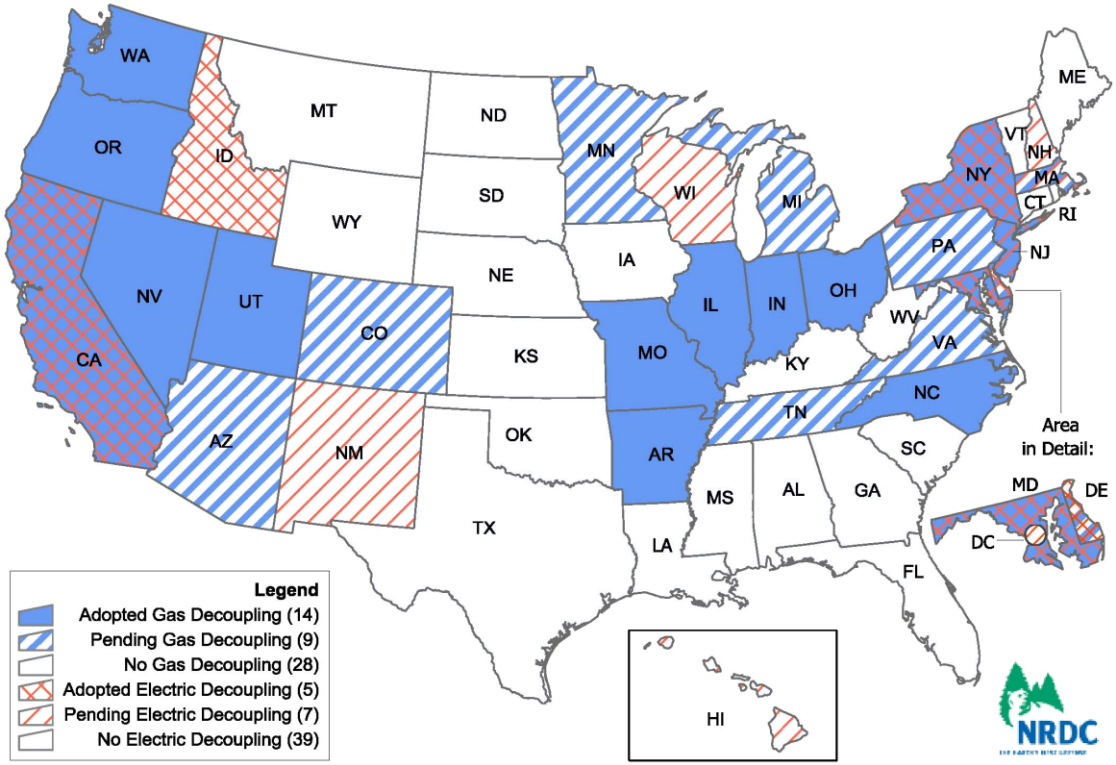
Rates rise but bills fall

Fewer kWhs means higher cents/kWhr



“Decoupling”

Profits decoupled from kWhr sales



Source: NRDC Feb 08

Price signal

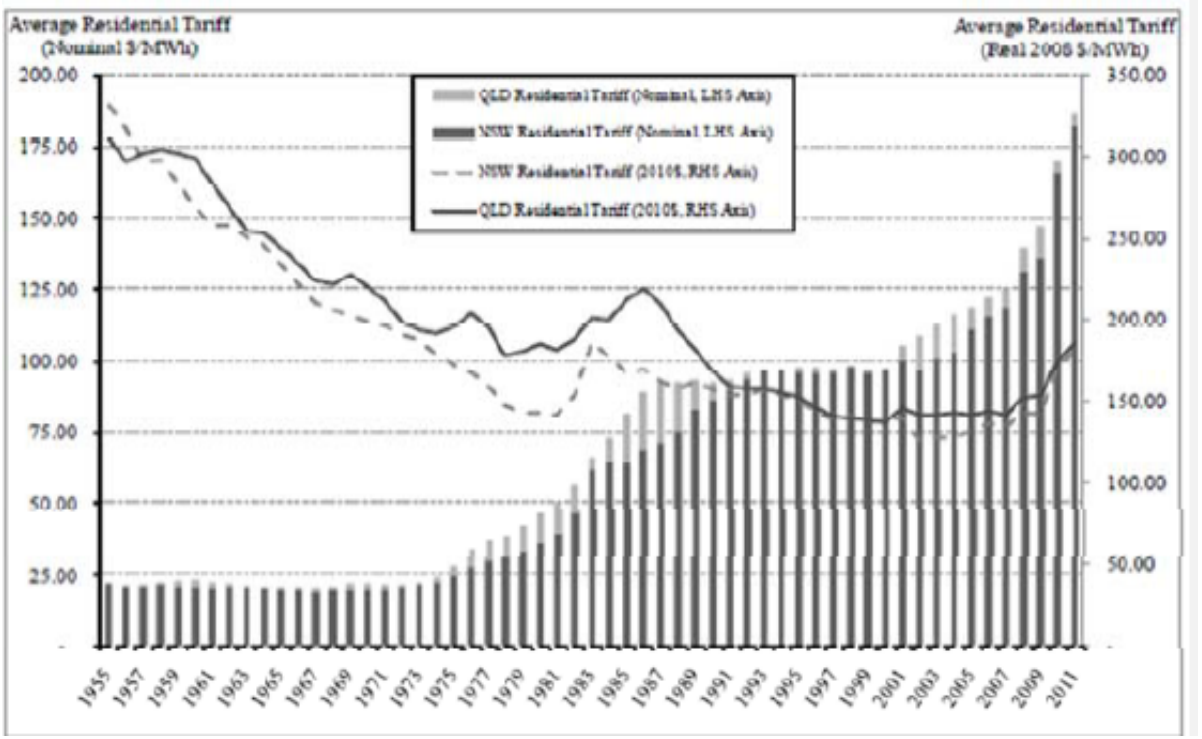
AT&T: “Let your fingers do the walking”

Direction of electricity prices?

- Universally up
- Why?
  - Shift to cleaner/low carbon fuels
    - Coal is facing strong headwinds within OECD
  - Shift to more renewables/DG
    - Requires significant subsidies
    - Intermittency requires backup
  - Environmental/emission restrictions
    - Example #1: US EPA
    - Example #2: Australia's carbon tax, CA climate bill

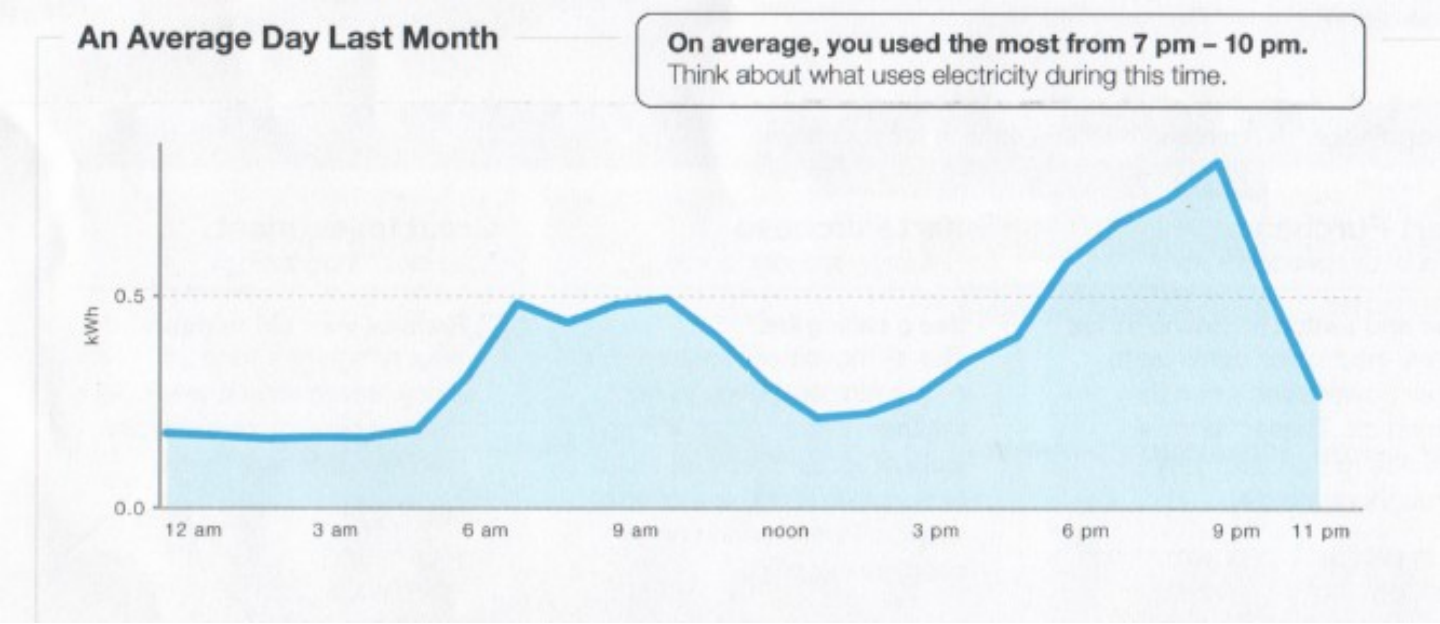
End of economies of scale?

Residential tariffs in NSW & QLD, in nominal Aus$/MWh (left scale) and inflation-adjusted (right scale)



Source: ESAA, Comparing Australian and international electricity prices, at http://www.esaa.com.au/content/detail/internationalAustralianelectricityprices based on study by NUS Consulting Group

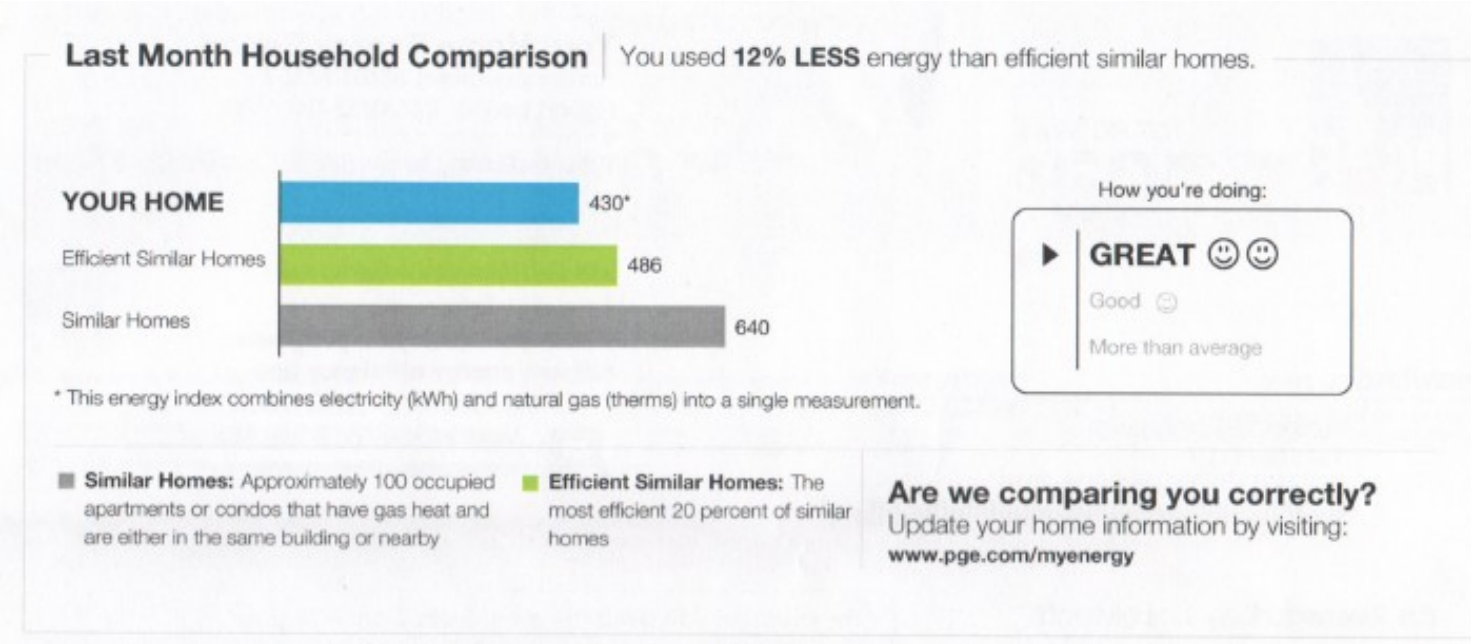
When do you use electricity?



Source: PG&E Home Energy Report

How do you compare to your peers?

Last month's consumption relative to others, in kWhrs



Source: PG&E Home Energy Report

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

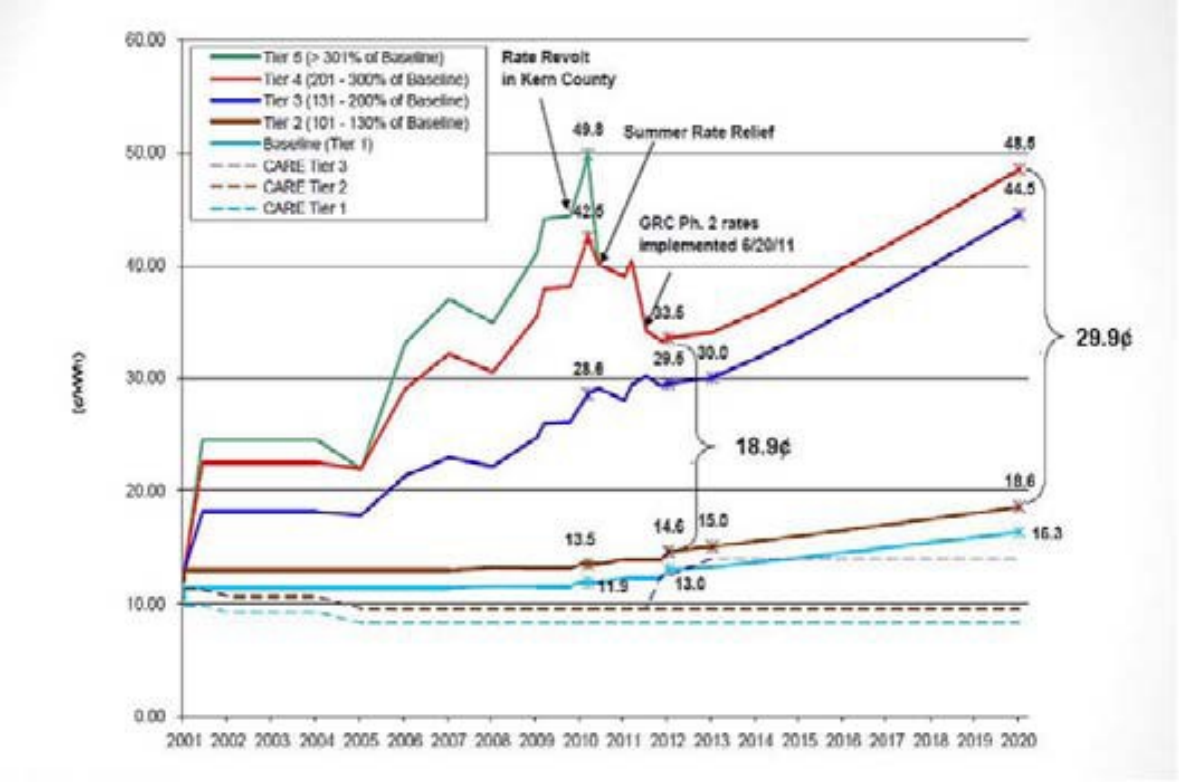
[1]For low-income customers, applicable prices for the first three tiers are 8.533, 10.668 & 18.051 cent/kWh respectively with tier 3 rate applied to all usage above 130% of baseline allowance.

[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

Sustainable?

Rising tariffs encourage more DG & EE



Source: Ed Cazalet presentation Mar 2012 based on PG&E projections

Distributed generation

California Gov. envisions 12 GW of DG

Residential Retrofit

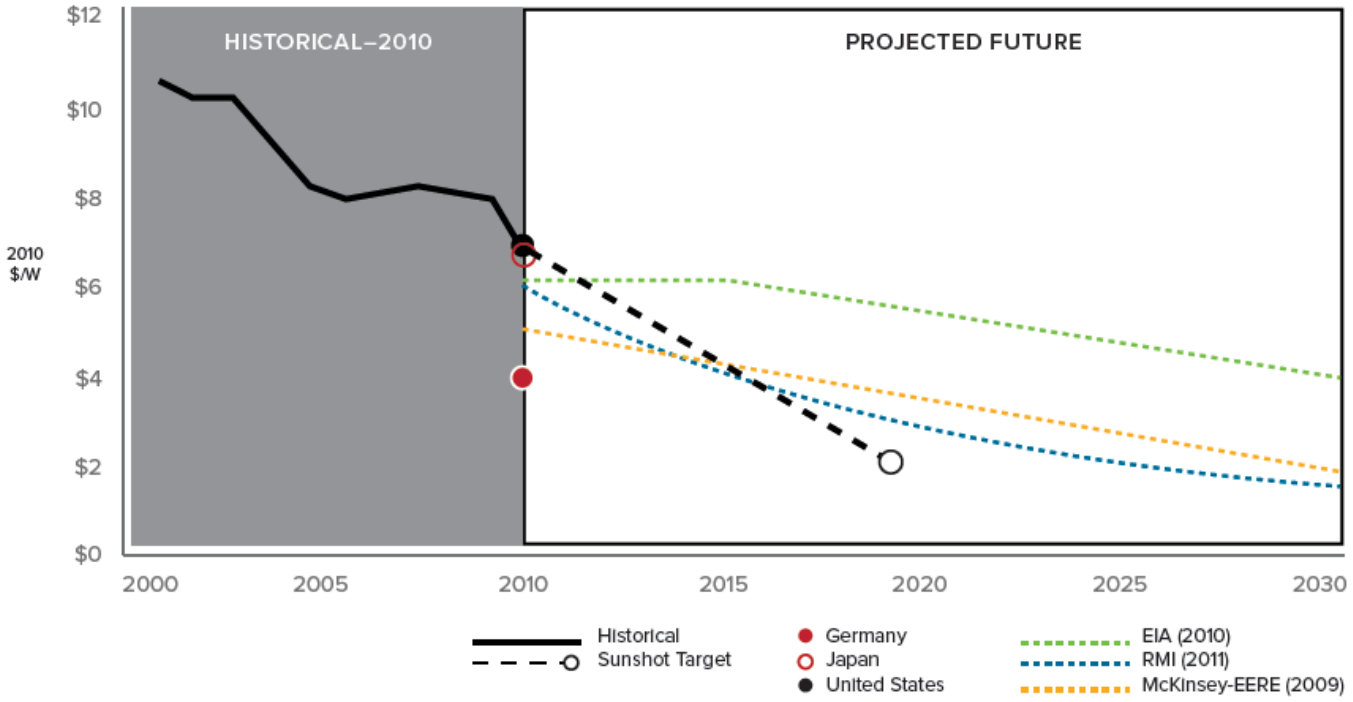
New Production Homes

Commercial & Public

Power Plants

Getting cheaper

Solar costs declining rapidly

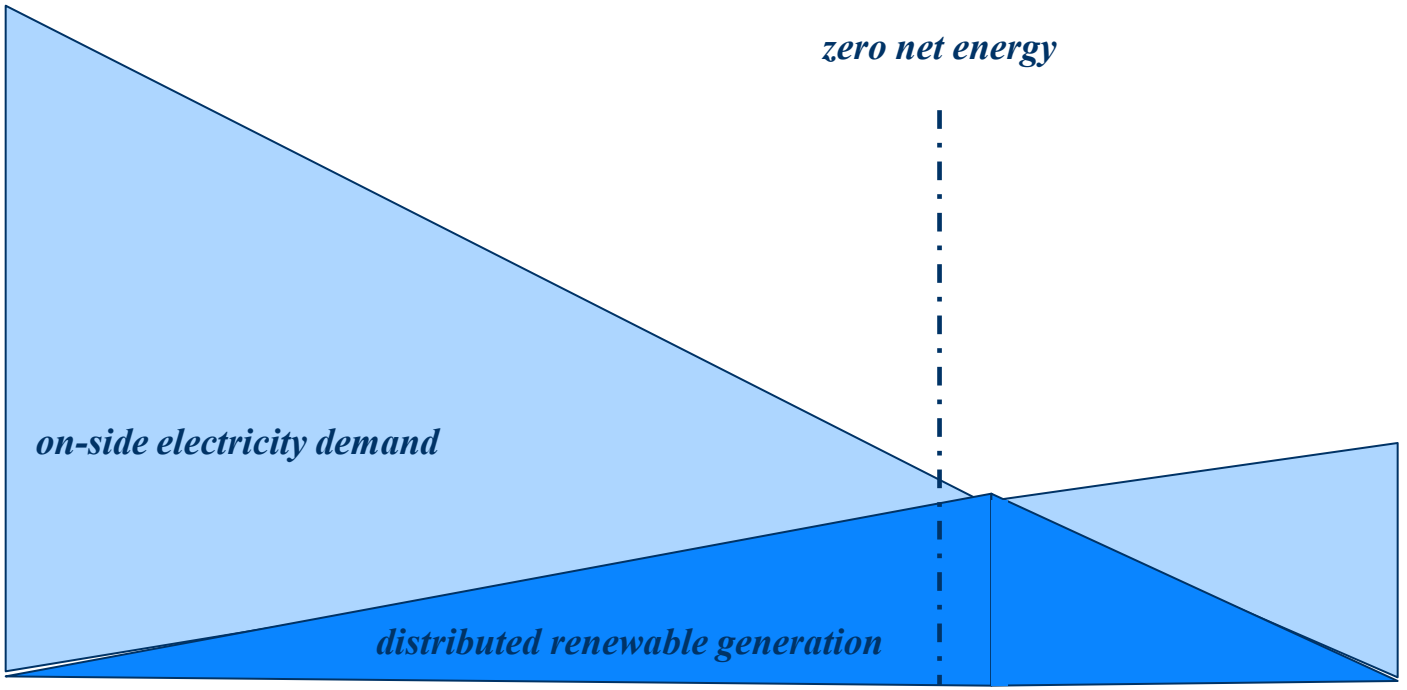


HISTORICAL DATA: BARBOSE G, WISER R, DARGHOUTH N. 2011. TRACKING THE SUN IV. LBNL. | COST PROJECTIONS: RMI 2010. ACHIEVING LOW-COST SOLAR PV; EIA 2009. DECEMBER SOLAR PHOTOVOLTAIC CELL/MODULE MANUFACTURING ACTIVITIES 2008J WASHINGTON, D.C.; EERE 2010. MAY 28 SOLAR VISION STUDY - DRAFT; TRACKING THE SUN IV.

Source: Net energy metering, RMI, Mar 2012

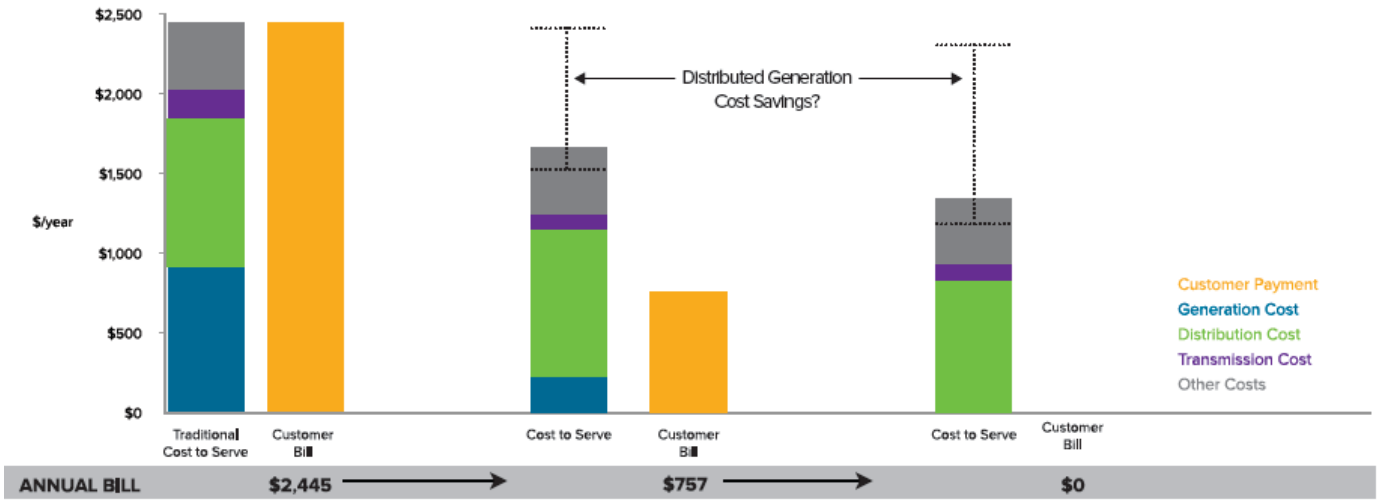
Zero Net Energy

Would it apply to developing countries?



Vanishing bill

For ZNE/DG customers consumption drops but costs remain



Traditional, Full Service Customer

This customer, whose load profile is average for the type of residential customer likely to install DG under NEM, pays for her electricity on PG&E's E-1S schedule. On average, the utility fully recovers its costs.

Distributed Generation Customer

The customer installs a PV system that meets part of her annual energy use. Under current rates, the utility is likely to under-recover its costs to serve such a customer, but the results depend on usage, load shapes, and other factors.

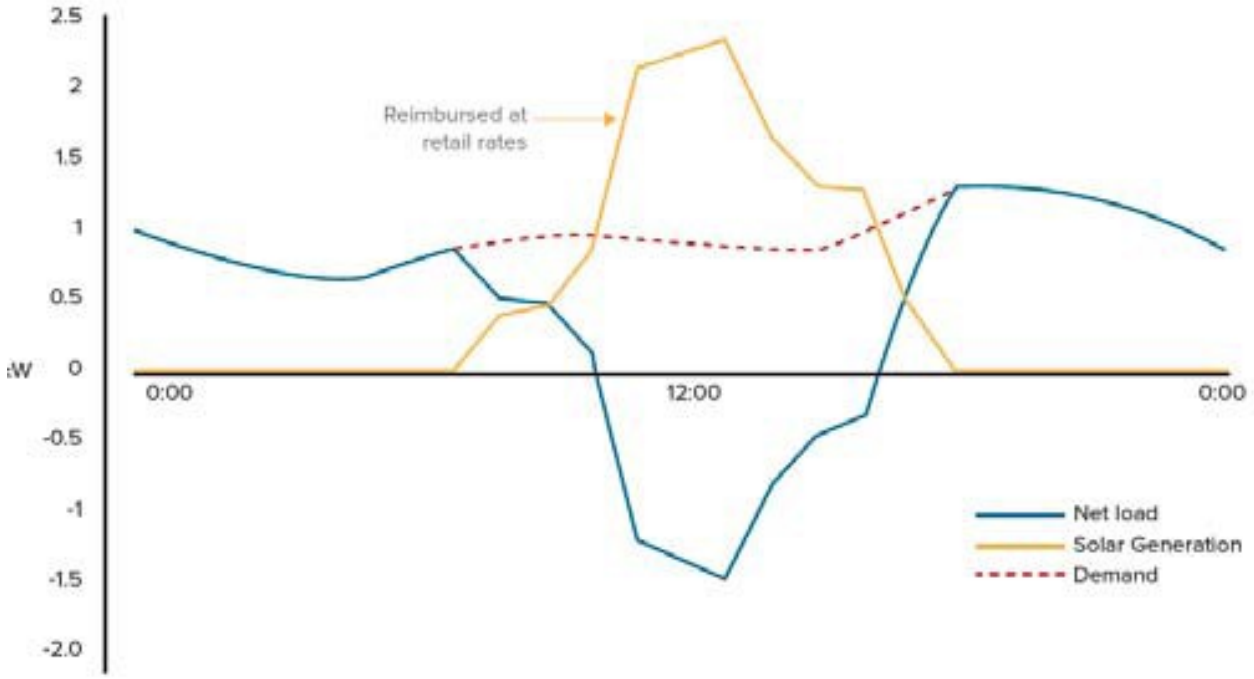
Zero Net Energy Customer

The customer installs a PV system that meets ALL of her annual energy use. The utility receives no revenue even though the customer still uses to the utility's network as a battery.

Source: Net energy metering, RMI, Mar 2012

From consumer to prosumer

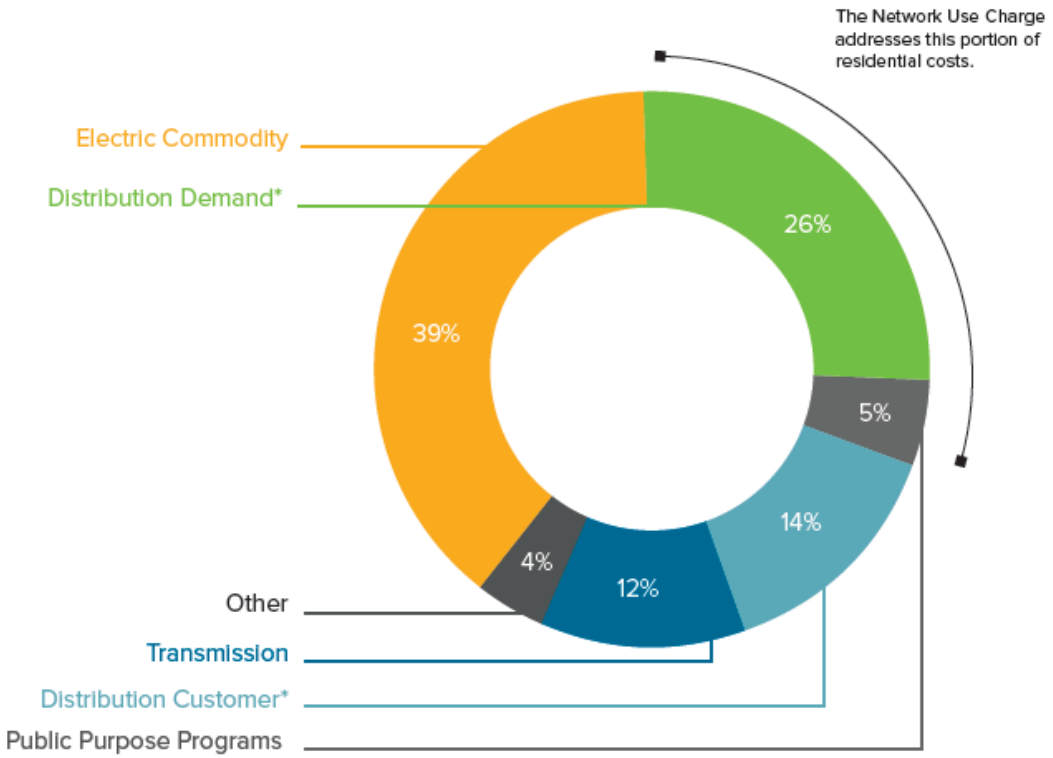
Net energy metering (NEM) gives credit for excess PV generation



Source: Net energy metering, RMI, Mar 2012

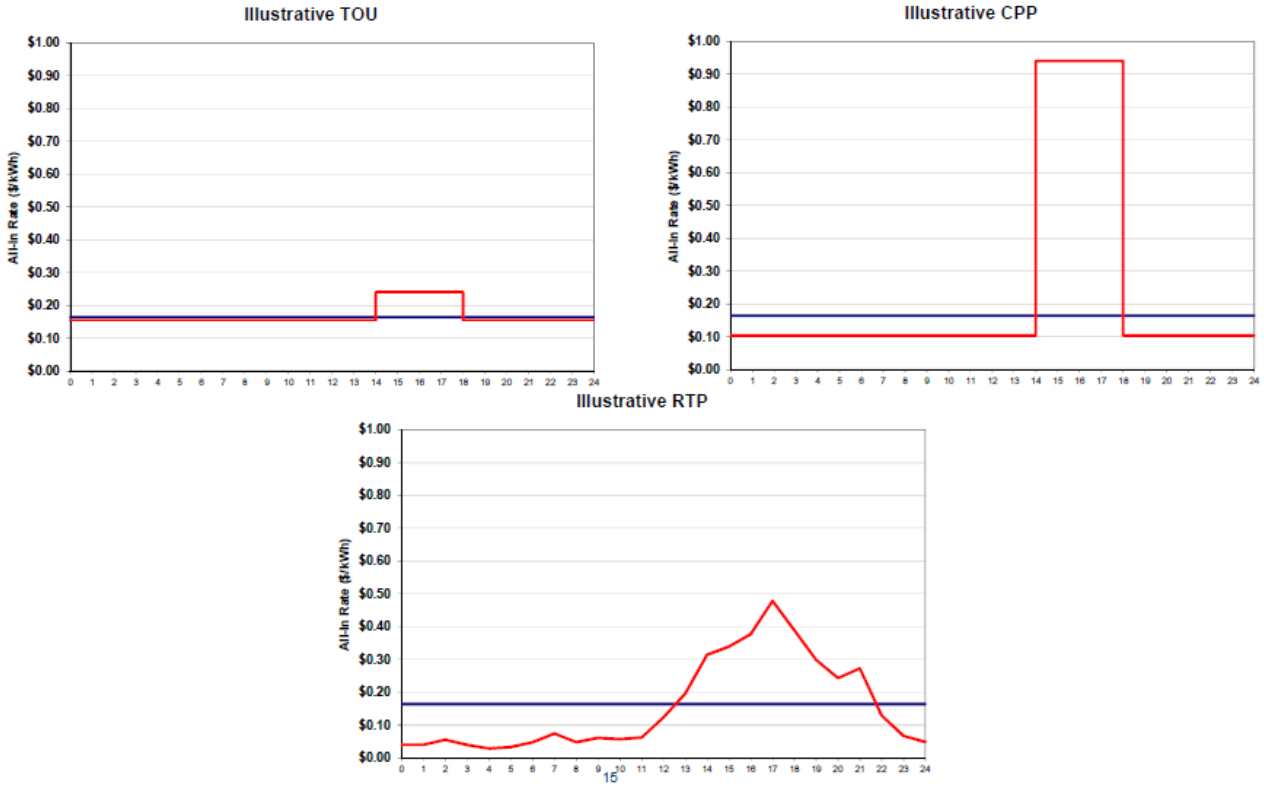
Vexing cost allocation problem

As network costs rise new ways are needed to allocate costs



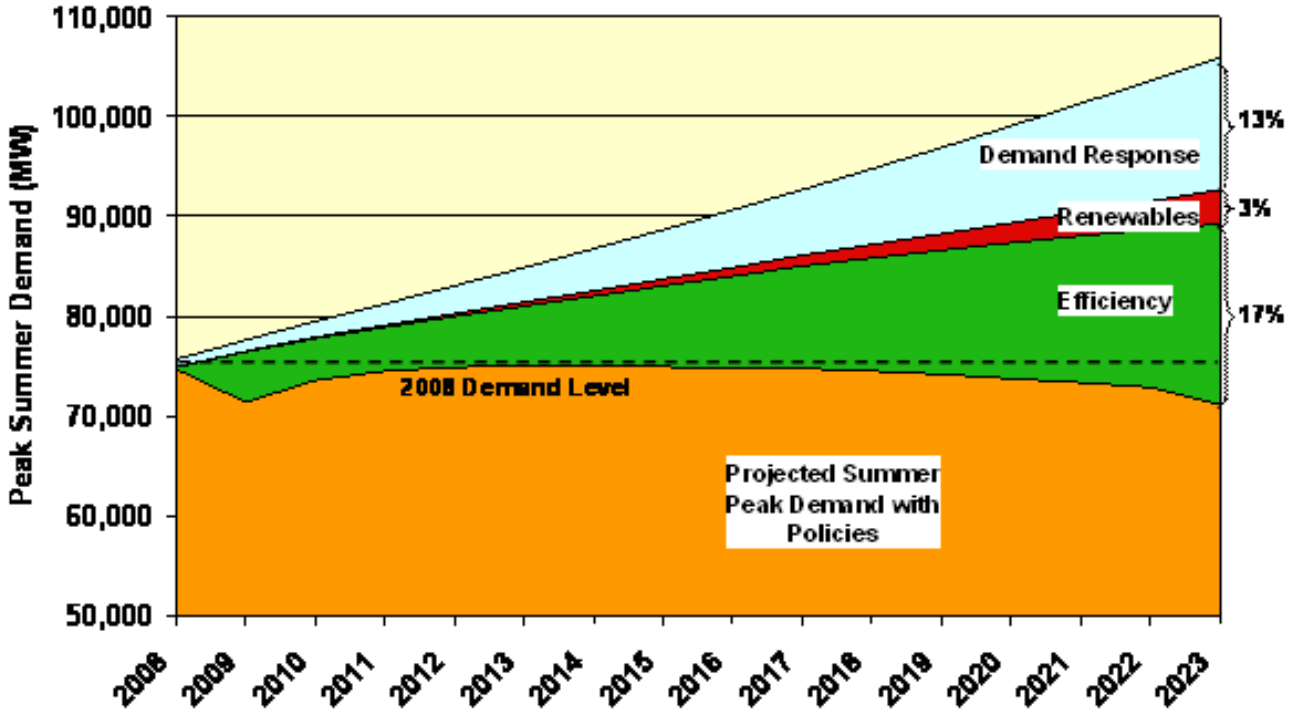
Source: Net energy metering, zero net energy & the distributed energy resource future, Rocky Mountain Institute report prepared for PG&E, Mar 2012

Other schemes to shift demand



Texas peak demand case study

ACEEE study, Mar 2007



Take away points

- End of demand growth is in sight
  - Almost a given within OECD
  - ROW to follow
- Policy matters
  - Can (and should) influence demand

Questions?

- Thank you

Smart Grid

Forthcoming Nov 2011

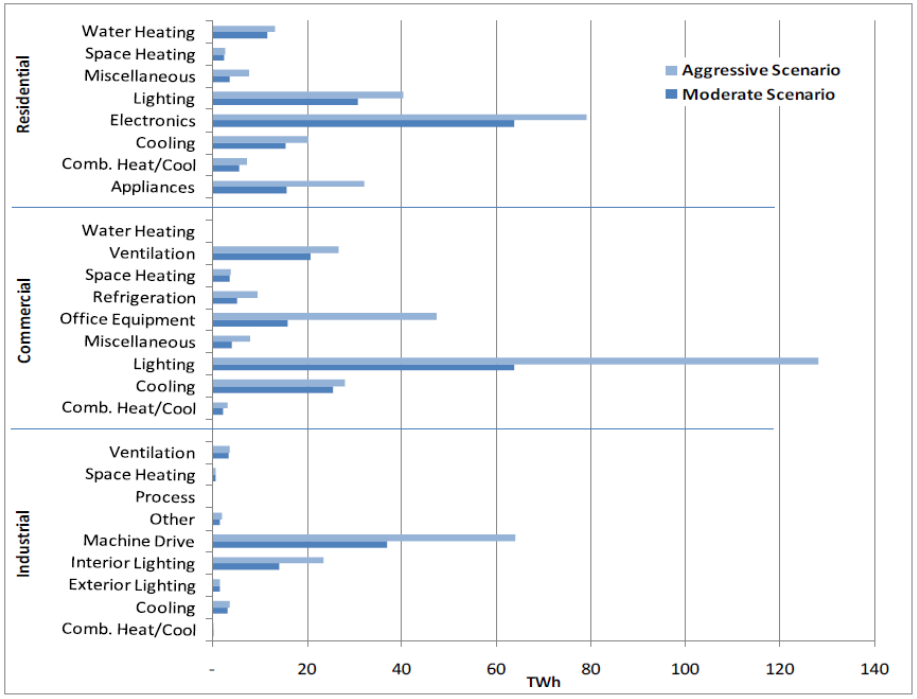
California on top

United but highly uneven states of America

		2008 Budget ($M)		
Rank	**State**	**Electric**	**Gas**	**Total**
1	CA	831	183	1,014
2	NY	258	30	288
3	NJ	135	61	196
4	WA	160	18	179
5	MA	121	28	149
6	WI	76	64	140
7	MN	106	30	137
8	FL	109	15	124
9	CT	107	7	114
10	TX	106	No data	106
All other States		592	94	686
U.S. total		**2,603**	**529**	**3,132**

Source: G. Barbose, C. Goldman & J. Schlegel in The Electricity Journal Oct 2009 based on data from Consortium for Energy Efficiency (EE), 2008 available at www.cee1.org/ee-pe/2008

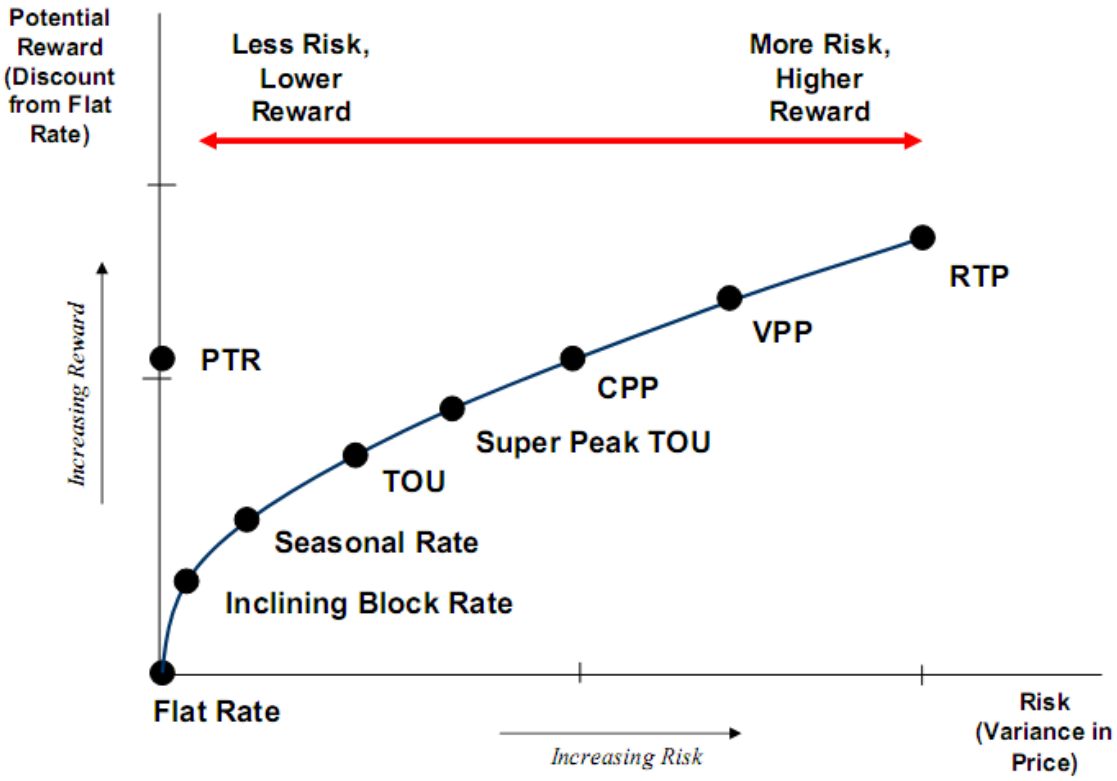
Low hanging fruit



Source: IEE white paper, May 2011

From static to dynamic pricing

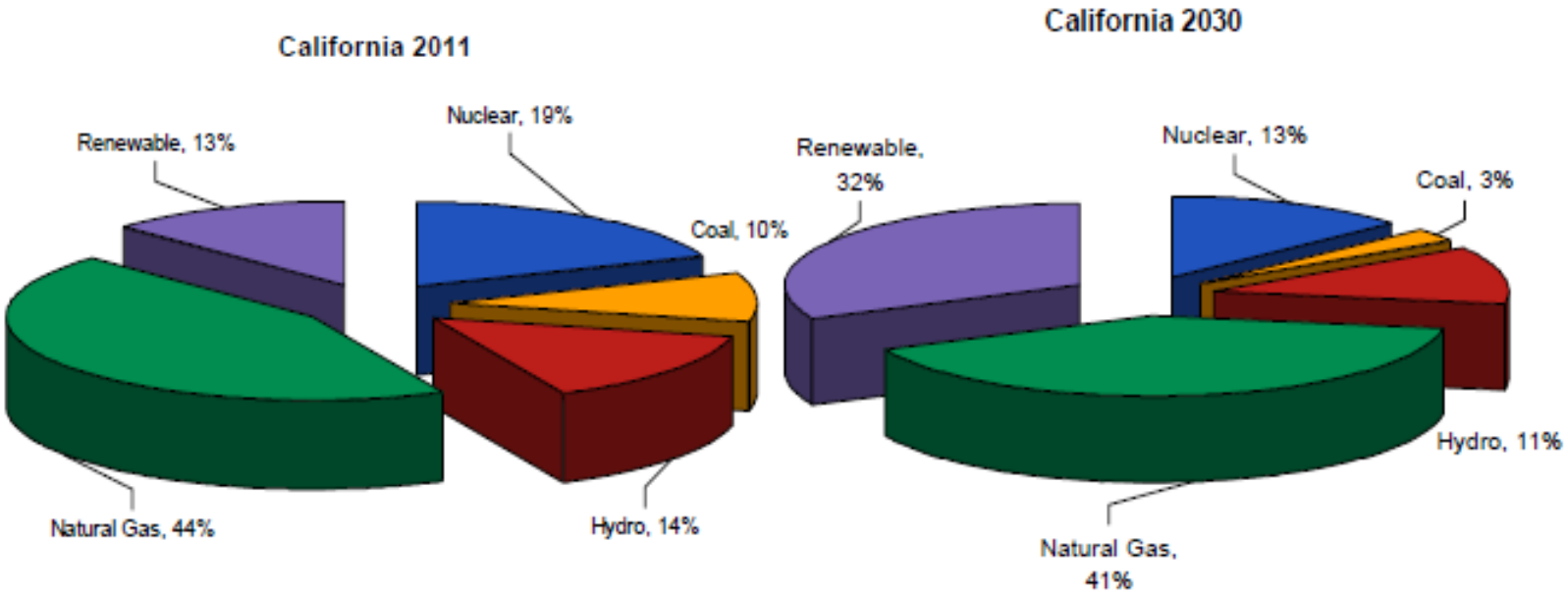
The question is how dynamic?



Source: A. Faruqui, Brattle Group, Aug 2010

California going low-carbon

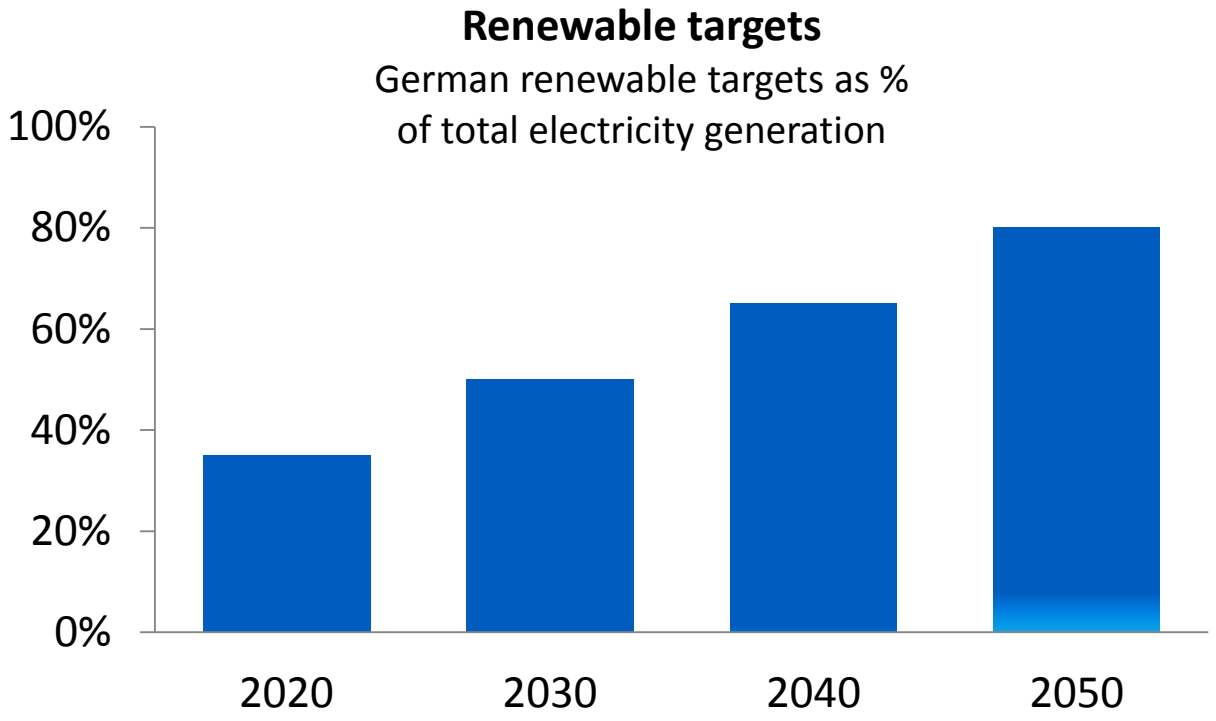
Don't count on nuclear, CCS, cap-&-trade, or market signals



Source: Black & Veatch

80% by 2050!

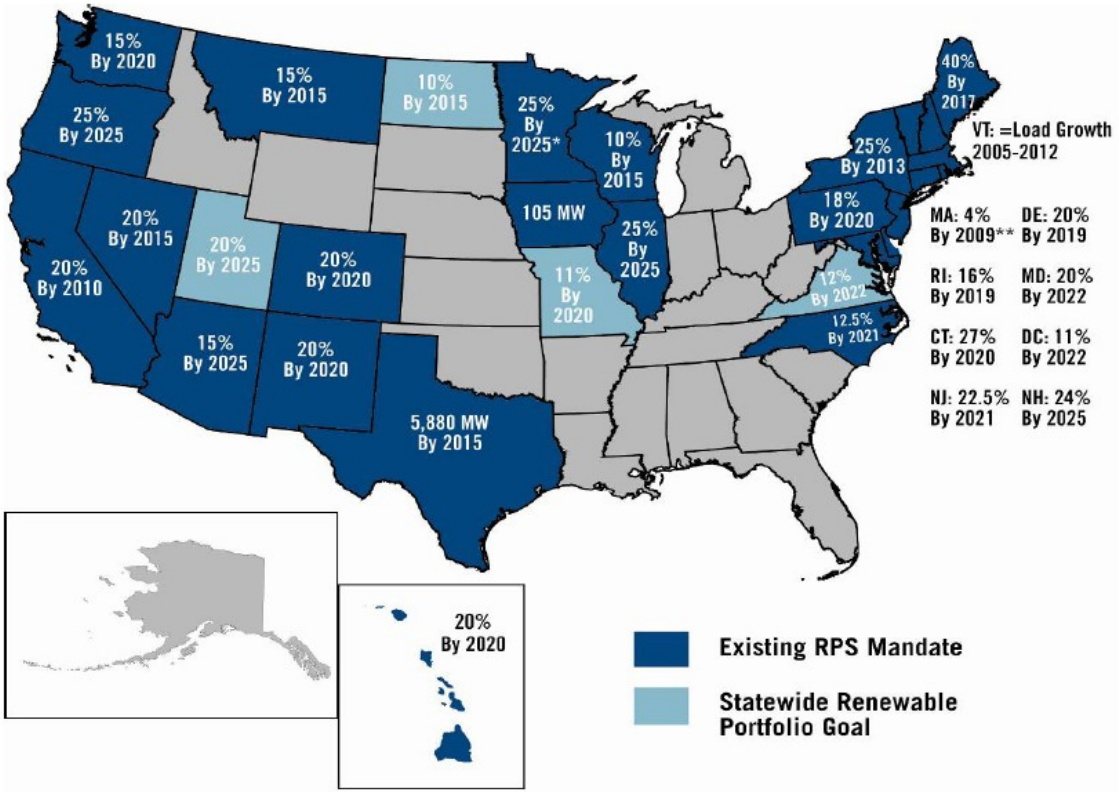
German target post Fukushima



Source: German Govt. proposals

Renewable portfolio standards

US states with mandatory targets



* Florida now has a 20% RPS by 2020 not reflected in the map. There may be other states as well that have adopted mandates since the map was published

Source: Edison Electric Institute, 8 Apr 08