Lessons for North and South from California’s Green Stimulus

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“It is not the strongest of the species that survives, nor even the most intelligent, but the one most responsive to change.”
- Charles Darwin

Seminar Presentation to the IFC – 10 April 2009 – Washington DC
Contents

1. Energy Efficiency and Growth
   • California evidence
   • Implications for LDCs

2. From Mitigation to Adaptation
   • California again
   • Climate risk and response in a North South context
Overview

This talk summarizes results from three studies (available @ www.next10.org):

1. Energy Efficiency and Job Creation in California (September)
2. California Climate Risk and Response (November)
3. Energy Pathways for California (March)
Energy Efficiency and Jobs: California’s Legacy

Total Electricity Use, per capita, 1960 - 2001

- U.S.
- California

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Energy Efficiency Gain Impacts from Programs Begun Prior to 2001

- 14% of Annual Use in California

Utility Programs: at a cost of ~1% of Electric Bill

Building Standards

Appliance Standards

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Historical Jobs Assessment

- A retrospective multiplier analysis of demand shifting
- Detailed BEA five-year Input-output Tables
- Employment data from California Employment Development Department dataset (CREE)
### Job Creation from Household Energy Efficiency

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<th>Agriculture</th>
<th>Energy Res</th>
<th>Elect Pwr</th>
<th>Oth Utl</th>
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<th>Oil Ref</th>
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<th>Cement</th>
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Total: 2,967

10 April 2009
### Employee Compensation (millions of 2000 US dollars)

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**Total: 44,611**
Why it works

The carbon fuel supply chain is among the least employment intensive in the economy.

Source: California Employment Development Department dataset.
Efficiency for Growth

- Promoting efficiency saves money for individuals and enterprises, liberating resources for more job-intensive growth.
- Standards and incentives should be extended nationally, using public policy to overcome adoption barriers and innovation constraints.
- Energy efficiency is the next breakout technology sector, and domestic standards to promote innovation will establish global markets.
Energy Efficiency in the LDC Context

Rather than promoting efficiency, many LDCs subsidize energy use. A stubborn artifact of the pre-climate change era:

**Pros**
- Real incomes – essential energy services
- Market access – lower trade margins

**Cons**
- Biased technology choice/urban and regional development
- Sustainability: Environmental and Fiscal
Sustainability: Can we really keep doing this?


Source: Author estimates from International Energy Agency and World Bank data. Bubble diameter is proportional to population.
Energy Efficiency

In principal, EE can confer the same benefits on non-OECD economies:
- Higher real incomes – net energy savings
- Market access – lower transport costs

Without the main drawbacks:
- Adverse technology bias
- Unsustainable emission and fiscal trajectories

Clean energy is great, but demand side management is far from realizing it’s potential.

To promote adoption, we must overcome:
1. Lack of access to new technology
2. Financial hurdles
Adoption versus Energy Subsidies

Consider the cost of new and old appliances with direct and indirect (energy) subsidies:

\[ C_1 = (1 - s_1)F_1 + \sum V_{1t} p_t \delta_t \]
\[ C_0 = F_0 + \sum (1 - s_0) V_{0t} p_t \delta_t \]

where F are fixed and V are variable cost determinants (e.g. VMT/mpg), \( s \) is a subsidy rate, \( p_t \) are energy prices, and \( \delta_t = 1/(1+r)^t \) is a discount rate.

The first approach can promote technology adoption, the second mainly promotes energy use and reinforces negative carbon externalities.

The second approach can also lead to fiscal problems in the face of rising energy prices.
Subsidizing Efficiency

Assuming constant variable costs and setting the \( C_1 = C_0 \) yields an adoption subsidy

\[
s_1 F_1 = (F_1 - F_0) + \left[ V_1 - (1 - s_0) V_0 \right] \sum p_t \delta_t
\]

which must compensate for

1. difference in initial cost and
2. present value difference in operating costs.

For identical appliances, we have

\[
s_1 F = s_0 V \sum p_t \delta_t
\]

i.e. the adoption subsidy equals the present value of the energy subsidies
Subsidizing Efficiency

For example, if improved energy efficiency equals the subsidy rate

\[ V_1 = (1 - s_0)V_0 \]

then the adoption subsidy need only compensate for the purchase price difference

\[ F_1 - F_0 \]
How to Promote EE Adoption

• US experience suggests that capital markets can fail here.
• California, the most successful state in promoting EE, has relied completely on standards (i.e. command and control).
• Even if the technology has to be imported, energy savings have domestic multiplier effects and usually reduce other (fuel) import dependence.
Demand Side Management:
This Fruit is Ripe and Low Hanging

United States Refrigerator Use v. Time

Energy Use per Unit (KWH/Year)
Refrigerator Price in 1983 $
1st Federal Standards
Refrigerator Price
Refrigerator Size (cubic ft)

Average Energy Use or Price


10 April 2009  Roland-Holst  18
Demand vs. Supply Side Solutions: Electric Power in China

三峡电量与电冰箱、空调能效对比

<table>
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<th>TWh/Year</th>
<th>Value of TWh</th>
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<td>Wholesale (3 Gorges) at 3.6 c/kWh</td>
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<tr>
<td>Retail (AC + Ref) at 7.2 c/kWh</td>
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Source: LBL data.

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Supply-side Solutions and Climate: China’s Electric Power Capacity

- Between now and 2020, more new capacity will be added than the entire installed capacity of the EU-25
- 87% coal-fired
- 30-50 year useful life
Why promote efficiency now...

Durable Goods: Linear Growth of Average Income Induces Exponential Growth of New Demand

Consumption Milestones:

Income

TV

Scooter

Auto

25 September 2008
Vehicle Demand Growth: 1960-2030

The graph illustrates the historical and projected vehicle demand growth per 1000 people from 1960 to 2030, comparing different countries. The data is presented on a log scale for both vehicles per capita and per-capita income in thousands of 1995 PPP dollars. The Gompertz function is used to model the growth patterns.
Adaptation: The New Agenda of Climate Defense

- No state or country can stop Climate Change alone, but each has a responsibility to protect itself.
- Over the next century, we face enormous adaptation challenges, regardless of our own mitigation policies.
## Economic Damage and Asset Risk Estimates for California

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Source: Roland-Holst and Kahrl, “California Climate Risk and Response”

[www.next10.org](http://www.next10.org)
Reduction in the Sierra Snowpack

Notes and Source: “Lower Warming Range Drier Climate” is based on a GFDL B1 scenario; “Medium Warming Range Drier Climate” is based on a GFDL A2 scenario. Luers et al., 2006.

10 April 2009
Coastal Vulnerability

Source: Adapted from USGS Woods Hole Science Center website, http://woodshole.er.usgs.gov/project-pages/cvi/
Inundation/Salinization Risk
San Francisco
International Airport
One Meter Sea Level Rise
Notes and Source: “Lower Warming Range Drier Climate” is based on an GFDL B1 scenario; “Medium Warming Range Drier Climate” is based on a GFDL A2 scenario. Luers et al., 2006.
Silicon Valley

One Meter Sea Level Rise
Acres Burned and Dollar Damage

Source: CDF, 2004
Developing Country Perspectives

Adaptation in OECD economies will be mainly about protecting assets.

In Developing Countries, the main priority will be to protect people.

Because of differing initial conditions, adaptation will emerge to become a prominent or even dominant component of North-South assistance flows.

Two leading issues:

1. Food security
2. Sea level risk
Food Security and Income

Percent of Income Spent on Food vs. 2005 Per Capita (PPP) Income in Thousands

50% of World Population
80%
Tropical Countries in Red

Percent of Income Spent on Food

2005 Per Capita (PPP) Income in Thousands

50% of World Population

80%
Policy Responses

- Water pricing
- Ag. Biotech
- Contracting in domestic agro-food supply chains (Mars)
- Trade policy – import water services

Example: Moroccan Embodied Water Trade

Source: Hoekstra and Chapagain: 2007
Sea Level Vulnerability

10 April 2009
Low Elevation Coastal Zones

Source: UN-HABITAT Global Urban Observatory 2008

Percent of National Population
- Non LECZ
- 0.0 - 5.0
- 5.1 - 10.0
- 10.1 - 15.0
- 15.1 - 20.0
- 20.1 - 25.0
- > 25.0

Vulnerable City Size
- Small
- Intermediate
- Big

Population of cities
- Small: 100 - 500 thousand
- Intermediate: 500 thousand - 1 million
- Big: More than 1 million

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Climate Refugees: Everybody’s problem

Potential impact of sea-level rise on Bangladesh

Today
Total population: 112 Million
Total land area: 134,000 km²

1.5 m - Impact
Total population affected: 17 Million (15%)
Total land area affected: 22,000 km² (16%)

Source: UNEP/GRID Geneva; University of Dacca; JRC Munich; The World Bank; World Resources Institute, Washington D.C.
Top 10 countries by assets exposed today and in the 2070s (OECD median scenario)

Source: OECD: 2008
Top 15 countries by population exposed today and in the 2070s

Source: OECD: 2008

3 July 2008
Carbon, Energy, and Income Inequality: A Basis for Climate Multilateralism

Source: Author estimates from World Bank and IEA data.
Conclusions

1. Energy efficiency can be a potent catalyst for job creation and growth, not just in new technology sectors, but across the economy.

2. Demand side management has enormous potential for improving energy/environmental sustainability. Incentives and standards are needed, however.

3. We face substantial risks from climate change, but Climate Defense offers a new agenda for economic stimulus and growth that is employment, technology, and skill intensive.

4. Globally, adaptation presents a momentous new agenda for North-South cooperation, including direct assistance, technology transfer, and a broad range of investment opportunities.
Discussion