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GREENING DEMAND: ENERGY CONSUMPTION AND U.S. CLIMATE POLICY

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ABSTRACT

The search for greener, less polluting energy supplies has dominated discussions of U.S. climate change strategy, but we often overlook cheaper and faster greenhouse gas emissions reductions achievable through energy efficiency and conservation. In this article, I outline a decade-long "greening demand" agenda to reduce the amount of energy consumed in the United States. The federal government should aim to reduce U.S. energy consumption by fifteen percent by 2016 and twenty percent by 2020 to achieve needed reductions in greenhouse gas emissions.

While the United States has achieved notable efficiency gains since the 1970s, several market failures and other barriers continue to serve as obstacles to energy savings. These include principal-agent divergence, high implicit discount rates used in decision making on efficiency upgrades, and outmoded forms of utility regulation. I demonstrate how a greening demand agenda, centered on price signals, performance standards, informational tools, and changes in utility regulation can be used to overcome these barriers. Many of the challenges are technical and scientific, but law will play a central role in structuring incentives and shaping national markets for efficiency innovations. I conclude with some thoughts on the technical and political feasibility of greening demand.

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In the heat of the presidential campaign in the summer of 2008, when gasoline sold for over $4.00 a gallon, Americans changed their driving and car buying habits. SUV sales plummeted.[1] Amtrak ridership was up.[2] For a brief time, we had a glimpse of the transformation in consumer behavior that could occur in response to higher energy prices. By the time President Obama was inaugurated in January 2009, however, gasoline was selling below $1.70 a gallon—a remarkable, unexpected decline in retail gas prices of more than fifty percent in just six months.

Price volatility is just one of many barriers to achieving long-term reductions in energy use in the United States[3]—reductions that are now essential for addressing climate change and improving energy security. Except for moments of public attention to energy consumption, as in the late 1970s and the summer of 2008, the United States has focused primarily on finding (or militarily defending) sources of energy supply. From the synfuel research program of the Carter Administration to today's interest in new offshore drilling and ethanol subsidies,[4] we are constantly looking for new cats to chase the speedy mouse of American energy demand.

We can no longer afford, however, to view rising energy demand as an exogenous variable—an unquestioned "given" of American life

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1. *See* Dee-Ann Durbin, *SUV and Truck Sales Plunge*, WASH. POST, May 2, 2008, at D2 (reporting dramatic SUV sales decreases at GM, Chrysler, and Ford between April 2007 and April 2008, including a thirty-six percent decline at Ford).

2. *See* Bob Dart, *Amtrak Ridership Rises Along with Gas Prices*, ATLANTA J. CONST., May 28, 2008, at E1 (noting that "[r]ising gas prices are contributing to a surge in train travel"); Press Release, Nat'l R.R. Passenger Corp., Amtrak *Downeaster* and *Empire Service* Show Dramatic Increases in Ridership and Revenue (Nov. 3, 2008), *available at* http://www.amtrak.com/servlet/ContentServer?pagename=Amtrak/am2Copy/News_Release_Page&c=am2Copy&cid=1178294243600&ssid=180 (noting that fiscal year 2008 marked the sixth straight year of ridership gains and saw the highest ridership since 1971).

3. In a November 16, 2008 interview with 60 Minutes, President-elect Obama was asked whether declining gas prices might reduce the relative priority of energy policy in his administration. Obama answered in the negative and responded:

> We go from shock to trance. You know, oil prices go up, gas prices at the pump go up, everybody goes into a flurry of activity. And then the prices go back down and suddenly we act like it's not important, and we start, you know filling up our SUVs again. And, as a consequence, we never make any progress. It's part of the addiction, all right. That has to be broken. Now is the time to break it.

Interview by Steve Croft, Correspondent, 60 Minutes, with Barack Obama, then President-elect of the United States, in Chicago, Ill., *in Obama on Economic Crisis, Transition*, CBS NEWS, Nov. 16, 2008, *available at* http://www.cbsnews.com/stories/2008/11/16/60minutes/main4607893.shtml.

4. *See, e.g.*, VITO A. STAGLIANO, A POLICY OF DISCONTENT: THE MAKING OF A NATIONAL ENERGY STRATEGY, at xiii–xvi (2001).

that drives policy decisions on supply. With urgent concerns about climate change and energy security, greening demand now needs to become the cornerstone of U.S. energy and environmental policy. By "greening demand," I mean reducing total annual U.S. energy consumption, particularly from fossil fuels.[5] To green demand, government and the private sector need to promote both energy-efficient technologies, which can produce the same work with fewer energy inputs, and conservation, which means consumers and firms must use energy less intensively.[6]

The objective of a greening demand agenda under the Obama Administration should be a fifteen percent reduction in total U.S. energy consumption by 2016 and a twenty percent reduction by 2020. These objectives are consistent with needed forty percent reductions in U.S. greenhouse gas emissions by 2030,[7] and with President Obama's campaign pledge to reduce U.S. greenhouse gas emissions to 1990 levels by 2020.[8] Achieving any substantial reduction in greenhouse gas emissions in the near-term depends critically on greening demand. Emissions reductions of fifteen percent or more within ten years are unlikely to occur solely through greening supply, such as changing the mix of energy sources in the United States.

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5. Currently, about eighty-five percent of the energy consumed in the United States comes from fossil fuels, such as oil, coal, and natural gas. U.S. Department of Energy, Fossil Fuels, http://www.energy.gov/energysources/fossilfuels.htm (last visited Mar. 20, 2009).

6. The difference between efficiency and conservation can be seen through an example of a typical office building. Efficiency measures would include replacing incandescent light bulbs with fluorescent bulbs that provide the same lighting services with far lower energy inputs. Conservation measures would include installing motion detectors to ensure that lights are on only when people are in a room or increasing natural light to reduce the number of light bulbs needed in the first place.

7. Climate scientists have stated that global greenhouse gas emissions must be reduced at least eighty percent below 1990 levels by 2050 to avoid dangerous climate disruption. *See, e.g.*, UNION OF CONCERNED SCIENTISTS, U.S. SCIENTISTS AND ECONOMISTS' CALL FOR SWIFT AND DEEP CUTS IN GREENHOUSE GAS EMISSIONS 5 (2008), *available at* http://www.ucsusa.org/assets/documents/global_warming/Scientist_Economists_Call_to_Action_fnl.pdf. Since the United States is currently emitting about seventeen percent more greenhouse gases annually than it did in 1990, *see* ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, EMISSIONS OF GREENHOUSE GASES IN THE UNITED STATES 2007, at 1 (2008), *available at* http://www.eia.doe.gov/oiaf/1605/ggrpt/pdf/0573(2007).pdf, a forty percent reduction from present levels is a reasonable minimum target for the year 2030.

8. *See* BARACK OBAMA AND JOE BIDEN: NEW ENERGY FOR AMERICA 1 (2008), *available at* http://www.barackobama.com/pdf/factsheet_energy_speech_080308.pdf; Jeff Zeleny, *Obama Proposes Capping Greenhouse Gas Emissions and Making Polluters Pay*, N.Y. TIMES, Oct. 9, 2007, at A24.

This article, which contributes to an emerging literature on consumption and climate change,[9] outlines the energy consumption challenge that the United States faces and proposes policy tools that the federal government should deploy to overcome longstanding barriers to reducing energy demand. I argue that putting a price on carbon emissions through a carbon tax or cap-and-trade system is an essential part of a greening demand strategy. Indeed, pricing carbon emissions is the policy change that would achieve the greatest economy-wide impact in tempering energy consumption. However, there are also numerous market failures and informational barriers that make energy prices a "fuzzy" signal for spurring reductions in energy consumption. These barriers include principal-agent divergence of interests, high implicit discount rates used in purchases of energy-using products, inadequate information on energy pricing and usage by individuals, and a lack of incentives for utilities to undertake investments in efficiency measures.

The persistence of these barriers suggests that we cannot rely solely on price signals to drive changes in behavior and consumption habits.[10] Instead, government needs to play an active role in surmounting these barriers through a toolbox approach that would include product performance standards, information disclosure requirements, and changes in utility regulation. These approaches have proven effective in the past in pollution control policy, and a more ambitious greening demand agenda, using this policy toolbox to reduce energy consumption, is technically and politically feasible. Greening demand offers the prospect of both cost savings and environmental improvement, and it is therefore an indispensable component of the U.S. climate change strategy.

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9. *See, e.g.*, Douglas A. Kysar & Michael P. Vandenbergh, *Introduction: Climate Change and Consumption*, 38 ENVTL. L. REP. 10825 (2008); Symposium, *The Next Frontier: Individual and Household Environmental Behavior*, 35 ENVTL. L. REP. 10, 723 (2005); Michael P. Vandenbergh, *From Smokestack to SUV: The Individual as a Regulated Entity in the New Era of Environmental Law*, 57 VAND. L. REV. 515 (2004); Bradley A. Harsch, *Consumerism and Environmental Policy: Moving Past Consumer Culture*, 26 ECOLOGY L.Q. 543 (1999); CONFRONTING CONSUMPTION (Thomas Princen, Michael F. Maniates & Ken Conca eds., 2002).

10. *See* AM. PHYSICAL SOC'Y, ENERGY FUTURE, THINK EFFICIENCY: HOW AMERICA CAN LOOK WITHIN TO ACHIEVE ENERGY SECURITY AND REDUCE GLOBAL WARMING 24 (2008), *available at* http://www.aps.org/energyefficiencyreport/report/aps-energyreport.pdf ("[M]arket forces alone cannot drive the adoption of energy-efficiency technologies in a beneficially sustained manner within the timeframe imposed by the challenges of global warming.").

I. THE CHALLENGE OF U.S. ENERGY CONSUMPTION

A. Long-Term Trends

There are two possible perspectives on long-term trends in U.S. energy consumption. The positive news is that the energy intensity of the U.S. economy—the energy needed to produce a dollar of gross domestic product (GDP)—has been declining for decades.[11] This means that the United States has succeeded over time in producing its goods and services with fewer energy inputs. Similarly, the greenhouse gas intensity of the U.S. economy—the amount of greenhouse gases emitted per dollar of GDP—has also been declining for decades.[12] These trends reflect policy measures adopted in the 1970s and 1980s to promote efficiency, as well as a macro-economic shift away from heavy manufacturing to information technology and service sector jobs that are less energy-intensive.[13] President Bush, taking advantage of these long-term trends, pledged in 2002 to reduce the greenhouse gas intensity of the U.S. economy by eighteen percent in ten years, and the United States has remained on track to achieve that goal.[14]

On the other hand, the absolute amount of energy consumed in the United States has been rising for decades. It is the absolute level of fossil fuel consumed and greenhouse gases emitted, not the ratio of those figures to GDP, which determines the ecological impacts from energy consumption. Total U.S. energy consumption has nearly doubled since 1965.[15] U.S. consumption of coal for electricity has

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11. U.S. Department of Energy, Energy Intensity Indicators in the U.S., http://www1.eere.energy.gov/ba/pba/intensityindicators/total_energy.html (last visited Mar. 11, 2009).

12. Energy Info. Admin., U.S. Dep't of Energy, Trends in U.S. Carbon Intensity and Total Greenhouse Gas Intensity (Dec. 2004), http://www.eia.doe.gov/oiaf/1605/archive/gg04rpt/trends.html.

13. John C. Dernbach, *Overcoming the Behavioral Impetus for Greater U.S. Energy Consumption*, 20 PAC. MCGEORGE GLOBAL BUS. & DEV. L.J. 15, 32 (2007).

14. *See* Gilbert E. Metcalf, *An Empirical Analysis of Energy Intensity and Its Determinants at the State Level*, 29 ENERGY J. 1, 19 (2008) (concluding that "little policy intervention may be required to achieve the Bush Administration's goal of an 18 percent reduction in carbon intensity by the end of this decade"); *see also* Press Release, The White House, Office of the Press Sec'y, Fact Sheet: Earth Day 2007 (Apr. 20, 2007), *available at* http://georgewbush-whitehouse.archives.gov/news/releases/2007/04/20070420-9.html (noting that "we are well on track to meet this [eighteen percent] goal").

15. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ANNUAL ENERGY REVIEW 2007, at 38 tbl.2.1(a) (2008), *available at* http://www.eia.doe.gov/aer/pdf/aer.pdf (providing energy consumption by sector from 1949–2007).

doubled since 1979.[16] Annual U.S. greenhouse gas emissions have already increased more than ten percent since 1992,[17] when the United States committed, in the UN Framework Convention on Climate Change, to "limit[] its anthropogenic emissions of greenhouse gases."[18]

On a per capita basis, Americans rank among the highest energy consumers on the planet. With 4.5% of global population, Americans annually consume about 22% of the world's energy supplies.[19] Americans' per capita energy consumption is about twice as high as other industrialized nations, as shown in Table I below. Our enormous consumption habit not only causes climate disruption, but also leaves the U.S. economy vulnerable to supply disruptions from war, political instability, and peak oil.

TABLE I – PER CAPITA ENERGY CONSUMPTION, IN MILLION BTUS (2006)[20]

United States	**335**
United Kingdom	162
Germany	178
France	181
Italy	139
Japan	179
South Korea	193

As Table I suggests, we have a severe case of energy bloat in the United States. If there is any upside to this energy profligacy, it is that there is enormous untapped potential to reduce both energy consumption and associated greenhouse gas emissions in the United States. The embedded "excess" energy in our current industrial,

16. *Id.* at 240 tbl.8.5(a) (providing consumption of combustible fuels for electricity by all sectors from 1949–2007).

17. *See* ENERGY INFO. ADMIN., *supra* note 7, at 1 (noting a 10.75% rise in U.S. greenhouse gas emissions since 1995 and a 16.7% rise since 1990).

18. United Nations Framework Convention on Climate Change, May 9, 1992, 1771 U.N.T.S. 164, art. 4(2)(a).

19. MCKINSEY GLOBAL INST., MCKINSEY & CO., WASTED ENERGY: HOW THE U.S. CAN REACH ITS ENERGY PRODUCTIVITY POTENTIAL 6 (2007) (providing 2003 figures).

20. *See* Energy Info. Admin., U.S. Dep't of Energy, International Total Primary Energy Consumption and Energy Intensity, Per Capita (Per Person) Total Primary Energy Consumption (Million Btu Per Person), *available at* http://www.eia.doe.gov/emeu/international/energyconsumption.html (follow "Most Countries, 1980–2006 for the *International Energy Annual 2006*").

transportation, and residential systems should be viewed as a mineable resource. Indeed, improved efficiency is the "first fuel" the United States should turn to for powering its economy in a time of deep fiscal constraints and dependence on hostile states for energy supplies.[21]

Reducing energy demand, however, is among the most neglected elements of U.S. environmental policy. Every president since Nixon has rhetorically touted the virtues of energy efficiency, but in practice, the federal government has focused primarily on ensuring uninterrupted supply.[22] The Bush Administration offered a meager energy efficiency package in its 2001 energy plan,[23] a package that focused mainly on public education, fuel savings at federal facilities, expanding the Energy Star labeling program, and undertaking further studies on efficiency measures. Just before the plan was released, Vice President Cheney famously dismissed energy conservation as a mere "personal virtue."[24] Under the Bush Administration, the most notable efficiency measures were the 2005 tax credit for hybrid vehicles (which was tilted toward benefiting U.S. automakers rather than promoting hybrids overall),[25] and the 2007 increase in Corporate Average Fuel Economy (CAFE) standards for automobiles (which

21. *See* MAGGIE ELDRIDGE ET AL., AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., REPORT NO. E082, ENERGY EFFICIENCY: THE FIRST FUEL FOR A CLEAN ENERGY FUTURE (2008), *available at* http://www.aceee.org/pubs/e082.pdf.

22. Federal efforts directly aimed at reducing energy consumption, such as Corporate Average Fuel Economy standards first mandated in the Energy Policy and Conservation Act of 1975, 49 U.S.C. §§ 32901–19 (2006), and appliance efficiency standards first mandated in the National Appliance Energy Conservation Act of 1987, 42 U.S.C. §§ 6291–97 (2006), are notable exceptions to the dominant focus on energy supply.

23. *See* NAT'L ENERGY POLICY DEV. GROUP, NATIONAL ENERGY POLICY: RELIABLE, AFFORDABLE, AND ENVIRONMENTALLY SOUND ENERGY FOR AMERICA'S FUTURE 4-11 to -12 (2001), *available at* http://georgewbush-whitehouse.archives.gov/energy/2001/National-Energy-Policy.pdf.

24. Dick Cheney, Vice President of the United States, Remarks at the Annual Meeting of the Associated Press in Toronto, Can. (Apr. 30, 2001), *available at* http://www.pbs.org/newshour/bb/environment/energy/cheney_4-30.html (declaring that conservation, while "a sign of personal virtue," is "not a sufficient basis for a sound, comprehensive energy policy").

25. *See* Energy Policy Act of 2005, Pub L. No. 109-58, 119 Stat. 594 (codified at 26 U.S.C. § 30B) (2006). The Energy Policy Act of 2005 created a consumer tax credit on the first 60,000 hybrid cars sold by each automaker (with a phase-out of the credit after the 60,000 mark). Toyota hit that mark in June 2006, and Honda reached it in late 2007. The tax credit has primarily benefited U.S. automakers producing hybrid models. *See* David Leonhardt, *U.S. Hybrids Get More Miles Per Congress*, N.Y. TIMES, June 21, 2006, at C1 (noting that the credit will incentivize consumers to purchase cars such as the Chevrolet Silverado hybrid, which gets only sixteen miles per gallon).

was less ambitious than fuel economy standards enacted in Europe, China, and Japan).[26]

The Obama Administration is clearly shifting toward a stronger national commitment to energy efficiency and greenhouse gas controls. In May 2009, the Administration reached an agreement with automakers and several states that will raise fuel economy standards faster than the 2007 legislation requires.[27] The economic stimulus package signed by President Obama in February 2009 contained over $20 billion in new funding for energy efficiency programs[28]—far more than any previous American legislation. This commitment toward greening demand needs to be sustained into the future.

The United States now confronts a formidable energy and environmental challenge: U.S. energy consumption is projected to increase continually through 2030.[29] But in the same time period, the United States must cut its greenhouse gas emissions at least forty percent below current levels—in conjunction with similar reductions by other nations—to avoid dangerous climate disruption.[30] It is unlikely that the United States can thread that needle solely through a massive shift from fossil fuels to renewable energy or through deployment of carbon capture and sequestration technologies. Instead, significant emissions reductions will be achievable only

26. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, § 102, 121 Stat. 1498–1499 (to be codified at 42 U.S.C. § 30101) (raising Corporate Average Fuel Economy standards from 27.5 mpg to 35 mpg by 2020); *see also* Andreas Biermann, Int'l Energy Agency, Integrating Climate Change and Security Concerns (Feb. 15, 2008), http://www.oecdwash.org/PDFILES/02_15_08_Biermann_Energy.pdf (comparing U.S., European, Japanese, and Chinese fuel economy standards).

27. *E.g.*, John M. Broder, *Obama to Toughen Rules on Emissions and Mileage*, N.Y. TIMES, May 19, 2009, at A1.

28. American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009). The stimulus bill included $5 billion in home weatherization assistance, $6.3 billion for energy efficiency grants to states and local governments, and $300 million in tax credits for purchase of energy-efficient appliances. *See What's in the Stimulus Bill—A Breakdown: Getting to $787 Billion*, WALL ST. J. ONLINE, Feb. 17, 2009, http://online.wsj.com/public/resources/documents/STIMULUS_FINAL_0217.html; *see also* Kate Galbraith, *Preparing for a Flood of Energy Efficiency Spending*, N.Y. TIMES, Feb. 25, 2009, at B1 (outlining how efficiency funds might be used by states and municipalities).

29. *See* ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ANNUAL ENERGY OUTLOOK 2009, at 109 tbl.A1 (2009), *available at* http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2009).pdf (projecting total energy consumption to increase by half a percent per year from 2006 until 2030).

30. *See supra* note 7 and accompanying text.

through a shift toward low-carbon sources of energy supply *and* reductions in energy demand.

B. Benefits of Greening Demand

Greening demand should be the cornerstone of U.S. climate change policy for several reasons.

1. Cost

Measured in terms of initial capital costs or ongoing expenses, investments that reduce energy consumption are usually far less expensive than building new sources of energy supply. According to the International Energy Agency, an additional $1 spent on more efficient electrical equipment, appliances, and buildings avoids, on average, $2 in investment in energy supply.[31] For planning purposes, U.S. government regulators estimate the cost of efficiency improvements at three cents per kilowatt hour saved,[32] and a widely cited 2007 report by McKinsey & Co. identified about a dozen energy efficiency improvements in the residential, commercial, and industrial sectors that could reduce greenhouse gas emissions at *negative* marginal cost—at a net savings to the economy.[33] In contrast, new coal-fired plants ordered in 2009 are likely to sell electricity for ten to thirteen cents per kilowatt hour, and new nuclear power plants are likely to sell electricity for fifteen to twenty-one cents per kilowatt hour, based on projected capital costs.[34] Efficiency improvements and energy conservation are the low-hanging fruit of U.S. greenhouse gas reductions.

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31. MCKINSEY GLOBAL INST., MCKINSEY & CO., THE CASE FOR INVESTING IN ENERGY PRODUCTIVITY 8 (2008), *available at* http://www.mckinsey.com/mgi/publications/Investing_Energy_Productivity.

32. FED. ENERGY REGULATORY COMM'N, DEP'T OF ENERGY, INCREASING COSTS IN ELECTRIC MARKETS 14 (2008), *available at* http://www.ferc.gov/legal/staff-reports/06-19-08-cost-electric.pdf.

33. JON CREYTS ET AL., MCKINSEY & CO., REDUCING U.S. GREENHOUSE EMISSIONS: HOW MUCH AT WHAT COST? U.S. GREENHOUSE GAS ABATEMENT MAPPING INITIATIVE, EXECUTIVE REPORT, at xiii exhibit B (2007), *available at* http://www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf.

34. AMORY B. LOVINS ET AL., ROCKY MOUNTAIN INST., NUCLEAR POWER: CLIMATE FIX OR FOLLY? 3 (2008), *available at* http://www.rmi.org/images/PDFs/Energy/E09-01_NuclPwrClimFixFolly1i09.pdf. The cost differential between efficiency improvements and fossil energy sources will be even more pronounced if a carbon tax or a cap-and-trade system is implemented.

2. Speed of Implementation

Energy efficiency improvements and energy conservation can often be implemented faster than bringing new sources of energy supply to market. Efficiency measures do not require lengthy siting, permitting, or construction processes. They also do not require construction of new transmission lines, which is one of the major current barriers to deployment of large-scale renewable energy projects.[35]

In contrast, adding carbon-neutral generating capacity, to the extent that it would make a substantial difference in overall U.S. greenhouse gas emissions, is likely to be a slow process extending over several decades. The Energy Information Administration projects that U.S. renewable energy generating capacity will increase by 1.9% annually through 2030.[36] However, absent major policy intervention, renewable energy is projected to comprise only about twelve percent of total installed capacity in 2030, when coal is still projected to be the dominant source of electricity in the United States.[37] The Nuclear Regulatory Commission has received applications for twenty-six new reactors,[38] but only a handful of these new plants will likely be in operation by 2020. The Electric Power Research Institute, the research arm of America's electric utilities, has acknowledged that carbon sequestration from current electric power plants will not be practicable before 2020.[39] With financing, construction, and permitting hurdles on the supply side, near-term reductions in U.S. greenhouse gas emissions depend critically on substantial reductions in energy demand.

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35. *See, e.g.*, Darrell Blakeway & Carol Brotman White, *Tapping the Power of Wind: FERC Initiatives to Facilitate Transmission of Wind Power*, 26 ENERGY L.J. 393, 393–94 (2005) (noting that wind generation faces "stiff obstacles in reaching customers" because wind resources are often located far from where the load is needed, requiring substantial investment in transmission capacity).

36. ENERGY INFO. ADMIN., *supra* note 29, at 141 tbl.A16.

37. *See id.* at 128 tbl.A9 (noting that total projected generating capacity in the United States in 2030 is 1,123.8 gigawatts, of which 138.2 gigawatts will be in the form of renewable generation and 347.9 gigawatts will be in the form of coal-fired power plants).

38. *See* U.S. Nuclear Regulatory Comm'n, Combined License Applications for New Reactors, http://www.nrc.gov/reactors/new-reactors/col.html (last visited Apr. 5, 2009). The Energy Information Administration projects that the total installed nuclear capacity in the United States will increase by eight percent by 2020, and by twelve percent by 2030. *See* ENERGY INFO. ADMIN., *supra* note 29, at 128 tbl.A9.

39. *See* Dallas Kachan, *1990 by 2020? Forget It, Says EPRI*, CLEANTECH GROUP, Apr. 20, 2007, http://cleantech.com/news/1064/1990-by-2020-forget-it-says-epri.

3. Conventional Pollutant Reductions

While current political attention focuses on the nexus between energy and climate change, the effects of rising energy consumption on conventional pollution should not be ignored. Nearly forty years after enactment of the Clean Air Act,[40] over 130 million Americans still live in regions that exceed health-based standards for ground-level ozone—a problem that is largely attributable to vehicle emissions and electricity generation (primarily from coal-fired power plants).[41]

A greening demand agenda for climate change will have numerous ancillary benefits for reducing conventional pollution. The American Council for an Energy-Efficient Economy has estimated, for example, that enacting or updating energy efficiency standards for fifteen common household and commercial appliances would reduce projected 2020 energy demand by fifty-two billion kilowatt hours.[42] This amount is equivalent to avoiding construction of forty 300 megawatt power plants in the United States.[43] And, as we were reminded by the devastating coal ash spill near Kingston, Tennessee in December 2008,[44] the ecological impacts of fossil-based electricity production go beyond air pollution. They include damage to rivers and streams, despoliation of public lands, production of toxic wastes and mining debris, and mountaintop removal in large swaths of Appalachia.

II. BARRIERS TO REDUCING ENERGY CONSUMPTION

Rising energy consumption in the United States since the 1970s has been driven by the combination of cheap energy and consumer

40. Clean Air Act, 42 U.S.C. §§ 7401–7671q (2000).

41. *See* U.S. EPA, Air Emission Sources: Nitrogen Oxides, http://www.epa.gov/air/emissions/nox.htm (last visited Mar. 21, 2009) (listing vehicles and electricity generation as the two largest sources of nitrogen oxide emissions, an ozone precursor); U.S. EPA, Air Emission Sources: Volatile Organic Compounds, http://www.epa.gov/air/emissions/voc.htm (last visited Mar. 21, 2009) (identifying vehicles as the greatest contributor of VOC emissions, an ozone precursor).

42. STEVEN NADEL ET AL., AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON. & APPLIANCE STANDARDS AWARENESS PROJECT, LEADING THE WAY: CONTINUED OPPORTUNITIES FOR NEW STATE APPLIANCE AND EQUIPMENT EFFICIENCY STANDARDS, at iv–v (2006) (recommending updated efficiency standards for various appliances such as commercial boilers, DVD players and recorders, pool heaters, hot tubs, residential furnaces and boilers, and walk-in refrigerators and freezers).

43. *Id.* at v.

44. Shaila Dewan, *Coal Ash Spill Revives Issue of Its Hazards*, N.Y. TIMES, Dec. 25, 2008, at A1.

desires for larger homes, bigger cars, and more energy-intensive products, such as cell phones, computers, and sixty-inch plasma TVs.[45] As some appliances, such as refrigerators, have become substantially more energy-efficient,[46] Americans continue to desire new appliances, such as large TVs and set-top boxes for digital cable, that consume almost as much energy as a refrigerator.[47]

A greening demand strategy, therefore, needs to be economy-wide, rather than focused on particular products. Putting a price on carbon emissions, through a carbon tax or cap-and-trade system, is the single most important policy change that would move the United States away from wasteful energy consumption habits. It is also the key to spurring new investment in renewable energy supplies. Because energy demand is price-elastic,[48] a carbon tax or a cap-and-trade system designed to raise the price of energy and to reflect the true costs of environmental damage from our energy system should be a central component of the greening demand agenda.

The optimal design of carbon taxes and cap-and-trade systems has been exhaustively covered in other literature,[49] and I do not

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45. *See* ANDREW FANARA ET AL., HOW SMALL DEVICES ARE HAVING A BIG IMPACT ON U.S. UTILITY BILLS, 1, 3 (2006), *available at* http://www.energystar.gov/ia/partners/prod_development/downloads/EEDAL-145.pdf (explaining that twenty-eight percent of all residential electricity consumption is for miscellaneous electronic devices other than the categories traditionally tracked by the Department of Energy, such as lighting and appliances, and that this proportion is rising over time).

46. *See* Dernbach, *supra* note 13, at 19–26.

47. *See* NATURAL RES. DEF. COUNCIL, TUNING IN TO ENERGY EFFICIENCY: PROSPECTS FOR ENERGY SAVINGS IN TELEVISIONS 1 (2006), *available at* http://www.nrdc.org/air/energy/energyeff/ftv.pdf.

48. Economists continue to debate price elasticities for various forms of energy and the optimal size of a carbon tax or carbon cap. For a discussion of how gasoline demand responds to price increases, see CONG. BUDGET OFFICE, REDUCING GASOLINE CONSUMPTION: THREE POLICY OPTIONS 15–18 (2002), *available at* http://www.cbo.gov/ftpdocs/39xx/doc3991/11-21-GasolineStudy.pdf. For a discussion of the optimal level of a gasoline tax, see Ian W.H. Parry & Kenneth A. Small, *Does Britain or the United States Have the Right Gasoline Tax?*, 95 AM. ECON. REV. 1276 (2005) (concluding that the optimal U.S. gasoline tax, reflecting externalities from environmental damage, road congestion, and accidents, is $1.01 per gallon).

49. *See, e.g.*, Michael J. Zimmer, *Carbon Tax: Ready for Prime Time?*, 8 SUSTAINABLE DEV. L. & POL'Y 67 (2008); Robert N. Stavins, *A Meaningful U.S. Cap-and-Trade System to Address Climate Change*, 32 HARV. ENVTL. L. REV. 293 (2008); William D. Nordhaus, *To Tax or Not to Tax: Alternative Approaches to Slowing Global Warming*, 1 REV. OF ENVTL. ECON. & POL'Y 26 (2007); CONG. BUDGET OFFICE, AN EVALUATION OF CAP-AND-TRADE PROGRAMS FOR REDUCING U.S. CARBON EMISSIONS (2001), *available at* http://www.cbo.gov/ftpdocs/28xx/doc2876/CapTrade.pdf. For an overview of the debate on the merits of carbon taxes versus cap-and-trade systems to address climate change, see U.S. GOV'T ACCOUNTABILITY OFFICE, NO. GAO-08-605, CLIMATE CHANGE: EXPERT OPINION ON THE

attempt to replicate that debate here. Rather, my central goal in this article is to show that a carbon pricing strategy, while critically important, needs to be supplemented with other federal initiatives to reduce energy demand. Price signals, on their own, are unlikely to drive sufficient reductions in energy demand because market failures, informational constraints, and other barriers often make energy prices a fuzzy signal for incentivizing reduced energy consumption by individuals and firms.[50] These barriers will persist even after enactment of a carbon tax or cap-and-trade system puts a price on emissions. Below, I discuss several of these barriers and propose policy initiatives to address them.

A. Principal-Agent Divergence

One persistent barrier to improvements in energy efficiency has been the divergence of interests between entities making purchase decisions for energy-using equipment and the entities paying the energy bill. Purchasers of equipment have little incentive to identify, or pay extra for, the most energy-efficient tools and appliances if they are not internalizing the long-term operating expenses of their choices. At the same time, the utility bill-paying "principal" often has little incentive or opportunity to monitor the choices of the "agent" making the initial capital purchase decisions.[51]

This divergence can be seen clearly in the example of rental housing, where landlords usually choose the major appliances for apartments and tenants usually pay the utility bills. Thirty-two percent of American households are rentals, and tenants pay utility bills in over eighty percent of these units,[52] so the impact of this

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ECONOMICS OF POLICY OPTIONS TO ADDRESS CLIMATE CHANGE (2008), *available at* http://www.gao.gov/new.items/d08605.pdf.

50. *See* Michael Vandenbergh et al., *Individual Carbon Emissions: The Low-Hanging Fruit*, 55 UCLA L. REV. 1701, 1755 (2008) ("[N]umerous empirical studies demonstrate that in practice, limited information, high transaction costs, and a wide range of behavioral phenomena limit the extent to which price alone affects behavior."); *see also* Adam B. Jaffe & Robert N. Stavins, *The Energy Paradox and the Diffusion of Conservation Technology*, 16 RESOURCE & ENERGY ECON. 91, 98–99, 111–19 (1994) (noting market failures for energy-efficient products and practices, such as principal-agent divergence and inadequate information, and positing a welfare-enhancing role for government interventions to correct those failures).

51. *See* John W. Pratt & Richard J. Zeckhauser, *Principals and Agents: An Overview*, *in* PRINCIPALS AND AGENTS: THE STRUCTURE OF BUSINESS 1, 5 (John W. Pratt & Richard J. Zeckhauser eds., 1985) ("[A]gency loss is the most severe when the interests or values of the principal and agent diverge substantially, and information monitoring is costly.").

52. *See* AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., QUANTIFYING THE EFFECTS OF MARKET FAILURES IN THE END-USE OF ENERGY 13 fig.1 (2007), *available at* http://

divergence is far from negligible. A similar divergence of interests can be seen in the market for new homes, where builders make essentially all the major decisions about insulation, windows, appliances, and other features of the home that affect energy use, while home buyers pay the subsequent utility bills. Even within a single firm, it is often the case that major capital equipment is purchased by one department whose employees have an incentive to minimize up-front costs, whereas the long-term energy cost of that equipment is paid by a separate department in the same corporation.[53] As these examples illustrate, energy is often consumed by end-users who have little control over the efficiency of the products they use or who are shielded, to some extent, from the costs of their energy consumption.[54]

B. Information and Search Costs

A second barrier to adoption of energy-efficient products and practices is that identifying areas for energy savings can involve substantial information and search costs.[55] To reduce energy consumption, firms and consumers need to understand their own energy usage habits, alternative available technologies, and the amount of energy and money that might be saved through a switch to an alternative product or behavior. These comparisons often require a level of technical expertise and knowledge of energy pricing beyond the grasp of most consumers. Moreover, the search costs of obtaining the relevant information may be greater than the dollar value of potential savings.

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www.aceee.org/Energy/IEAmarketbarriers.pdf (noting that there were 33.6 million rental households in the United States in 2003, and that in approximately 29.2 million of those households the tenants paid the utility bills).

53. *See* Stephen J. DeCanio, *Barriers within Firms to Energy-Efficient Investments*, 21 ENERGY POL'Y 906, 908 (1993) ("Within the framework of decentralized corporations, multidivisional structures or government bureaucracies, individual maximization can produce results contrary to the formal goals of the organization. A wide variety of circumstances can lead to a failure of the organization to maximize profits or minimize costs, even though the individual agents are fully rational wealth maximizers.").

54. *See, e.g.*, SCOTT MURTISHAW & JAYANT SATHAYE, ERNEST ORLANDO LAWRENCE BERKELEY NAT'L LAB., QUANTIFYING THE EFFECT OF THE PRINCIPAL-AGENT PROBLEM ON U.S. RESIDENTIAL ENERGY USE 2–4 (2006), *available at* http://ies.lbl.gov/iespubs/59773Rev.pdf.

55. *See* Richard A. Posner, *Hayek, Law, and Cognition*, 1 N.Y.U. J.L. & LIBERTY 147, 163 (2005) ("The gallon of gasoline for which I pay $1.75 may be selling for $1.50 a block away, yet if I and other consumers do not know this, the disparity in price may persist. The existence of search costs and other information costs is now an established feature of rational-choice economics . . . .").

In the residential sector, a related problem is that most consumers cannot calculate how much electricity or natural gas any one item in their home or apartment uses,[56] nor do they usually know their real-time energy use in the residence, given current metering practices. Consumers therefore have little incentive to absorb the information and search costs to find alternative products or to cut back on energy usage. With our current system of electricity and natural gas metering, we are like diners at a restaurant with no prices on the menu. We may be shocked by the bill at the end of the dinner, but without item-specific price information, we will leave the restaurant unsure about how to order differently next time.

C. High Discount Rates

Economists have documented that purchasers of cars, appliances, lighting, and electronics employ a high implicit discount rate, ranging from 25% to 300%, with respect to future savings from energy efficiency.[57] Such discount rates mean that consumers have a very low sensitivity to the prospect of a reduction in energy bills even a year or two into the future. Consumers instead have a laser-like focus on the initial purchase price of equipment and tend to heavily, and irrationally, discount future savings in operational costs, demanding rates of return from energy efficiency that widely exceed market interest rates. Literature in behavioral economics suggests that this deviation from predicted rationality results from aversion to present losses and consumer difficulty in trading off present and future losses and gains.[58] Whatever the roots of the behavior, the implicit use of high discount rates is an important barrier to more widespread adoption of energy-efficient technologies in the retail market.[59]

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56. The National Research Council, noting that most consumers lack awareness about their levels of residential energy use and the sources of their energy supply, has referred to this phenomenon as "energy invisibility." *See* COMM. ON BEHAVIORAL & SOC. ASPECTS OF ENERGY CONSUMPTION & PROD., NAT'L RESEARCH COUNCIL, ENERGY USE: THE HUMAN DIMENSION 36–42 (Paul C. Stern & Elliot Aronson eds., 1984).

57. *See* Shane Frederick et al., *Time Discounting and Time Preference: A Critical Review*, 40 J. ECON. LITERATURE 351, 384 (2002).

58. *See, e.g.*, George Lowenstein & Richard H. Thaler, *Anomalies: Intertemporal Choice*, 3 J. ECON. PERSP. 181 (1989).

59. *See* Vandenbergh et al., *supra* note 50, at 1734 ("Consumers' extremely high discount rates for long-term savings from one-time purchases tend to serve as a barrier . . . to economically favorable investments in energy-saving devices."). For a review of research in the behavioral sciences on consumption habits and environmental decision making, see PANEL ON SOC. & BEHAVIORAL SCI. RESEARCH PRIORITIES FOR ENVTL. DECISION MAKING, NAT'L

Moreover, economists have documented similar trends in the corporate sector when managers make decisions on energy efficiency investments.[60]

D. Utility Incentives

The rate structures of electric and natural gas utilities serve as yet another barrier to the adoption of energy-efficient products and practices. Retail rates are generally set by cost-of-service regulation, in which regulators set rates to compensate utilities for their capital costs and a set profit margin,[61] or through regional wholesale markets. In either setting, the more energy that utilities supply to end-users, the more revenue utilities earn, and there is therefore little incentive for utilities to undertake programs to reduce energy demand. They are in the business of selling megawatts, not negawatts.[62]

As a result of this rate structure, firms that are best positioned to promote conservation and efficiency (because they have an established business relationship with millions of building owners)[63] are indifferent, or even hostile, to the task. To be sure, American electric utilities have implemented programs aimed at reducing energy consumption, particularly during peak hours,[64] but through the 1980s and 1990s, such programs remained tangential to the core business objectives of utilities. In 2004, spending by American

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RESEARCH COUNCIL, DECISION MAKING FOR THE ENVIRONMENT: SOCIAL AND BEHAVIORAL SCIENCE RESEARCH PRIORITIES 78–81 (Garry D. Brewer & Paul C. Stern eds., 2005).

60. *See* DeCanio, *supra* note 53, at 908 (noting the prevalence of high internal "hurdle rates," which widely exceed prevailing costs of capital, used by managers when considering investment decisions); *see also* SOREN T. ANDERSON & RICHARD G. NEWELL, RESOURCES FOR THE FUTURE, INFORMATION PROGRAMS FOR TECHNOLOGY ADOPTION: THE CASE OF ENERGY-EFFICIENCY AUDITS 4–5 (2002), *available at* http://www.rff.org/Documents/RFF-DP-02-58.pdf (finding a sixty-five to eighty-five percent hurdle rate in a study of efficiency investments made by small and medium-sized firms, implying that managers demand a 1.25- to 1.5-year payback on efficiency investments).

61. *See* NAT'L ACTION PLAN FOR ENERGY EFFICIENCY, ALIGNING UTILITY INCENTIVES WITH INVESTMENTS IN ENERGY EFFICIENCY 2-3 to -4 (2007), *available at* http://www.epa.gov/cleanenergy/documents/incentives.pdf.

62. *See* PAUL HAWKEN ET AL., NATURAL CAPITALISM: CREATING THE NEXT INDUSTRIAL REVOLUTION 279 (1999) (defining negawatts as "electricity saved by reducing inefficiencies in its use").

63. *See* Edward Comer, *Transforming the Role of Energy Efficiency*, 23 NAT. RESOURCES & ENV'T 34, 35 (2008) ("Electric companies maintain the key supporting infrastructures (e.g., rates, metering, billing), which are essential for the delivery, verification, and pricing of many efficiency services.").

64. *See* FRED BOSSELMAN ET AL., ENERGY, ECONOMICS, AND THE ENVIRONMENT: CASES AND MATERIALS 1054 (2d ed. 2006).

electric utilities on energy efficiency programs was a paltry five dollars per capita.[65] Utilities continue to invest in relatively low-return sources of energy supply while ignoring opportunities for efficiency investments that offer far higher rates of return. In the past decade, however, over a dozen states have passed "decoupling" legislation that separates utility revenues from provision of energy, and there has been an expansion of state legislation promoting energy efficiency in the utility sector through mandates and performance targets.[66] These trends need to be encouraged to align the private interests of utilities with the public interest in reducing energy consumption and greenhouse gas emissions.

III. GREENING DEMAND: A TOOLBOX APPROACH

As a result of the barriers discussed above, private investment in energy-efficient technology and practices is far less than the socially optimal level of investment. Individual ignorance (not knowing) or inaction (not bothering) about energy consumption results, collectively, in a national energy appetite that contributes to climate disruption and leaves the United States dangerously exposed to energy supply shocks.

President Obama has committed to working with Congress to enact cap-and-trade legislation for greenhouse gas emissions.[67] Beyond this critical policy of putting a price on emissions, there are hundreds of policy measures—from subsidies, to tax credits, to direct regulation and government R&D—that could potentially be deployed to promote reductions in energy demand. When land use and long-term transportation changes are included in the mix, the policy options to reduce energy demand expand even further. This article does not provide detailed policy recommendations for all the various energy use sectors (i.e., residential, industrial, and commercial buildings; automobiles, aviation, and other transportation; industrial

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65. MAGGIE ELDRIDGE ET AL., AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., REPORT NO. E075, THE STATE ENERGY EFFICIENCY SCORECARD FOR 2006, at 7 (2007), *available at* http://www.aceee.org/pubs/e075.htm.

66. MAGGIE ELDRIDGE ET AL., AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., REPORT NO. E086, THE 2008 STATE ENERGY EFFICIENCY SCORECARD 16–18 (2008), *available at* http://www.aceee.org/pubs/e086.htm.

67. Remarks on the Federal Budget, 2009 DAILY COMP. PRES. DOC. 00108, at 2 (Feb. 26, 2009), *available at* http://www.gpoaccess.gov/presdocs/2009/DCPD200900108.pdf; *see also* Steven Mufson, *Push to Reduce Greenhouse Gases Would Put a Price on Emitting Pollution*, WASH. POST, Mar. 13, 2009, at D1, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2009/03/12/AR2009031203318.html.

process equipment; consumer electronics and appliances; etc.). Such comprehensive recommendations have been provided elsewhere,[68] and may very well require a book-length treatment.

Rather, my purpose here is to emphasize the feasibility of achieving substantial reductions in energy demand through implementing a toolbox approach that draws on diverse policy instruments. These instruments should include performance standards, information provision, and changes in utility regulation, and should be designed to counteract the barriers to reducing energy consumption discussed above.

A. Efficiency Performance Standards

Performance standards directly address the issues of principal-agent divergence, high discount rates, and informational barriers by establishing targets for the efficiency of energy-using products. Performance standards aimed at energy efficiency would specify the level of energy use or energy efficiency that must be obtained, while leaving flexibility for manufacturers to determine how to hit that target.[69] Examples of performance standards would include building codes that mandate minimum energy efficiency requirements for new construction and energy efficiency standards for new appliances.[70]

Building codes specifying energy efficiency requirements have been used by various states for decades (California enacted the first in 1978).[71] While the federal government is unlikely to enact a

68. *See, e.g.*, NAT'L COMM'N ON ENERGY POLICY, ENDING THE ENERGY STALEMATE: A BIPARTISAN STRATEGY TO MEET AMERICA'S ENERGY CHALLENGES 37 (2004), *available at* http://www.energycommission.org/ht/a/GetDocumentAction/i/1088 (outlining energy efficiency recommendations); AM. PHYSICAL SOC'Y, *supra* note 10; MCKINSEY GLOBAL INST., *supra* note 19; AMORY B. LOVINS ET AL., WINNING THE OIL ENDGAME: INNOVATION FOR PROFITS, JOBS, AND SECURITY 43–102 (2005).

69. *See* David M. Dreisen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, 55 WASH. & LEE L. REV. 289, 297–98 (1998) (explaining that performance standards do not require the use of any particular technique to achieve the standard).

70. *See* John Dernbach, *Stabilizing and Then Reducing U.S. Energy Consumption: Legal and Policy Tools for Efficiency and Conservation*, 37 ENVTL. L. REP. 10003, 10016–17 (2007) [hereinafter Dernbach, *Stabilizing and Then Reducing*] (discussing the history of CAFE standards and appliance efficiency standards in the United States and detailing associated energy savings).

71. For a list of states that have implemented building codes with minimum energy efficiency requirements, see U.S. DOE, Building Energy Codes—Status of State Energy Codes, http://www.energycodes.gov/implement/state_codes/index.stm (last visited May 3, 2009). California's energy efficiency requirements for new construction are found at CAL. CODE REGS.

national building code, the February 2009 stimulus bill tied energy efficiency block grants to the states to certifications by governors that the states will implement energy-efficient building codes[72]—a measure that should help to promote greener building practices nationally.

With respect to appliances, the Obama Administration should resuscitate the existing program of appliance efficiency standards, which was neglected under prior administrations. By statute,[73] the Department of Energy (DOE) was obligated to issue thirty-four minimum efficiency standards for twenty different consumer product and industrial equipment categories. It missed the deadline for every category.[74] In a 2006 settlement of litigation brought by fifteen states, DOE committed to completing all necessary rulemakings by 2011.[75] The Department needs adequate staff and resources to meet that deadline and lock in gains in appliance efficiency that likely would not be achievable through market forces alone. The appliances covered by these rulemakings—such as air conditioners, furnaces, and clothes dryers—account for about thirty percent of total U.S. energy usage.[76]

An emerging problem is skyrocketing energy consumption for consumer electronics that are not covered by any efficiency performance standard, such as televisions, cell phones, video game players, and other media devices. This is the fastest-growing segment

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tit. 24, pt. 6, *available at* http://www.energy.ca.gov/2008publications/CEC-400-2008-001/CEC-400-2008-001-CMF.PDF (amended code to take effect Aug. 1, 2009).

72. *See* American Reinvestment and Recovery Act of 2009, Pub. L. No. 111-5, § 410(a)(2), 123 Stat. 115 (2009).

73. *See* National Appliance Energy Conservation Act of 1987, Pub. L. No. 100-12, 101 Stat. 103 (codified as amended at 42 U.S.C. §§ 6291–97, 6299, 6302, 6303, 6305, 6306, 6308 & 6309 (2000)) (establishing rule-making requirements for twelve appliances); *see also* Energy Policy Act of 1992, Pub. L. No. 102-486, 106 Stat. 2776 (codified in Titles 15, 16, 38, and 42 of the U.S. Code) (adding rule-making requirements for twelve additional appliances). Rule-making requirements for sixteen additional appliances were added in the Energy Policy Act of 2005, Pub. L. No. 109-58, § 135, 119 Stat. 594.

74. U.S. GOV'T ACCOUNTABILITY OFFICE, NO. GAO-07-42, ENERGY EFFICIENCY: LONG-STANDING PROBLEMS WITH DOE'S PROGRAM FOR SETTING EFFICIENCY STANDARDS CONTINUE TO RESULT IN FORGONE ENERGY SAVINGS 1 (2007). The missed deadlines resulted in foregone energy savings of at least $28 billion. *Id.* at 11.

75. *See* Press Release, Office of the N.Y. Attorney Gen., Federal Energy Dept. to Improve Appliance Efficiency: States Achieve Major Energy Conservation Agreement with Feds (Nov. 13, 2006), *available at* http://www.nyc.gov/html/law/downloads/pdf/pr111306a.pdf.

76. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 74, at 1.

of household energy consumption.[77] The International Energy Agency recently projected that the global growth in energy use for these products through 2030 will be equivalent to *all* of the current residential electricity consumption in the United States and Japan combined.[78] While governments have started to address the disposal impacts of electronic products once they are in the waste stream,[79] there has been comparatively little governmental action to address the climate impacts of these same products resulting from their energy consumption. Efficiency performance standards for consumer electronics should be strongly considered to counteract this projected leap in energy consumption.

One drawback of performance standards is that they generally apply only to new products, and therefore contribute only incremental changes to the efficiency of the existing capital stock. Performance standards make a difference over many years as capital stock turns over and more products on the market are subject to the standards. This is why performance standards should be implemented as a supplement to energy price signals, which have a more immediate effect on the operating costs of all products in the marketplace.

B. Information Provision

To help counteract the problem of search and information costs, the federal government should expand existing product labeling programs aimed at energy efficiency, such as Energy Star. The Energy Star program, the most successful eco-labeling program in the United States,[80] applies to consumer products in over fifty categories.[81] The Energy Star label is awarded to products that are typically ten to

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77. *See* INT'L ENERGY AGENCY, GADGETS AND GIGAWATTS: POLICIES FOR ENERGY EFFICIENT ELECTRONICS 21 (2009), *available at* http://www.iea.org/Textbase/npsum/Gigawatts2009SUM.pdf.

78. *Id.*

79. *See, e.g.*, Noah Sachs, *Planning the Funeral at the Birth: Extended Producer Responsibility in the European Union and the United States*, 30 HARV. ENVTL. L. REV. 51 (2006) (comparing the approaches of the European Union and the United States regarding the management of electronics waste).

80. *See, e.g.*, Abhijit Banerjee & Barry D. Solomon, *Eco-labeling for Energy Efficiency and Sustainability: A Meta-Evaluation of U.S. Programs*, 31 ENERGY POL'Y 109 (2003) (assessing private and government-run eco-labeling programs targeting energy efficiency and concluding that government support is crucial for the credibility, financial support, and long-term viability of the programs).

81. *See* Energy Star, Energy Star Qualified Products, http://www.energystar.gov/index.cfm?fuseaction=find_a_product. (last visited Mar. 22, 2009).

twenty-five percent more efficient than applicable minimum requirements.[82] Energy Star labels visually highlight potential savings and help consumers choose among competing products. DOE estimates that in 2007 alone, the program reduced greenhouse gas emissions by the equivalent of taking 27 million vehicles off the road.[83] Additional funding is needed, both to expand Energy Star to other product categories[84] and to ensure that Energy Star ratings are accurate and reflect the latest testing techniques. A 2008 investigation by Consumer Reports found wide discrepancies between claimed energy consumption on Energy Star labels and actual energy consumption when the product is put into use.[85]

A second area in which information provision could reduce energy consumption is real time pricing (RTP) for electricity. RTP involves the use of "smart-meters" that would allow end-users of electricity to see their actual electricity use at any given hour of the day, as well as the current price of electricity. RTP could make end-users as sensitive to electricity prices as drivers are to short-term fluctuations in gas prices—prices that are displayed in huge numbers at every gas station.[86] However, RTP must be implemented in the context of consumer education campaigns and traditional demand response programs of utilities, such as technology rebates, to win customer acceptance.[87] If expanded successfully beyond initial pilot programs, RTP would solve several problems at once. It would not only help to reduce energy consumption, but it would also reduce stress on the electric grid during peak periods and reduce the need for new generating plants.[88]

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82. *See* Dernbach, *Stabilizing and Then Reducing*, *supra* note 70, at 10016.

83. Energy Star, About Energy Star, http://www.energystar.gov/index.cfm?c=about.ab_index (last visited Mar. 22, 2009).

84. Funding for Energy Star was flat under the Bush Administration, at around $48 million per year. President Bush's last budget request, for Fiscal Year 2009, cut Energy Star funding by $4 million, or almost ten percent. *See* STEVEN NADEL, AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., FEDERAL ENERGY-EFFICIENCY BUDGET AND ENERGY-EFFICIENCY TAX INCENTIVES 8 (2008), *available at* http://files.eesi.org/Nadel_2.14.08.pdf.

85. *Energy Star Has Lost Some Luster*, CONSUMER REP., Oct. 2008, at 24.

86. *See* David B. Spence, *Can Law Manage Competitive Energy Markets?*, 93 CORNELL L. REV. 765, 814 (2008) (advocating real-time pricing and arguing that "[m]arket designers need to enhance demand response by letting retail customers see, and respond to, the effects of very short-term price changes") (emphasis omitted).

87. *See* GALEN BARBOSE ET AL., LAWRENCE BERKELEY NAT'L LAB., A SURVEY OF UTILITY EXPERIENCE WITH REAL TIME PRICING, at ES-9 (2004), *available at* http://repositories.cdlib.org/cgi/viewcontent.cgi?article=2733&context=lbnl.

88. *See* Comer, *supra* note 63, at 34–35.

C. Changing Utility Regulation

To promote major reductions in energy consumption, the federal government should closely examine lessons from utility regulation in California, which rewards investments in energy efficiency. In 1982, California was the first state to enact utility decoupling legislation. In a 2007 expansion of the program, the California Public Utilities Commission adopted a "shared savings" model, in which the state adopts energy savings targets, and utilities are then entitled to between nine and twelve percent of the verified net savings (depending on whether they come close to, or exceed, the targets), potentially up to $450 million over a two year period.[89] The model allows California utilities to earn substantial return from reductions in energy consumption, reversing and upending some of the basic assumptions of traditional utility regulation. California's original decoupling legislation and the subsequent commitment of state government to achieve energy efficiency gains help to explain why per capita electricity consumption in California has remained constant for thirty years, while per capita electricity consumption in the rest of the United States has increased by fifty percent in the same time period.[90]

The federal government needs to tread carefully in expanding utility incentive programs nationally. Shared savings models are already in place in six states[91] and should not be preempted. Moreover, utility rate regulation has traditionally been a state, rather than a federal, function, and the Tenth Amendment would preclude federal legislation directing states to change their existing rate regulation practices to reward efficiency.[92] Rather than a national program of utility rate regulation, the Obama Administration and

89. *See id.* at 36 (outlining shared savings models in California, Arizona, and Ohio); *see also* JIYONG EOM, SHAREHOLDER INCENTIVES FOR UTILITY-BASED ENERGY EFFICIENCY PROGRAMS IN CALIFORNIA 5–6 (2008), *available at* http://www.iaee.org/en/students/best_papers/Jiyong_Eom.pdf (describing the goals of California's shared savings model).

90. AM. PHYSICAL SOC'Y, *supra* note 10, at 23; CAL. ENERGY COMM'N, 2007 INTEGRATED ENERGY POLICY REPORT 3 (2007), *available at* http://www.energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CTF.PDF.

91. *See* NAT'L ACTION PLAN FOR ENERGY EFFICIENCY, *supra* note 61, at 6-1 tbl.6-1.

92. The Tenth Amendment prohibits "commandeering" state or local government to effectuate a federal regulatory program. *See* New York v. United States, 505 U.S. 144 (1992) (striking down a portion of the Low Level Waste Policy Act requiring states to take title to radioactive waste not disposed of prior to 1996, and upholding provisions involving financial rewards from the federal government); Printz v. United States, 521 U.S. 898 (1997) (striking down a portion of the Brady Handgun Violence Prevention Act requiring state and local officials to conduct background checks on gun purchasers).

Congress should provide grants and technical assistance to states to implement rate structures that reward efficiency gains, promoting state experimentation in this area.[93]

IV. CONCLUSION—IS GREENING DEMAND FEASIBLE?

Substantial reductions in energy consumption should be a central focus of U.S. climate change policy. Greening U.S. energy demand offers the prospect of greenhouse gas reductions, conventional pollutant reductions, reduced dependence on foreign energy supplies, a lower trade deficit, and cost savings. A fifteen percent reduction in total energy consumption by 2016 and a twenty percent reduction by 2020 are the minimum targets that the Obama Administration should set.

Are such substantial national reductions feasible? Technical analyses strongly suggest that they are. A 2007 report by McKinsey & Co. found that realistic efficiency gains in just three sectors (buildings, appliances, and industrial facilities) could offset almost all of the projected increase in national electricity demand by 2030, and notably, could almost offset the need for new coal-fired power plants.[94] The same report concluded that a "widespread and sustained national commitment" on energy efficiency and renewable energy could reduce U.S. greenhouse gas emissions twenty-eight percent below 2005 levels by 2030.[95] California and several other U.S. states are already demonstrating that high standards of living can be achieved with far lower energy consumption than the U.S. average. According to a recent study by the Rocky Mountain Institute, if forty U.S. states could match the top ten U.S. states on electricity productivity, national electricity consumption would drop approximately thirty percent.[96] And because of the 2008–2009

93. The February 2009 stimulus bill provides, somewhat cryptically, that energy efficiency block grants to states are conditioned, in part, on state regulatory authorities implementing "cost recovery for prudent investments by utilities in energy efficiency" and an "earnings opportunity for utilities associated with cost-effective energy efficiency savings." American Reinvestment and Recovery Act of 2009, Pub. L. No. 111-5, § 410(a)(1), 123 Stat. 115 (2009).

94. JON CREYTS ET AL., *supra* note 33, at xv.

95. *See id.* at xii, 19 (noting that twenty-eight percent emissions reductions are possible under McKinsey's "high-range" greenhouse gas abatement scenario and that achieving the high-range of abatement would require "aggressive, simultaneous, successful actions across all sectors and geographies fueled by a sense of great urgency").

96. *See* NATALIE MIMS ET AL., ROCKY MOUNTAIN INST., ASSESSING THE ELECTRIC PRODUCTIVITY GAP AND THE U.S. EFFICIENCY OPPORTUNITY 6 (2009), *available at* http://ert.rmi.org/files/documents/CGU.RMI.pdf. Electricity productivity refers to dollars of GDP divided by kilowatt hours consumed. *Id.*

recession, near-term reductions in energy demand are expected even without significant policy intervention.[97]

The real question is whether a long-term national greening demand agenda, led by the federal government, is politically feasible. As John Dernbach has noted, Americans simultaneously follow two contrasting story lines on energy consumption. On the one hand, they equate energy consumption with affluence and reductions in consumption with "a form of martyrdom or impoverishment."[98] "Energy conservation" is a negative term for many Americans, bringing to mind images of President Carter in his cardigan sweater by the fire, imploring them to turn down the thermostat and make "modest sacrifices" to save energy.[99] On the other hand, a new storyline has evolved over the past few years (and particularly during the presidential campaign), in which energy efficiency means achieving more with less waste.[100] It means financial opportunities, improved competitiveness, and green jobs.

The challenge for President Obama is to frame the long-term effort to reduce U.S. energy consumption in terms of this second narrative, connecting a greening demand strategy with jobs, opportunity, national security, environmental improvement, and growth in GDP. The President should stress that we have made remarkable gains in energy productivity since the 1970s,[101] and that the nation needs to increase those gains so that the absolute amount of fossil fuel energy consumed in the United States declines. With the

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97. *See, e.g.*, ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, SHORT-TERM ENERGY OUTLOOK 4 (2009), *available at* http://www.eia.doe.gov/pub/forecasting/steo/oldsteos/jan09.pdf (reporting a 5.7% decrease in daily U.S. petroleum consumption in 2008 compared to the 2007 average); *see also* ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, U.S. CARBON DIOXIDE EMISSIONS FROM ENERGY SOURCES: 2008 *FLASH* ESTIMATE 2, 15 (2009), *available at* http://www.eia.doe.gov/oiaf/1605/flash/pdf/flash.pdf. (reporting a 2.8% decline in CO_2 emissions from all fossil fuels and a 6% decline in CO_2 emissions from petroleum between 2007 and 2008, attributed to higher oil prices and to declining economic activity at the end of 2008).

98. Dernbach, *Stabilizing and Then Reducing*, *supra* note 70, at 10004.

99. *See* Videotape: President Jimmy Carter, Report to the American People on Energy (Feb. 2, 1977) (Miller Ctr. of Pub. Affairs, Univ. of Va.), *available at* http://millercenter.org/scripps/archive/speeches/detail/3396.

100. For examples of candidate statements on energy efficiency and green jobs during the presidential campaign, see BARACK OBAMA AND JOE BIDEN: NEW ENERGY FOR AMERICA, *supra* note 8, at 3–4 (discussing the job-creation potential of proposed energy efficiency policies); JOBS FOR AMERICA: THE MCCAIN ECONOMIC PLAN 8–10 (2008), *available at* http://www.scribd.com/doc/4296859/John-McCains-Jobs-for-America (discussing transportation and building efficiency programs as a component of McCain's proposed job creation plan).

101. For example, by 2003, the U.S. was wringing twice as much GDP out of each barrel of oil used, as compared to 1975. *See* LOVINS ET AL., *supra* note 68, at 43.

prospect of cost savings and job creation from energy efficiency investments, there may be a governing coalition to implement the greening demand agenda. That coalition needs to be skillfully assembled. The future of U.S. climate strategy depends on it.