

Good for You, Bad for Us: The Financial Disincentive for Net Demand Reduction

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An unexpected drop in U.S. electricity consumption has utility companies worried that the trend isn't a byproduct of the economic downturn and could reflect a permanent shift in consumption that will require sweeping change in their industry.

—Rebecca Smith, Wall Street Journal¹

Good for you, bad for us.

—Electric Utility Official²

INTRODUCTION

Energy policy debates often focus on increasing the supply of renewable energy, but energy demand merits equal attention. Low-carbon energy sources will not be able to displace fossil fuels at the levels necessary to achieve climate goals if global demand continues to grow at projected rates.³ To meet the widely endorsed goal of 50% global carbon emissions reductions by 2050, including 80% reductions from developed countries, global emissions from fossil fuel use will need to decline by more than seven billion tons from projected levels by 2050.⁴ Major new sources of low-carbon energy will become available, but it is unrealistic to assume that new low-carbon sources will expand quickly enough to displace existing fossil fuel sources if

1. Rebecca Smith, *Surprise Drop in Power Use Delivers Jolt to Utilities*, WALL ST. J., Nov. 21, 2008, at B1.

2. The electric utility official made this comment at a recent installation of a household solar photovoltaic system. Email from Linda Breggin, Senior Att'y & Dir., Nanotechnology Program, Env'tl. Law Inst., to Michael Vandenberg (on file with author) (quoting the utility official). Although this example involves household energy supply, not demand, a utility's gatekeeping role and incentives regarding household solar programs are often similar to those regarding household energy efficiency and conservation programs.

3. Nathan S. Lewis & David G. Nocera, *Powering the Planet: Chemical Challenges in Solar Energy Utilization*, 103 PROC. NAT'L. ACAD. SCI. 15729, 15730 (2006); Nathan S. Lewis, *Powering the Planet*, ENGINEERING & SCI., No. 2, 2007, at 12, 16, available at <http://www.ccser.caltech.edu/outreach/powering.pdf>. By low-carbon, we mean sources that generate little or no carbon emissions (e.g., solar, wind, and nuclear energy) or that capture and store the emissions (e.g., fossil fuel plants with effective carbon capture and storage). We use the term "carbon" as shorthand for the six greenhouse gases included in the Framework Convention on Climate Change ("FCCC") and typically expressed as carbon dioxide equivalents ("CO₂e"). See *Fact Sheet: The Need for Mitigation*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (November 2009), http://unfccc.int/files/press/backgrounders/application/pdf/press_factsh_mitigation.pdf. Our focus here is on energy demand, and we do not take a position on the optimal mix of energy sources.

4. See, e.g., S. Pacala & R. Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next Fifty Years with Current Technologies*, 305 SCIENCE 968, 968 (2004) (identifying strategies that would enable emissions to "be held near the present level of seven billion tons per year (GtC/year) for the next fifty years, even though they are currently on course to more than double" by 2054).

global demand doubles as projected.⁵ In fact, although the percentage of global electricity generation from fossil fuels has decreased in recent years, the total amount of fossil fuels consumed has increased.⁶ The same analysis holds true for energy supply and demand in the United States: the supply of low-carbon energy is projected to grow, but without a substantial reduction from projected levels of demand, it is difficult to imagine how low-carbon sources can supply enough energy to enable the United States to achieve its share of global carbon emissions reductions.⁷

Recognition of the need to reduce energy demand has spawned a vast literature on energy policy measures that will increase efficiency and conservation at the industrial, commercial, and household levels.⁸ Although the precise magnitude of the opportunity is the subject of debate, the literature has identified large, low-cost opportunities to reduce energy use and carbon emissions from these sectors.⁹ For example, recent research in the social and behavioral sciences suggests that the use of information and other nonintrusive interventions could achieve a “behavioral wedge” of carbon emissions reductions at the household level.¹⁰ Behavioral wedge strategies

5. Lewis, *supra* note 3, at 12, 16.

6. INT’L ENERGY AGENCY, WORLD ENERGY OUTLOOK 2010 EXECUTIVE SUMMARY 5, 9 (2010).

7. See discussion *infra* Part II.A (highlighting the projected increase in energy use in the United States in the coming decades).

8. See, e.g., DAN YORK ET AL., AM. COUNCIL FOR AN ENERGY EFFICIENT ECON., THREE DECADES AND COUNTING: A HISTORICAL REVIEW AND CURRENT ASSESSMENT OF ELECTRIC UTILITY ENERGY EFFICIENCY ACTIVITY IN THE STATES 1 (2012); Michael P. Vandenberg & Anne C. Steinemann, *The Carbon-Neutral Individual*, 82 N.Y.U. L. REV. 1673, 1675 (2007) (discussing household energy efficiency and carbon emissions reductions); see also John Dernbach, *Stabilizing and Then Reducing U.S. Energy Consumption: Legal and Policy Tools for Efficiency and Conservation*, 37 ENVTL. L. REP. 10003, 10003 (2007); Noah Sachs, *Greening Demand: Energy Consumption and U.S. Climate Policy*, 19 DUKE ENVTL. L. & POL’Y F. 295, 298 (2009).

9. See, e.g., HANNAH CHOI GRANADE ET AL., MCKINSEY & CO., UNLOCKING ENERGY EFFICIENCY IN THE U.S. ECONOMY 4 (2009), available at http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/unlocking_energy_efficiency_in_the_us_economy (concluding based on an engineering study that large increases in efficiency can be achieved in the United States at a net negative cost). *But see* Hunt Alcott & Michael Greenstone, *Is There an Energy Efficiency Gap?* 3–4 (Energy Inst. at Haas, Working Paper No. 228, 2012), available at http://ei.haas.berkeley.edu/pdf/working_papers/WP228.pdf (arguing based on economic theory that the efficiency gap is smaller than claimed by engineers); MALCOLM KEAY, OXFORD INST. FOR ENERGY STUDIES, ENERGY EFFICIENCY—SHOULD WE TAKE IT SERIOUSLY? 20 (2011) (same).

10. See Thomas Dietz et al., *Household Actions Can Provide a Behavioral Wedge to Rapidly Reduce U.S. Carbon Emissions*, 106 PROC. NAT’L ACAD. SCI. 18452, 18452 (2009) (describing “behaviorally oriented policies and interventions” as a potential behavioral wedge). The wedge concept was introduced in Pacala & Socolow, *supra* note 4, at 968–69. See also JASON CZARNESKI, EVERYDAY ENVIRONMENTALISM: LAW, NATURE AND INDIVIDUAL BEHAVIOR 1–4 (2011); Dernbach,

reduce carbon emissions by reducing household energy demand through improved efficiency (e.g., purchase of less energy-intensive appliances) and conservation (e.g., reduced use of existing appliances).¹¹ Any one strategy could have a small effect on its own, but aggregate behavioral efforts have the potential to produce reasonably achievable reductions in total U.S. emissions of 7% by 2020. This amount exceeds the total emissions of many major industrial sectors and is larger than all of the emissions from France.¹²

Notable reductions in the growth of household energy use have occurred in recent years,¹³ but the United States is not on track to achieve a behavioral wedge.¹⁴ Although many scholars have emphasized demand reduction as an important area for new legal and policy tools,¹⁵ few have focused on the institutional barriers to its achievement.¹⁶ In this Article, we identify the incentives of electric distribution utilities as a frequently overlooked barrier to achieving household energy demand reductions in the United States, examine the conceptual obstacles to overcoming this barrier, and explore a range of potential responses.¹⁷ Although we focus on U.S. household

supra note 8, at 10003; Katrina F. Kuh, *When Government Intrudes: Regulating Individual Behaviors That Harm the Environment*, 61 DUKE L.J. 1111, 1112 (2012).

11. Although improved efficiency and conservation are distinct mechanisms for achieving demand reduction, many commentators treat them together as “low-hanging fruit” among possible behavioral wedge measures. Michael P. Vandenbergh, Jack Barkenbus & Jonathan Gilligan, *Climate Change: The Low-Hanging Fruit*, 55 UCLA L. REV. 1701, 1705–06 (2008).

12. *Id.* at 1731. For a discussion of the importance of the cumulative effects of multiple small reductions in energy use and carbon emissions, see Elinor Ostrom, *Nested Externalities and Polycentric Institutions: Must We Wait for Global Solutions to Climate Change Before Taking Actions at Other Scales?*, 49 ECON. THEORY 353, 356–57 (2012).

13. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2012 WITH PROJECTIONS TO 2035, at 85–86 (2012) (discussing how increasing efficiency has led to slowing demand growth for electricity since 1950).

14. *See, e.g.*, U.S. DEP’T OF COMMERCE, U.S. CARBON DIOXIDE EMISSIONS AND INTENSITIES OVER TIME: A DETAILED ACCOUNTING OF INDUSTRIES, GOVERNMENT, AND HOUSEHOLDS 16–18 (2010) (predicting improvement in household emissions efficiency for the 2006 to 2010 period); Smith, *supra* note 1, at B1.

15. *E.g.*, Dernbach, *supra* note 8, at 10003; Sachs, *supra* note 8, at 295; Vandenbergh & Steinemann, *supra* note 8, at 1675.

16. *See, e.g.*, Paul C. Stern et al., *Design Principles for Carbon Emissions Reduction Programs*, 44 ENVTL. SCI. & TECH. 4847, 4847 (2010) (noting the importance of institutional barriers); Jiyong Eom & James L. Sweeney, *Shareholder Incentives for Utility-Delivered Energy Efficiency Programs in California 2–3* (May 8, 2009) (unpublished manuscript, Precourt Energy Efficiency Ctr., Stanford Univ., 2009), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1401529.

17. We focus on the demand for electricity in the United States at the household or residential level, but our analysis is also relevant to other energy users (e.g., small businesses) and to other energy sources (e.g., natural gas). *See* discussion *infra* Part II.A; *see also* Daniel A. Farber, *Controlling Pollution by Individuals and Other Dispersed Sources*, 35 ENVTL. L. REP.

demand, global household demand is projected to increase dramatically over the next several decades, and utilities' incentives to reduce household demand are important at the global level as well.¹⁸

The incentives of retail electric distribution utilities are essential because these utilities are critical gatekeepers for household demand reduction programs. This is an important but easily overlooked point. Retail electric distributors, both public and private, interact regularly with consumers, and they control much of the flow of information to and from households and the access to opportunities for demand reduction. They can act aggressively to induce widespread adoption of new practices and more efficient equipment. Or they can conduct widely publicized programs that comply with applicable mandates and generate goodwill without actually generating major reductions in demand. In addition, by controlling access to information and connection with the grid, they can encourage or discourage other firms from selling goods and services that may reduce household demand.¹⁹ All of this can occur with little transparency to regulators and the public.

Despite the gatekeeping role of electric distribution utilities and the importance of reducing household energy demand, distributors in most jurisdictions do not have incentives to ensure that demand reduction strategies succeed on a wide scale.²⁰ In fact, under the regulatory regimes in most states, utilities would suffer revenue erosion if they induced substantial reductions in demand. Instead, the rate structure in most jurisdictions creates incentives for utilities to promote demand growth. If an essential gatekeeper has financial incentives to increase aggregate demand, it should not be surprising that large-scale demand reduction is not occurring.

10745, 10745 (2005) (noting the importance of behavioral interventions for small businesses). Reductions in U.S. energy demand from projected levels are necessary whether nuclear power or coal with capture and storage are part of the energy supply mix.

18. For example, China is expected to add as many new households between 2005 and 2030 as existed in the Western Hemisphere in 2000. Jianguo Liu & Jared Diamond, *China's Environment in a Globalizing World*, 435 NATURE 1179, 1184 (2005), available at http://archive.csis.msu.edu/Publications/JLiu_2005_Nature.pdfhttp://archive.csis.msu.edu/Publications/JLiu_2005_Nature.pdf. A recent study suggests that fifty million new household air conditioning units were added in China in 2010 alone. See Stan Cox, *Cooling a Warming Planet: A Global Air Conditioning Surge*, YALE ENV'T 360 (July 10, 2012), http://e360.yale.edu/feature/cooling_a_warming_planet_a_global_air_conditioning_surge/2550/.

19. For example, Carbon Salon, through online carbon emissions tracking, has provided individuals with carbon reduction strategies and data if the local utility allows disclosure of electric bills. CARBON SALON, <http://www.carbonsalon.com> (last visited Sept. 6, 2012).

20. See discussion *infra* Part II (noting the lack of incentives for utilities to achieve an NDR).

Two conceptual barriers undermine efforts to create incentives for electric distribution utilities to sell less of their product. The first is the use of policy efforts known as “demand-side management” (“DSM”), which we discuss in Part II. On the surface, DSM appears to address all forms of demand management, including demand reduction, but DSM efforts have focused on shifting the timing of demand, not on reducing the total amount of demand. DSM efforts typically involve reducing electricity generation costs by shifting demand from peak to off-peak periods. This shift allows utilities to fully deploy their lowest-cost sources of electric power, while under-deploying or under-investing in higher-cost sources, including renewable energy. For example, in areas where air conditioning is a large component of total electricity use, peak summer use occurs during the late afternoon and early evening. Utilities have generating units standing by to provide the additional electricity necessary at peak times. These “peaker” units are often natural gas turbines that are more expensive to operate than the coal-fired units that supply base load electricity for about half of the country.

If the costs of operation captured all of the important considerations, this approach to demand would not be problematic. But the social costs of carbon are externalized, and coal-fired units generate roughly twice the carbon emissions of natural gas units. As a result, in many areas, DSM programs that shift electricity use to off-peak periods may increase total carbon emissions from electricity generation.²¹ DSM efforts thus may be working at cross-purposes with efforts to reduce carbon emissions. With increasing concerns about the carbon emissions of electricity generation, policymakers have begun to emphasize demand response options, renewable or clean power standards, and other measures. DSM programs may undermine these efforts, however, by increasing carbon emissions in those areas dependent on high-carbon base load units. DSM thus has facilitated a subtle shift in energy debates and policies from how much electricity is used to when it is used, yet DSM can actually increase carbon emissions by increasing overall electricity use and by shifting the mix of base load and peak generation sources.

To address the conceptual confusion caused by the use of the term DSM, in this Article we advance “net demand reduction” (“NDR”) as an important, but oft-overlooked, concept. By NDR, we mean

21. As used in this Article, “base load” refers to the minimum amount of power that a utility must make available to meet its customer demand by providing reliable electricity during “peak” periods. Base load plants are plants that are dedicated to the production of base load power supply. Such plants typically are characterized by efficiencies that favor operating at or near capacity and very stable and predictable fuel availability and operational characteristics.

reductions in the total demand for energy, including electricity. Part II defines the problem by examining how carbon constraints affect projected energy supply and demand, and by highlighting the potential carbon emission reductions from NDR. It shows how well-entrenched policy instruments such as DSM mask NDR's benefits by assuming a demand curve that is largely fixed. This conventional approach to demand reinforces the strategic business purposes of a utility, whose regulatory incentives lead it to view NDR as revenue erosion. We argue that the conventional approach is not likely to yield long-term energy demand at levels that can be satisfied by low-carbon energy sources.

Part II also demonstrates how utilities' financial incentives, reinforced by state regulators, sustain this NDR blind spot, despite many laudatory federal goals. In theory, DSM and NDR are fully compatible, or at least are not inconsistent. Any effort to manage demand, however, should include careful attention to total energy demand—not merely to the timing of demand or industry efforts to expand total customer usage. This is consistent with many of the stated goals of DSM, and perhaps even with its conservation roots as endorsed in statutes such as Public Utility Regulatory Policies Act (“PURPA”).²² However, given the financial incentives faced by firms, as reinforced by the treatment of price and risk in the regulatory process, DSM has failed to meet its promises. For utilities in many jurisdictions, efficiency and conservation promotion make good business sense to a point, especially where firms are guaranteed compensation for investing in these efforts, but aggressive implementation of sophisticated NDR efforts could lead to revenue erosion and financial hardship.²³ The incentive to shift energy usage from peak to off-peak periods but not to achieve NDR affects a wide range of household efficiency and conservation programs on the ground, including the design and implementation of smart meter programs, electric car recharging programs, and others.²⁴

A second conceptual barrier makes shifting the regulatory regime for utilities particularly difficult. For almost a century, the principal focus of energy regulation has been to keep per-unit rates for consumers as low as possible. The goal under the dominant approach

22. Public Utility Regulatory Policies Act, Pub. L. No. 95-617, 92 Stat. 3117 (1978).

23. See AM. PUB. POWER ASS'N, THE EFFECT OF ENERGY EFFICIENCY PROGRAMS ON ELECTRIC UTILITY REVENUE REQUIREMENTS 1–2 (2010), available at <http://appanet.cms-plus.com/files//PDFs/EffectofEnergyEfficiency.pdf>.

24. See, e.g., Michael P. Vandenbergh, Amanda R. Carrico & Lisa Schultz Bressman, *Regulation in the Behavioral Era*, 95 MINN. L. REV. 715, 766–73 (2011) (discussing electric car recharging).

has been to ensure efficient supply in the face of a limited monopoly for electricity distribution and, to an extent, generation. This goal assumes that market prices are the best indicator of the true costs of production. Under this approach, externalities are largely ignored, and policymakers instead focus on various ways that competition can yield lower-cost supplies of energy through innovations such as wheeling power, deregulation, and unbundling generation from distribution.²⁵ We demonstrate, however, that although pursuing low rates is politically convenient for regulators, utilities, and consumer advocates, it is acceptable to utilities for precisely the reason that it is often not in consumers' long-term interest: by discouraging efficiency and conservation and encouraging additional energy use, it leads to overall demand increases that yield higher total energy costs to the consumer. If a low-rate approach did not achieve this outcome, in most areas of the country, utilities would suffer revenue erosion and would have strong incentives to oppose the low-rate approach. Instead, emphasizing low rates allows each participant in regulatory debates to take a popular position, but at the cost of ever-increasing energy use and total energy costs.

In Part III, we argue that large-scale NDR will not occur without specific policy instruments that address the financial incentives of electric distribution utilities. We evaluate how those incentives must change to produce effective demand reduction policies. We then survey how options such as carbon pricing, performance mandates, and decoupling might be used to advance NDR. Ultimately, we conclude that widespread demand reduction is not likely to occur until utilities shift from viewing NDR as revenue erosion to viewing it as a financial opportunity. Achieving this shift will require a more aggressive commitment by utilities, regulators, and consumer groups to a different business model—one that treats prices and risks in a fundamentally different manner from traditional ratemaking.²⁶

Part IV concludes. We note that our goal in this Article is not to explore the specific options necessary to achieve NDR but rather to emphasize the importance of NDR and the conceptual barriers that

25. For a discussion describing how deregulation has made it more difficult to get an accurate price signal given the externalities, see, for example, Richard J. Pierce, Jr., *Natural Gas Regulation, Deregulation, and Contracts*, 68 VA. L. REV. 63, 90–99 (1982) (discussing the likely inefficiencies in natural gas markets resulting from deregulation in 1978).

26. See Ronald Brownstein, *The California Experiment*, THE ATLANTIC, Oct. 2009, at 66, 70 (quoting Peter Darbee, Pacific Gas and Electric's Chief Executive Officer, for the proposition that customers sometimes tell him that "you would love us" because they are using large amounts of power, but, due to California's decoupled rates, he responds, "Well, actually I'd prefer that you use a lot less. . . . We actually make more money if we sell you less power, and we make less if we sell you more power.").

must be overcome to achieve it. Moving forward, reducing net demand is an important goal alongside increasing the efficiency of supply. Regardless of the precise regulatory instrument selected, achieving NDR will require laws and policies that create incentives for electricity distributors to implement demand reduction programs with the same vigor as they implement programs to sell power. Pricing carbon could shift utilities' incentives, but the adoption and implementation of laws requiring electricity prices to reflect the social cost of carbon will not occur for some time. Direct regulatory commands to adopt programs or spend specific amounts will have some effect, but these efforts will not be implemented as a strategic priority and may fail for many nontransparent reasons. Major reductions in demand, in contrast, will require the creation of ongoing, genuine incentives for utilities to sell less of their product.

II. UTILITY INCENTIVES

We begin by briefly examining why NDR is an important social goal and by addressing the conceptual and practical barriers to achieving NDR. Policies and programs that achieve NDR decrease the need for power supply and thus can directly reduce carbon emissions. Equally important, NDR reduces the need for power supply infrastructure,²⁷ thus creating system-side benefits that can improve the viability of renewable power supply options. Yet the predominant industry initiatives and policy instruments aimed at addressing demand assume that energy usage levels will grow. These efforts view total customer demand as largely fixed, focusing on exploiting differences in demand across time or fuel types. Despite laudatory federal efforts beginning in the 1970s to make efficiency and conservation the thrust of a nationwide demand response initiative, demand regulation has deviated from a demand reduction path. The financial incentives of both utility firms and customers, along with the approach of state public utility laws, create an NDR blind spot in U.S. energy policy.

A. The Carbon Reduction Benefits of NDR

A starting point for our analysis is the widely held view that substantial reductions in carbon emissions from the domestic and global energy sectors will be a necessary part of any successful climate

27. Such infrastructure includes base load power generation facilities, as well as transmission and distribution facilities built to serve peak demand.

change mitigation effort.²⁸ Global carbon emissions are projected to double by 2050.²⁹ To reduce the likelihood that global average temperature increases will exceed two degrees Celsius, however, global emissions will need to be reduced by 50% or more.³⁰ For developed countries, the common target is 80% to account for greater contributions to existing carbon stocks and ability to pay for reductions.³¹

Despite the need for 50 to 80% emissions reductions by 2050, the business-as-usual projection of the U.S. Energy Information Administration (“EIA”) suggests that electricity use in the United States will increase by 45% by 2030 (the EIA does not publish projections for 2050).³² Global electricity use is projected to increase by over 300% by 2030.³³ Increases in energy demand at these levels will make it very difficult to reduce overall carbon emissions from the energy sector. Even if new sources of low-carbon energy are brought online at extraordinary rates, these new sources will be necessary just to meet the increases in projected demand, and it will be very difficult to replace existing fossil fuel–based sources with low-carbon sources.³⁴

28. To reduce the risk of catastrophic climate change, a consensus has emerged that temperature increases should not exceed two degrees Celsius over pre-industrial levels, and that to reduce the risk of exceeding two degrees Celsius, atmospheric concentrations should not exceed 550 ppm of CO₂e. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SUMMARY FOR POLICYMAKERS (2007). The views of the Intergovernmental Panel on Climate Change (“IPCC”) represent mainstream thought among climate scientists. See William R. L. Anderegg et al., *Expert Credibility in Climate Change*, 107 PROC. NAT’L ACAD. SCI. 12107, 12107 (2010); Naomi Oreskes, *Behind the Ivory Tower: The Scientific Consensus on Climate Change*, 306 SCIENCE 1686, 1686 (2004). A growing literature suggests that there is a substantial risk of reaching a climate tipping point even if CO₂e levels do not exceed 550 ppm. See, e.g., Michael Vandenbergh & Jonathan Gilligan, *Macro Risks: The Challenge for Rational Risk Regulation*, 21 DUKE ENVTL. L. & POL’Y F. 401, 403 n.8 (2011) (reviewing tail risk literature).

29. See Pacala & Socolow, *supra* note 4, at 968–69 (describing 2050 emissions projections and targets “likely to occur in the absence of a focus on carbon”).

30. See, e.g., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 28, at 16 fig.2 (providing chart of temperature targets and atmospheric concentrations); see also UNITED NATIONS DEV. PROGRAM, U.N. HUMAN DEVELOPMENT REPORT 2007/2008: FIGHTING CLIMATE CHANGE: HUMAN SOLIDARITY IN A DIVIDED WORLD 26, 46 (2007), available at http://hdr.undp.org/en/media/HDR_20072008_EN_Complete.pdf.

31. See UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, REPORT OF THE CONFERENCE OF THE PARTIES 6 (2009), available at <http://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf> (setting forth specific targets for various countries); see also American Clean Energy and Security Act, H.R. 2454, 111th Cong. (2009) (proposing to statutorily mandate specific emissions cuts in coming years); U.S. CLIMATE ACTION P’SHIP, A CALL FOR ACTION 7 (2007), available at <http://us-cap.org/USCAPCallForAction.pdf>.

32. See ENERGY INFO. ADMIN., INTERNATIONAL ENERGY OUTLOOK 2011, at tbl.D3 (2011) (providing projections on “total world energy consumption by end-use sector and fuel”).

33. *Id.* at tbl.D1.

34. See *id.* at 86 (demonstrating a projected increase in utilization for various types of energy). Under a business-as-usual scenario regarding energy use, we will need ten terawatts

In short, meeting widespread carbon targets will be difficult even with major reductions from projected levels of demand, but it will be almost impossible without them.³⁵ Although remarkable advances in low-carbon technologies are likely over the coming decades,³⁶ there is some maximum amount of renewable or low-carbon energy that can reasonably be expected to be produced in any given year or over this period as a whole.³⁷ In the absence of near-miraculous new technologies or major efficiency gains, high carbon-emitting sources will step in to fill the gap.

Extraordinary efforts will be required to achieve even modest annual reductions in net energy demand. Professor Nathan Lewis has examined the role of energy supply and demand in light of the need for climate change mitigation, and his analysis provides a good example of the extent of the demand reductions necessary by 2050 if low-carbon sources are to displace fossil fuels, not just meet new demand. His business-as-usual scenario assumes that the ratio of energy consumption to GDP, which has been declining at about 1% per year,

(i.e., ten trillion watts) of carbon-free power. Lewis, *supra* note 3, at 17. Current global energy use is now roughly thirteen terawatts. Nathan S. Lewis, *Powering the Planet*, 32 MRS BULL. 808, 808–09 (2007), available at <http://authors.library.caltech.edu/9302/1/LEWmrsb07.pdf>. More than 80% of that energy demand is supplied by fossil fuels, which contribute roughly two-thirds of anthropogenic greenhouse gas emissions. Thus, even with a 1% efficiency gain per year assumption, carbon-free sources will need to supply fifteen to twenty terawatts of energy by 2050. These types of efficiency gains and deployment of carbon-free sources must continue for the foreseeable future after 2050, leading to a carbon-free supply of almost all energy by 2100. Lewis, *supra* note 3, at 14, 16. Not all commentators agree that carbon emissions goals cannot be achieved in the United States or globally without a reduction in energy demand growth at less than business-as-usual rates. Jeff Goodell, *Q&A: Bill Gates on How to Stop Global Warming*, ROLLING STONE (Dec. 9, 2010, 11:05 AM), <http://www.rollingstone.com/politics/news/the-miracle-seeker-20101028> (noting Gates's view that the climate problem arises from supply—not consumption—issues).

35. Scott Barrett, *The Coming Global Climate-Technology Revolution*, 23 J. ECON. PERSP. 53, 54 (2009); cf. Tim Foxon & Peter Pearson, *Overcoming Barriers to Innovation and Diffusion of Cleaner Technologies: Some Features of a Sustainable Innovation Policy Regime*, 16 J. CLEANER PRODUCTION S148, S151 (2008) (discussing advances in energy technology from an innovation-systems perspective).

36. The IPCC assumes a substantial amount of “spontaneous” technological development leading to reduced energy intensity. See Roger Pielke, Jr., Tom Wigley & Christopher Green, *Dangerous Assumptions*, 452 NATURE 531, 531–32 (2008).

37. Peak renewable energy is a subset of peak low-carbon energy. The concept of “peak oil” has been discussed at length, and Peter Gleick has applied the concept to “peak renewable water.” See Peter H. Gleick, *Global Freshwater Resources: Soft-Path Solutions for the 21st Century*, 302 SCIENCE 1524, 1525 (2003). It is notable that there are significant differences with how “peak” is used by economists and policymakers in different contexts. Within the context of “peak oil,” the term signifies the historical point at which there are diminishing returns to extracting more of a supply resource. In the context of electric power generation, the term describes the power supply deployed to meet total “peak” demand forecasts, regardless of whether there are diminishing returns to any particular type of electric power generation source.

globally averaged, will continue until 2050.³⁸ As Lewis notes, this would mean that in 2050 each person around the world would demand on average only two kilowatts a year.³⁹ Currently, the average demand per person in the United States is ten kilowatts.⁴⁰ According to Lewis, to achieve this two kilowatt demand in the United States, “we would need to start today to do everything possible—including using 100 mpg cars and zero-energy homes—to conserve energy.”⁴¹ Furthermore, food production alone in Western societies requires one kilowatt per person.⁴² Reducing net energy demand thus is an essential element of successful climate mitigation efforts.⁴³

B. Existing Demand-Related Policy Instruments and NDR

When energy demand is at issue, energy policy debates have largely ignored NDR and instead focused on a policy tool known as demand-side management (“DSM”). Beginning with PURPA in the

38. Lewis, *supra* note 3, at 16. This assumption has also been made by the IPCC. Lewis also notes that the United States “actually saves energy at a faster rate, about two percent per year” because of the high per capita energy baseline consumption in the United States, relative to developing countries. *Id.*

39. Lewis, *supra* note 34, at 812.

40. *Id.*

41. *Id.* at 812–13.

42. *Id.* at 813.

43. Although our primary focus is on NDR through increases in household efficiency and conservation, many of the same opportunities for demand reduction may exist in the small business sector. To date, energy and climate scholars have not focused on the small business sector as a separate category of analysis. The Environmental Protection Agency does not distinguish between small and large businesses in its annual greenhouse gas inventory. See U.S. ENVTL. PROT. AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2010, at 1-9–1-12 (2012), available at <http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-Main-Text.pdf>. Similarly, the Department of Commerce categorizes small business emissions by the economic sector in which the business operates, despite including household emissions as a separate category of analysis. See U.S. DEP’T OF COMMERCE, *supra* note 14, at 7. For the purposes of reducing energy use and carbon emissions, however, a small business often resembles a household more than a multinational corporation. More than twenty million Americans work for small businesses that employ fewer than twenty people, a category constituting 18% of the total private sector workforce. U.S. SMALL BUS. ADMIN., OFFICE OF ADVOCACY, SMALL BUSINESS PROFILE: UNITED STATES 2, tbl.1 (2012), available at <http://www.sba.gov/sites/default/files/us11.pdf> (calculating percentage from “Total” row (20,738.3 / 114,509.6 = 0.181)). If these businesses are responsible for 18% of the total private sector emissions, then they are responsible for 711 million metric tons of carbon dioxide emissions. See *id.* (multiplying total private sector emissions, GRANADE, *supra* note 9, at 7, by the percentage of small businesses employing fewer than twenty people, U.S. SMALL BUS. ADMIN., *supra* at 2 tbl.1). Given the minimal number of employees, these businesses are likely to produce emissions that more closely resemble a large household than a small factory, and if these small businesses often resemble households, then they are ripe for efficiency gains.

1970s, federal law envisioned a conservation direction for DSM.⁴⁴ But PURPA and later amendments did not mandate the adoption of conservation-minded DSM and left most implementation of federal goals to the state and local authorities that regulate distribution utilities. PURPA also emphasized utility rate design only, and it did not purport to regulate how states provided for overall cost recovery to produce revenue for utilities.

For firms in the industry and many state regulators, DSM seems to have long left the conservation path that PURPA envisioned. Although DSM policies might have held some promise for electric power demand reduction in theory, as implemented, the policies often led only to load shifting and even increased total energy usage and electricity production. For example, many in the industry define DSM to mean active efforts by utilities to modify use patterns in the consumption of energy, conceding that the total level of use is not of concern to DSM.⁴⁵ DSM appears to conflate many different concepts, but it often emphasizes two narrow goals: (1) load shifting, or changing the timing of energy use within one energy type (e.g., electricity),⁴⁶ and (2) fuel substitution, or shifting between different energy sources (e.g., petroleum to electricity).⁴⁷

44. See James W. Moeller, *Electric Demand-Side Management Under Federal Law*, 13 VA. ENVTL L.J. 57, 57–62 (1993).

45. See JOSEPH ETO, LAWRENCE BERKELEY NAT'L LAB., *THE PAST, PRESENT, AND FUTURE OF U.S. UTILITY DEMAND-SIDE MANAGEMENT PROGRAMS* 1 (1996) (“DSM refers to active efforts by electric and gas utilities to modify customers’ energy use patterns.”); MICHAEL F. HORDESKI, *NEW TECHNOLOGIES FOR ENERGY EFFICIENCY* 105 (2003) (“DSM involves peak clipping, strategic conservation, valley filling, load shifting, strategic load growth and flexible load shaping.”). Others define DSM more expansively to emphasize conservation—a goal that seems quite consistent with federal policies to promote DSM under statutes such as PURPA, but that we argue is hobbled by the financial incentives faced by firms in the industry and state public utility laws. *But see* Bernard S. Black & Richard J. Pierce, Jr., *The Choice Between Markets and Central Planning in Regulating the U.S. Electricity Industry*, 93 COLUM. L. REV. 1339, 1354–55 (1994) (noting that utilities consider DSM to include load shifting).

46. The EIA defines DSM as “[a] utility action that reduces or curtails end-use equipment or processes,” but emphasizes that “DSM is often used in order to reduce customer load during peak demand and/or in times of supply constraint.” See *Glossary*, ENERGY INFO. ADMIN., <http://205.254.135.7/tools/glossary/index.cfm?id=D> (last visited Sept. 6, 2012).

47. A classic example is utility-sponsored electric lawn mower exchange programs, which would reduce emissions from combustion lawnmowers in certain areas but increase the amount of electricity used. See LeRoy C. Paddock, *Green Governance: Building the Competencies Necessary for Effective Environmental Management*, 38 ENVTL. L. REP. 10609, 10622 (2008) (describing exchange program implemented by Clean Air Minnesota, a program managed by the Chamber of Commerce via the Minnesota Environmental Initiative). DSM for natural gas utilities has also encouraged switching from electric to natural gas water heaters and stoves. See Steven D. Czajkowski, Note, *Focusing on Demand Side Management in the Future of the Electric Grid*, 4 PITT. J. ENVTL. & PUB. HEALTH L. 115, 132 (2010).

Contemporary energy policy proposals at the national level highlight this problem. For example, so-called “Smart Grid” programs, a major funding priority of the Department of Energy (“DOE”) under the Obama Administration, emphasize load shifting through critical-peak, time-of-day, and real-time pricing.⁴⁸ Electric car programs, another major DOE priority, emphasize fuel substitution by shifting the automobile fleet from petroleum to electricity.⁴⁹ The carbon reduction benefits of shifting from petroleum to electricity vary based on the timing of vehicle recharge. In many areas of the country, utilities have incentives to shift recharging to off-peak, low-cost times. The effect is to shift the electricity source from natural gas turbines to coal-fired units, however, and in many areas this shift will increase the carbon emissions attributable to use of the electric vehicles. In these situations, the time-shifting form of DSM may actually increase total carbon emissions.⁵⁰

Smart meter programs also reflect the focus of DSM on shifting electricity use from peak to off-peak hours rather than on reducing total energy demand. Smart meter programs, which provide immediate information on household electricity use, are often used to shift household energy demand from peak to off-peak periods (e.g., by facilitating variable rate pricing schemes or allowing remote shutdown of air conditioners or pool pumps at peak periods). These programs could give customers real-time information about the price and amount of electricity used in the household. Although over the long run retail electricity prices can be expected to have a substantial effect on household energy demand, rate regulation of electric power in most states has kept consumers from having experience with electricity price fluctuations. Research suggests that people often have limited or incorrect information about what activities use the most electricity.⁵¹

48. Elias L. Quinn & Adam L. Reed, *Envisioning the Smart Grid: Network Architecture, Information Control, and the Public Policy Balancing Act*, 81 U. COLO. L. REV. 833, 842 (2010).

49. See, e.g., Ashley Morris Bale, *The Newest Frontier in Motor Vehicle Emission Control: The Clean Fuel Vehicle*, 15 VA. ENVTL. L.J. 213, 268 (1995–96).

50. See, e.g., Joshua Graff Zivin, Matthew T. Kotchen & Erin T. Mansur, *Spatial and Temporal Heterogeneity of Marginal Emissions: Implications for Electric Cars and Other Electricity-Shifting Policies* (Nat'l Bureau of Econ. Research, Working Paper No. 18462, Oct. 2012) (noting that in the upper Midwest charging electric vehicles during recommended nighttime hours increases electric car emissions to levels that are higher than the average gas-powered vehicle on the road); see also Vandenberg, Carrico & Bressman, *supra* note 24, at 766–68 (examining research on the implications of peak versus off-peak electricity generation for the carbon emissions associated with recharging electric cars).

51. Shazeen Attari et al., *Public Perceptions of Energy Consumption and Savings*, 107 PROC. NAT'L ACAD. SCI. 16054, 16057 (2010). This is true about other forms of energy use as well. See, e.g., Amanda R. Carrico et al., *Costly Myths: An Analysis of Idling Beliefs and Behavior*

Not surprisingly, consumer responses to variable or dynamic pricing have been disappointing.⁵² Notably, just providing real-time information in homes about costs and impacts associated with electric power usage, without introducing price variations, can reduce electricity use by roughly 5 to 15%.⁵³ Yet from the perspective of utilities in many parts of the United States, this kind of demand reduction, when not tied to dynamic pricing, might occur at times when electricity production is low cost, leading to utility revenue erosion. Not surprisingly, utilities have focused less on using smart meters and other devices to provide households with information that would reduce overall household electricity use than on shifting use to off-peak periods. Shifting use to off-peak periods will reduce the need for firms to invest in new base load plants and will save money by allowing them to deploy their existing base load resources at capacity. But this timing shift often can increase carbon emissions. The focus on load shifting has induced utilities to link smart meter programs to dynamic pricing schemes, even though the higher rates at peak periods have often been very unpopular with customers.⁵⁴

DSM that is directed toward shifting peak use to off-peak use is popular with utilities, and as we discuss below, policies that follow this view of DSM seem especially attractive to incumbent firms to the extent they help firms maximize their revenues from energy sales. Utilities often have an incentive to shift demand from high-cost natural gas turbines at peak load periods to lower-cost coal-fired or

in *Personal Motor Vehicles*, 37 ENERGY POL'Y 2881, 2882–84 (2009) (examining myths about motor vehicle idling).

52. On the effects of dynamic pricing, see Paul L. Joskow & Catherine D. Wolfram, *Dynamic Pricing of Electricity*, 102 AM. ECON. REV. PAPERS & PROC. 381 (2012); *Electricity Prices and Conservation: Do Current Policies Reduce Consumption?*, RES. REV. (Energy Institute at HAAS, Berkeley, CA), Spring 2011, at 1, 4–5, 7 (discussing the effects of changes of electricity pricing in California).

53. KAREN EHRHARDT-MARTINEZ ET AL., AM. COUNCIL FOR AN ENERGY EFFICIENT ECON., ADVANCED METERING INITIATIVES AND RESIDENTIAL FEEDBACK PROGRAMS: A META-REVIEW FOR HOUSEHOLD ELECTRICITY-SAVING OPPORTUNITIES 39 (2010), available at <http://www.acee.org/research-report/e105> (discussing real-time household electricity feedback); see also Hunt Allcott & Sendhil Mullainathan, *Behavior and Energy Policy*, 327 SCIENCE 1204, 1204 (2010) (discussing monthly feedback on electricity use); Ian Ayres et al., *Evidence from Two Large Field Experiments that Peer Comparison Feedback Can Reduce Residential Energy Usage* 13–15 (Nat'l Bureau of Econ. Research, Working Paper No. 15386, 2009), available at <http://www.nber.org/papers/w15386.pdf> (finding significant reductions in home energy caused by peer comparison reports). The effects of information on energy use have been shown to occur even for individuals who are not responsible for paying for the bills. See Amanda Carrico & Manuel Riemer, *Motivating Energy Conservation in the Workplace: An Evaluation of the Use of Group-Level Feedback and Peer Education*, 31 J. ENVTL. PSYCHOL. 1, 10 (2011).

54. See Vandenbergh, Carrico & Bressman, *supra* note 24, at 730–40 (discussing consumer responses to dynamic pricing).

nuclear base load units at off-peak periods because deploying resources in an off-peak period can lead to overall increases in total kilowatt-hour sales of electricity without any need for any additional capital investment.⁵⁵ At the extreme, DSM can increase a utility's strategic overall load, increase the overall demand for electricity, and maximize its revenues—a profitable strategy some in the industry call “strategic load management.”⁵⁶ Although approaches vary from state to state, because of the failure to fully embrace NDR, DSM programs have had only a modest impact on the total demand for electricity—decreasing less than 2% of demand over the long term.⁵⁷

The carbon implications of shifting the timing of energy demand or the source of energy supply are also very different when NDR is emphasized as an independent goal. NDR does not assume energy usage is constant, that the shape of the demand curve is fixed over time or across fuels, or that the demand curve is inevitably shifting outward. Instead, NDR also emphasizes reducing aggregate demand by changing the shape of the demand curve or shifting it inward. We focus here on reductions in aggregate demand.⁵⁸ By subtly shifting the debate from reducing the amount of energy used to the timing of the use, many DSM policy initiatives claim to focus on demand but only do so in a way that focuses on timing of use, not reducing overall consumption.

Less explored, but equally important, DSM policies may lead to increases in carbon emissions by increasing the importance of high-carbon base load units to the utility. DSM can shift load to avoid deployment of gas peakers, but this might cause total demand to increase. Even if total demand does not increase, DSM may increase

55. BRANDON DAVITO ET AL., MCKINSEY & CO., *THE SMART GRID AND THE PROMISE OF DEMAND-SIDE MANAGEMENT* 38–39 (2010), available at <http://www.mckinsey.com/Search.aspx?q=demand%20side%20management>.

56. See C.W. Gellings, *The Concept of Demand Side Management for Electric Utilities*, 73 PROC. INST. ELECTRICAL & ELECTRONICS ENGINEERS 1468, 1468 (1985) (describing marketing and strategic load growth as benefits of DSM).

57. See TOSHI H. ARIMURA ET AL., *RESOURCES FOR THE FUTURE, COST-EFFECTIVENESS OF ELECTRICITY ENERGY EFFICIENCY PROGRAMS* 3–4 (2011), available at <http://www.rff.org/rff/Documents/RFF-DP-09-48-REV.pdf> (estimating that DSM expenditures from 1992 to 2006 produced a 0.9% savings over that period and a 1.8% longer term savings); see also Nic Rivers & Mark Jaccard, *Electric Utility Demand Side Management in Canada*, ENERGY J., No. 4, 2011, at 93, 108–12 (finding that investments in DSM in Canada did not have a substantial impact on overall electricity consumption).

58. See Douglas A. Kysar & Michael P. Vandenbergh, *Introduction: Climate Change and Consumption*, 38 ENVTL. L. REP. 10825, 10825–33 (2008) (discussing the need to address aggregate consumption of energy and goods and the reluctance of the Supreme Court to interpret the National Environmental Policy Act to require evaluation of consumption reduction as opposed to the effects of building new generation units).

dependence on the lowest-cost base load plants, which are often coal-fired units.⁵⁹ In fact, emphasizing peak capacity as a way of allocating energy usage over time may be pushing demand to base load through DSM. This focus on peak capacity feeds on itself, as more consistent demand over time means that base load units become even more important to a utility's system. The more that a utility invests in base load generation units, the more electricity it needs to sell to pay for them.

More recent federal policy efforts also do not require DSM to address NDR and may even undermine it. In 2005, Congress passed legislation that required DOE to evaluate the impacts of demand response.⁶⁰ DOE reported to Congress on demand response initiatives in 2006, finding that limited demand response opportunities currently exist and that “[s]tates should consider aggressive implementation of price-based demand response for retail customers as a high priority.”⁶¹ DOE found that demand response potential in 2004 was “about 20,500 megawatts (MW), 3% of total U.S. peak demand, while actual delivered peak demand reduction was about 9,000 MW,” or 1.3% of total peak demand.⁶² These initiatives conflate DSM and NDR, however, rather than address the distinct challenge of NDR.

In addition, two aspects of DOE's recent push towards DSM further entrench the NDR blind spot in energy demand policy. The first is DOE's emphasis on reducing peak consumption as its primary demand response goal. This is consistent with the dominant approach to DSM and to preserving a focus on regulation designed to ensure revenue recovery for capital costs associated with a peak that is defined with respect to individual base load plants. Second, DOE continues to look to states, rather than the federal government, as the primary innovators for demand response policies. DOE's emphasis on states for demand response solutions is not surprising, given that the Federal Power Act protects state jurisdiction over retail rates.⁶³ But this also means that the ultimate responsibility for demand initiatives that flow through to the customer level will remain with state

59. Clean Air Act standards might help to soften this effect to some extent regarding coal if the standards regulate hourly emissions rather than average or daily, weekly, or monthly emissions. For example, this may be effective for sulfur dioxide.

60. BENEFITS OF DEMAND RESPONSE IN ELECTRICITY MARKETS AND RECOMMENDATIONS FOR ACHIEVING THEM, A REPORT TO THE UNITED STATES CONGRESS PURSUANT TO SECTION 1252 OF THE ENERGY POLICY ACT OF 2005, at v (2006), *available at* http://energy.gov/sites/prod/files/oeprd/DocumentsandMedia/DOE_Benefits_of_Demand_Response_in_Electricity_Markets_and_Recommendations_for_Achieving_Them_Report_to_Congress.pdf.

61. *Id.*

62. *Id.* at v n.2.

63. *See id.* at 52 n.58.

regulators, rather than the federal government, and that their regulatory approach will be important to meeting federal goals related to DSM.

C. Distribution Utilities as NDR Gatekeepers

Electric distributors are perhaps the most important actors for demand reduction. The traditional electric utility provides bundled generation, transmission, and distribution services to retail customers under rates regulated based on the cost of service, as determined based on the costs of producing electricity. Such firms set or affect retail prices in most jurisdictions; have monthly communications with retail consumers; control access to efficiency, conservation, and renewable energy generation options; determine the transaction costs households will occur in adopting new technologies or participating in conservation programs; and lobby for and against demand-related measures with federal, state, and local governments.⁶⁴ Electric distributors also set standards and require approvals for connecting with the local grid, such as the approvals necessary for installation of solar photovoltaic systems. They provide information through bills and advertising that can promote⁶⁵ or discourage⁶⁶ demand reduction. They also maintain large staffs of technicians that interact with households on a frequent basis.

In these ways, the distribution utility serves as an intermediary and gatekeeper between the consumer and the electric grid. A utility that has incentives to reduce household or other demand for electricity can play its information, service, and access roles in ways that will induce widespread uptake of efficiency and conservation measures. A utility that does not can discourage widespread uptake of these measures and can do so in a variety of nontransparent ways, whether by increasing consumers' transaction costs (e.g., by requiring numerous or slow approvals for household solar photovoltaic installation, by understaffing key positions necessary for promotion of efficiency and conservation programs, and

64. See, e.g., Brandon Hofmeister, *Bridging the Gap: Using Social Psychology to Design Market Interventions to Overcome the Energy Efficiency Gap in Residential Energy Markets*, 19 SOUTHEASTERN ENVTL. L.J. 1, 62 (2010) (noting that if private utilities can be properly incentivized to maximize energy efficiency, they can be "particularly effective delivery mechanisms for energy efficiency programs," and that "utilities are perceived to be a trusted source of information on efficiency and energy use . . . [and] that information provided by utilities will often have more impact than information provided by other sources").

65. An example would include switching incandescent bulbs to compact fluorescent lamps.

66. Examples include encouraging the purchase of larger electric water heaters, or electric as opposed to gas water heaters.

by imposing stringent requirements on grid access), or by limiting the extent or efficacy of information provided to consumers (e.g., by not making prompt, in-home energy use feedback easily available).⁶⁷

D. Regulatory Incentives for Efficiency and Conservation

Whether a public entity (such as a municipal utility) or a private firm, the distribution utility historically operated as a monopoly and was (and in many respects largely remains) regulated by a state regulatory commission whose mission emphasizes protection of consumers from abuses by the monopolist. In the early era of energy regulation, efficient supply was the goal, so protecting consumers became a priority. Importantly, protecting consumers was framed as providing low rates for customers, not necessarily low total consumer expenditures on electricity. Regulators used ratemaking as the principal tool to provide low electric rates for consumers. Low electric rates resonated politically with many consumers and consumer advocacy groups, and this “low rate mindset” continues to resonate, even if it is not always in the interest of consumers.

Although low rates have obvious appeal to consumers and consumer advocates, the impacts of low rates on consumers are mixed. To the extent they enable increased energy use, low rates allow consumers to satisfy preferences for more energy-using services, such as the additional cooling provided by lowering the thermostat in the summer or the entertainment from new electronic equipment. At the same time, low rates undermine incentives to acquire information about energy use, to purchase more efficient appliances, and to reduce waste, such as by taking simple behavioral steps that have very small pecuniary or cognitive costs but large effects on the quantity of electricity used (e.g., turning up the thermostat when leaving the home for long periods in the summer). In addition, by creating incentives for utilities to increase the overall quantity of electricity that customers purchase, low rates create hydraulic pressure in the system for increasing supply, undermining the ability to substitute low-carbon for high-carbon sources. Low rates thus can lead to higher total consumer costs in the long run by undermining incentives for efficiency and conservation and can undercut efforts to reduce the carbon emissions from electricity generation.

Less obvious is why the low-rate mindset found favor with regulated utilities. A monopoly firm with market power typically will

67. As discussed above, such feedback has been shown to reduce residential electricity use by 5% to 15%. EHRHARDT-MARTINEZ ET AL., *supra* note 53, at 39.

favor charging higher rather than lower per-unit prices, but rate regulation guaranteed cost recovery for capital investments associated with generating electricity while also ensuring a high volume of power sales. Volumetric pricing—selling more units at lower cost—remains the dominant business model for electric utilities. The NDR blind spot can be traced to the incentives under which both firms and regulators operate with volumetric pricing and its related approach to investment risks. To the extent the dominant approach to utility rate structures favors volumetric rates, utilities are encouraged to offer low per-unit rates while increasing their total sales. This allows them to recoup the business costs associated with their capital investments in base load power and transmission, and to increase net revenues over the long term.

Low rates are not problematic to a utility so long as the volume of power sold increases sufficiently to make up for the lost revenue from the low rate. If low rates undermine incentives for consumers to invest in more energy efficient technologies or to avoid waste, and thus increase total consumer expenditures on electricity that exceed the revenue loss from low per-unit rates, the utility prospers. So long as consumer advocates focus on low per-unit rates as the goal of ratemaking proceedings, rather than consumers' total electricity costs, consumer advocates can achieve their goal in a way that the utility is happy to accommodate. Consumer advocates can announce success in holding down rates, and utilities can increase their revenue each year as low rates induce increased consumption and undermine incentives to invest in efficiency and conservation.

Thus, although often against consumers' long-term interests, consumer advocacy groups often take the bait offered and focus on low rates, and utilities are quite happy to feed it to them. On the surface, both groups win: utilities increase revenues, and consumer groups report success to their stakeholders on lower rates, even though consumers' total costs will go up in the long run. The total costs to consumers are more important but less obvious to consumers and voters. In addition, the regulator is in a sweet spot, since both utilities and consumer advocacy groups are placated. The losers in this arrangement are consumers, who end up spending more money each year on electricity, as increased usage outstrips low rates, and everyone who is adversely affected by an electricity generation and distribution system that is constantly in need of increasing supply.

The incentives of consumer advocates, utilities, and regulators in the low-rate regime are reflected in the dominant approach to DSM. The shift in timing of consumption that many energy policies seek to achieve under current conceptions of DSM promises firms enhanced

revenue with their current business model under the rate structures applicable in most states. By focusing on shifting the timing of demand, not on reducing net demand with efficiency and conservation programs, DSM programs offer the near-term appeal of less costly power, but they miss the opportunity to enable customers to use less electricity overall and to spend less on electricity in the long run. So long as consumer advocates, utilities, and regulators focus on low per-unit rates, however, it should not be surprising that utilities favor DSM over NDR and view efficiency and conservation as revenue erosion; effective overall demand reduction programs will lead to less total electricity use and thus less total revenue from consumers.

Given electric distribution utilities' incentives in most jurisdictions, it is hardly a surprise that utilities' implementation of demand reduction measures has been inconsistent. Serious initiatives to reduce demand have occurred on a one-off, local basis, not with the aggressive, widespread implementation necessary to achieve a behavioral wedge. As a general matter, state regulators have not been very effective at changing firms' financial incentives. In fact, DSM policies were adopted in most states under the cost recovery model of traditional rate regulation, which sees stabilizing and increasing the sales of energy as the main business model for generating revenue—a strong business incentive that is at direct odds with efficiency and conservation goals. Of course, efforts to manage demand produce costs for electric utilities, just as new generation facilities can produce costs. If deemed prudent by regulators, these costs are typically built into the approved rates for regulated utilities. Yet the kinds of DSM programs that regulated firms have sought, and that regulators tend to approve, emphasize load-shifting and fuel substitution along with marketing and strategic load growth, and they ignore, or at least underemphasize, NDR. An Electric Power Research Institute-sponsored report bluntly highlights the problem: “The heart of a DSM program is a series of measures intended to encourage one or more specific groups of customers to modify their energy usage patterns *in a manner consistent with the utility's objectives*.”⁶⁸

Empirical analysis has determined that utility estimates of the actual conservation savings associated with DSM investments to date are often overstated.⁶⁹ One reason is that DSM's emphasis on load

68. AHMAD FARUQUI & JOHN H. CHAMBERLIN, ELEC. POWER RESEARCH INST., PRINCIPLES AND PRACTICE OF DEMAND-SIDE MANAGEMENT, at ES-1 (1993) (emphasis added).

69. See Maximilian Auffhammer, Carl Blumstein & Meredith Fowle, *Demand-Side Management and Energy Efficiency Revisited*, ENERGY J., No. 3, 2008, at 91, 91 (“The key finding of Loughran and Kulick (2004) . . . is that utilities have been overstating electricity savings . . .

management, fuel substitution, and strategic load growth has masked the impacts of energy policies on total demand. NDR emphasizes the need to confront these impacts. NDR therefore captures an important goal that DSM, in its practical implementation, fails to emphasize, and that merits attention in its own right as a regulatory tool in discussions regarding efficiency, conservation, and demand reduction.

Even in states with traditional rate structures, utilities may feel some public pressure to promote conservation and efficiency. For a firm that is rewarded on a volumetric sales basis, demand shifting to off-peak periods can lower costs and produce some limited efficiencies. For these firms, however, aggregate demand reduction also comes at a significant cost. In retail rate-regulated environments, utilities can be expected to seek demand reduction only if regulators offer to provide them a guaranteed return for it. Similar incentives can be expected for gas and water utilities.

In sum, so long as volumetric pricing and guaranteed cost recovery through regulated rates leads utilities to view efficiency and conservation as revenue erosion, they will have incentives to create an appearance of demand reduction (e.g., to maintain reputation, satisfy regulators' demands, etc.), but under the existing approach neither utilities nor customers can be expected to be firmly committed to reducing the aggregate usage of electricity. In fact, many utilities would be lowering their short-term return on investment and risking their ability to recover the capital costs of their investment in generation plants if they induced meaningful aggregate demand reduction among their residential or business customers. Aware of this implication of NDR, the American Public Power Association has warned, "[a] reduction in sales . . . leads to a greater reduction in revenues than in costs, and potentially can threaten a utility's financial health."⁷⁰ The history of utility efficiency and conservation programs around the country—highly touted programs that are not designed or implemented to exploit the full potential for household demand reduction, as opposed to programs and innovations designed to “go viral” among customers or reduce electricity use on a widespread basis—reflects this mixed incentive.⁷¹

associated with energy efficiency . . . (DSM) programs.”). *But see id.* (“Our results suggest that the evidence for rejecting utility estimates of DSM savings and costs should be re-interpreted.”).

70. AM. PUB. POWER ASS'N, *supra* note 23, at 3.

71. For example, the utility industry has been slow to adopt social media techniques. Carolyn Elefant, *The “Power” of Social Media: Legal Issues & Best Practices for Utilities Engaging Social Media*, 32 ENERGY L.J. 1, 5 (2011).

E. NDR and Incentives for Alternative Supply Options

Similar issues arise regarding generation of electricity at the household level. Penetration of renewables into power supply is unlikely to occur if electric distributors lack incentives to permit, much less actively encourage, substantial increases in the supply of household-generated electricity.⁷² As a general rule, investments in alternative supply options are not consistent with volumetric rates, such as investments in distributed renewable generation by either consumers or nonutility firms. The historic emphasis on promoting low rates influences how regulated utilities and regulators view the risks associated with infrastructure investments in power production and delivery, reinforcing an industry-wide approach to planning and building power generators that favors base load plants over renewable projects.

Small-scale, low-carbon energy projects (such as household solar photovoltaic installation) share many characteristics with household efficiency and conservation since they reduce the demand for centralized generation and transmission by supplying energy onsite. As with efforts to reduce demand, renewable energy scholars have noted that the process of installing household renewable generation systems must become routine if these systems are to make a substantial contribution to the supply of low-carbon energy.⁷³ Yet firms and regulators have a strong preference for base load generators over renewable plants, because investments in base load plants (which tend to be large-scale nuclear and coal plants, or hydro facilities) can be justified as providing power on a reliable basis twenty-four hours a day.⁷⁴

Diversification of electric power generation towards renewable resources is especially responsive to reductions in demand because most renewable resources deploy at a smaller scale and do not immediately scale up the way traditional fossil fuel plants do. To the extent these renewable sources reduce a customer's demand and this effect is multiplied across all customers on a utility's network, this

72. See generally Joel B. Eisen, *Residential Renewable Energy: By Whom?*, 31 UTAH ENVTL. L. REV. 339, 339–40 (2010) (discussing the importance of incentives to overcome the current distributional status quo of utilities).

73. See, e.g., *id.* at 340 (discussing the need for “routinization” of household solar services).

74. Fuel storage *after* generation, a serious problem that plagues nuclear generation, is an issue beyond the scope of this Article.

total reduction in demand can offset the need for larger scale investments in base load fossil plants and transmission facilities.⁷⁵

A formidable obstacle to this kind of penetration for renewable energy is that the conventional approach to planning and building base load power plants assumes that the statistical certainty that customers are able to receive reliable power twenty-four hours a day is a requirement for every generation unit. That approach keeps both regulators and distribution utilities from valuing smaller-scale distributed renewable facilities. Once built, a base load unit will operate most efficiently at or near its capacity level. The large capital investment in a base load plant can crowd out alternative sources of electricity supply as utility engineers make decisions to dispatch individual plants to meet demand at the margin, and operation of a base load plant will typically be most efficient where it is working at or near capacity. Also, expanded transmission, once built, creates an incentive for utilities to wheel in the lowest-cost power options from the wholesale market, which will tend to be from base load plants. Although some of these plants are low-carbon nuclear plants, most of the power generated at these plants is drawn from coal-fired generators.

Instead of evaluating the statistical certainty of reliability plant-by-plant, an alternative approach views reliability as a characteristic of the power system as a whole. For example, a widespread network of renewable resources could provide a stable and predictable source of electricity without expanding transmission or the number of base load power plants.⁷⁶ Interconnected and redundant smaller-scale generators, including distributed renewable projects, can serve as a type of insurance against reliability interruptions. Moreover, viewing reliability at the systems level allows demand reduction to play a role as a mechanism for enhancing reliability. Power engineers who operate the grid on a daily basis for regional transmission systems already see their risk management challenge from the perspective of the complete mix of power generation options, rather than focusing on reliability as a feature of an individual power

75. Terms such as “demand” and “energy” are terms of art among utility regulators, especially in the ratemaking process. For them, “demand” frequently refers to the capacity designed to meet customer peaks. “Energy” often refers to the fuel costs associated with deploying demand to serve particular customers. In this Article we use the terms in a more conventional manner, consistent with lay and economic understandings of demand.

76. For an example of how a combined heat and power natural gas distributed generation can produce similar system benefits, see DRAGOLJUB KOSANOVIC & CHRISTOPHER BEEBE, CTR. FOR ENERGY EFFICIENCY & RENEWABLE ENERGY, SYSTEM WIDE ECONOMIC BENEFITS OF DISTRIBUTED GENERATION IN THE NEW ENGLAND ENERGY MARKET (2005), available at <http://ceere.org/iac/pubsdownloads/DG%20Benefits%20Report.pdf>.

plant. Despite this, for the firm, rather than a larger regional system operator, the dominant approach to building and planning power plants conflates an individual firm's business risks with the risks of reliability interruptions, leading firms to invest in overcapacity, large-scale power plants, and transmission as the main mechanisms for reliability enhancement. This preference for overcapacity fits with the history of most electric power investments in the twentieth century, which were primarily base load plants. Low customer rates financed these investments, as accompanying demand growth provided a predictable source of revenue to protect the firm's large-scale investment risks and encouraged firms to conflate minimizing reliability risks with minimizing business risks associated with potential revenue decreases. As wholesale markets have evolved, and day-to-day operation decisions about the grid are increasingly made by power system operators, the separation between the operational decisions regarding the grid as a system and the investment decisions of the firm have become even greater.

The preference for low rates and their accompanying base load plant investment cycle is not a purely private phenomenon. By emphasizing volumetric rates, public regulators' ratemaking practices for most distribution utilities reinforce a consumption mentality that takes supply for granted. By focusing primarily on low per-unit rates, utilities can get what they are incentivized to want: the appearance of responsiveness to consumers along with growing total payments from consumers to utilities. And the public utility commissions ("PUCs") and consumer groups can say they are delivering what consumers want, but that is only true if the issue is framed as low rates, not low bills. Volumetric rates help keep per-unit prices low and encourage firms to sell as much electricity as possible, rather than increase price and decrease unit sales. They are also consistent with the idea of keeping per-customer demand charges low; investing in base load capacity leads to high "demand" charges on bills (the portion of fixed costs allocated to customers), so that once such investments are made, the base load cycle is reinforced by regulators allocating demand charges plus energy charges on a per-unit basis. By keeping energy charges low, this increases per-unit consumption and also increases overall bills.

III. POTENTIAL SOLUTIONS

This is a propitious time for state and local regulators to take the aggregate demand for electricity seriously in their policy initiatives and to examine new approaches to overcome the conceptual

and practical barriers to NDR. In 2011, five years after DOE's initial report on demand response, DOE and the Federal Energy Regulatory Commission ("FERC") issued a new report calling for a national demand response policy, responding in part to Congress's request in the Energy Independence & Security Act ("EISA") in 2007.⁷⁷ In contrast to previous demand response efforts, in the new report DOE and FERC promote a greater federal role in demand response efforts, including development of tools and templates to assist states in demand response initiatives.⁷⁸

Memorializing such efforts, FERC's landmark new rule on demand reduction provides wholesale utilities with incentives to reduce their demand for electricity,⁷⁹ an approach that FERC Chairman Wellinghoff has referred to as the "killer application" for the electric power industry.⁸⁰ This approach could introduce incentives for demand reduction for the largest-scale transactions, but whether it will lead to reductions in actual customer demand will depend on the responses of individual utilities in the pricing of retail sales to customers. We see two particular impediments, however, to current federal demand response policy fully realizing its potential. The first is a lack of a carbon-pricing apparatus, which we discuss further below. The second is that, even if federal efforts to address demand are well intended, the retail sales of electric distribution utilities remain regulated by states, not FERC. To the extent retail utilities still have strong volumetric sales incentives, as they do in most jurisdictions, any attempt at wholesale demand reduction will be muted. The scope of the federal jurisdiction to address demand for electric power is limited,⁸¹ and many demand response solutions remain vague.

We examine three policy options that are being deployed to address the demand growth problem: (1) social cost approaches such

77. FED. ENERGY REGULATORY COMM'N & DEPT OF ENERGY, IMPLEMENTATION PROPOSAL FOR THE NATIONAL ACTION PLAN ON DEMAND RESPONSE iii (2011), *available at* <http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/ImplementationProposalforNAPDRFinal.pdf>.

78. *Id.* at 4–10.

79. Demand Response Compensation in Organized Wholesale Energy Markets, 76 Fed. Reg. 16,658, 16,678 (Mar. 24, 2011) (to be codified at 18 C.F.R. pt. 35).

80. Kate Galbraith, *Dimming the Lights to Meet Demand*, N.Y. TIMES GREEN BLOG (Apr. 17, 2009, 8:02 AM), <http://green.blogs.nytimes.com/2009/04/17/dimming-the-lights-to-meet-demand/>.

81. The FERC's jurisdiction extends only to wholesale power supply transactions, and states retain jurisdiction over retail sales to customers. For discussion of the limited jurisdiction FERC has in implementing demand response, see Richard J. Pierce, *A Primer on Demand Response and a Critique of FERC Order 745*, 3 GEO. WASH. J. ENERGY & ENVTL. L. 102, 105–06 (2012) (noting that the FERC has limited ability to overcome the reluctance of states to adopt retail systems that will create appropriate incentives and pass the savings of demand response on to customers).

as carbon pricing; (2) performance standards such as demand reduction mandates; and (3) decoupling initiatives. We conclude that a combination of all three approaches will be necessary to overcome the long history of financial incentives created by volumetric pricing and the accompanying mindset that limits utility, consumer, and PUC commitment to NDR. Embracing all three policies would recognize that electricity distribution utilities should not be viewed as simply selling electricity to customers, but as providing a service that produces positive social and economic value for the energy system. Energy services may actually include selling technologies or services that enable the sale of less electricity. Such a model holds promise to induce demand reduction, in the form of both improved efficiency and conservation, by creating positive value for firms. Large, sophisticated customers, such as large industrial consumers of electricity, already know that it is in their interest to focus on demand reduction. They have strong incentives to invest in demand reduction, and many have already taken the initiative to reduce their demand.⁸² Smaller-scale household customers achieve less obvious benefits (they have lower energy costs), but as the discussion in Part II.A demonstrates, the collective benefit of all customers reducing demand is substantial. The energy services business model would have far-reaching implications for utility decisions that affect NDR.

A. Carbon Pricing and Social Cost Approaches to Demand Reduction

The emphasis of volumetric pricing on low rates provides little incentive for utilities and customers to pay attention to the carbon impacts of energy use. The commonplace policy solution to environmental externalities such as carbon emissions focuses on internalizing social costs by making them private. In theory, the optimal policy instrument is a carbon tax. Such a tax would increase the cost of producing and selling electricity from high-carbon fuels, encouraging firms and customers to adjust their energy production and use in response to prices that fully reflect the social cost of carbon emissions. In the electricity context, high prices for electricity generated from high-carbon fuels would make alternative supply options, such as renewable energy, more attractive, and would lead to reductions in demand by consumers. Yet a national carbon tax or cap-and-trade system is unlikely to be adopted and implemented in the

82. This is because energy costs for larger customers will be greater, producing greater dollar savings per individual customer. Any expensive meters or energy audits will be more affordable to larger customers with cash flow, such as businesses, which also face competitive pressure to reduce their energy costs as much as possible.

United States in the near term. Failure to bend the carbon curve during this time will mean not only greater stocks of carbon in the atmosphere, but substantial growth in annual carbon emissions and the possibility of passing tipping points in the climate system.⁸³

Even though adoption of a national carbon tax or cap-and-trade system is unlikely in the near term, however, state regulators may be able to internalize the social costs of carbon indirectly if they reengineer the ratemaking process to emphasize the actual costs of carbon emissions rather than the private market costs of supplying electricity. A social cost approach could readily fit within the existing process by which state regulators determine utility rates based on the cost of service. Now that the Office of Management and Budget has established a range for the social cost of carbon,⁸⁴ designing an electricity rate to be welfare enhancing could readily incorporate the social cost of the carbon emitted from the generation of the electricity.⁸⁵ If state utility regulators were to price carbon emissions and build them into utility rates as a cost, it would produce higher per-unit rates.

The effect would be twofold: customers would have incentives to use less electricity as the per-unit price goes up, and utilities would have incentives to invest in reducing demand for fossil fuel-generated electricity. Even if the current measure of carbon costs is not precise, utility regulators have mechanisms at their disposal to true up adjustments as new information is gathered in the future. For

83. See Vandenberg & Gilligan, *supra* note 28, at 403–04 (discussing tipping points and feedback effects in the climate system).

84. The social cost of carbon is the present value of future damages caused by one metric ton of greenhouse gas emissions; the working group that calculated the social cost of carbon produced a range of \$5 to \$65 per metric ton, with \$21 per metric ton as the central figure of analysis. INTERAGENCY WORKING GRP. ON SOC. COST OF CARBON, U.S. GOV'T, APPENDIX 15A, SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12866, at 3 (2010), available at http://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/smallmotors_tsd/sem_finalrule_appendix15a.pdf. There is reason to believe that the range of social costs of carbon generated through the OMB process does not fully reflect the tail risks that many climate scientists have identified. See Jonathan S. Masur & Eric A. Posner, *Climate Regulation and the Limits of Cost-Benefit Analysis*, 99 CALIF. L. REV. 1557, 1581 (2011) (“[T]he IWG’s recommendations are not adequately defended. Many of its errors are likely errors of underestimation: it is likely that the IWG does not incorporate all the potential harms of global warming, and thus underestimates the benefits of curbing emissions.”).

85. For commentary on the working group results and process, see Jody Freeman & Andrew Guzman, *Climate Change and U.S. Interests*, 41 ENVTL. L. REP. 10695, 10721–23 (2010); Douglas A. Kysar, *Politics by Other Meanings: A Comment on “Retaking Rationality Two Years Later”*, 48 HOUS. L. REV. 43, 57–66 (2011); Vandenberg & Gilligan, *supra* note 28, at 406–07. For a discussion on the prevalent approach to evaluating discount rates for cost-benefit analysis of climate change mitigation efforts, see generally Richard L. Revesz & Matthew R. Shahabian, *Climate Change and Future Generations*, 84 S. CAL. L. REV. 1097 (2011).

example, based on the likelihood of error in carbon cost calculations, regulators could contribute a percentage of the cost to a trust fund, which would allow for adjustments in the future as new information about carbon impacts is processed.

We favor such an approach, but we think it also is not politically feasible in the near term and is unlikely to be a complete solution to the problem. Increasing utility rates to reflect social costs, rather than business costs, is likely to be politically unpopular at the state and local level, where a populist consumer protection message dominates in the rate-setting process and focuses on near-term consumer pecuniary interests, not long-term consumer welfare. The political appeal of a decentralized, state-centric approach to adopting implicit carbon pricing in ratemaking varies geographically, and opposition to carbon regulation appears strongest in states that use the most carbon-intensive fuels.⁸⁶ Moreover, using a state ratemaking process to impose a carbon tax implicitly does not guarantee changes in generation choices if utilities simply pass that cost through to customers and increase their own profits rather than invest in lower-carbon power sources. Given the strong financial incentives that attract firms to large-scale base load sources of energy, use of carbon-intensive fuels is likely to continue at high levels without some kind of supplemental regulatory approach designed to change firm investment decisions. A carbon-pricing approach, if adopted in isolation, thus does not guarantee changes in the supply of new low-carbon electricity sources and places its bet almost entirely on a hope that the demand for electricity is elastic.

A more feasible approach would be for PUCs to be more mindful of social costs in evaluating utilities' investments in NDR during the ratemaking process. Efforts to reduce demand may require the expenditure of dollars by utilities, and thus regulators will need to determine whether NDR investments (e.g., investments in infrastructure such as metering and other energy efficiency services) are prudent or cost effective. A social cost approach to evaluating NDR would not only be attentive to NDR's costs but also would recognize its benefits, including its potential for reductions in carbon emissions over the fuel cycle of various sources of electricity. This would require regulators to take a broader approach to assessing the cost effectiveness of various utility investments and fuels than occurs with the current emphasis on volumetric rates and near-term consumer protection goals. Many states use a rate impact measure ("RIM") test

86. See, e.g., Felicity Barringer, *Climate Legislation Sends Chill Through Areas Fueled by Coal*, N.Y. TIMES, Apr. 9, 2009, at A17.

to evaluate the prudence of investments in DSM, examining the overall effect of DSM investments on customer rates. The RIM approach encourages overinvestment in the kind of DSM that is at odds with NDR and with carbon-pricing strategies that may be adopted in the future.⁸⁷

States should consider and evaluate the use of alternative tests for investments in NDR, focusing on total resource costs or societal costs in comparing NDR investments to their alternatives.⁸⁸ Such approaches might assess the cost effectiveness of NDR from a larger system perspective, taking into account positive environmental externalities associated with these investments, including the cost of the full fuel cycle for alternative approaches to generating electricity.⁸⁹ Even if regulators do not price carbon in ratemaking, if they begin to look at carbon impacts in evaluating the cost effectiveness of various investments, this could improve firms' ability to evaluate the risks of reliability from a systems perspective, could provide a way out of the current overemphasis on base load plants, and could make NDR a more appealing option to utilities.⁹⁰

87. As discussed in Part II, it is important to highlight that the current energy policy emphasis at the federal and state levels on smart meters does not adequately confront the problem, and may even reinforce it. Smart meter technology holds promise to give customers information about their power usage to influence when and how they use energy. See Vandenberg, Carrico & Bressman, *supra* note 24, at 739 ("Behavioral research on household responses to energy information suggests that a proposal to install smart meters that simply provide feedback to household energy users might have yielded substantial use reductions . . ."). Many smart meter discussions to date are limited to load-shifting strategies such as critical-peak pricing, however, and do not focus on communicating real-time information to customers about electricity use and its carbon implications. See *id.* at 739, 739 n.97 (discussing the rejection of a smart meter program in Maryland linked directly to demand peak pricing and the recognition that the success of such initiatives depends on customer education and communication). Research shows that the types of information that can be gathered and disclosed to the consumer through smart meter programs can reduce electricity use by 5.5% to 14%. See EHRHARDT-MARTINEZ ET AL., *supra* note 53, at 48 ("[M]edian household savings vary from 5.5% for programs that employ enhanced billing strategies to 14% for those that provide real-time feedback disaggregated by energy end use."). See generally Ahmad Faruqui & Jenny Palmer, The Discovery of Price Responsiveness—A Survey of Experiments Involving Dynamic Pricing of Electricity 1, 11 (Mar. 12, 2012) (unpublished manuscript), available at <http://ssrn.com/abstract=2020587> (surveying 126 pricing experiments with dynamic pricing and time-of-use pricing of electricity to show that "the presence of enabling technology allows customers to increase their peak reduction").

88. For example, Florida law requires the Florida Public Service Commission to contract for an independent evaluation of the Florida Energy Efficiency and Conservation Act ("FEECA") to determine if the Act remains in the public interest, including whether it is cost effective in reducing peak demand and overall consumption. 2012 Fla. Laws 117.

89. See ARIMURA ET AL., *supra* note 57, at 23–24 (discussing previous studies that overstated the benefits of DSM).

90. See COLUMBIA LAW SCH., CTR. FOR CLIMATE CHANGE LAW, PUBLIC UTILITIES COMMISSIONS AND ENERGY EFFICIENCY: A HANDBOOK OF LEGAL AND REGULATORY TOOLS FOR

B. Performance Standards for Demand Reduction

Another option for state regulators is to mandate that the electric distribution utility reduce demand by specific amounts or that it spend specific amounts on demand reduction activities.⁹¹ Roughly twenty states have mandated reductions in overall demand, including Maryland and New York.⁹² Many of these mandates emphasize efficiency improvements, which can be realized in power supply investments or at the customer level, but they also include efforts to encourage conservation. The strength of these approaches is that they provide clear, unequivocal direction to a utility that might otherwise be tempted by volumetric rates to favor investing in large-scale base load plants over reducing demand.

These approaches do not confront the underlying problem of utility incentives, however, and thus are unlikely to lead to widespread change. Under the mandated reductions approach, utilities may comply with the mandate at the cost of pursuing other desirable goals such as investment in renewable projects. Perhaps most important, utilities may have incentives to lobby against large mandated reductions and may lack incentives to exceed the mandates. As a result, utilities cannot be expected to be subject to aggressive targets or to exceed the targets that are set. Similarly, under the mandated spending approach, to the extent the utility's revenues are derived from its volume, it does not have an incentive to spend more than the mandated amount or to spend the funds any more effectively than necessary to satisfy regulatory oversight. In short, utilities lack incentives for innovation and for exceeding minimum standards.

As a modest alternative, state policymakers might consider merging demand reduction performance standards into other policy tools to promote innovation in NDR at the state and local level. A clean energy standard, such as that favored by the Obama Administration, differs from a state renewable power standard ("RPS") in that it does not focus entirely on power supply but allows efficiency and conservation to compete with energy supply options on a one-to-one basis. Many states already allow conservation and efficiency savings to qualify as a type of renewable energy for an RPS or renewable energy credit purposes, although some of these states

COMMISSIONERS AND ADVOCATES 25–27 (2012) [hereinafter ENERGY EFFICIENCY HANDBOOK], available at http://www.smartgridnews.com/artman/uploads/1/PUC_Handbook_August_2012.pdf (contrasting rate impact measures with other approaches to analyzing energy efficiency programs, including the total resource cost test).

91. This approach is discussed in ENERGY EFFICIENCY HANDBOOK, *supra* note 90, at 46–47.

92. See ARIMURA ET AL., *supra* note 57, at 2.

discount the value of conservation and efficiency.⁹³ If the goal is NDR, there is no reason for discounting the value of conservation and efficiency, given that these can be even more valuable than investments in renewable projects. Indeed, such an approach could have broader appeal than an RPS, and it may be attractive to some additional state legislatures for the same reasons that an RPS originally was—the promise of jobs and new technologies.

However, any benefits of these more modest approaches as compared to a stand-alone NDR mandate would be limited. Even if NDR is compared one to one with investments in renewable energy, this will place NDR in direct competition with renewable investments, which will undermine the ability to reduce overall fossil fuel use. Perhaps there is a natural limit on the combination of NDR and renewable energy that any jurisdiction will tolerate, but this seems unlikely, at least in the near term. Moreover, since many renewable resources also qualify for both state and local tax credits, and few NDR initiatives enjoy such subsidies, unless these programs focus heavily on explicit NDR goals they are likely to produce underinvestment in NDR.

C. Revenue Decoupling and Shared Savings in Demand Reduction

Neither the social cost of carbon nor the performance mandate approach acknowledges the principal issue of how the distribution utilities sell power. Addressing how utilities sell power is the only solution that simultaneously confronts how volumetric pricing has contributed to utilities' strong preference for investments in base load and to the preference among policymakers for low rates and increasing use. This is also the only approach that has the prospect of inducing levels of management attention, staffing, innovation, and investment in demand reduction that are comparable to the utilities' investments in increasing revenue under a volumetric-pricing regime. "Revenue decoupling" initiatives separate a distribution utility's revenues from its incentives to increase the amount of power it sells to customers.⁹⁴ These decoupling programs may be the best way to

93. For a discussion on the need for a national RPS, see generally Lincoln L. Davies, *Power Forward: The Argument for a National RPS*, 42 CONN. L. REV. 1339 (2010). See also American Clean Energy and Security Act, H.R. 2454, 111th Cong. § 610(f)(1)(A) (2009) (calling for the FERC to "specify the types of energy efficiency and energy conservation measures that can be counted" when defining and measuring electricity savings).

94. The term "decoupling" is loaded with different meanings depending on the policy context. In discussion about competition in electric power, "decoupling" might be taken to mean the separation of distribution and generation. "Bundled" rates, reflecting the costs of generation, transmission, and distribution are offered in many states (e.g., Tennessee and Florida). These

ensure that utilities have ongoing incentives to develop, fund, and implement highly effective efficiency and conservation measures. Decoupling has been adopted, in varying forms and degrees, by roughly twenty states, although many of these states have not adopted decoupling in a form that is likely to create ongoing incentives for NDR.⁹⁵ The American Recovery and Reinvestment Act also included language that promoted but did not require state adoption of revenue decoupling.⁹⁶

Revenue decoupling can be implemented through a variety of policy instruments.⁹⁷ A common approach is a type of “decoupling lite” that provides for lost revenue adjustments designed to compensate utilities for lost revenue and presumably make them neutral between lost sales and new investments.⁹⁸ These approaches remove disincentives for NDR, but they do not create incentives to achieve NDR. More proactive approaches to decoupling offer utilities affirmative incentives for retail demand reduction. For example, some regulators offer utilities incentives by rewarding them post sale for NDR savings associated with conservation and efficiency. If a utility

differ from the unbundled prices customers are offered in states with retail choice (e.g., Texas), where an electric distribution utility provides distribution lines and the meter, and it simply passes through the cost of the power from generators. In these types of jurisdictions, in a sense the distributor has been “decoupled” from the generator. We choose to call this unbundling, and our emphasis is on a different kind of decoupling, what we call “revenue decoupling.” For a discussion on the different degrees of decoupling, see THE REGULATORY ASSISTANCE PROJECT, REVENUE REGULATION AND DECOUPLING: A GUIDE TO THEORY AND APPLICATION 11–13 (2011). For a recent analysis of decoupling in the economics literature, see TIMOTHY J. BRENNAN & KAREN PALMER, RES. FOR THE FUTURE, ENERGY EFFICIENCY RESOURCE STANDARDS: ECONOMICS AND POLICY (2011), available at <http://www.rff.org/RFF/Documents/RFF-DP-12-10.pdf>.

95. See *Decoupling Policies*, CTR. FOR CLIMATE AND ENERGY SOLUTIONS, <http://www.c2es.org/sites/default/modules/usmap/pdf.php?file=7016> (last updated July 5, 2012) (identifying the states that have adopted decoupling measures); see also *Decoupling in Detail*, CTR. FOR CLIMATE AND ENERGY SOLUTIONS, http://www.pewclimate.org/what_s_being_done/in_the_states/decoupling_detail (last visited Sept. 6, 2012) (explaining the general issues of revenue decoupling in energy markets using electricity-specific examples). For a recent article that is skeptical of decoupling approaches, see Brian S. Tomasovic, *Revenue Decoupling for Electricity Distributors: Current Approaches and Future Outlook*, 6 TEX. J. OIL, GAS, & ENERGY L. 176, 180–82 (2010–2011). See also Shannon Baker-Branstetter, *Distributed Renewable Generation: The Trifecta of Energy Solutions to Curb Carbon Emissions, Reduce Pollutants, and Empower Ratepayers*, 22 VILL. ENVTL. L.J. 1, 19 n.113 (2011); Davies, *supra* note 93, at 1356. Both show a lack of enthusiasm for the effects of decoupling measures.

96. American Recovery and Reinvestment Act, Pub. L. No. 111-5, § 410, 123 Stat. 115, 147 (2009); see also Tomasovic, *supra* note 95, at 177 (noting that the final version of the bill softened any pressure on states to “adopt or experiment with decoupling measures” in order to receive \$3.1 billion in state grants).

97. For further discussion of revenue decoupling, see ENERGY EFFICIENCY HANDBOOK, *supra* note 90, at 31–35.

98. *Id.* at 33 (noting that this approach has been critiqued for failing to remove utility incentives to invest in supply-side resources and being subject to strategic gaming by utilities).

meets some annual NDR target, regulators might provide that firm a more beneficial rate of return in approving its rates. Or if the utility fails to meet an annual NDR target, regulators might penalize the firm by reducing its rate of return. This approach directly incentivizes the firm to focus on NDR in its business decisions.⁹⁹

Another approach, akin to the social cost approach discussed above, is to build the benefits from NDR more directly into the pricing of electricity by directly decoupling revenue from sales prior to the point of sale. For example, firms could explicitly propose to produce “negawatts” (basically, a reduction in capacity corresponding to a decrease in demand) and could be compensated for the costs of the negawatts in the same way they are compensated for building a new power plant or expanding the plant’s operation. The costs might include the opportunity cost of lost sales, since the firm might suffer some short-term financial losses due to demand reduction. The basic point is that if negawatt investments are built into a utility’s rate base, competing side by side with alternatives such as building a new power plant, this will challenge the firm to consider NDR along with base load power options in its business decisions.

Whatever policy instrument is chosen as a vehicle for implementing it, revenue decoupling rejects the conventional emphasis on volumetric rates. Decoupling also has important implications for changing firm behavior and consumer perceptions; when revenue is decoupled from sales, it can be recoupled to some other goal, such as improved efficiency or the climate change benefits from NDR. With decoupling, firms are less likely to focus on investing in base load power plants and allocating these costs among customers, a cycle that volumetric rates reinforce. For electric distribution utilities, building new base load capacity would no longer be seen as the only guaranteed revenue source. Investing in conservation and efficiency programs would now be seen as equally significant to the bottom line of the firm.

With revenue decoupling, customers also are less likely to focus on low rates, especially if firms offer incentives to reduce energy usage in order to share in the rewards of NDR. This can be viewed as a type of “decoupling-plus.”¹⁰⁰ Shared savings programs such as the decoupling-plus approach adopted in California have analogues in

99. For an example based on an experience in Idaho, see Ralph Cavanagh, *Graphs, Words, and Deeds: Reflections on Commissioner Rosenfeld and California’s Energy Efficiency Leadership*, INNOVATIONS, Fall 2009, at App. (paid subscription required).

100. See Sachs, *supra* note 8, at 316 (discussing California’s efforts to supplement decoupling and characterizing this effort as a type of shared savings).

health care regulation and can take many forms.¹⁰¹ For example, a decoupling approach might invite nonutility energy services firms to sell demand reduction or efficiency directly to consumers (e.g., Energy Service Companies or “ESCOs” at the industrial, small business, and household scales). Large industrial and commercial customers have achieved substantial savings from the use of ESCOs. A collective action problem, however, discourages the spread of the ESCO approach to small businesses and residential customers. Once the savings are aggregated, they may be large enough to make it attractive to invest in the services they provide, which again highlights the significance of the utility’s selling power.

Revenue decoupling has strengths and weaknesses in terms of political viability and policy implications. Many details need to be resolved, including how incentives are allocated between utilities and customers and who will pay for NDR. Still, revenue decoupling ultimately merits serious consideration alongside both social cost and performance standard approaches to demand reduction. It also has advantages over alternative approaches. One advantage is that it is the only option that directly confronts both the low-rate approach of volumetric pricing and the reliability approach that favors investments in base load plants by utilities. Revenue decoupling

101. Health care regulators confront a comparable problem: how to create incentives for hospitals and doctors to sell less of their product—health care. They have turned to the shared savings model as well. For example, the Accountable Care Organization Demonstration Project (“ACO”), established by the Patient Protection and Affordable Care Act, is a new Medicare program designed to achieve quality and savings improvements in healthcare by efficiently coordinating primary care doctors, specialists, hospitals, and other providers. News Release, Dept’t of Health and Human Servs., HHS Announces New Incentives for Providers to Work Together Through Accountable Care Organizations When Caring for People with Medicare (Oct. 20, 2011), *available at* <http://www.hhs.gov/news/press/2011pres/10/20111020a.html>. The coordinating providers are encouraged to participate in the program through a shared savings model. See Mark McClellan et al., *A National Strategy to Put Accountable Care into Practice*, 29 HEALTH AFF. 982, 983–84 (2010), *available at* <http://content.healthaffairs.org/content/29/5/982.abstract> (noting that the ACO model builds on similar shared savings initiatives that Medicare has implemented in the past several years). The Patient Protection and Affordable Care Act states that “the Secretary shall establish a shared savings program . . . that promotes accountability for a patient population and coordinates items and services . . . and encourages investment in infrastructure and redesigned care processes for high quality and efficient service delivery.” 42 U.S.C. § 1395jjj(a)(1) (2011). Eligible providers may opt into the ACO program but they must “be willing to become accountable for the quality, cost, and overall care of the Medicare fee-for-service beneficiaries assigned to it.” *Id.* § 1395jjj(b)(2)(A). Under the ACO program, the Secretary sets savings benchmarks based on “average per capita Medicare expenditures . . . adjusted for beneficiary characteristics” and also sets “quality performance standards to assess the quality of care furnished by ACOs.” *Id.* § 1395jjj(b)(3)(c)–(d)(1)(b). However, “ACOs will only share in savings if they meet both the quality performance standards and generate shareable savings.” 76 Fed. Reg. 67,801, 67,804 (Nov. 2, 2011) (to be codified at 42 C.F.R. pt. 425).

provides an opportunity to address incentives for some customers and to allow them to share in the savings. Decoupling also may be the only option that is likely to overcome utilities' emphasis on volumetric rates and on investment in base load plants, as well as the emphasis among PUCs on low consumer rates, as opposed to low total consumer expenditures.

IV. CONCLUSION

For many decades, the goal of efficient provision of supply based on an assumption of continued demand growth was considered sacrosanct in utility regulation. An emerging new approach focuses on reducing externalities from supply, challenging the longstanding assumption of demand growth on which many regulatory solutions have been built.¹⁰² Assumed growth in demand limits how firms and regulators see their options in approaching low-carbon sources of supply.

A full transformation in the scholarship and the industry may not occur until a new generation of scholars and decisionmakers are in place who view the electricity regulatory goal not simply as a matter of efficient supply, with efficiency narrowly defined to exclude consideration of effects that are not priced, such as carbon emissions. But initial movement is underway. In recent years, a growing literature has examined how a combination of legal, economic, and social influences can reduce the growth in energy demand.¹⁰³ This literature suggests that the demand side of the equation is as important as the supply side, but this literature has focused largely on the incentives of households and other consumers, not on the incentives of utilities, the key gatekeepers for demand reduction.

Our logic is simple. The scientific consensus is that catastrophic climate change poses a genuine threat and that substantial reductions in global carbon emissions are necessary over the next several decades. Energy supply accounts for by far the largest source of carbon emissions. Energy experts project that global energy demand will double by 2050 if we follow the business-as-usual path.

102. This is occurring with water supply and demand as well. *See* Gleick, *supra* note 37, at 1525–26 (discussing a new approach to water services that shifts focus away from decades of inconsistent demand projections to one that relies on the users' needs).

103. *See generally* Dernbach, *supra* note 8, at 10003 (evaluating a range of legal and policy tools to promote greater efficiency and conservation of energy in the United States); Vandenbergh & Steinemann, *supra* note 8, at 1674–75 (relying on norms theory and empirical studies to propose legal reforms for reducing individual contributions to greenhouse gas emissions).

Energy experts also suggest that major carbon emissions reductions are possible from a variety of low-carbon and non-carbon-emitting sources, but that it is unrealistic to assume that these sources will be able to displace existing fossil fuel sources and keep up with the anticipated growth in energy demand. Some miraculous technological fix could solve this problem, but energy experts are doubtful that this will occur. The physics of energy and the scope of the energy infrastructure are such that a single miraculous breakthrough or group of breakthroughs is unlikely to occur and to be deployed at the scale and in the time necessary.¹⁰⁴

Something has to give. Countries will either miss their carbon emissions targets (and hope the consensus targets were too conservative), or they will need to invest in reducing demand as well as increasing the supply of low-carbon energy sources. For the most part, the United States has focused on the supply side. Regulators and firms have made some investments in low-carbon energy supply and have taken occasional steps to reduce demand, but they have not treated demand reduction as a priority at the federal level or in many states and localities.

We argue not only that legal and policy interventions can affect demand growth, but also that policymakers should recognize the important gatekeeping role that utilities play for the uptake of various efficiency and conservation measures. Electricity distributors alone probably cannot induce households to achieve an adequate level of NDR, but they are an essential intermediary. Yet in most U.S. jurisdictions, electricity distributors lack the financial incentives to achieve widespread success with NDR programs. Instead, the regulatory structure induces these utilities to view NDR as revenue erosion. Programs that provide financial or social incentives for households to reduce demand will not achieve their potential if electricity distributors do not consistently face incentives to sell less electricity—or at least no longer face incentives to sell more electricity to finance their base load plant investments.

Many law and policy options are available for shifting utilities' incentives to induce reduced household energy demand. We do not believe the choice of a specific regulatory intervention is as important as the conceptual shift toward recognizing the need to treat NDR as an important goal and to provide ongoing incentives for utilities to pursue NDR with gusto. Once regulators and firms begin to make the conceptual shift, the policy debate is more likely to yield productive

104. See, e.g., Nathan Lewis, *Toward Cost-Effective Solar Energy Use*, 315 SCIENCE 798, 798–801 (2007) (discussing the challenges facing the widespread implementation of solar energy).

regulatory changes. To the extent regulatory changes are possible, some mix of shared savings and other approaches may create sufficient incentives for utilities to view demand reduction not as “good for you, bad for us,” but as “good for you, good for us.”