Invisible Energy: How Far Can We Go With Energy Efficiency?

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Based on a book in process
"Invisible Energy"

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Efficiency is Invisible…

- Physically, which makes it hard to promote
  - What kind of picture do you use??
- Politically, because no one can get rich quick from efficiency
  - Instead, the economic benefits are distributed more democratically
- In the press, because there is no efficiency trade association, much less one each for housing, smart growth, commercial buildings, etc.

The public still does not understand what energy efficiency is

- Debates over energy in Washington DC often ignore efficiency or put it last
  - Even the President's inaugural address is not explicit about efficiency, even though it was about several types of renewables
- Even people who should know better still confuse conservation (cutbacks) with efficiency

Size of the Efficiency Resource

- Conventional analyses show 30% savings from measures already available and cost effective.
  - These measures cost less than half of new energy supply
- Conventional analyses low-ball the efficiency resource due to systematic biases.
  - Details to follow;
  - But this results in less attention to efficiency

Why Invisibility is a Problem

- Because efficiency becomes a lower priority than other resources that are more costly and less green
  - Lower budgets
  - Fewer “asks” on a list of top-3 priorities
- $ tens of trillions of potential efficiency benefits get lost in dialogues about alternatives with much smaller benefits

Efficiency Policy Provides the Centerpiece of the Solution to Critical Problems

- Climate change
- “Peak oil” and high fuel prices
- Global security
- The Great Recession (what we’re in now)

Why should we care about energy efficiency in the middle of a recession?

- This recession did not just occur randomly. It is largely a predicted result of fundamental problems.
- Weak energy efficiency policy is at the heart of many of them and is related to all of them.

Causes of the recession-I

- The mortgage meltdown
- The risk of inflation
- The large trade deficit
- The low savings rate

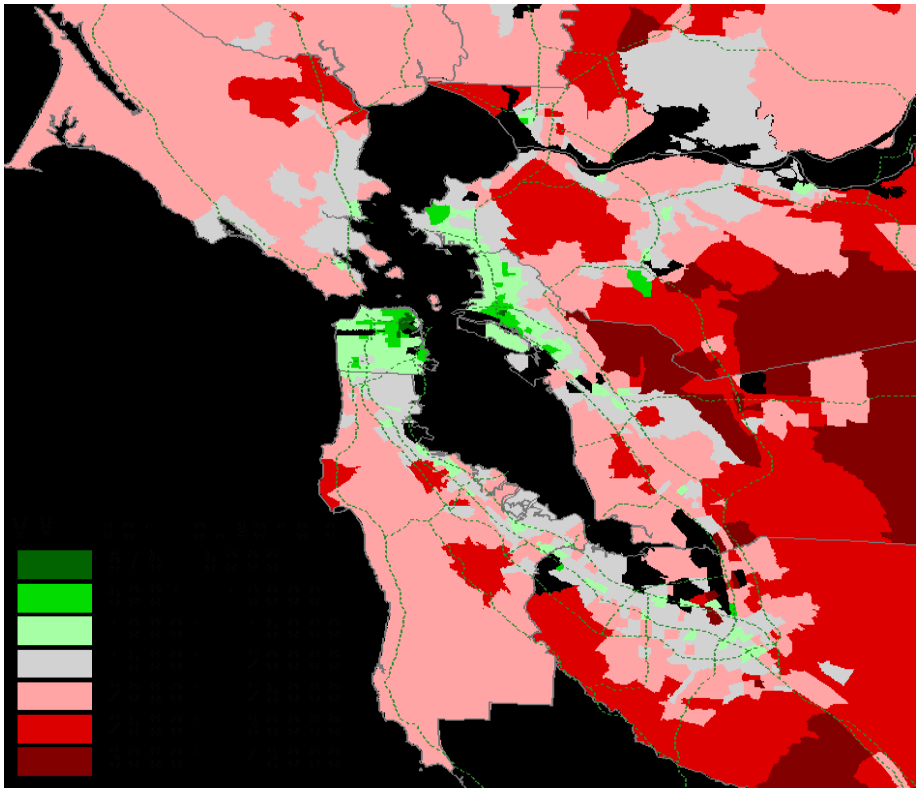
Causes of the recession-II

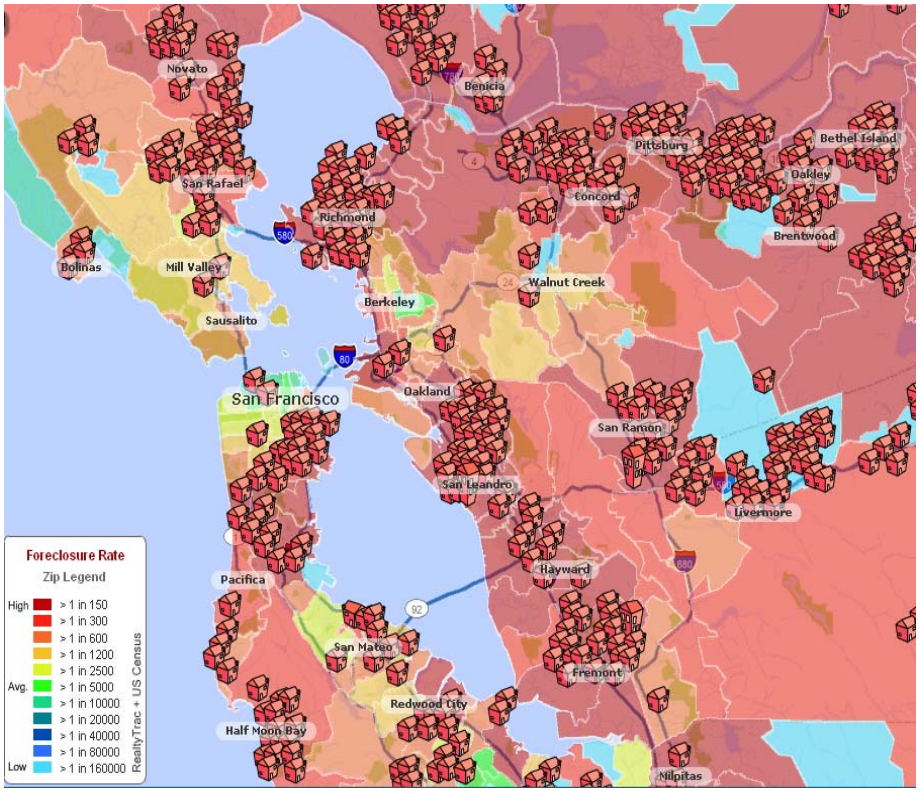
- Productivity increases that are too low
- Government deficits
- Weak consumer spending
- Too few jobs

Another primary cause?

- For a typical house in suburban sprawl:
  - the median price is $200,000
  - the average 30-year commitment to utility costs is $75,000
  - the cost to drive to and from it is $300,000.
  - (Utilities and transportation could be cut in half by green building practices and smart growth)
- It is not surprising that a lending system that looked only at the $200,000 commitment and not the $375,000 went wrong.

Household Mileage v. Foreclosures





Sources: Center for Neighborhood Technology; http://hotpads.com.

Digging Out

- Unless we correct the fundamental causes of the recession, we will not recover fully
- Conventional stimulus is less effective in the mid and long term if the starting point is high debt and low savings
- Spending must be accompanied with a payback
- We can’t cut interest rates any more

Energy Efficiency as the Cornerstone

- Investments in efficiency pay back quickly, allowing short term stimulus and long term responsibility
- Many efficiency investments allow immediate investments of modest amounts to eliminate the need for larger investments in the future.
  - E.g., California High Speed Rail business plan

Why the Efficiency Resource is Always Understated

- This talk identifies 8 different systematic biases towards low savings in existing potentials studies
- What is a “conservative” assumption for addressing climate change?

What Does “The Technical Potential for Efficiency” Mean?

- Potentials studies provide specific answers to specific policy questions
  - Thus they are limited by the portfolio of the agency that commissioned them
- How motivated is the sponsor of the potentials study?

Examples of Dramatic Success with Strong Motivation

- 1992 refrigerator standards
- Hood River Conservation Project and PG&E Delta Project
- California's 2001 efficiency program

Systematic Biases Resulting in Low Potentials

- Subjecting efficiency measures to a criterion of proof beyond a serious doubt
- Assuming arbitrary realization factors less than 100% due to questions about social acceptance of energy efficiency
- An implicit assumption that a lack of research on the cost or feasibility of a particular measure means that it is excluded from the study

Systematic Biases Resulting in Low Potentials

- A failure to consider issues of systems integration (see next slide for example)
- An assumption that once known efficiency measures are implemented, technological progress ceases and no further improvements are possible
- Ignoring the economic value of non-energy benefits such as increased thermal comfort at higher levels of information, or increased productivity of high efficiency commercial space


VIKING

Systematic Biases Resulting in Low Potentials

- A reliance on projected costs of efficiency without looking at realized costs, which, whenever data has been available, have always been lower than projected costs and often lower than zero
- Ignoring the economic benefits of reductions in energy price due to reductions in demand with the same amount of supply

What is a Conservative Assumption?

- “Conservative” depends on the context
- Most potential studies directly define conservative as meaning “biased low” because supply-side capacity is being cancelled in favor or cheaper efficiency: KEEP THE LIGHTS ON!
- Climate policy leads to the opposite definition: an underestimate of efficiency will entail overinvestment of both money *and management attention* in more expensive and problematic resources

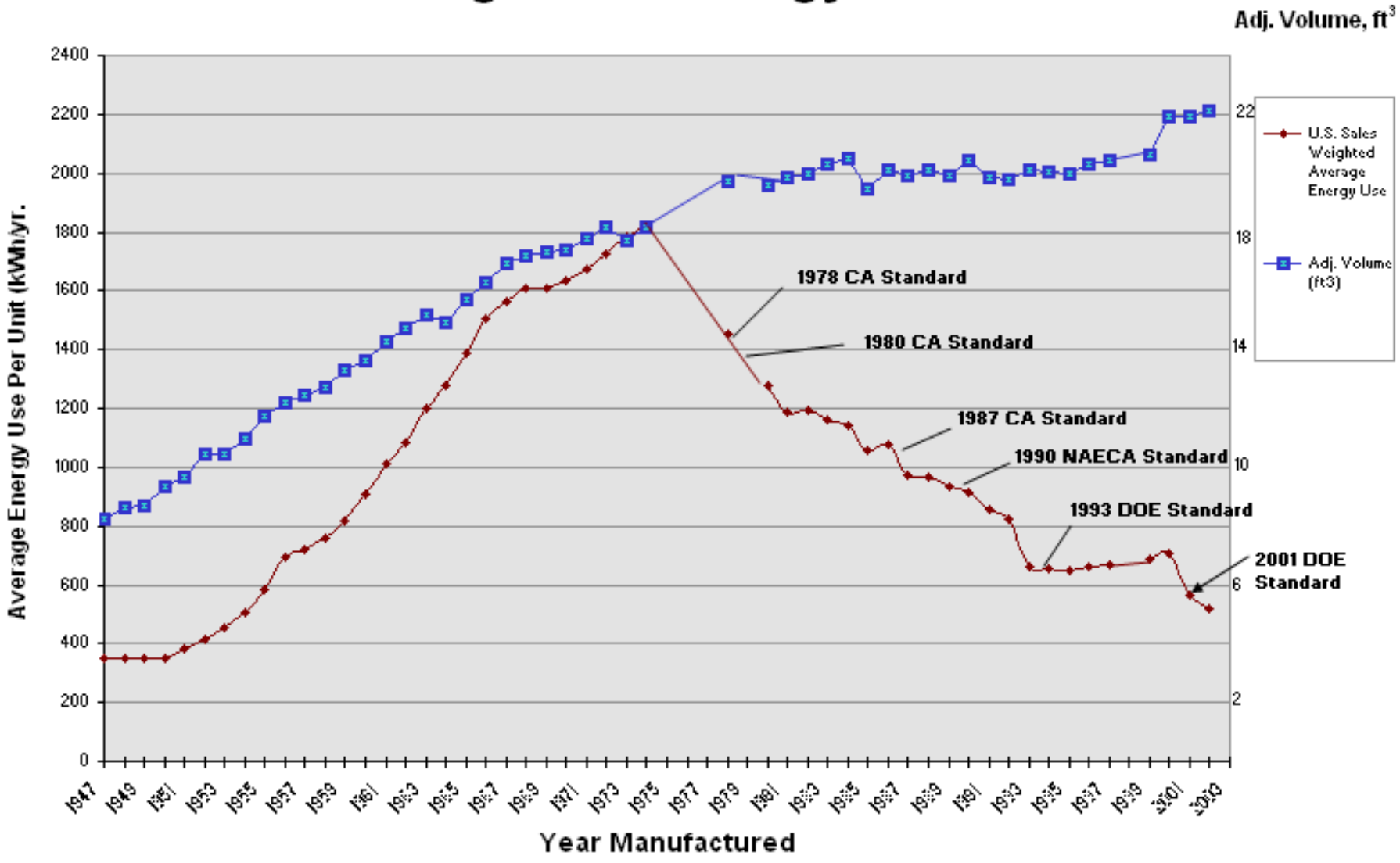
How Much Energy Do We Really Need?

- There is not much up-to-date analysis of the physical limits to how efficiently an energy service can be provided
- But looking at all of the major consumer end-uses of energy, the limits to plausible efficiency are at least an order of magnitude higher than current efficiencies; more careful research is needed

So How Far Can We Really Go?

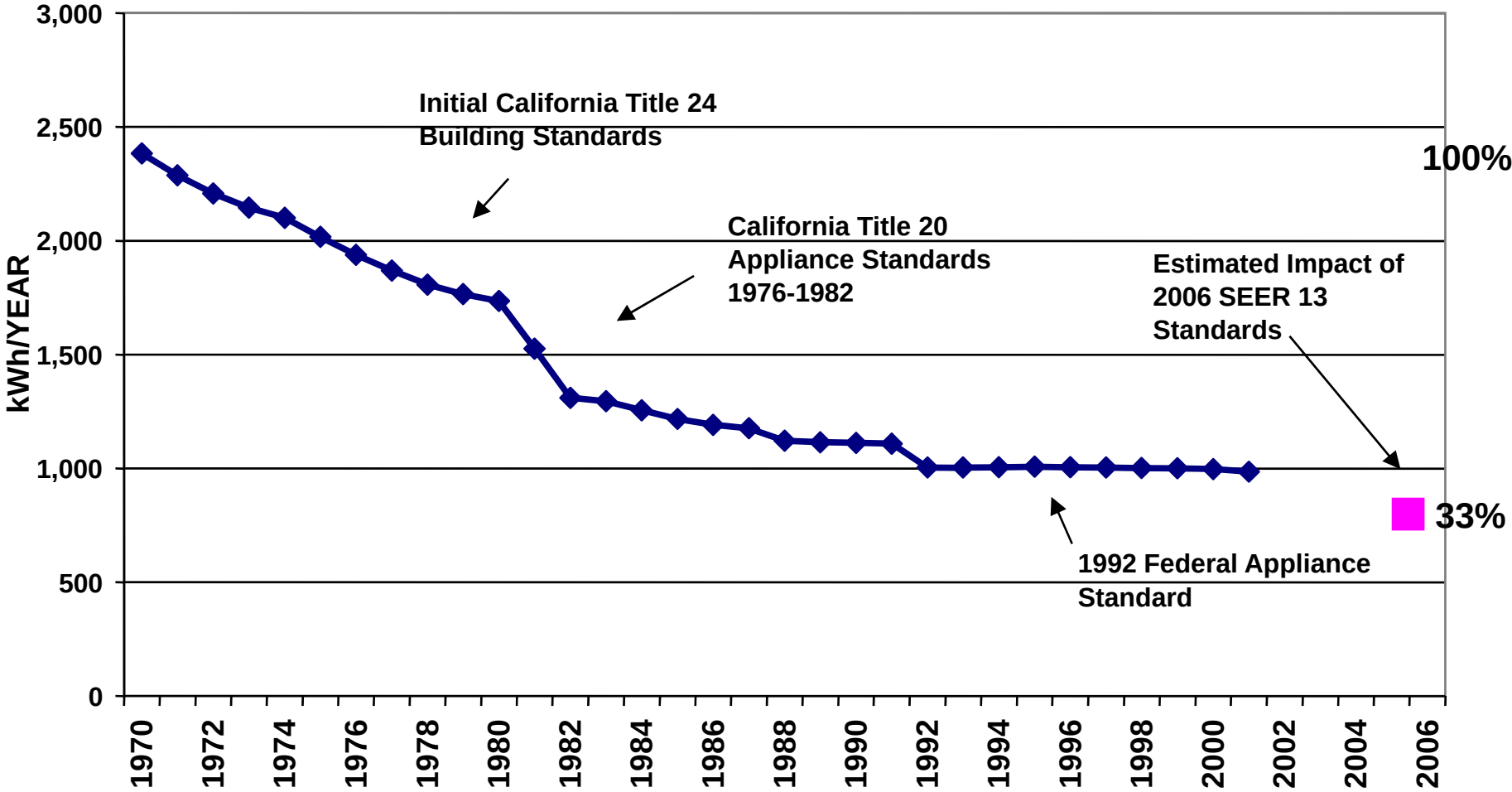
- Even with their biases, potentials studies suggest 35% to 50% savings after 20-40 years
- I believe the right answer is 80% to 90% within 10-20 years, plus some time lag for stop-turnover
  - This is consistent with the 2030 Zero Energy Challenge
- The key is in establishing markets that provide continuous improvement (Moore's Law)
  - What can the exponent be?
  - For refrigerators and CA Title 24 it is about 4-5%/yr

U.S. Refrigerator Energy Use v. Time



Annual Usage of Air Conditioning in New Homes in California

Annual drop averages 4% per year



Source: CEC Demand Analysis Office

So How Far Can We Really Go?

- The limits to efficiency have never been tested in the real world
- We have always run out of budget or will before we ran out of opportunity.
  - California’s emergency 2001 efficiency program

So…Do We Need More Aggressive Potentials Studies?

- Pro: a larger savings potential will generate more excitement politically
  - It will provide more realistic forecasts for energy supply industry
- Con: We learn what the true potential is only by acquiring the easy stuff first
  - More study could lead to delay in implementation

Policy Recommendations:

- *Set mandatory declining greenhouse gas emission caps*.
- Mandatory standards that encourage performance-based compliance.
  - Regular revisions to higher efficiency.
  - Standards include criteria for energy ratings.
  - Applicable to buildings, appliances, equipment, and cars.
- Simple normative labels to distinguish the most efficient buildings and equipment, such as the U.S. "Advanced Buildings Benchmark™", "Energy Star®" and "LEED™".

Policy Recommendations: II

- Informative labels to provide the information needed to establish property values for energy efficiency
  - The Russian “Energy Passport”
  - Building energy ratings required by the EU by 2006
- Managed incentives for modest improvements (~15%-30%) beyond the standards.
  - Some of these programs can be operated by utilities
- Long-term incentives for 50%-75% savings.
  - S.822/H.R. 1385 is a current example

Policy Recommendations III:

- Reform utility regulation to align customer benefit with utility profit
  - Require utilities to meet goals for renewable energy use
- Encourage location efficient development by:
  - Reducing regulatory restrictions on compact and mixed use development
  - Enhancing transit and other non-auto infrastructure

We are in a crisis, but don't panic

- Bold solutions must build on 35 years of policy—successes and failures.
- The details matter. Careless program designs usually fail.
  - Base incentives on performance, not cost.
  - Enhance markets by overcoming failures.
- Create fast incremental change.