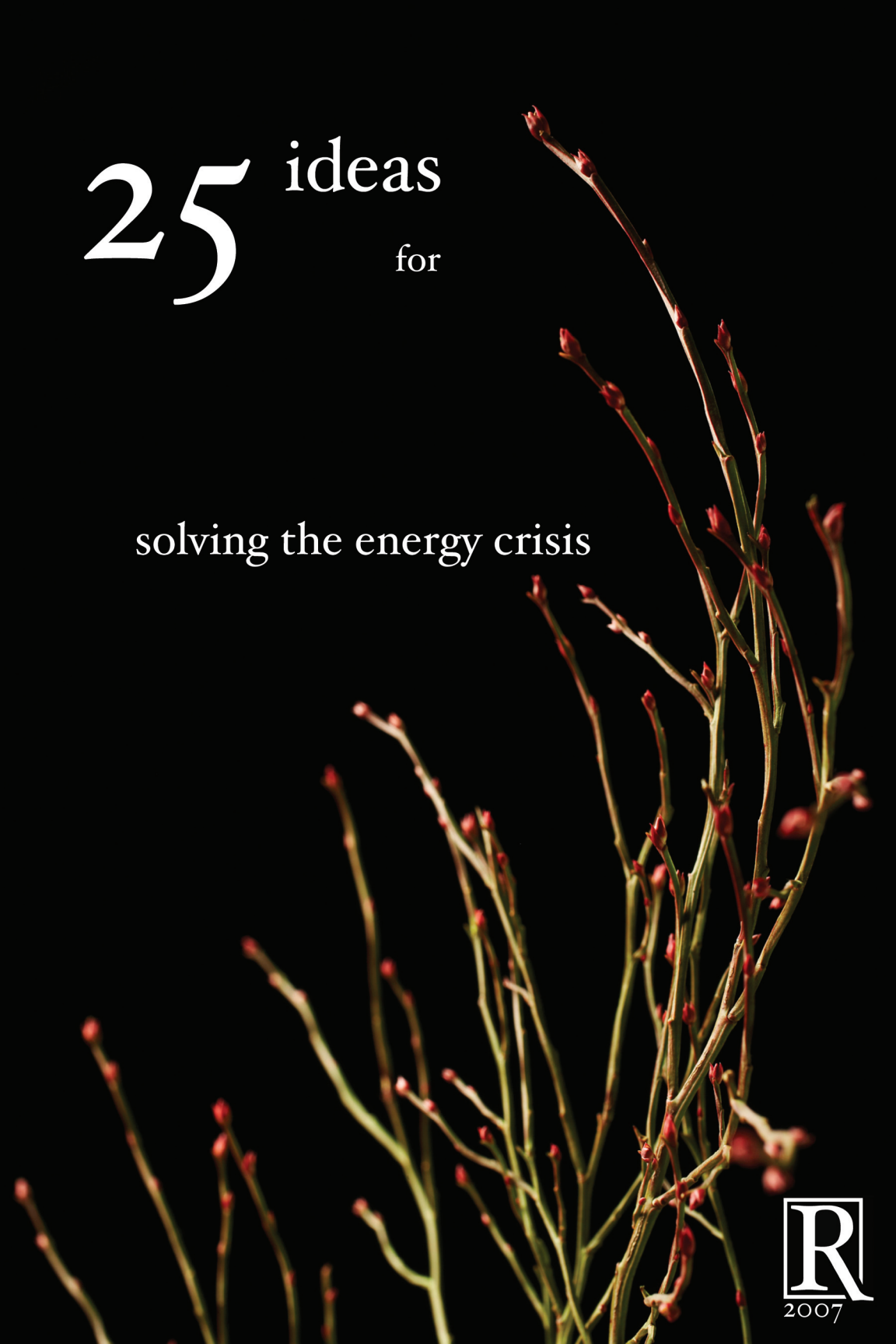
25 ideas for solving the energy crisis



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25 ideas for

The Energy Crisis

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Summer 2007

The 25 Ideas project is a direct extension of the Roosevelt Institution's mission to connect students' policy ideas to policymakers. Each aspect has been designed with the lawmaker in mind: from the two-page, condensed formatting, to the inclusion of concise sets of key facts and talking points. Both easy to read and easy to understand, these ideas have been distilled into small bursts of creativity and thoughtfulness. Though they have been condensed here for the busy reader's convenience, several of these Ideas are also available in extended form through rooseveltinstitution.org or in our upcoming issue of the *Roosevelt Review*.

While we hope that you will enjoy reading these Ideas, they are not meant to stay on your coffee table. Some Ideas have ramifications for those who work at the federal policy level; others, at the state and municipal levels. Still others focus primarily on what universities can do. So no matter what level of government you focus on - or even if you are still a student - there is an Idea in these pages that you should consider acting on.

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The Roosevelt Institution is a national student think tank with nearly 7,000 members at over 50 college campuses across the United States. Founded in 2004, the Institution strives to connect students to the policymaking process in a variety of ways through print and online publications, direct student-to-lawmaker connections, and annual conferences. The Roosevelt Institution has been featured in such publications as *The New York Times*, *The Chronicle of Higher Education*, and *Der Spiegel*.

The Institution wishes to give special thanks to its outgoing Executive Director and co-founder, Kai Stinchcombe. Kai's enthusiasm for this project and his indefatigable energy propelled the 25 Ideas from the white board to the Roosevelt chapters, collecting hundreds of ideas and turning a wish into a reality. Since 2004, Kai's vision for the potential of his fellow students has developed into an organization that is changing the way many students study and interact with public policy. The Roosevelt Institution is truly fortunate to have had his entrepreneurial spirit, and he will be sorely missed at our offices in Washington, D.C.

Letter from the Editors

Our nation faces an energy crisis fueled by global warming, destructive resource depletion, and dependence on foreign sources of energy. The challenge is multidimensional and solutions must be implemented at different levels of government, on different time frames, on different scales, and in different regions.

No single panacea exists to solve our problems. Instead, a multitude of solutions are needed from energy efficient traffic signals to publicly funded advertising campaigns, from greening our schools to cash prize contests for new clean energy technologies. To come up with these varied solutions a great deal of optimism and open-mindedness is required.

In that spirit, the Roosevelt Institution challenged its members in the summer of 2006 to develop strategies which reduce our dependence on foreign, harmful, and unsustainable energy. We encouraged authors to submit both pragmatic and visionary ideas, novel and familiar ones which may have been forgotten. Students from across the nation have answered the call and the very best of those ideas are presented here.

The breadth of ideas in this volume should show both the scope and the urgent nature of the energy crisis we are facing. More importantly, these ideas demonstrate our hope that the innovative ideas and determined initiative of students from around the country can solve that crisis.

Sincerely,

Paul Burow, Kirti Datla, and Emily Hallet
Editors, Roosevelt Challenge on the Energy Crisis

Acknowledgments

The Roosevelt Institution recognizes and thanks the following people for their outstanding dedication to the success of this inaugural publication. Any accolades earned by this new venture are due to their guidance and aid.

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To our friends and donors, whose continued generosity
makes the impossible happen every day,
thank you.

25 ideas

Twenty-Cent Consumer Tax on Plastic and Paper Bags

Olivia Katz, Middlebury College

The federal government should implement a 20-cent consumer tax on plastic and paper shopping bags to internalize the environmental costs of bag consumption. The legislation would both discourage use of disposable bags and raise money to implement a more comprehensive bag-recycling program.

Grocery stores' distribution of disposable bags is a classic example of the tragedy of the commons: the individual consumer does not pay for the convenience of disposable bags, but society bears the financial and environmental burdens. Resolution of this collective-action problem requires government intervention. A 20-cent consumer tax on bags holds the individual consumer financially responsible for the burden of that bag on society.

KEY FACTS

- Twelve million barrels of oil are required to produce the 100 billion plastic bags used annually in the United States.
- Thirty-five million trees are cut down to produce the 25 billion paper bags used in the United States each year.
- Paper and plastic bags are similarly harmful to the environment. Paper bags consume more resources, but unlike plastic bags, they come from a renewable resource, have a higher rate of recycling, and can be composted.
- While there are plastic bag recycling bins in many big stores and paper bags can be recycled along with paper, the EPA estimates that only one percent of plastic bags and 20 percent of paper bags in the United States are recycled.

It is necessary to tax both paper and plastic bags because a tax solely on plastic bags shifts consumer demand from plastic to paper bags. This would likely fail to decrease overall disposable bag consumption and would be expensive for retailers (plastic bags cost one-cent whereas paper bags cost four-cents). The tax can be adjusted over time in response to consumer behavior, new technologies, and inflation. The EPA can use the money raised from the bag tax to subsidize the cost of reusable bags for low-income shoppers and to set up in-store bag recycling programs that will provide five-cent rebates for each returned bag.

TALKING POINTS

- An average of the estimations of bag externalities for various cities and states indicates that the national bag tax should be 20 cents per bag.
- A consumer tax on plastic and paper bags maintains consumer choice to use disposable bags when the benefit of using the bag outweighs the cost.
- A consumer tax on plastic and paper bags would cost very little to implement because the grocery tax infrastructure already exists.

HISTORY

Governments worldwide are struggling with disposable bag overuse. In 2002, Ireland implemented a consumer plastic bag tax of .15 Euro (now .22 Euro), much like the one described in this proposal. The tax decreased plastic bag use by 90 percent and raised ten million Euros for environmental

projects. The tax did not apply to paper products and as a result disposable paper use increased.

While Irish consumers initially resisted tax, they now embrace it, after recognizing its positive environmental and aesthetic effects. The Government of Denmark taxes retailers 22 DKK per kilo of plastic bags. This tax has been less effective—only decreasing plastic bag use by 66 percent—because it does not hold individual customers accountable for their plastic bag use. Bangledesh, India, Taiwan and the city of San Francisco have taken a more extreme approach, banning plastic bag use entirely. A tax on paper bags has yet to be instituted.

ANALYSIS

The cost of plastic bags to society varies by region, depending on production, distribution, and disposal. An average of the externalities of plastic bags calculated by various cities and states nationwide indicates that the national bag tax should be 20 cents per bag. This tax is also high enough to influence consumer behavior, given the elastic nature of bag use. Externalities come from each stage of paper and plastic bag consumption, including production, transportation, and disposal.

Other options for decreasing disposable bag use include efforts to increase bag-recycling, rebates for customers who bring their own bags, or a complete ban on plastic bags. None of these policies would be as effective or as efficient as a disposable bag tax. Implementing a campaign that solely encourages bag recycling would not decrease overall consumption, and recycling requires substantial energy. If sufficiently high, providing a rebate for returned bags would incentivize people to recycle, but this would be costly and depend on retailers' promotion. A ban on plastic bags would eliminate worthwhile bag applications and take away the customer's choice to use bags if the customer were willing to pay for the societal costs of bag consumption. The tax would also benefit businesses, as they would not have to distribute as many disposable bags and would benefit from increased reusable bag sales.

AUDIENCE

A tax on plastic and paper bags would have the most impact if implemented by the federal government. However, if cities and states adopted such a tax, it would put pressure on the federal government to mandate such a tax. Individual retailers can also encourage bag conservation and re-use by charging for bags, although this could deter customers.

NEXT STEPS

Consumers must pay the 20-cent tax, but retailers are responsible for collecting the tax and itemizing it on the customer receipts. The IRS will issue a return form to each retailer identified as likely to have a liability and then debt the amount due from the retailer's bank account.

SOURCES

* A full list of sources is available upon request.

Decoupling: Removing Market Barriers to Energy Efficiency

Jonas Ketterle, Stanford University

In California, utility revenues are independent from electricity sales, which removes the economic disincentive for utilities to promote energy efficiency. California also has the most effective energy efficiency programs nationwide. Spreading decoupling to every state would allow all utilities to profit from energy efficiency and reduce global warming impact.

Under decoupling, utilities use standard rate-making procedures to predict energy sales and required revenue, from which electricity rates are determined. However, rather than generating revenue from actual energy sales multiplied by the rate, the utilities are guaranteed an "authorized revenue" that includes operating costs and a predetermined return on investment.

KEY FACTS

- Decoupling is a tried and true concept used for gas and electricity in several states already.
- A coalition of stakeholders must approach each state's public utility commission to implement decoupling with the electric utilities.
- Decoupling only removes a market barrier for energy efficiency; it does not provide incentives for energy efficiency.
- Pacific Gas and Electric's (PG&E) own Jonathan Livingston calls decoupling "the single most important efficiency measure in the state of CA."
- Combined with shared savings, PG&E returns 89 percent of savings to the customer as lower bills, and keeps 11 percent. Shared saving was PG&E's second largest source of revenue.

If the income from electricity sales is above the authorized revenue, the utilities place excess income in a balancing account. Similarly, if the income from electricity sales is below the authorized revenue, the utilities draw from the balancing account to meet their authorized revenue. Doing so insulates the utilities' profits from the price shocks that occur under normal market regulation.

TALKING POINTS

- Standard electricity rate setting in the US is economically inefficient because utilities do not have an incentive to choose the least-cost option to provide energy service.
- Decoupling does not specify a technology, or provide large subsidies.
- All alternatives, such as Lost Revenue Adjustments, more frequent rate cases, and fixed charges do not tackle the fundamental market disincentive problem, and have proven to be less effective than decoupling.
- Right now utility companies make money off wasted energy. Under decoupling, they make money by being energy efficient.

California's decoupling policy, known as the 'Electric Rate Adjustment Mechanism,' or ERAM, was first implemented for Pacific Gas and Electric in 1982, then later for

all other regulated gas and electric utilities in CA. Electric decoupling is pending in seven states, and natural gas decoupling exists in nine states, and is pending in seven more.

HISTORY

During deregulation in California, decoupling was discontinued, but reinstated in 2001. In 1999 and 2000, energy efficiency savings in CA were the lowest in a decade, because utility investment all but disappeared when decoupling was not in place. The results so far are overwhelmingly positive, with reduction in rate risk to consumers and reduction in profit risk to utilities, and energy use per capita in California that is much lower than the national average.

ANALYSIS

Energy efficiency measures in CA reduced electricity consumption by 15 percent in 2003. Notably, almost half of these reductions are the result of utility-initiated efficiency programs. Without decoupling, utilities would not have embarked on such expansive energy efficiency measures, so much of this reduction in electricity consumption can therefore be attributed to incentives introduced by decoupling.

One can also look at investments in energy efficiency. For example, of the more than $700 million per year invested in energy efficiency in California, around $400 million comes from utilities' own investments in energy efficiency programs, which is encouraged by policies that decouple electricity revenue and sales. The remaining $300 million results from mandatory mechanisms.

NEXT STEPS

Electricity markets are not centralized nationally; rather, in each state, the public utilities commission regulates electricity markets. This means that the Federal Energy Regulatory Commission has no authority to mandate decoupling. The National Energy Policy Act of 1992 also recommended decoupling. Now, a coalition of stakeholders, including environmentalists, utilities, businesses, residents and politicians, should approach their state public utilities commission and push for a decoupling measure. There are many variations possible with decoupling, and each is suited for a particular market/region/situation. On a state by state case, each PUC can implement decoupling in the most appropriate manner.

The good news is that decoupling can be implemented now. It has been tried and proven successful with several utilities, such as in Oregon and California; these utilities are now strongly in favor of decoupling. The National Resources Defense Council and the Energy Foundation are now working on building a coalition to push decoupling in each state nationwide. There is much room for students and policy legislators to support their work.

Climate Change Insurance

Kai Stinchcombe, Stanford University

Mandating insurance to protect homeowners against rising sea levels on the 50-year horizon will improve planning and bring the free market to bear on the real costs of climate change.

Global climate change puts millions of Americans living in coastal areas in the same position as the residents of pre-Katrina New Orleans: their homes are going to end up under water.

Before the storm, governments urged residents to purchase insurance or move to higher ground. When the storm hit, the response was bungled, and to make up for a failure of planning the government spent billions on temporary housing. Many families lost their homes; some lost their loved ones as well.

KEY FACTS

- The Intergovernmental Panel on Climate Change predicts that sea levels will rise about one half-meter by 2100.
- A half-meter sea level rise will put 9,000 square miles of the United States underwater and an additional 7,000 square miles at risk of flooding.
- The Gulf Coast, Mid-Atlantic, South, and San Francisco Bay Area will be most affected by rising sea levels.
- Flood defenses will need to be upgraded in New York, Washington, D.C., Miami, and New Orleans.
- The cost of the rising sea level will be between $20 billion to $150 billion, depending on how smart we plan.

If America does not plan for climate disaster, our response to rising sea levels will suffer the same problems as our response to Hurricane Katrina—it will be an expensive and inefficient bailout rather than a smart prevention and readiness plan. It will also once again likely leave the poor to fend for themselves.

It does not have to be that way. The linchpin of successful climate change planning is coastal climate change insurance, a policy that will pay the value of your property if it becomes uninhabitable due to rising sea levels.

TALKING POINTS

- Many coastal families could lose everything as a result of global climate change.
- Government disaster response has been poorly planned and executed, while proactive solutions have not been adopted.
- Natural disasters disproportionately affect the poor. Rising sea levels will share this tendency.
- Right now nobody knows what the probability is and which homes will be most affected. Dealing with climate change in a free market context will improve analysis and encourage investment in accurate science.

Mandatory climate insurance policies on all homes above a certain value would insure that communities prepare for climate change and that no family loses everything as a result of global warming.

STRUCTURING INSURANCE POLICIES

Most insurance is designed to protect against sudden, unpredictable events such as home fires, car accidents, medical emergencies, or death. The rising sea level is a slow, steady, predictable process -- you can see it coming decades before it happens. Therefore, insurance policies would need to be specially designed to spread out the risk over a number of years.

One possibility is to make policies extend out fifty years, more like a futures market. In other words, one's purchase of 2007 climate change insurance pays the value of the house if it becomes uninhabitable in 2057. Policies could be structured so as to vest fully over the period between 2010 and 2030: the insurance first purchased in 2010 could cover the year 2060 and also 2049, the insurance purchased in 2011 would cover 2061 and also 2047, and so on, so that in 2029 the insurance purchased would cover 2079 and also 2030. In 2030 the house would be currently insured and insurance would only need to be purchased for 2080, and in 2031, 2081, and so on. Families could switch insurers at any time to find the most competitive rate.

To protect residents unable to afford such insurance, regulators could increase the payout so for every $100 in claims, the insurance company would also have to pay out $25 into a government-administered fund to help resettle the area's poorer residents. This would increase premiums on wealthier residents by 25 percent, but would also reduce the human costs of rising sea levels and mean the federal government would not need to become involved in insuring homes.

Families would not wake up one morning to find that the home they had worked their whole lives for was suddenly under water; instead, they would have prepared for that contingency over the preceding fifty years.

ADDITIONAL BENEFITS

Climate change insurance would improve climate change planning, because people with high premiums might move to higher ground or lobby for premium-reducing changes like local erosion control efforts, dunes, earthworks, or levees. If economically efficient, they could also demand federal climate change policy that would reduce the estimated economic burdens homeowners would face from having to relocate in the future.

Second, the market to resell climate change insurance would help to quantify the costs of climate change by implicitly creating a climate change futures market. Those who claim that sea levels are not rising would have a chance to invest in their assertion by buying climate change reinsurance, and those who believe it will rise could short sell climate futures. This market would enable governments to see through the spin and controversy and more accurately estimate the costs of climate change.

SOURCES

Pew Center on Global Climate Change, "Sea-Level Rise & Global Climate Change: A Review of Impacts to U.S. Coasts." James E. Neumann, Gary Yohe, Robert Nicholls, and Michelle Manion. February 2000.

LED Standard Traffic Signals

Kyle Atwell, Paul Burow, and Nick Santos, University of California at Davis

States should pass laws that mandate use of the most energy-efficient traffic signal technologies available. State actions should include:

(1) Setting a minimum energy efficiency requirement for traffic signals;
(2) Providing low interest loans to fund the transition to more energy efficient technologies provided a reasonable payback period can be proved.

The replacement of standard incandescent lamps with light emitting diodes (LEDs) in traffic signals offers a pragmatic and cost effective way to increase states' energy efficiency. LED lights use approximately one tenth the energy of traditional incandescent bulbs, and save money for cities within years of installation.

We propose a mandatory energy efficiency standard for traffic signals which must be met by all municipalities by the year 2015, necessitating the conversion of incandescent lamps to LEDs. The current loan program would be expanded to increase the availability of low-interest loans to help municipalities cover both initial transition costs and the purchase of module designs which use less energy.

KEY FACTS

- LED lights save money in the long run, with an average payback period of three to five years after initial transition.
- This proposed policy would mandate a conversion of all traffic signals to LED technology by 2015 through an energy efficiency standard.
- While California uses LEDs for 60 percent of its signals, the national average is below 20 percent.
- Australia and the EU have banned incandescent bulbs, and New York did a full LED transition in 2004.

BACKGROUND

LEDs require only ten percent of the energy used by incandescent lamps, making them an energy-efficient alternative source of lighting. While the relatively high initial cost of LED lamps compared to incandescent lamps can present a barrier to entry, falling LED prices make the transition away from incandescent bulbs a more viable solution for municipalities striving to save energy and money. Currently, the payback period for transition to LED modules ranges from three to five years.

TALKING POINTS

- LEDs use approximately one tenth of the energy consumed by incandescent bulbs.
- If the remaining 40 percent of traffic lights in California transitioned to LED, it would produce the equivalent of removing 820,000 cars from the road and save $520 million statewide for each bulb replacement period.
- Of 55 California cities who took loans to install LEDs, 94 percent of them reached their payback period goals.

The State of California currently requires traffic signal manufacturers to meet predefined minimum efficiency standards, which only LED technology can achieve. In addition,

California offers low-interest loans to municipalities seeking to replace incandescent lamps with more efficient LED bulbs. These programs have been successful in speeding the transition to a new LED standard statewide. However, a LED standard is not mandatory, and some municipalities have stated they have no intention of replacing antiquated incandescent traffic signals with more energy efficient LEDs.

ANALYSIS

The biggest obstacle to achieving a statewide LED standard has been the initial cost of replacing the hardware modules. The California Energy Commission priced a typical red 12-inch LED lamp at $60 in 2004, compared to three dollars for a comparable incandescent bulb. While this cost differential is significant, the costs of LED lighting have decreased significantly, falling from earlier prices of $200-$300 per head. Prices are expected to fall further with rising demand.

The costs of LED installation are low, and the bulbs can be switched on already scheduled routine service calls. Moreover, the cost savings associated with increased efficiency, a rise in energy prices, and the decrease in maintenance costs, mean that a LED standard will pay for itself in the long-term. The California Energy Commission estimates that if a city converts all its intersections to LED it will reduce energy use by 70 percent, paying back the initial investment in 3-5 years.

State and federal funding assistance has helped municipalities fund LED transition. In California, the state offers low-interest loans to municipalities that project a payback period of 10 years, which the LED standard easily accomplishes. Past loans have typically been repaid from the energy savings alone. These state loans have been essential for covering the high initial costs of LED transition, and are not high risk; a study of 55 LED projects in California found a 94 percent success rate in meeting the payback period.

NEXT STEPS

States can take action immediately by having the responsible state agency determine what energy efficiency standard would necessitate a conversion to LED technology and passing the required legislation to mandate the change.

SOURCES

Bronson, M. *Light Emitting Diodes (LED) Traffic Signal Survey Results*. California Energy Commission. Sacramento, CA, 2005.

Layberry,R. and M. Ledbery. "Traffic Signals. Quick Hits". U.K. Energy Research Institute. http://www.eci.ox.ac.uk/research/energy/downloads/qh3-trafficsignals.pdf, 2006

High Performance Schools for America

Tyler Huebner, Jonas Ketterle, Stanford University

Reduce global warming emissions and increase learning through implementing a green buildings standard and loan fund for all elementary and secondary schools.

A recent study by Greg Kats of Capital E quantifies the costs and benefits of using green building techniques to design school buildings. Green building pays particular attention to reduced energy and water consumption, improved air quality, and building performance. Many studies have shown that students perform better in green schools, and the study by Greg Kats compiles various efforts to quantify the benefit of these high performance schools. The outcome is clear: a slight cost premium results in savings for the school district and more successful students.

Current schools are built to meet building code, which is a bare minimum design standard that is not optimized for educating children. High performance schools go beyond this code and create schools that are designed as a good learning environment that teachers and students benefit from. All parents should support this policy, because it would improve the education and health of their children.

KEY FACTS

- On average, a high performance school has an initial cost premium of less than two percent.
- The direct resource cost savings over the lifetime of the school are almost four times this initial investment, and social costs are sixteen-fold the initial investment.
- Currently, over one quarter of school children, or 15 million students, attend schools with below standard or dangerous air quality.
- Social benefits of high performance schools include increased earnings, asthma reduction, cold and flu reduction, teacher retention, and employment impact, among others.

HISTORY

In 2000, a California nonprofit group called the Collaborative for High Performance Schools (CHPS) formed a points-based incentive program aimed mainly towards improving indoor air quality and student health in schools and reducing student absenteeism. Results from this program have been extremely promising, and include academic performance increases up to 25 percent, lowered operating costs through 20-40 percent reductions in energy and water usage, and providing unique educational opportunities using the school itself as a teaching tool.

TALKING POINTS

- This idea tackles both an environmental and education problem with one policy.
- No other educational policy addresses the simple fact that many existing schools are unhealthy and not designed for learning.

Each school applying for CHPS' high performance standard must fill out a scorecard, with such categories as furnishings and finishes, daylighting, acoustics, and electric

lighting. In November 2006, as part of a $10.4 billion effort to upgrade California public schools, California voters passed Proposition 1D which allocated $100 million to fund the design and construction of energy efficient, healthy school facilities for the California public school system. There have been ten CHPS schools built in California to date, and another 18 are in the pipeline for construction. The CHPS standard has been extremely popular, and has been adopted by at least eight other states and fifteen school districts throughout the state.

In addition, the California Energy Commission created the Bright Schools Program to promote high performance design strategies, with consultation and design services provided at little or no cost to the school district. Energy Efficiency Financing is available for installing energy saving projects.

ANALYSIS

Nationwide, five hundred new schools will be constructed per year to keep up with the estimated 6% increase in enrolled students from 2003 - 2015. To ensure that all new schools built are high performance schools, a national loan program would have to lend schools $3/sq.ft, which is the cost premium for high performance schools. The school would pay back the loan over eight years with its $44,000 average reduced annual operating cost, due to energy and water efficient design. Our calculations show that for ten years of operation, this program would require $750 million net present value, and would be budget-neutral after eighteen years.

NEXT STEPS

We propose a budget-neutral national high performance schools loan program to accompany a building standard so that schools can realize the educational benefits and reduced operating costs of high performance schools. The building standard would be adopted from one of many in use today. The loan program would give schools the extra initial premium they need, up to $3 per square foot, to increase the performance of their building, and would be paid back yearly through reduced operating costs. This policy should be put into practice now. The technology used in green schools draws from a much larger green architecture movement called green building, which is mature and rapidly expanding. This policy can be implemented by the government on a state or nationwide level, but would have the broadest impact nationwide.

SOURCES

United States Green Building Council, www.usgbc.com, accessed 1/28/07.

Kats, Gregory. National Review of Green Schools: Costs, Benefits, and Implications for Massachusetts, December 2005.

Kats, Gregory. Greening America's Schools: Costs and Benefits, October 2006.

"School Facilities: America's Schools not Designed or Equipped for the 21st Century." General Accounting Office Report #HEHS-95-95.

Sustaining Community Energy Solutions through Cost-Saving Investment

Timonthy Den Herder-Thomas, Zach McDade, Kate Ballard, Macalester College

Community-managed and implemented sustainability projects should be combined with a revolving fund, empowering transformative energy solutions at the local level.

Confronting global warming and the energy crisis requires cooperative community transition driven by our entire society. To fundamentally transform our energy systems, communities must have some degree of self-determination in navigating the challenges and opportunities of building an integrated clean energy society.

Communities should establish a citizen-based team to manage initial funding and guide local, long-term implementation plans. After implementing initial projects determined by this team, and funded from an initial source, the community would use the cost-savings from reduced fossil energy use to finance more extensive projects.

KEY FACTS

- Community-group solutions—like the Rural Renewable Energy Alliance's use of solar hot water—save money, build sustainable infrastructure, and pioneer innovative community development.
- Revolving funds are economically lucrative. Harvard University runs a revolving fund worth $12 million with an average return on investment of 27.9 percent per year.
- UC Berkeley professor Daniel Kammen did a study showing that investment in renewable energy produces ten times more American jobs than such an investment in fossil fuels, as many as 240,000 by 2020.

In this manner, community energy transitions become self-sustaining and serve as an example for other communities and larger collaborative projects. United grassroots action focused on actually transitioning to a new energy society will spur the nation as a whole toward broad-based, pragmatic global warming solutions.

TALKING POINTS

- Community-based: Projects are community generated, managed, and driven utilizing grassroots collaboration and communication.
- Locally appropriate: Communities can implement initiatives that most effectively drive sustainable economic and energy development in their area.
- Solutions-oriented: Rather than regulation and mitigation, initiatives focus on tangible solutions to global warming and the energy crisis.
- Citizen Leadership: Produces community development and citizen empowerment founded on a clean, 21st century energy economy.

AUDIENCE

This proposal empowers community ownership and leadership, building clean energy systems and significant financial returns locally. Importantly, a group of any size can run a revolving fund. A single landowner, a rural Minnesota farm community, a large urban center, or even a national system funded by costs imposed on carbon

or fossil energy could all benefit from such a program. As long as members of the communities on all of these scales manage collaboratively, the benefits will support the people most directly affected by the programs.

HISTORY

Self-sustaining, transformative community energy initiatives through revolving funds unite several previously isolated concepts. Revolving mechanisms are a successful hallmark of nonprofit and business energy efficiency initiatives. Sustainability-focused groups and support systems like Minnesota's Community Energy Councils and the Clean Energy Resource Teams have gained prevalence since the 1970s. However, few have thought to drive global energy solutions through such innovative local empowerment, which would literally transform energy systems from the inside out. Revolving funds for community energy groups give citizens the means to implement tangible community transition and combat global warming and the energy crisis.

ANALYSIS

Initial investment results in long-term gains; the returns will be greater with a larger initial investment, but a community can make progress with even minor funding, which can also be used to expand future initiatives. Harvard University and various energy projects have demonstrated the individual efficacy of these ideas.

NEXT STEPS

First, one needs to identify a community, its specific needs, the scale on which action will take place, and the involved constituencies. From there, a project board of several managers should be formed to take charge and spearhead implementation. This board will identify viable projects, available funding, and begin implementation. After initial implementation, progress should be monitored, new projects implemented, and nearby communities modeled on the successes of their neighbors.

SOURCES

Harvard University Green Fund. "Green Campus Loan Fund @ Harvard Green Campus Initiative." Harvard University, <http://www.greencampus.harvard.edu/gclf/index.php>.

Community Energy Resource Teams. "Phillips Community." <http://www.cleanenergyresourceteams.org/metro/CS-Phillips%20Community%202_05.pdf>.

Community Energy Resource Teams. "Solar Hot Water Sytems." <http://www.cleanenergyresourceteams.org/central/CS-Hotwater%20heater.pdf>.

UC Berkeley News. "Investment in renewable energy better for jobs as well as environment." University of California, Berkely, http://www.berkeley.edu/news/media/releases/2004/04/13_kamm.shtml

C-BED. "Community-Based Energy Development." Xcel Energy, http://www.c-bed.org/overview.html.

Energy Efficiency Commitments for Cities

Emma Kaimiola Rodriguez Yuen, Stanford University

Cities can reduce electricity usage and save money by making a reduction commitment, creating a task force, doing an audit of buildings, and hiring energy managers.

Many cities do not want to wait for federal or state action on climate change, and are in prime positions to make direct changes by taking the "low hanging fruit" of electricity conservation. This proposal for energy conservation synthesizes the most successful approaches of different cities around the country, from Seattle's market-based approach, which gives consumers rebates and grants to buy new technologies, to Chicago's regulatory approach which involves an innovative building code for electricity conservation. The cost of such a program should be determined by the size of the city, but we recommend that cities take a $7 million bond measure, hire four full-time employees, and place an additional electricity fee of $0.0022 per kWh on the electricity bills of municipal buildings to raise money for energy retrofit efforts.

KEY FACTS

- Four hundred and forty-two cities around the country have accepted the Mayor's Climate Protection Agreement.
- This commits cities to reduce carbon emissions by seven percent below the 1990 levels by 2012.
- Focusing on conserving electricity is one of the most effective ways that cities can reduce their carbon emissions.

HISTORY

Different parts of this proposal have been implemented in many cities, especially Seattle, Boulder, Portland, Honolulu, and Chicago. Seattle has invested $90.7 million to reduce the city's overall electricity use by 47.34 MW in the first four years. Chicago's building code has been very successful and many architects in the city voluntarily implement it.

TALKING POINTS

- Conserving energy creates two to three times more jobs than power plant expansion per kWh saved/produced.
- Energy conservation retrofit projects reduce maintenance costs because the new technology is more durable, utilizes more natural light, and allows users to have control over temperature.
- Conservation measures may also avoid political controversies because of the location issues associated with new power plant creation.

AUDIENCE

Mayors, city managers, council members, and city-based utilities are in the best position to adopt this proposal. In addition to improving municipal buildings and saving long-term costs for the city, the community liaison could connect residents and commercial owners to rebates, technological information, and free audits that would allow them to make cheaper and better-informed decisions on how to benefit from electricity conservation.

Cities can begin to reach their energy conservation goals by creating a Department of Sustainability or a Green Task Force that is authorized to hire a community liaison to coordinate outreach efforts both internally and externally. This would entail raising awareness about sustainable practices and presenting the positive financial implications associated with these practices.

Additionally, the city could utilize the services of onsite energy specialists capable of tracking energy usage, internalizing or overseeing the audit process, and making recommendations to improve current city practices, focusing on municipal buildings. These specialists should assess an energy usage fee, so as to build an account dedicated to expanding efficiency measures, especially in city facilities. This fee would provide a disincentive for energy waste as well.

The city cannot impose a tax on electricity bills without a ballot measure approved by citizens, but can publicly support such measures. If a measure fails, the city should create a bond measure of $6 million dollars to support efficiency projects and to hire energy specialists for municipal facilities retrofits. Some projects may include: converting incandescent-bulb traffic signals to light-emitting diode (LED) light bulbs, lighting HVAC retrofits for buildings, and daylighting retrofits. Finally, modifications to the existing building code can begin to be made, with clear emphasis on Green Building practices. New municipal buildings should also meet the Leadership in Energy & Environmental Design (LEED) standard, which has already been informally adopted as the standard in some cities.

SOURCES

City of Boulder, 2006. "Boulder – Climate Action Plan Fund." http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=1058&Itemid=396

EPA Region 7. 2006. "Low Hanging Fruit."http://www.epa.gov/region7/p2/bgfruit.htm

(EMSD) Energy Management Services Division, 2006. "Energy Management Services Plan, 1997-2002." www.seattle.gov/light/Conserve/Reports/**plan**_4.pdf

SolarAccess.com, 2004. "Honolulu Bond Aims for Solar Projects." http://www.irecusa.org/articles/static/1/1087339560_1018302029.html

The Green Guide, 2005. "Top Ten Green Cities."http://www.thegreenguide.com/doc.mhtml?i=107&s=cities

U.S. Council of Mayors. 2005. U.S. Mayor's Climate Protection Agreement. http://www.seattle.gov/mayor/climate/PDF/Resolution_FinalLanguage_06-13-05.pdf

Cutting Auto Emissions Through City Carbon Trading

Adam Millard-Ball, Stanford University

Give local governments the right incentives by making them the "transportation manager" for their citizens—responsible for purchasing carbon permits for all urban transportation emissions.

Individuals have little scope to reduce widespread auto use. They are constrained by the preexisting environment (is there a shop within walking distance?) and the transportation system (can I get where I want to go by bus or train?). Cities, by contrast, have the power to implement a huge range of potential reductions, but have little incentive to do so.

Carbon trading would give cities the financial impetus to reduce many transportation emissions. They could choose to build sprawling, auto-dependent tract homes, office parks, new highways or parking garages, only if they pay for the privilege. Or they can cash-in by building bike networks, cutting road capacity or building mass transit-oriented neighborhoods.

Transportation planning would become a budgetary issue, with city managers and mayors vested in reducing traffic.

KEY FACTS

- Existing fuel-efficient cars, like hybrids, may improve gas mileage by 50 percent (and the same effect can easily be achieved by regulation). A fuel-efficient city can improve efficiency by much more—a Munich resident emits just 28 percent of the transportation CO_2 produced by the average Houston dweller.
- Los Angeles could gain $700 million a year by cutting traffic to San Francisco's levels, assuming a carbon price of $40/ton. This gain represents 50 percent more than LA's existing transportation budget.

TALKING POINTS

- Most ideas to reduce transportation emissions focus on alternative fuels and gas mileage standards. We've forgotten about the savings from fuel-efficient cities.
- City carbon trading would give local governments the right incentives to reduce auto use.
- It is a new revenue stream for transportation.
- It would be a revolution in municipal finance as well as climate policy.

AUDIENCE

Cities and other local governments would have the most at stake. California would be the natural place for a pilot program, given its history with similar measures.

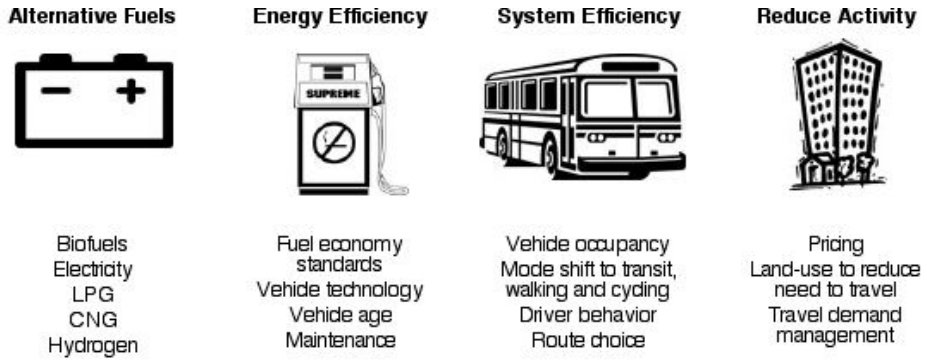
HISTORY

While there have been many suggestions to implement carbon trading within transportation, these have usually assumed that refineries ("upstream") or households ("downstream") would be the point of regulation.

Some of the options open to cities include:

1. *Planning.* Cities could give financial incentives for developers to provide less parking or build densely around mass transit. Wal-Mart and Home Depot could face heavy development-impact fees.
2. *Road Building*. The cost of lifetime carbon emissions would need to be included in all new highway or parking garage projects. Conversely, cities that knock down freeways would gain a fiscal windfall.
3. *Cash Incentives.* Cities could provide tax credits or other financial incentives for their citizens to limit or forego driving a personal car.
4. *Alternatives to the Car.* Bicycle, pedestrian and mass transit projects would become more financially attractive options.

Permits would be given based on current traffic levels. If a city's transportation emissions stay constant, there would be no fiscal impact. If they fall, there would be a huge fiscal benefit. If they rise, the city pays. If they rise because of growth, the city can pass the cost on to developers. Potential reductions can come from:



NEXT STEPS

Carbon trading legislation has been introduced in the US Congress, and programs may be introduced earlier in California and the northeastern states. City carbon trading can be seamlessly integrated into these initiatives. The concept could extend beyond transportation, allowing cities to cash in from home energy savings gained through tighter building codes, and similar extensions.

SOURCES

Haites, Erik (1998), "Experience with Mobile Source Emissions Trading and Its Potential Application to Greenhouse Gas Emissions by the Transportation Sector."

Newman, P. and Kenworthy, J., "Sustainability and Cities," Washington, DC: Island Press.

Federal High-Performance Buildings Initiative

Scott Moore, Princeton University

The federal government should adopt measures to improve energy efficiency and environmental sustainability in buildings, including:

(1) Providing construction cost rebates for the additional costs of meeting high energy efficiency standards;
(2) Creating a National Center for High Performance Buildings to increase and disseminate knowledge on improving energy efficiency and environmental sustainability in buildings;
(3) Funding and expanding the Healthy and High Performance Schools program in the No Child Left Behind Act.

The United States uses nearly 40 percent more energy than the entire European Union. America also contributes 25 percent of global greenhouse gas emissions, despite having only five percent of the world's population. Reliance on vulnerable overseas energy supplies also concerns the American electorate, with 42 percent of voters naming it in a 2006 poll as the top national security concern. Lawmakers have also recently emphasized the need to increase energy security and address climate change. Making buildings more energy efficient can mitigate a significant proportion of these interrelated problems.

KEY FACTS

- The United States contributes 25 percent of global greenhouse gas emissions.
- Buildings account for 65 percent of electricity consumption and 30 percent of greenhouse gas emissions in the United States.
- The green building movement is expanding, but experts agree that federal government leadership and incentive are essential, especially in the public sector.

In the U.S., buildings account for 65 percent of electricity consumption and 30 percent of greenhouse gas emissions. Several reports have identified the need for federal government leadership in implementing energy-efficient designs. Through policies that encourage public-sector green buildings, the federal government can help reduce energy costs, lower greenhouse gas emissions, and reduce foreign fuel dependency.

TALKING POINTS

- Encouraging green design and construction is a simple and relatively cost-effective way to make a big impact in terms of cutting greenhouse gas emissions.
- Green design not only cuts emissions, but also creates healthier and more comfortable buildings that improve employee productivity levels and profit attainment.

HISTORY

There is little history of federal involvement in high-performance building design and research. However, the Department of Energy generally supports the practice and maintains a National High-Performance Buildings

Database. In addition, the No Child Left Behind Act 2001 contains a provision to provide funding for green schools, because studies indicate that student performance is higher in specially designed green buildings. The Healthy and High Performance Schools program, however, was never funded.

POLICY RECOMMENDATIONS

This proposal envisions a three-part initiative. The first provides rebates to construction clients for the additional cost of meeting energy efficiency standards. To receive this rebate, buildings would have to reduce energy use by at least 30 percent below the predominant national energy efficiency standard, known as ASHRAE 90.1. Buildings eligible for this rebate would also have to be public, serve a primarily noncommercial or industrial function, and be at least 20,000 square feet in size. Because cost premiums for reducing energy use by 30 percent are typically no more than two percent, this program would be inexpensive relative to its economic and environmental benefits. A similar rebate program has been used in the existing Healthy and High Performance Schools program (HHPS).

The second element of this initiative creates a National Center for High Performance Buildings; despite its importance, little federal funding is available for research on energy-efficient buildings.

The third element would fund the existing HHPS grant program. Several studies have detailed the benefits of energy efficient, sustainable schools, including a better learning environment and higher student achievement. Though approved by Congress, HHPS has received no meaningful funding. By supporting this initiative, the U.S. government can be a leader in cutting energy costs, reducing dependence on foreign energy, and addressing climate change.

ANALYSIS

There is potential for fraud in the rebate program. To prevent this, as well as to control the program's overall cost, the value of the tax credit would be capped at 12 percent of total project costs. Since the cost premiums for projects involving highly energy-efficient buildings are almost always less than ten percent, this cap should be sufficient. In addition, independent verification of increased energy efficiency would be required after the building is made operational in order to receive the rebate.

NEXT STEPS

A formal cost-benefit analysis would be a useful next step, but the benefits of high-performance buildings are already well documented. A consultation process with representatives from the construction industry and academia would also be a useful next step, as would meaningful progress in the three-part initiative outlined above.

SOURCES

* A full list of sources is available upon request.

Big City Car Tax

Nick Santos, University of California at Davis

A car tax for entering certain zones of a major city on a given day is an effective and pragmatic way to ease traffic congestion and reduce greenhouse gas emissions. While this method would not be useful everywhere due to variation in infrastructure, large municipalities in the United States with well-established public transit systems should consider creating such zones.

In 2003, London created a "congestion charge" that levies a tax or fee on any car that enters specific areas of the city on a given day. The charge is a flat rate of £8 per day, up from the £5 it initially cost, regardless of car size, number of passengers, income level, or duration of time in the charge zone. The only exception is for residents of the zone, who are given a break on the tax (about 90 percent off) if they drive their car on a given day, but restrictions do apply. The net effect of this charge was an immediate 25 percent drop in congestion and a halving of travel times in the zone. If implemented in the United States, this program could feasibly be modeled on the one in London. Charge zones would be created and cameras or radio tracking devices mounted at all entrances to a given zone, to track visitors and check with the state Department of Motor Vehicles to assess a fee to the registered owner of the vehicle. While the initial cost of such a camera system is significant, it is quickly paid off by the income generated.

KEY FACTS

- In London, traffic was reduced by 25 percent and travel time by 50 percent.
- The first six months yielded a drop in traffic of 30 percent and revenues of £64 million.

TALKING POINTS

- The fees pay for the costs to implement the program, with surplus revenues going to improve public transportation.
- The Department of Transportation recently earmarked up to $1.2 billion for cities creating programs to reduce congestion.

HISTORY

While London is the largest city to create a congestion charge, it is not the first. Other places, mostly medium-to-large European cities, have also created these charges, including Stockholm, Oslo, Trondheim, Bergen, and Singapore. The oldest plan of these, Bergen's, dates back to 1986. The prevalence of these programs attests to the viability of instituting a similar program in the United States.

In 2007, New York City Mayor Michael Bloomberg laid out a plan for a congestion charge that would integrate with current tolls already in place to enter the city. While it is impossible for anyone but New York City's planners and analysts to say whether a charge would actually be good for the city, one can speculate that it would be a nearly ideal location due to its excellent public transportation infrastructure. However, it is predicted that Bloomberg will face an uphill battle with the New York State Legislature in order to implement a congestion charge program. In addition, some suburban residents have threatened to fight such a charge if it is attempted.

ANALYSIS

There have been many criticisms of London's congestion charge, foremost among them being the potential for damage to businesses within the zone. Suggestions have been made to allow five days per year of free entrance in order to not hurt the occasional visitor, such as tourists and others with infrequent trips to the city. The second criticism is that those who benefit the most are those who can afford to pay the charge. While valid, if the city reinvests the charge money into transit, those who cannot afford the charge stand to gain from it as well.

However, damage to businesses is expected and the best way to mitigate such damage is to implement this program only in cities with an effective public transportation network, making cities like New York prime locations for a congestion charge. Furthermore, some of the money returned from the London congestion charge was put into making more buses available, since much of the car traffic was shifted to public transportation.

The other main criticism states that, despite the initial drop in congestion and the dramatic decrease in travel times that London citizens experienced at first, travel times and congestion are now on the rise again. While this is extremely important to take note of, it will vary between cities. For London in particular, it is difficult to know whether London's traffic is on the rise again because the charge is becoming ineffectual or because of changes in other policies, the population, and citizen needs. These are all factors for cities to take into account when considering whether a similar charge would meet their needs.

AUDIENCE

A car tax or congestion charge is not something a city should go into without significant amounts of research on feasibility and effects on the public and businesses. While it can certainly be extremely effective in the right cities, it could also be disastrous if used in the wrong location, due to the vast scope of its effects. However, it is a potentially powerful tool when used in the proper location, i.e. cities with road networks that are over-capacity, but which have transportation systems ready to take up more travelers

NEXT STEPS

The first thing to do in implementing any congestion charging scheme is to conduct a thorough study of the potential effects on the charge zone and surrounding regions. An exhaustive and comprehensive study will benefit cities in the long run by ensuring that a charge will help instead of harm. Major factors to consider are the number of cars, travel times, road capacities, public transit infrastructure, residents inside and outside of the zone, businesses in the zone, and costs of implementation. Additional factors will vary by location but must invariably be understood in order to implement an effective congestion charge scheme.

SOURCES

* A full list of sources is available upon request.

Stimulating a Transition to Hybrid Taxis in New York City

Brandon Avrutin, Middlebury College

New York City should encourage the transition to hybrid taxis. Such a transition would benefit both the environment and taxi drivers. NYC can do so by levying a Pigouvian tax on non-hybrid taxis of an amount equal to the social cost of their carbon emissions in excess of hybrid emissions.

As hybrid engines consume less gasoline than conventional combustion engines, they are both environmentally and economically beneficial. Hybrids, however, only engage their electric motors at low speeds and thereby benefit cars such as taxis that drive primarily in city conditions. Hybrid taxis in NYC can decrease taxi emissions by over 50 percent and save taxi drivers approximately $8,768 each year. The government can stimulate the implementation of hybrid taxis through a Pigouvian tax on the emissions from non-hybrid taxis in excess of those from hybrid taxis. Such a tax would heighten the incentives for a transition to hybrids, bolster awareness of climate change, and serve as a model for other cities.

KEY FACTS

- Transportation accounts for approximately 27 percent of total U.S. carbon emissions; this percentage is increasing faster than that of any other sector.
- "Light Duty" vehicles (passenger cars, sport-utility vehicles, minivans, etc.) account for approximately 62 percent of transportation emissions (17 percent of U.S. emissions overall).
- In 2005, New York City taxis consumed 46,331,999 gallons of gasoline, emitting approximately 430,887,589 kilograms of carbon equivalents.
- Hybrid cars reduce emissions by over 50 percent.

TALKING POINTS

- If all NYC taxis switched to the 2007 Toyota Prius, taxi emissions would fall by 72 percent.
- The Toyota Prius would initially save taxi drivers $3,965, and then $8,768 annually.
- Over a five-year vehicle lifetime, these numbers add up to a total savings of $47,807.
- Despite these clear economic incentives, most NYC taxis are not hybrids. A tax is needed in order to overcome the inertia of familiarity.

HISTORY

The city has taken previous measures to encourage the use of hybrid taxis, but these efforts have been insufficient. Since 2003, the New York City Council has authorized the issuance of approximately 300 alternative fuel medallions, which account for less than three percent of the nearly 13,000 New York taxis. Following the Clean Air Taxis Act signed in 2005 by Mayor Bloomberg, the Taxi and Limousine Commission has approved eight hybrid vehicles for use by taxi drivers: the Ford Escape, the Toyota Highlander, the Toyota Prius, the Honda Accord, the Honda Civic, the Lexus Rx 400h, the Saturn Vue, and the Toyota Camry. Legislation proposed in 2006 calls for these clean-air

taxis to be clearly identified and to provide information to passengers regarding the environmental benefits of using clean-air taxis. These policies are necessary, but they are insufficient. The government must also provide information to taxi drivers regarding the economic benefits of driving clean-air taxis.

ANALYSIS

The 2007 Toyota Prius (one of the most fuel efficient hybrids) would initially save taxi drivers $3,965 when compared with the 2007 Ford Crown Victoria (the most common NYC taxi). Of these savings, $2,390 are from a lower market set retail price and $1,575 are from tax benefits. The Prius would also save taxi drivers $8,768 annually in gasoline consumption as well as in the opportunity cost of refueling. The Prius runs at 60 miles per gallon (MPG) under city conditions, whereas the Crown Victoria runs at 17 MPG. This yields an annual savings of 2,738 gallons of gasoline or $8,214 assuming the cost of gasoline is three dollars per gallon. Additionally, the Prius refuels 126 less times per year, which results in an annual savings of $554. Over a five-year vehicle lifetime (the average life of an NYC taxi), the Prius would save taxi drivers a total of $47,807.

Although there is some disagreement about the social cost of carbon (estimates range from $0 to over $300 per ton), as long as the tax gives non-hybrid taxis the option to abate and the price of the tax exceeds the cost of abatement (approximately $5.50 per ton), the tax will force non-hybrid taxis to abate and will lead them to learn about the economic benefits of hybrids.

AUDIENCE

This proposal focuses on NYC taxis and, therefore, the suggested policies are directed towards the local government of NYC. A transition to hybrid taxis, however, will have similar effects in other cities as well. This is an opportunity for NYC to establish a paradigm that other cities may choose to follow.

NEXT STEPS

New York City could implement a carbon tax immediately. Past legislature shows that New York is in favor of such a transition, and between the NYC Council and the Taxi and Limousine Commission, the necessary political infrastructure is already in place.

SOURCES

* A full list of sources is available upon request.

Efficient Big Rigs for Efficient Trade

James Coan, Princeton University

The efficiency of heavy-duty trucks can be substantially improved with the introduction of fuel economy testing, efficiency standards, tax credits for purchasing more efficient models, and incentives for development of anti-idling technologies. The vehicles will travel over mandated rubberized asphalt that saves a substantial amount of oil as well.

Heavy-duty trucks and road construction have been neglected when it comes to finding ways to reduce oil consumption, but simple steps can be taken to dramatically decrease their need for petroleum. Unlike light-duty passenger vehicles that have been intensely analyzed and subject to Corporate Average Fuel Economy (CAFE) standards, no fuel economy test even exists for heavy-duty vehicles, let alone standards. Similarly, rubberized asphalt is a proven technology for reducing road maintenance that a few states have mandated. Both the trucks and the maintenance of the roads on which they run will require less oil with this proposal.

KEY FACTS

- The fuel economy of trucks is not currently measured.
- The average truck idles about 1,800 hours/year and burns about one gallon of fuel per hour.
- The Department of Energy (DOE) 21st century truck roadmap notes that their fuel economy can increase by 39 percent with improvements to aerodynamics, engines, transmission, and auxiliary systems.
- Rubberized asphalt has already been mandated in Arizona and California.

This efficiency improvement is sure to benefit both producers and consumers as transport costs fall, not to mention the environmental and national security benefits of reduced oil use. Together, this moderately aggressive plan should reduce expected consumption by heavy-duty trucks by .6 million barrels of oil per day (MBD) and road construction by .28 MBD. An aggressive plan increases those figures to .8 MBD and .36 MBD respectively.

TALKING POINTS

- Heavy-duty vehicles consume a substantial amount of oil each day, 2.4 MBD in 2002, over ten percent of U.S. consumption and almost 20 percent of the 13.4 MBD used in the transportation sector that year.
- Rubberized asphalt cuts oil consumption in half compared with traditional techniques.
- No standard efficiency test exists, even though freight operators are concerned with cost and making profits.

HISTORY

The efficiency mechanisms promoted in this proposal are generally accepted ways to improve efficiency. Mandates on environmental issues date from the earliest environmental legislation, and fuel economy for passenger vehicles began to be monitored in earnest when CAFE was passed in 1975.

Considering the DOE published its 21st Century Roadmap in 2000, experts in the field and inside government recognize that heavy-duty truck efficiency can improve.

ANALYSIS

The changes, according to the American Council for an Energy-Efficient Economy (ACEEE), would benefit both truckers and consumers in the long-run. .9 MBD is equivalent to about 13 billion gallons/year, so fuel costs should fall by about $25 billion, at two dollars per gallon of diesel. Truckers would not being forced to give up their less efficient models, but many would likely choose to buy a new model if the economics are favorable. Existing truck manufacturers could potentially lose out if they are slow to introduce more efficient models or have lackluster research and development departments.

This proposal should be bolstered by Wal-Mart's recently expressed interest in doubling the efficiency of their heavy-duty fleet. If the government institutes a testing program and mandates while Wal-Mart invests in technology, trucking should soon become a more efficient means of transporting goods.

AUDIENCE

A state can take a bold initiative and test all big rig models for their efficiency. For instance, Arkansas, the home state of Wal-Mart, may want to pursue such an option. However, mandates on fuel economy standards and incentives for truckers who buy efficient models will most likely come from the federal level.

Similarly, some states have decided to mandate rubberized asphalt. While the nation could switch over state-by-state, a federal mandate would be more effective since road building companies would not have to face a patchwork of regulation.

NEXT STEPS

1. Create a method for testing big-rigs on highways.
2. Consider creating a contest to develop anti-idling technologies.
3. Contact manufacturers to see if they have already developed efficiency tests.
4. After establishing standardized tests, set mandated efficiency targets and tax credit levels for consumers.
5. Fund the $95 million authorization contained in the 2005 Energy Act to invest in anti-idling technology.

SOURCES

"Reducing Oil Use Through Energy Efficiency: Opportunities Beyond Cars and Light Trucks." American Council for an Energy Efficient Economy. Report E061.
http://www.aceee.org/store/proddetail.cfm?CFID=2138425&CFTOKEN=73166198&ItemID=406&CategoryID=7
http://aceee.org/pubs/e061.pdf?CFID=2138425&CFTOKEN=73166198
"Wal-Mart Seeks to Double Truck Fuel Economy. 15 Dec. 2005. Green Car Congress. http://www.greencarcongress.com/2005/12/walmart_seeks_t.html.

Buyback of Inefficient Older Vehicles

James Coan, Princeton University

The government can purchase older, inefficient vehicles from consumers at the consumption difference between that one and a more efficient new or used vehicle, thereby taking into account the entire life-cycle of vehicles and improving the efficiency of the fleet.

Few policies focus on removing inefficient vehicles from the road. Efficiency standards and gasoline taxes instead receive much more attention. While these policies are helpful, they take time before they change the composition of the fleet. In contrast, the buyback of inefficient older vehicles immediately begins to make the existing fleet of vehicles more efficient. While driving a ten year old Excursion or Suburban may have made sense without this policy, it now is much more beneficial to scrap it and buy a used efficient vehicle—possibly at a profit to the consumer.

KEY FACTS

- Consumers will receive $750 for every 1gal/100 mile decrease in consumption.
- The government will find scrap dealers to dispose of these inefficient old vehicles.
- Only consumers who purchase another vehicle will qualify. Otherwise, a consumer could dispose of one vehicle and secretly purchase another one equally as inefficient, resulting in no improvement.
- Participants will have had to own the previous vehicle for two years, and they must own the new one for at least a year.
- Among current owners, at most eight million trucks and ten million cars can reasonably be expected to participate. The program at that level should cut consumption by about 140,000 barrels/day (bpd), about 1.5 percent of gasoline consumption, at a cost of about $20 billion.

TALKING POINTS

- Most policies focus on the beginning of a vehicle's life, but the average car stays on the road for about 15 years.
- This policy encourages individuals to make a decision to change the type of vehicle they drive. Beginning-of-lifecycle policies such as providing a rebate for an efficient vehicle may just encourage those who like small cars to buy a new one when the price is lower.
- The automakers and used car dealerships will appreciate the incentive this program provides for consumers to purchase new vehicles.

HISTORY

Although this policy has not been directly implemented, various Canadian provinces allow residents to scrap their older vehicles that produce higher smog-producing emissions. Consumers receive about $500 or various gift certificates, and they do not need to prove they have purchased a newer vehicle. This program proves that government buyback and scrapping of vehicles can exist, but the buyback of inefficient vehicles has the complication that vehicles have not tended to get more efficient over time. Tracking which vehicle is purchased next therefore becomes very important.

ANALYSIS

This proposal uses consumption rather than efficiency as a benchmark. It does so in order to focus entirely on reducing oil consumption. For instance, moving from a 10 to 20 mpg vehicle reduces oil consumption by five gallons per 100 miles. Yet going from 20 to 40 mpg, twice the mpg increase, only reduces gasoline consumption by half.

The number of vehicles and cost were estimated using various published sources. A recent N.A.D.A. used vehicle guide provided prices of used vehicles. The EPA notes that the average efficiency of cars and trucks in 2005 were 17.1 and 24.1 mpg respectively, and it has been similar for the past fifteen years. The Transportation Energy Data Book provided data about the composition of the fleet. Combining this data with estimates of participation rates resulted in an estimate that the average truck efficiency will improve from 16 to 22 mpg and cars from 21 to 30 mpg for participating vehicles. Vehicle scrapping will recoup about two billion dollars for the government. After-effects may reduce participation and costs slightly from predicted levels. As demand for efficient vehicles increases, so will their price, especially for used autos, so fewer drivers will want to participate and buy an efficient vehicle.

The 140,000 bpd decrease in consumption is about 2.1 billion gallons per year. At two dollars per gallon for fuel, the nation will recoup the cost of roughly $20 billion in about five years.

Consumers who own inefficient vehicles will benefit both directly from the program and from reduced fuel costs. Producers will also gain from increased demand that may lead to less need for rebates. Scrap dealers have a new market. However, used vehicle consumers who are not participating but are looking to buy an efficient vehicle will likely face higher prices. An efficient used vehicle rebate may reduce this problem.

AUDIENCE

As the Canadian example demonstrates, both states and the federal government can get involved. Other than country-like California, individual states may be able to implement it more easily because the after-effects of price changes of used and new vehicles will be minimized or even non-existent.

NEXT STEPS

1. Find and contact major scrap dealers.
2. Conduct a survey of citizens to better determine the expected participation rate.
3. Have the tax bureau create an easy system to match the owners of vehicles given up with the next more efficient vehicles purchased. Owners would likely dispose of their vehicle, receive a secure PIN, and then use it when purchasing their next vehicle.
4. Contact the Justice Department and ACLU to make sure tracking vehicle registration over time does not raise substantial privacy concerns.
5. Determine a marketing strategy to figure out how to promote this new program to consumers who may not otherwise consider buying a new vehicle.

Vehicle Window Stickers that Reflect Long-Term Cost

James Coan, Princeton University

Every vehicle window sticker on new vehicles will include the expected fuel costs over three, five, and ten-year time horizons so consumers in the showroom do not underestimate the gasoline or diesel costs on the road.

Adding life-cycle fuel costs to the window sticker of vehicles is a cost-effective and simple way to improve the efficiency of new automobiles sold. The window sticker policy presents consumers with a distorted view of fuel costs. Most consumers keep their cars and SUVs for more than one year. While a savvy consumer should take into account the number of years s/he will own the vehicle, calculating lifetime fuel costs are not the primary concern that most customers have in the showroom. They are confronted with many vehicle models, options, and financing choices. This large amount of data is overwhelming enough as it is, and calculating lifetime fuel costs should not be an extra burden on a consumer.

KEY FACTS

- Current vehicle stickers only have information about fuel costs for one year.
- Consumers are known to underestimate the fuel costs over the lifetime of a vehicle.
- The average driver owns his/her vehicle for more than one year.
- The average car is disposed of after roughly fifteen years, and the lifespan of a truck is closer to twenty.
- The mandate will cost as much as it costs to re-format vehicle window stickers. Considering that manufacturers change their stickers yearly, the cost should be almost zero.

This policy will be especially useful if there is a price floor on fuel. Then consumers will not ignore all price predictions with the belief that fuel prices are too volatile to predict. This mandate will cost almost nothing and allow consumers to focus on purchasing the best possible vehicle—for themselves, and in turn, the environment and national security.

TALKING POINTS

- The change is extremely simple and cost-effective to implement.
- Consumers benefit from having more perfect information.
- The average vehicle efficiency of vehicles should rise without requiring many costs incurred by either consumers or producers.

HISTORY

This idea recognizes that missing information can lead to poor purchasing choices. Most cost information consumers receive is about the actual price of the vehicle or its financing, not the cost of the upkeep that should be factored into any rational purchasing decision.

The government already has regulations about what must be on vehicle stickers, including fuel economy ratings and

the fuel economy ratings of vehicles in its class. The one-year estimated fuel cost component of the regulation is designed to give consumers an idea of what they should expect to pay, but it does not adequately reflect the cost over a lifetime of a vehicle. Automakers create new stickers with each new model year, and this change will add a few pieces of information to the reformatting.

ANALYSIS

This policy is targeted at lower-to-moderately aware consumers. They may or may not realize and take into account the entire fuel cost into their purchasing decision. Regardless, the change will help some better plan when they are presented with the values right in front of them.

AUDIENCE

This policy is designed with the federal government in mind. States could only mandate additional cost information be shown in showrooms.

NEXT STEPS

1. A body of psychological research should be conducted to test how consumers value fuel costs into their purchasing decision.
2. More ideas about increasing fuel cost knowledge in the showroom should be generated. Possibly consumers will be more receptive to a mandated computer that asks for expected years owning the vehicle, vehicle miles, and percentage highway/city driving.
3. Automobile manufacturers should be contacted to ensure that such a change is as nearly costless as expected before a bill is introduced.

SOURCES

Jansen, Heinz and Cecile Davis. "A Welfare Cost Assesment of Various Policy Measures to Reduce Pollutant Emissions for Passenger Road Vehicles." European Commission. Sept. 1999. http://www.ingentaconnect.com/content/els/13619209/1999/00000004/00000006/art00017

Nationwide Personal Transportation Survey. 2001. www.fhwa.dot.gov/ohim/nptspage.htm

Plugging the Flex-Fuel Loophole

James Coan, Princeton University

Instead of receiving Corporate Average Fuel Economy (CAFE) credits for producing flex-fuel vehicles that allow automakers to decrease their fleet-wide fuel economy by up to 1.2 mpg, vehicle manufacturers will instead receive a monetary reward directed at easing their legacy costs. They will receive the payment each time they produce more flex-fuel vehicles as a percentage of their fleet than the top three automakers in a baseline year.

The current policy is dubbed the "flex-fuel loophole" in the efficiency community because it weakens existing CAFE standards, ironically leading to more fuel consumption even though biofuels are supposed to reduce foreign oil dependence. National security hawks should also be alarmed at this backward logic. Currently only about one percent of all ethanol is used as E85 (85 percent ethanol), which amounts to about 50 million gallons/year or about 3,000 barrels per day (bpd). Compare this with the additional 80,000 bpd in consumption that the flex-fuel loophole causes. However, over the long-term, the availability of vehicles that can use E85 should not be a stumbling block for the development of cellulosic biofuels like ethanol and butanol. This policy recognizes this future goal and prepares for it.

KEY FACTS

- Flex-fuel vehicles are able to run on gasoline up to 85 percent ethanol (E85).
- About ten percent of GM's vehicles are flex-fuel. If half of all vehicles purchased in the first five years of the program are flex-fuel, the policy will cost roughly two billion dollars per year.
- Legacy costs include pensions and health care. They amount to about $1,500/vehicle (six billion dollars per year) for GM.
- The Union of Concerned Scientists reports that the current policy, which weakens CAFE standards, increased U.S. oil dependence by 80,000 barrels per day (bpd) in 2005, about one percent of gasoline use.

TALKING POINTS

- The U.S. needs to have vehicles in place that can consume E85 (85 percent ethanol) as it becomes available.
- This proposal directly deals with a severe problem plaguing domestic automakers (high legacy costs) while avoiding the problem of increasing America's oil dependence with weaker fuel economy standards.
- This policy will not create a culture of dependence among automakers because the monetary incentive decreases during the last four years of the program and ultimately stops.

The policy proposed also addresses the devastating problem of high pension and health care costs (frequently called legacy costs) that are faced by domestic automakers. This proposal is not a giveaway to foreign automakers. The Big Three make the most flex-fuel vehicles, and automakers only receive the monetary incentive when

they produce more than the average percentage of the top three manufacturers. In this program, the percentage of flex-fuel vehicles each manufacturer produces in the previous year is tabulated. The average percentage of the top three automakers becomes the baseline. When a manufacturer makes additional flex-fuel vehicles above this baseline percentage, it receives $250 per vehicle. This policy continues for five years. Afterwards, manufacturers receive $50 less per vehicle during each succeeding year.

HISTORY

The government has given extra CAFE credit to flex-fuel vehicles since 1994, and the policy is supposed to be in place until 2014. Concerning this proposal, the federal government has a long history of subsidizing various products, and this program is very simple to implement.

ANALYSIS

The actual cost of the program depends upon automaker willingness to participate. The Union of Concerned Scientists notes that making a vehicle flex-fuel capable costs about $50-$100, so $250 should be a strong incentive to adopt the technology. About 17 million vehicles are sold in the United States each year. If all vehicles were flex-fuel, about 15 million would qualify for the rebate. Thus, the program could cost nearly four billion dollars per year in the first five years. However, automakers will incur CAFE penalties if their fuel economy does not improve. Penalties are $5.50/.1 mpg under the standard multiplied by production. So if, for instance, GM were 1.2 mpg under both car and truck CAFE requirements, it would pay about $270 million/year at current production levels.

Nathaniel Greene of the Natural Resources Defense Council (NRDC) believes yearly cellulosic biofuel production can reach 40 billion gallons by 2030. In contrast, most expect corn ethanol production to remain at or below 15 billion gallons/year. At that level, many E85 vehicles are not necessary. In 2006, gasoline consumption was at 141 billion gallons, and ethanol was overwhelmingly used in ten percent concentration (E10).

The automakers should benefit on the whole, especially if they adopt flex-fuel technology. Investors looking into cellulosic biofuels will be pleased. Consumers should also benefit since the subsidy can lead to lower car prices. As for the effect on the budget, the current subsidy on ethanol fuel itself is at least two billion dollars per year ($.51/gallon), so the cost is not exorbitant considering what is already spent on biofuels.

NEXT STEPS

This program is vital for reducing foreign oil dependence and giving the emerging cellulosic biofuel community confidence that there will be vehicles that can use the product. Legislation should be introduced, but it should be proposed concurrently with a study that addresses resolution of healthcare and pension costs. This proposal is helpful for laying the groundwork for reducing foreign oil dependence in the future, but it is only a stopgap toward addressing the problems of legacy costs.

Capping Energy Use on College Campuses

Kristen Tullos and Balaji Narain, University of Georgia

The first step in reducing America's dependence on unsustainable energy sources is to reduce energy consumption. State legislators can start by reducing electricity consumption on college campuses by creating a cap and trade system, similar to pollution permits, for energy usage.

In the United States, college campuses are places where energy is often wasted. At the University of Georgia, there is rising concern over the university's energy usage, which has run over budget for the past five years; last year the university exceeded its budget by six million dollars.

KEY FACTS

- U.S. buildings account for approximately 79 percent of all electric expenditures.
- As of 2005, the University System of Georgia owned 3,169 buildings; of those, 1500 were affiliated with the University of Georgia.

The University System of Georgia and other state Boards of Regents should impose formal caps on each institution in their respective budgets and distribute permits, which allow them to consume an allotted amount of energy. The number of permits should equal the Megawatt Hours (MWH) equivalent to the budgeted amount at fair market value. Institutions that have more permits than required can sell them, while those needing permits can buy them on open markets. Institutions that exceed their allotted amount without purchasing extra permits will face sanctions, such as suspension of construction projects. Any institution with unused and unsold credits at the end of each fiscal year may roll over those credits to the following fiscal year, providing an incentive for campuses to be energy efficient.

Each institution within a university system should form its own strategy to curb energy usage. The cap and trade system creates a favorable climate for innovative solutions.

TALKING POINTS

- Besides transportation, physical structures are the largest consumers of energy.
- Cap and trade systems are more economically efficient than forced, across-the-board energy reductions.

HISTORY

At the University of Georgia, over 5000 students live in campus dormitories; since they pay a fixed cost for room and board at the start of each semester, there is no financial incentive for them to control energy usage. Similarly, at the state level, each institution within the University System of Georgia is assigned an energy budget at the start of each year, but face very light penalties for overspending the budget.

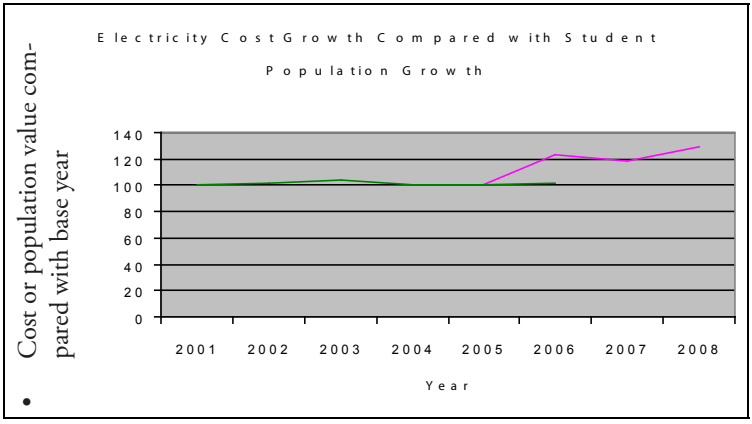
AUDIENCE

Our proposal offers a valuable option to state governments looking to curb dependence on foreign or unsustainable energy sources while ensuring that higher education institutions spend money within their budgets.

ANALYSIS

In the university system of Georgia, which includes over 30 institutions of post-secondary education, energy usage is skyrocketing; electricity costs have risen by 36 percent between 2005 and 2007.

The graph below illustrates how the University of Georgia's spending on electricity has changed between 2005 and its estimate for 2008, and compares this change in spending with the change in the student population at the main campus. For electricity expenditures (pink), the year 2005 is selected as the base year and the amount spent is given the value 100. The amounts for the other years are computed by dividing the value by the year 2005 value and multiplying by 100. A similar method is used for student populations, which begin in 2001. Although estimates for the student population data are not available for the years 2007 and 2008, the enrollment for the past six years is highly stable compared to the actual and estimated changes in electricity usage. Even though the student population is not growing very rapidly, electricity usage is; this suggests that energy usage is likely to be growing at similarly alarming rates at other state institutions.



NEXT STEPS

Establishing a cap and trade program for energy usage within state public university systems is just one of many possible steps to reduce energy use. Other levels of government, such as municipalities, should also consider implementing a similar program to restrain energy usage within departments.

SOURCES

Crowe, Ken. (2007), University of Georgia Physical Plant Data on Utilities Charges.

"Dorms compete at conservation," *Red and Black*, February 9, 2007.

University System of Georgia Board of Regents, (2006), Minutes from August 2006 Meeting.

University System of Georgia Board of Regents, (2006), Information Digest.

Switch to Consuming Sustainable Food Products in Universities

Emily Hallet, Kristen Nothwehr, Danny Townsend, and Adam Trettel, Yale University

Consuming food that has been produced locally with sustainable agricultural methods reduces gas consumption in every area of production, from farming to transportation to retail, reducing our dependence on foreign oil. Universities are key institutions to transition to sustainable consumption, both because their populations consume lots of food and because they are uniquely positioned to teach students to make principled lifestyle decisions.

Conventional agricultural techniques in the United States account for about 16.5 percent of our energy consumption. The farm system is an appealing target for reducing our nation's energy dependence on foreign oil because of the amount of excess energy put into the system, compared to the food energy the system produces. For example, between energy-intensive feedlot production techniques and long-distance transportation to multiple stops (farms, slaughterhouses, packaging facilities, retail stores), there are 188 calories of fossil fuel expended for every one calorie of protein in conventionally produced lamb.

KEY FACTS

- Agriculture, food transportation, and processing account for 16.5 percent of the energy consumed in the United States.
- Twenty five percent of carbon dioxide emissions are attributable to changes in land use and agriculture.
- On average, for every calorie of food produced in the United States, ten calories of energy are invested, 90 percent of which is from fossil fuel use.

Sustainable food production, on the other hand, implies that more or the same amount of energy is created as is consumed by the production process. Sustainable farms use techniques such as crop rotation, and cover crops to aid in nutrient cycling, nitrogen fixation, erosion protection, soil regeneration, and integrated pest management, reducing the need for fossil fuel derived fertilizers and pesticides. Animals are range-fed, decreasing mechanization and energy consumed in feedlot processes. Locally produced food travels an average of one twenty-seventh the distance of conventionally produced food, drastically reducing gas use in transportation as well.

TALKING POINTS

- Sustainable farming practices can reduce fossil fuel use by 70 percent for meat products, 80 percent for dairy, and 30 percent for plant products.
- In addition to decreasing oil and gas consumption, sustainable farms' decreased reliance on mechanization also increases employment, building stronger communities. Historically, communities with smaller farms have had better employment, schools, and public services.

HISTORY

The story of agriculture in the 20th century is one of replacing manpower with mechanized farm equipment. However, despite the increase in production from the Green Revolution, no

basic advances have been made with regard to the efficiency with which crops use solar energy—rather, the advances come from transferring the energy of fossil fuel-based external inputs into food. While yield doubled from 1945-1970, energy inputs rose faster, resulting in a tenfold decrease in the ratio of energy inputs to returns. Only one fifth to one third of this energy is used on farms, though, with the rest used in processing, packaging, distribution, and cooking.

ANALYSIS

The Yale Chapter of the Roosevelt Institution analyzed the consumption of Yale University's Dining Hall Services, and found that switching from conventional to sustainable food would reduce fossil fuel use associated with food by 70 percent, or 630,000 gallons per year. Sustainable food is more expensive than local food, at about one third more under Yale's system. However, this expense reflects the problems our existing system has with assigning costs, as the overuse of fossil fuels inflicts costs in terms of both environmental damage as well as political independence on other countries for our oil supply.

NEXT STEPS

Universities and other institutions should evaluate their dining systems to see to what extent they can replace current offerings with sustainable options. Each incremental offering of sustainable food is a step in the right direction — universities can experiment with farmers' markets or other creative ways to supplement student diets. Sourcing locally is of key importance, and universities should consult with their food service providers to find the best available local farms and dairies. Legislators can smooth this transition in many ways, by creating subsidies or incentives for farmers, retailers, or universities themselves so as to transition to more sustainable methods.

SOURCES

* A full list of sources is available upon request.

A Cellulosic Ethanol Plan for Research Universities

Zach Fox, University of Georgia

A cellulosic ethanol plant and revamped recycling program would provide the University of Georgia (UGA) light vehicle fleet with a cleaner burning fuel blend while decreasing streams of waste paper. This could serve as a model for research institutions across the nation.

The American transportation sector uses roughly 68 percent of the nation's oil, and 96 percent of the fuel used in the transportation sector is from petroleum products. One alternative to fossil fuels is cellulosic ethanol—a cleaner-burning fuel that is blended with conventional gasoline. A cellulosic ethanol research facility coupled with a stronger campus-wide recycling initiative to ensure consistent feedstock supply would increase the University's research and production of cellulosic ethanol.

KEY FACTS

- UGA vehicles consumed 313,317 gallons of gasoline in 2006.
- Ethanol can be blended with conventional gasoline for fuel usage in inexpensively adapted vehicles.
- Cellulosic ethanol has higher energy yields than does corn ethanol.

Additionally, by using this inexpensive, cleaner-burning ethanol in its light vehicle fleet, the University would mitigate its reliance on oil. Locally, this plan would promote ethanol use, relieve energy budget pressure, and provide licensing opportunities for researchers. This project would spur similar projects in other universities through dissemination of new science and technology.

HISTORY

Cellulosic ethanol is produced from biomass including logging residues, agricultural waste and municipal yard waste. Ethanol in all forms provided only 1.2 percent of all transportation fuels consumed in the United States in 2005, and cellulosic ethanol played almost no part in this contribution. Nevertheless, cellulosic ethanol has higher energy yields, produces fewer greenhouse gases, and requires less land compared to corn ethanol.

TALKING POINTS

- Cellulosic ethanol results in less environmental pollution than does burning fossil fuels.
- The use of cellulosic ethanol will reduce U.S. dependence on foreign oil.
- An improved recycling plan reduces paper waste and associated disposal fees.

Despite recent publicity and heavy investment, the cellulosic ethanol industry is relatively new and commercial application of the technology is essentially nonexistent.

ANALYSIS

The costs of such a program are difficult to determine due to the multitude of variables involved and the lack of existing models. Currently, there are no facilities at the pilot-scale stage that utilize wood products, such as paper, to serve as models. However,

by working in stages, technological advancements can be tested and vetted without a wholesale, upfront investment in a pilot-scale facility. The infrastructure can be incrementally installed as needed and when warranted. Furthermore, newly developing advanced technology is rarely, if ever, inexpensive. We should not be deterred from developing cellulosic ethanol, but rather recognize the value of investing now in the interest of long-term energy independence.

AUDIENCE

Environmentalists, businesses, and university officials will all reap benefits from such a conversion. Though some may question the feasibility of a plant on such a scale, the incremental approach should alleviate doubts.

NEXT STEPS

The university should immediately improve its recycling program and form an investigative committee to address specific plant details. Within two years, the University should advance cellulosic ethanol technology, develop a comprehensive plan for staged development, and organize a funding framework focused on soliciting funds from the community, businesses, and government. Within five years, it should aim to have a pilot-scale plant fully functioning and all fleet vehicles running on at least a 20 percent blend. Other research institutions will then be able to adopt similar programs, having learned from this model.

SOURCES

Council on Foreign Relations. "National Security Consequences of U.S. Oil Independent Task Force Report No. 58. New York: October 2006. http://www.cfr.org/publication/11683/

Jonathan Fox, The University of Georgia Fleet Manager. Email. March 7, 2007.

Natural Resources Defense Council and Climate Solutions. "Ethanol: Energy Well Spent." www.nrdc.org/air/transportation/ethanol/ethanol.pdf

U.S. Department of Energy. "Biomass Energy Data Book: Edition One." Oak Ridge National Laboratory. September 2006. http://cta.ornl.gov/bedb/index.shtml

Contest for a Clean and Mobile America

James Coan, Princeton University

The federal government should institute four major contests to spur technological development of efficient motor vehicles with the ultimate dream of producing a plug-in hybrid or electric vehicle that can be economically charged on-site, using solar energy.

Creating contests to spur technological change dates from the 1920s, when Charles Lindberg became the first man to fly across the Atlantic. Now Sir Richard Branson from Virgin Atlantic is offering $25 million for an idea that can remove one billion tons of carbon from the atmosphere. With its DARPA contest that challenges mostly college teams to make a self-driving vehicle perform tasks in difficult situations, the federal government is beginning to invest in contests. This initial experiment must be expanded. Utilizing the innovative capacity of Americans and a university system that boasts 17 of the top 20 universities in the world should help improve oil security.

KEY FACTS

- There are four main categories: "Plug-in," designing a 20-mile range plug-in hybrid that costs $5000 more than a traditional vehicle; "Gas Sipper," making a competitively priced 70-80 mpg family vehicle; "Pound for Pound," constructing an inexpensive auto-body frame that is 30 percent lighter than what is used today; and "Solar," fashioning an easily installable solar panel array that generates electricity at nine cents/kWh.
- Each of the four categories has a top prize of $50 million. There is a $25 million prize given to entries that come close to the target (say $5500 more expensive for "Plug-in" and ten million for those a farther away (about $6500 for "Plug-in") as long as a different technique is used.

Contests for technological advancement reduce the risk that, even if a new product is great, its inventor still may wind up in bankruptcy. For the technologically adept, the fear of business failure hinders the willingness to devote many resources to innovation. Additionally, contests have the unique ability to capture the public's imagination. With only four main competitions, each major winning entry can get significant press exposure. The smaller aspects of each contest then try to harness every ounce of America's creative spirit.

TALKING POINTS

- Contests have historically produced astounding technological progress at minimal cost (i.e. Lindberg's Spirit of St. Louis and the X-prize's Space Ship One that went into suborbital space).
- Competitors have less to fear about bankruptcy when investing in R&D, and the opportunity for public attention and praise should compel some to enter such a contest.
- Current grant programs will remain largely or totally unaffected.
- Spillover effects/positive externalities of increased interest in science and engineering result.

HISTORY

The government does not have a long history

of sponsoring these open competitions other than DARPA, but famous historical successes, including Lindberg and Rutan, exist. The DARPA competition had a one million dollar prize and the X-prize was ten million dollars, but in each case the competitors collectively spent more than the prize totals. Having the competitors spend more on research than the government offers is part of the point of contests; the most technological development is made for the least cost.

ANALYSIS

Determining the actual prize amounts is challenging considering there really is no active economics field concerning contest theory. The X-prize's ten million dollars and Branson's $25 million prize set the standard for the top prize amount in this competition. The prize structure with graduated levels and smaller competitions should encourage the greatest number of innovative applicants.

The technological targets are improvements over existing performance levels. For "Plug-in," the American Council for an Energy-Efficient Economy notes that current battery costs add about $10,000 to the price of a plug-in vehicle. Seventy to 80 mpg was the target for the Clinton-era Partnership for the Next Generation of Vehicles (PNGV), and DaimlerChrysler reached a similar level with its "bionic" concept whose body is modeled after that of a boxfish. These efficiencies provide the target for the "Gas Sipper" contest. The PNGV also had a target for a 20-30 percent decrease in vehicle weight. Finally, the average residential consumer pays about nine cents/kWh of electricity.

NEXT STEPS

1. Grant a stipend to some economists and psychologists to study the incentives of contests.
2. Precisely determine all the contest targets and prize levels.
3. Create a nonpartisan judging commission.
4. Discuss the effect of this program on patents with the U.S. Patent Office.
5. Find potential investors to gauge how well this contest level will induce investment.

SOURCES

http://www.msnbc.msn.com/id/8129979/
http://www.washington.edu/alumni/uwnewslinks/200410/article_study.html
http://www.xprize.org/
http://www.darpa.mil/grandchallenge/index.asp
http://www.greencarcongress.com/2005/06/daimlerchrysler_1.html
http://books.nap.edu/openbook.php?isbn=0309060877
http://www.eia.doe.gov
http://www.aceee.org/store/proddetail.cfm?CFID=2138425&CFTOKEN=73166198&ItemID=418&CategoryID=7

REALITY:
The Environmental Campaign Proposal

David Richardson, Brown University

The REALITY Campaign is a proposal to combat global warming by increasing energy efficiency through an informative and extensive ad campaign targeted at youth.

Improving energy efficiency with currently available technology, the United States could cut its energy consumption by 30 percent, decreasing America's energy use from 100 quadrillion Btu's a year to 70 quadrillion. A media campaign targeted at youths aged 12-17 promoting energy efficiency would have the potential to affect over 28 million people. Though the program would cost roughly $300 million per year, the cost pales in comparison to the billions that could be saved every year. By changing the views of tomorrow's leaders, we can create an entire generation dedicated to combating global warming, which has the potential to significantly impact our way of life.

KEY FACTS

- Improving energy efficiency with technology currently available could cut U.S. energy consumption by 30 percent.
- A media campaign targeted at youths aged 12-17 promoting energy efficiency would have the potential to affect over 28 million people.
- While the program would cost roughly $300,000 per year, the cost pales in comparison to the billions that could be saved every year.

HISTORY

This idea is based on the truth® campaign to "engage teens by exposing Big Tobacco's marketing and manufacturing practices, as well as highlighting the toll of tobacco in relevant and innovative ways." It has been one of the most successful media campaigns ever. It helped decrease teen smoking substantially, lowering the number of teen smokers by 1 million over three years (2000-2002). The ads reached over ninety percent of teens aged 12-17, with seventy-five percent able to accurately describe an ad from memory, and nearly ninety percent saying that the ads were convincing. Thus the potential for a REALITY campaign is substantial, given the success of the truth® campaign.

TALKING POINTS

- Almost everyone will support saving the environment if it means saving money.
- Investing in energy efficiency will help lower energy usage, dependence on foreign oil, and combat global warming.
- Reducing pollution will decrease costs in the future, as people will not have to adapt as much to the changing climate.
- Combating global warming is a great way to save money and save lives.

ANALYSIS

The truth® campaign cost nearly $300,000 a year, during its prime. As it is a media campaign, it is more effective when more ads are shown. Costs could potentially be much lower or higher, depending on how many ad spots can be purchased. The market of 28 million teens is huge, not to mention the 'residual,' i.e people who see the ads but do not necessarily fall into the target demographic. Effective marketing in the truth® campaign was able to give 24 million teens good reasons not to smoke. REALITY could give 24 million American teens convincing reasons not to pollute. Change starts from the bottom up. Convince the younger generations to combat global warming, and those people will be the catalyst for the future. In ten years, they will be the ones buying cars and houses. Therefore, if America's youth sponsors the fight against climate change, business will have to follow or fail.

AUDIENCE

Energy efficiency saves money and reduces the burden placed on the environment. Anyone interested in ameliorating the changing global climate or saving hundreds of dollars each year should invest in energy efficiency. Governments, businesses, and individuals would all benefit from decreasing pollution and saving money on energy bills. Tomorrow's leaders are the prime market for a media campaign because they are coming to their own conclusions about important issues right now, and they will determine the trajectory of our country over the coming decades. As the global leader, the United States is in a prime position to lead the vanguard against global warming and promoting energy efficiency.

NEXT STEPS

The REALITY campaign is fundamentally based on an extremely effective prior media campaign. Its success depends on raising enough money, year after year, and on effective advertising. Global warming is a highly contentious issue in today's society, but if the REALITY campaign is promoted as a way to support initiatives already being spearheaded (such as in support of corn ethanol or hybrid cars) and a way to substantially decrease the energy costs, many businesses could be convinced to financially support the campaign. Effective advertising can be created through poignant images and catchy phrases—an image of birds dying from an oil spill with a sign that says, "Pollution kills. Invest in clean energy," or an image of smog over Los Angeles combined with an elderly person struggling to breathe, with a sign, "Pollution kills. Replace your gasoline with ethanol." The REALITY campaign has the ability to change the trajectory of this country's stance toward climate change.

SOURCES

Natural Resources Defense Council, "Reducing America's Dependence," Natural Resources Defense Council, http://www.nrdc.org/air/transportation/gasprices.asp

Protect the Truth, "truth® Campaign," Protect the Truth, http://www.protectthetruth.org/truthcampaign.htm

* A full list of sources is available upon request

Government Ad Campaign for Energy Efficiency

Josh Gallen, Jarret Zafran, Harvard University

By educating the public, the government can spur a change in culture in our country, leading to more efficient buildings inside and out, and a more eco-friendly lifestyle for the average American.

Seriously addressing our national energy crisis requires investing in the participation and knowledge of the average citizen. By targeting many forms of media, the federal government can promote recycling, weatherizing, buying energy efficient appliances and vehicles, and replacing light bulbs, as the newest ways to both save money and express one's patriotism. We need to spend this money in advance of all of the other changes in power sources, alternative fuels, and infrastructure expected in the following decades, so that the eventual adjustment in lifestyle will not be as hard on John Q. Public.

KEY FACTS

- Federal spending for the program would be $500 million.
- Only about one percent of the fuel consumed by flexible-fuel vehicles is an alternative fuel (E85).
- Replacing just one incandescent bulb with an Energy Star®-approved fluorescent bulb in every U.S. home would save enough energy to light more than seven million homes for a year and save $600 million in utility bills.
- In 2006, Energy Star® helped Americans save $14 billion on their utility bills.

Ultimately, whether we have green power, more fuel efficient vehicles, or better public transportation, it is the choice that the average American makes to buy that power, that car, or take that train that makes the final difference in energy consumed and greenhouse gasses emitted. Any truly comprehensive program to reduce energy consumption and carbon dioxide emissions must make these changes appealing to the consumer, and if in certain cases tax incentives and subsidies still won't make the right environmental choices into the right economic choices, advertising can help convince the public.

TALKING POINTS

- The benefits would be threefold: saving Americans money on their energy bills, reducing harmful emissions, and increasing awareness of eco-friendly technology.
- This program can be financially supported by private nonprofit organizations and for-profit companies, as happened with Energy Hog.
- The Bush Administration spent over $1.6 billion on advertising and PR between 2003 and 2006.
- The Bush administration cut funding by 18 percent for energy programs like Energy Star® and the weatherization program in FY2006.

Broad awareness of Energy Star® appliances has reached 68 percent, but awareness does not guarantee action on this matter. The problem of climate change and dependence on foreign energy sources exists right now, and we do not have the luxury of simply targeting teenagers and children in the hopes of inculcating the right

behaviors in the next generation. This advertising must attempt to convert consumers into energy-conscious shoppers and citizens, willing to replace their bulbs and make energy an issue they consider when voting in elections.

HISTORY AND ANALYSIS

Historically, public service ads have been effective. From "Rosie the Riveter" to "Just Say No," these public service announcements have been part of American culture for over 60 years. Smokey the Bear is recognized by 95 percent of adults and 77 percent of children. The Ad Council reports, "The amount of total waste recycled increased 24.4 percent from 1995 to 2000, and 385.4 percent from the 1980s after the launch of the Environmental Defense campaign." If everyone knew that recycling just the Sunday paper would save over half a million trees every week, then each person might think twice before tossing that paper in the regular trash.

Right now, Energy Star® Advertising Partnerships encourage businesses to partner with the EPA in promoting efficient appliances. A joint venture between the EPA and DOE also developed an ad campaign with a cartoon-villain called the "Energy Hog" targeted at children, to teach them and their parents about conserving energy in the house. These efforts are a good start, but are not enough to buoy the rapid growth in environmental consciousness needed in the next decades.

The proposed cost, $500 million, is less than two days' worth of spending in Iraq, a war with definite ties to our global energy concerns. Plus, the program will end up paying for itself. If the average American family reduces their energy bills even minimally, they will have more money to spend on other taxed goods, and the benefit of addressing our environmental concerns now helps ward off higher costs later.

NEXT STEPS

A program like this would likely garner private financial backing, just as the Energy Hog campaign has, from corporations like BP and Home Depot, and organizations like the Alliance to Save Energy and the Insulation Manufacturers Association. It can also spur local initiatives, such as the recent proposal in Cambridge, MA, where the government is expected to save 164 million kilowatt-hours of electricity annually. Though this proposal is targeted for a nationwide ad campaign, states would be wise to invest in this form of public education as well. This can be implemented now with simple legislation on the national level.

SOURCES

Energy Star®, "Overview of 2006 Achievements," Energy Star®,http://www.energystar.gov/ia/partners/pt_awards/2006_Achievements_Overiew.pdf

Ad Council, "About Ad Council," Ad Council, http://www.adcouncil.org/default.aspx?id=68

Alliance to Save Energy, "Energy Hog," Energy Hog, www.energyhog.org

* A full list of sources available upon request.

Waste-to-Energy Technology: A Solution to New Orleans' Debris Burden

Kristen Ardani, Tulane University

Rapid start-up of a waste-to-energy facility will provide an alternative energy source while ridding New Orleans of debris and waste generated by Hurricane Katrina.

Rich in natural capital, New Orleans East exhibits a voluminous amount of debris created by Hurricane Katrina, which complicates the recovery of wetland and neighborhood areas. More than 22 million tons of construction and demolition (C&D) debris was generated by Hurricane Katrina, an overwhelming inundation to the waste stream when considering that the largest landfill in Louisiana normally processes one million tons of C&D debris per year. By and large, New Orleans East is characterized by an unusual concentration of waste, as it continues to serve as the primary dumping site for the greater New Orleans area.

KEY FACTS

- Successful waste-to-energy facilities have been developed nationally and internationally.
- The positive impact of leveraging waste for the generation of energy benefits both the local population and the burgeoning world population.
- Waste-to-energy facilities reduce global dependence on hydrocarbons while removing waste from landfills.
- By investing in waste-to energy technologies instead of landfill sites, millions of dollars in annual tipping fees can be leveraged towards the long-term recovery of New Orleans.

HISTORY

Waste-to-energy plants implement various technologies, though one of the most efficient means of turning waste into energy is with Plasma Arc gasification. Plasma Arc gasification uses a high heat Plasma Arc torch, originally developed to test the integrity of space shuttle heat shields. Newer gasification-based models, like those proposed for New Orleans, maintain an ultra low emission standard. Similar models have been deployed in Japan. Waste-to-energy facilities have been developed in 35 nations, which process a total of 130 million tons of waste per year. The United States' waste-to-energy capacity is 30 million tons per year and 2,800 megawatt hours per year. Several states have defined waste-derived energy as renewable. New York currently has ten operational plants and Europe is quickly phasing out the landfilling of waste.

TALKING POINTS

- Landfilling is not sustainable.
- Hydrocarbon-derived energy contributes to global climate change, which in turn increases the strength and frequency of natural disasters.
- Waste contains valuable energy that can be extracted and utilized. Waste derived energy serves the dual purpose of generating alternative energy and diverting waste from landfills.
- Waste-to-energy technology has been developed and implemented successfully. The installation of a waste-to-energy facility in New Orleans is feasible.

ANALYSIS

A waste-to-energy Plasma Arc gasification facility takes in waste and converts it into a sustainable construction material and energy. With the use of a Plasma Arc torch, the facility gasifies trash at high temperatures that cause cell disassociation; inorganic material is then reconstituted into a slag. Essentially, the input of waste yields a solid, recycled material that can be used in construction, and electricity that can be fed directly to the grid. The intake capacity of gasification facilities vary; typically, for every 465 wet tons of waste, 23 megawatts of electricity are produced.

AUDIENCE

Waste-to-energy technology is primarily a private business endeavor, though its implementation requires political action and collaboration with local regulatory agencies. Saturated with debris, New Orleans is a target market for a waste-to-energy facility and the entire population will benefit from its installation.

NEXT STEPS

In order to take advantage of waste-to-energy technology, the city of New Orleans needs to:

1. Allocate resources in the LDEQ Comprehensive Plan for Disaster Clean-Up and Debris Management for waste-to-energy technology and land fill remediation.
2. Institute a Renewable Portfolio Standard that mandates a certain percentage of Louisiana's energy be derived from renewable sources.
3. Collaborate with LDEQ in the permitting of waste-to-energy facilities and clean closure of Old Gentilly and Chef Manteur landfill sites.

SOURCES

"Comprehensive Plan for Disaster Clean Up and Debris Management." Louisiana Department of Environmental Quality, July 2006.

Taylor Biomass Energy LLC. "Who and What is Taylor Biomass Energy." <http://www.taylorbiomassenergy.com/company/?id=2> March 2007.

Themelis N., "Renewable Portfolio Standard Collaborative." Columbia University, New York, April 8, 2003.

Rebuilding New Orleans and Sugarcane Ethanol Distillation

Patrick Burbine, Tulane University

Advertising the potential for sugarcane growth and distillation in New Orleans could attract environmental groups who would be encouraged to assist in rebuilding struggling neighborhoods.

Those familiar with New Orleans politics remember the recent controversy involving the Bring New Orleans Back Commission (NOBC) and its proposal for mass forced buyouts, employing eminent domain. Neighborhoods that failed to sufficiently recover would be bought out by the Crescent City Redevelopment Corporation with or without owner's consent and plowed over for conversion into green spaces. The cost of such a plan is estimated at $12 billion, and it would be expected that the federal government significantly aid New Orleans with the financial burden.

KEY FACTS

- An ethanol distillery being built in Tampa will cost $85 million and produce 44 million gallons of ethanol annually.
- Brazil is producing ethanol at $0.60/gallon using sugarcane, and ethanol can be sold at levels comparable to gasoline.
- Sugarcane yields 662 gallons/acre.

I propose that buyouts be offered on a voluntary basis at 100 percent of the current property value, while assisting those who wish to rebuild. This creates sporadically spaced plots of empty land that are not conducive toward the creation of green spaces. Instead, sugarcane can be grown and distilled to produce ethanol at a distillery that should also be locally built. Instead of seeking exclusive assistance directly from the federal government, environmental groups that have an interest in ethanol distillation can also be encouraged to non-monetarily assist in reconstruction and conversion. The profits from selling distilled ethanol as an alternative fuel can be used to reimburse those who lend their aid, which should prevent organizations from being scared off by a perceived high level of commitment with low returns. Such a production plant will also create jobs,

TALKING POINTS

- While searching for solutions to New Orleans' city planning in the wake of Hurricane Katrina, it seems both reasonable and productive to take green city planning methods into account.
- New Orleans' historical ties to the sugarcane industry provides a logical, locally-inspired means of production that could benefit both a city in need of repair and rural areas in need of revitalization.
- By fusing rural and urban planning in innovative ways, the city of New Orleans could both regain its former strength and become more environmentally sound.

addressing the primary concern of rebuilding New Orleans. These jobs would help recreate the base of a community that can thrive into the future on a more sustainable energy source.

HISTORY

Brazil began its ethanol program in 1975 and was the world's leading producer of ethanol, distilling approximately four billion gallons per year. In 2005, it was overtaken by the United States, which produced 4.9 billion gallons in 2006. Despite the U.S.'s recent surge in ethanol production, demand for importation has not slowed, and the U.S. imported 650 million gallons in 2006, up from 135 million in 2005.

ANALYSIS

Many people are not returning to New Orleans because they do not know if they have a basic communal infrastructure to come back to. This plan creates job positions that need to be filled, providing a base from which a larger community might flourish.

In the state of Louisiana 435,000 acres are currently grown (although 550,000 acres were grown pre-Katrina). Six hundred thousand acres (at 667 gallons/acre) of sugarcane are necessary to create the 40-plus million gallons of ethanol that a large plant like the one being built in Tampa is capable of producing. A significant portion of the sugarcane crop can therefore be expected to come from local state sources. It is also reasonable to expect that sugarcane growth will rise along with the demand for ethanol.

Since sugarcane can be distilled for as little as $0.60/gallon, and then sold at gasoline prices, there are obviously large monetary gains to be made in the ethanol industry.

NEXT STEPS

This is a project that will benefit New Orleans, and clearly that is where everything should start. The New Orleans city council should be informed of the potential the ethanol industry holds. From there, it ought to be confirmed that a plot of land large enough to house an ethanol distillery can be secured. Next, the city may begin to approach federal and independent agencies interested in ethanol production and request assistance in rebuilding New Orleans in return for the opportunity to invest in this lucrative industry.

SOURCES

* A full list of sources is available upon request

Advancing Carbon Sequestration with Oil

A.J. Singletary, Washington University

Oil royalty payments can be used to fund carbon sequestration technologies that combat global warming.

Global warming will devastate the world. Especially worrisome is the fact that emissions predominantly from industrial countries will wreak havoc on subsistence systems and human health in underdeveloped countries. Temperatures will rise most dramatically in South America, Africa, and the Arctic; all face a probable five degree Centigrade increase in the next century. This will lead to the collapse of fisheries and agricultural systems that the most impoverished depend on. The number of people exposed to malaria will double to 60 percent of the world, mostly in the poor equatorial regions, causing up to 80 million additional cases a year. Sea level rise will cause at least 20 million extra people per year to be at risk of coastal flooding by mid-century (United Nations Environmental Program). Regions most at risk are South Asia and Africa, and many island nations will literally disappear.

KEY FACTS

- The United States emits 25 percent of the world's carbon dioxide while only containing four percent of the world's population.
- The United States oil industry, the most predominant source of U.S. greenhouse emissions, achieved a world historical record of $140 billion in profits in 2005.
- The Department Energy has identified carbon sequestration opportunities in the U.S. that have the potential to safely store more than 600 billion tons of carbon dioxide, equivalent to over 200 years of U.S. emissions.
- U.S. federal funding for all new energy research to address climate change was only three billion dollars in 2006, less than half of the budget 25 years ago.

TALKING POINTS

- As the world's largest greenhouse gas emitter, the U.S. has a moral responsibility to take the lead in developing global warming solutions.
- Carbon sequestration is an "equal opportunity" global warming solution; no matter the source of emissions, sequestration lowers carbon dioxide concentrations in the atmosphere.
- It is feasible that sequestration can not only offset present emissions, but it may also lower atmospheric carbon dioxide concentrations to past levels, like the pre-1990 levels the Kyoto Protocol demands.

Meanwhile, the sector driving climate change is booming, and green technology research is lagging. The U.S. oil industry achieved a world historical record of $140 billion in profits in 2005, representing over twice the entire gross domestic product of Bangladesh in the same year. Conversely, U.S. federal funding for all new energy research to address climate change was only three billion dollars in 2006, less than half of the budget 25 years ago. America is failing in the effort to combat global warming, and the entire world is suffering as a result.

HISTORY

Carbon sequestration is a financially unrecognized technology that could revolutionize the climate debate. Even with the future use of emission-free energy sources, sequestration will be essential if the world is to stabilize carbon dioxide at safe levels in the atmosphere. The Department of Energy (DOE) recently identified sequestration opportunities in the U.S. that have the potential to safely store more than 600 billion tons of carbon dioxide, equivalent to over 200 years of U.S. emissions. However, lack of adequate technology has prevented work on any of the sites. The DOE's National Energy Technology has developed the FutureGen, a power plant that will produce hydrogen electricity and sequester carbon dioxide in one process, but low federal funding has kept the project from becoming an operational reality. To combat global warming, the U.S. must ensure that the sequestration of carbon dioxide can be done safely, permanently, and economically.

Oil industry royalty payments can be used creatively for carbon sequestration development. Industries that retrieve oil on federal property are required to pay government royalties totaling about 16 percent of profits; in 2005, oil companies paid about ten billion dollars in royalties. However, Section 342 of the Energy Policy Act of 2005 mandates that the oil industry will pay royalties-in-kind: instead of tax dollars, the government receives oil as royalty payments. The U.S. should instead accept royalties in dollars and direct the funding to carbon sequestration.

Royalty payments directed to the DOE would more than triple its 2006 research budget, making sequestration a closer reality. Present costs are about $150 to sequester a ton of carbon; increased funding could drop the price to a reasonable ten dollars per ton with the use of new methodology. The FutureGen project is currently on an extended plan lasting nearly a decade; royalty funding would increase its budget a hundredfold, bringing reasonable clean power generation and sequestration into the near future. Furthermore, the DOE has an official network of global partners which act as leading recipients of DOE-funded sequestration research. Based on 2006 funding, oil royalties would increase the distribution of DOE resources by 8,520 percent, sparking sequestration research across the nation and around the world. This necessary funding can be used in a variety of ways to support carbon sequestration development and eventual implementation.

SOURCES

"Greenhouse Gases, Climate Change, and Energy." National Energy Information Center. Energy Information Administration, *U.S. Department of Energy.* http://www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html (accessed April 2, 2006).

Andrews, Edmund L. "Budgets Falling in Race to Fight Global Warming." The New York Times, A:1. October 30, 2006.

"Technologies: Carbon Sequestration." National Energy Technology Laboratory, *U.S. Department of Energy.* http://www.netl.doe.gov/technologies/carbon_seq/index.html (accessed January 2, 2007).

"Department of Energy advances commercialization of climate change technology." Office of Science, *U.S. Department of Energy*. http://www.energy.gov/news/4450.htm (accessed October 31, 2006).

Replacing Coal Power with Nuclear Using Japanese and European Waste Storage Methods

Matt Colgan, Stanford University

Fuel recycling plants can cut high-level waste by a factor of ten and then convert the waste into a stable glass form, preventing leakage into ground water.

Since the United States is the number one emitter of greenhouse gases in the world, with a third of these gases coming from coal power plants, a reduction in U.S. coal burning is necessary. Coal is a source of baseload electricity; thus, a replacement for coal must meet baseload demands. Coal, hydroelectric (dams), and nuclear power are the only three sources of baseload electricity (wind and solar are intermittent due to varying wind speeds, cloud cover, etc). Hydropower resources are mostly built to capacity, and while capturing and storing emissions from coal is a possibility, CO2 sequestration is not commercially available and is expected to be roughly 1.5 to three times more expensive than nuclear energy.

KEY FACTS

- Coal power plants produce 33 percent of U.S. greenhouse gas emissions.
- Nuclear and hydro are the only types of baseload power that do not emit greenhouse gases, and hydro is already built to capacity.
- European reprocessing reduces their high-level waste (spent fuel) by a factor of nine to ten.
- Remaining waste has a significantly shorter half-life, allowing waste to be handled within 40 years.
- Trapping this waste in glass, called vitrification, prevents leakage into ground water.

By process of elimination, nuclear is the most viable substitute for coal. With an increase in nuclear power comes an increase in spent fuel. Reprocessing plants will allow this growth to occur with minimal waste. Reprocessing chemically breaks down spent nuclear fuel, allowing reuse of 95-97 percent of the fuel at a power plant. The remaining three to five percent waste is then combined with glass forming materials (called vitrification), trapping the radioisotopes like insects in amber in a solid form, preventing leakage.

TALKING POINTS

- A single reprocessing plant in France recycles all fuel rods from each of 59 French nuclear reactors.
- The United States has no reprocessing plants, but building two of similar size to the French La Hague plant would allow the United States to process all of its spent nuclear fuel each year.
- According to Patrick Moore, co-founder of Greenpeace, "Nuclear energy is the only large-scale, cost-effective energy source that can reduce greenhouse gas emissions while continuing to satisfy a growing demand for power."

HISTORY

The United States has decided since the 1970s not to pursue civilian reprocessing because of concerns about nuclear proliferation.

This is why the United States currently stores all spent fuel as liquid waste. In contrast, the United Kingdom and

Europe built several reprocessing plants over 40 years ago and continue to process their own nuclear waste. These older reprocessing plants separate the plutonium, uranium, and other products, creating a potential for weapons grade plutonium to be intercepted en route back to the power plant. Japan's state-of-the-art reprocessing plant does not separate the plutonium from the uranium at any step along the way, which helps address the proliferation concerns about previous reprocessing cycles.

ANALYSIS AND NEXT STEPS

Currently, existing waste is stored on-site at nuclear reactors and dry cask sites all over the United States, but as waste increases it will need to be stored in stable geologic formations, such as Yucca Mountain, and this space is at a premium.

Building just two reprocessing plants in the United States, similar in design and capacity to the Japanese reprocessing plant, will be approximately enough to process all nuclear waste produced in the United States each year. This would reduce the volume of total U.S. nuclear waste (including radiated equipment) by a factor of five and reduce high-level waste by a factor of ten. Since the US currently has no sites for permanent storage until Yucca Mountain is opened (2017 or later), a tenfold reduction in high-level waste production would significantly reduce the required number of cooling pools and dry cask storage.

Reprocessing does increase the overall generating cost of nuclear power. A 2004 Japanese government study estimates a price increase of nuclear energy in Japan from 3.75 cents/kWh to 4.33 cents/kWh. Compare this to CO2 sequestration, which is estimated to roughly double the current cost of coal power to 6.2-8.6 cents/kWh. Let us learn from, and work with, our Japanese, European, and other counterparts in building a safe reprocessing program to counter the increase in waste that will accompany more nuclear power.

SOURCES

"Nuclear Wasteland." IEEE Spectrum. February 2007. http://www.spectrum.ieee.org.feb07/4891/3

Wang, Brian. "Japan reprocessing Uranium 95% of nuclear waste." http://advancednano.blogspot.com/2007/02/japan-reprocessing-uranium-95-of.html

IPCC Special Report on Carbon dioxide Capture and Storage. Ch. 8, pg. 5. http://www.ipcc.ch/activity/srccs/SRCCS_Chapter8.pdf

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