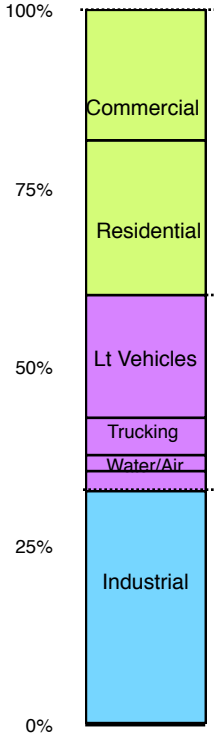
Rocky Mountain Institute: Top Federal Energy Policy Goals

Together, these 17 goals can reduce U.S. oil use and greenhouse gas emissions each by 50% in 10 years—while creating over three million jobs in the next four years, and rapidly generate economic benefit for the nation.

U.S. 2007 Energy Demand



Demand Side Top Goals for 2020

CO_2e reduction

Commercial and Residential Buildings — 14%

1. Government incentives are strong enough to ignite retrofits for existing buildings.
2. All new buildings are constructed on a path to exceed the 2030 Challenge.

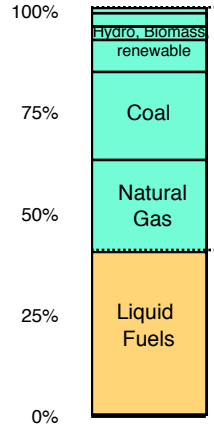
Transport — 14%

3. Federal feebate legislation is enacted in conjunction with scrap-and-trade programs.
4. All new U.S. vehicles get at least 50MPGe by 2020 (and OEMs are incentivized to transform).
5. An open-source national infrastructure for plug-in vehicles accelerates penetration.
6. New trucks get double the fuel economy of today's, and are on the way to triple efficiency.

Industrial — 11%

7. Distributed generation (including combined heat and power) competes fairly.
8. Industrial efficiency is incentivized, slowing off-shoring.

U.S. 2007 Energy Supply



Supply Side Top Goals for 2020

Electricity and Heat — 7%

9. A stable market for renewables enables growth.
10. Renewables and distributed generation are integrated seamlessly and cheaply onto the grid.
11. Energy efficiency competes fairly in the energy and capacity markets.

Liquid Fuels — 5%

12. The United States only uses biofuels that do not degrade soil fertility.

Overarching Top Goals for 2020 — *n/a*

13. The Smart Grid is installed, enhancing energy security, enabling distributed resources, and integrating electrified vehicles.
14. Better electricity end-use data are available.
15. A new corps of workers is trained to power the clean energy economy.
16. All energy subsidies are consistently reviewed, transparently displayed, and thoroughly addressed.
17. Government purchasing power spurs the clean energy economy.

Rocky Mountain Institute

Introduction

The Obama-Biden team endorses IPCC's target of reducing greenhouse gas emissions 80% below 2000 levels by 2050. Federal focus on saving, reducing fossil fuels, and decarbonizing remaining fuels for mobility and electricity[1] will achieve this while advancing economic renewal, oil independence, and broader energy security.[2] In this memo, Rocky Mountain Institute (RMI)—an independent, nonprofit, trans-ideological think-and-do tank—outlines 17 ways the U.S. can cut greenhouse gas emissions ~50% or more by 2020 and establish conditions for realistically and profitably achieving the 80% goal by 2050. In addition, we estimate these 17 suggestions will save 50% of our oil use by 2020, and create over three million jobs by 2012. While our memo does ask for significant upfront spending, all of these investments will rapidly generate economic benefit to the nation.

RMI has worked for decades on issues touching almost every facet of energy use, and supported extensive private-sector advances in energy efficiency and clean supplies. Many of these goals draw from and update three of our past publications, which are free and available to those interested in more detail.[3]

We assume carbon will be priced. That's important but not sufficient. We therefore emphasize here some policy instruments and reframings that complement and potentiate proper pricing. We strongly recommend that "barrier-busting"—systematically turning market failures in buying energy efficiency into business opportunities, so that citizens can respond intelligently to price signals—move to the top of the policy agenda. Economic theorists tend to undervalue barrier-busting because they think market failures are unimportant. As practitioners who strive to surmount those barriers every day, our experience is different and compels a different emphasis.

This experience also suggests that the climate conversation urgently needs three key shifts:

• *climate protection is not costly but profitable*: saving energy costs less than buying it (efficiency is cheaper than fuel), and much climate-safe supply already beats fossil fuels even at zero carbon price;[4]

• *focus on outcomes, not motives*: many people not worried about climate do care about national security or economic strength or both—but pursuing those goals can yield precisely the same results, greatly broadening the constituency for climate protection.

• *reduce demand first, then substitute supply:* this path is almost universally more profitable and practical. Efficiency is the key to reducing demand. Its biggest levers are building retrofits, efficient vehicles, and industrial efficiency. Next, we need to move to a renewable energy-based economy by providing nondiscriminatory rules, a more stable demand and capital environment, and integration support.

To declare our biases, we think a sensible framework for U.S. energy policy would allow and require all ways to save or produce energy to compete fairly, at honest prices, regardless of their type, tech-

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[1] Currently, energy use accounts for 88% of U.S. CO_{2e} emissions. The other major categories are land-use change and methane emissions not related to energy.

[2] http://rmi.org/images/PDFs/Energy/E06-02_SenateTestimony.pdf. This Senate Energy Committee testimony, explains our view of energy security.

[3] (1) http://move.rmi.org/oilendgame gives a detailed, transparent, uncontroverted, Pentagon-cosponsored 2004 roadmap, *Winning the Oil Endgame*, for eliminating U.S. oil use (not just imports) by the 2040s at an average cost of $15/bbl (2000 $), led by business for profit. (2) www.smallisprofitable.org gives a 2002 *Economist* book of the year showing how 207 hidden benefits make distributed electrical resources (demand- or supply-side) typically about 10x more valuable. This book sets out our detailed agenda for reforming the U.S. electricity system. (3) http://move.rmi.org/files/smartgarage/SmartGarage_CharretteReport_v1.1beta_11.10.08.pdf, RMI's 2008 *Smart Garage Charrette Report,* organizes industry and policy thinking about how electrified road vehicles, buildings, and a smart electric grid can exchange electrons and information to create important new forms of value for all parties, thus bridging the worlds—previously almost unrelated—of electricity and oil.

[4] http://www.sciam.com/article.cfm?id=more-profit-with-less-car: RMI's *Scientific American* 2005 article "More Profit With Less Carbon" is a useful lay summary of why climate protection is not costly but profitable.

nology, size, location, or ownership. That is largely the opposite of existing policy, but fits most fossil-fuel advocates' professed doctrine. If faithfully followed, it would yield very large, fast, and profitable reductions in fossil carbon emissions while comprehensively enhancing energy security.

Government leaders have already recognized and begun to move on some goals presented here. Where our suggestions differ from more commonly discussed ones, it's usually because we've consistently emphasized reducing energy demand first through efficiency, and then substituting cleaner energy supply, and because our assessment is based on our own real-world experience, pushing for the most aggressive goals while remaining practical and profitable.[5]

At RMI we are practitioners, not theorists; we do solutions, not problems; and we do transformation, not incrementalism. Our goals address the biggest sectors in energy demand and supply (as shown in the figure on page 1). The body of this memo lists enablers for each goal that can be executed in the next four years, including some lesser policies not in the main list.

Achieving these goals requires significant political, regulatory, and institutional changes. We selected the goals in this document based on the following criteria:

1. These are goals, *not* specific policies; they attack the biggest barriers that we see as practitioners, and could be turned into actionable laws and rules by expert policy makers.
2. They'll significantly reduce energy use, greenhouse gas emissions, and energy insecurity.
3. Wherever possible, they leverage change in several sectors simultaneously.
4. They're designed to achieve diverse and valuable non-energy side-benefits, including good jobs.
5. They reflect RMI's expertise and areas of most innovative thinking.
6. They reflect growing international alignment, especially among business leaders, on what must be done.
7. They can be addressed by federal-level policy, while not trying to do what is better done by subnational and local policy, or by the very dynamic forces of innovation in technology, design, and businesses' competitive strategy.

Deeper discussion of each of our ideas can be found in the cited literature.

For more information about any of the goals and enablers, as well as details on our assumptions and methodology for our quantification, please contact Rocky Mountain Institute:

Overarching goals and transportation: Laura Schewel (lschewel@rmi.org)

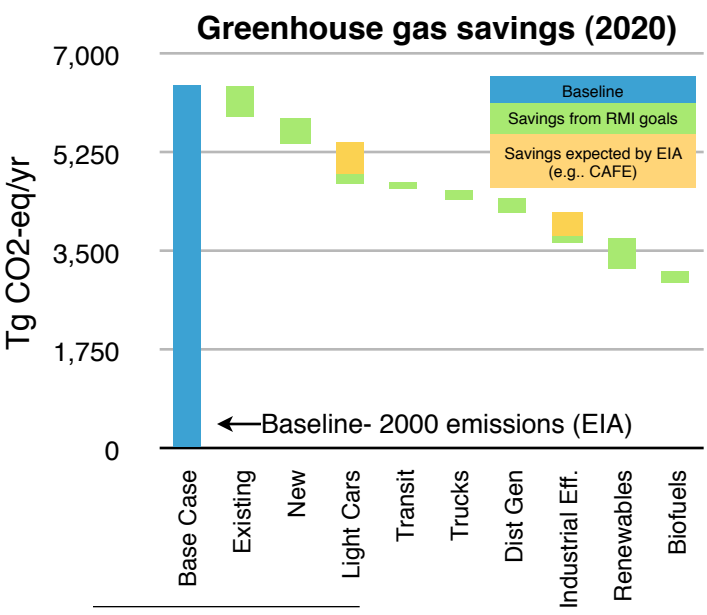
Electricity, heat, and industry: Virginia Lacy (vlacy@rmi.org) and Mathias Bell (mbell@rmi.org)

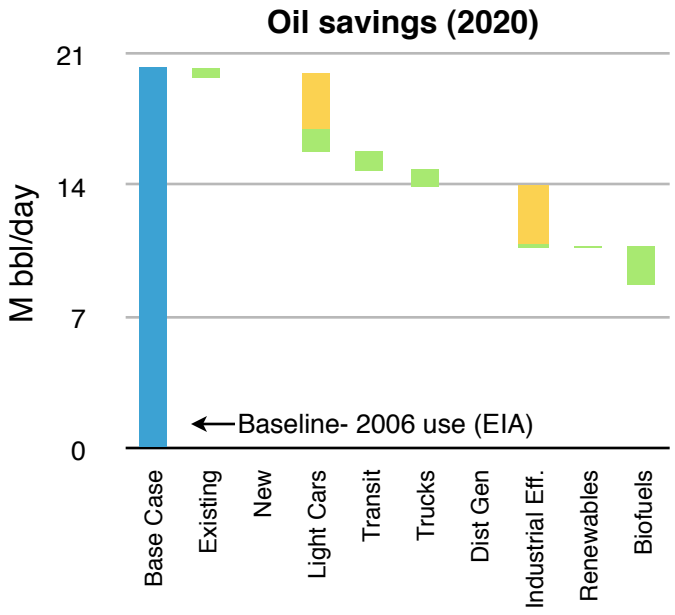
Buildings: Caroline Fluhrer (cfluhrer@rmi.org) and Eric Maurer (emaurer@rmi.org)

[5] http://www.rmi.org/images/PDFs/Energy/E05-16_EnergyEndUseEff.pdf: "Energy End-Use Efficiency," a 2005 RMI white paper commissioned by Steve Chu, summarizes the astonishing potential of modern energy efficiency. For further detail, see RMI's five 2007 public lectures at Stanford's School of Engineering (www.rmi.org/stanford).

Estimates of Quantitative Impact[6]

#	Goal	CO_2-eq	Oil	Jobs-2012
	[unit]	*In 2020, 2000 baseline*	*In 2020, 2006 baseline*	*Net new jobs in 2012*
1	Existing buildings	8%	2%	1,000,000
2	New buildings	6%		700,000
	Expected savings, CAFE	8%	14%	
3	Feebate/scrap and trade	2%	4%	600,000
4	50 mpg-e*	1%	2%	*(incl. above)*
5	Plug-in infrastructure	*(included in 50 mpg-e)*		
6	2x Trucks	2%	4%	100,000
7	Distributed Generation	3%		
8	Industrial Efficiency**	8%	15%	500,000
9&10	Renewables	7%	1%	200,000
11	Efficiency		See 1, 2, 8	
12	Biofuels***	5%	10%	100,000
13	Smart Grid			
13 to 15	*Enablers support the above recommendations are are not quantifiable.*			
	TOTAL	**50%**	**52%**	**3,200,000**





[6] Our calculations are estimates and include the most important factors affecting each policy. We did not include indirect benefits such as improved health or ecosystem services. We welcome discussion of these calculations.

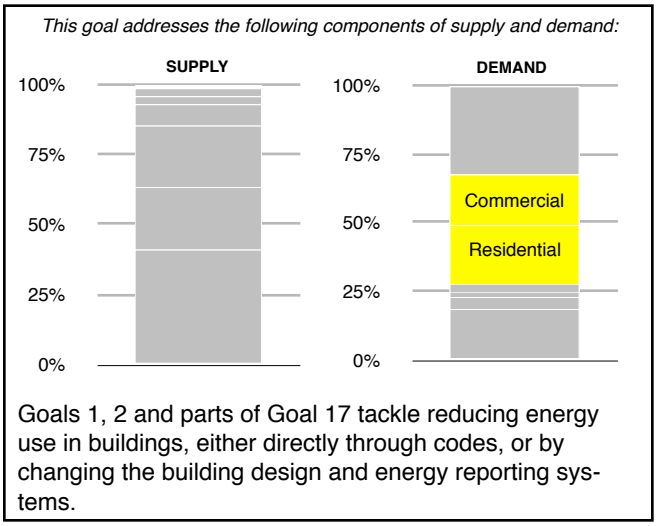
*We calculated the additional benefit of a 50 mpg-e target after accelerating fleet turnover. Because of turnover, targets for new cars and trucks take many years to accrue benefits.

** The EIA predicts a significant loss of industrial facilities, reducing projections of this sector's emissions and oil use. Our approaches can achieve similar benefits, while maintaining the current industrial sector size.

*** The biofuels sector is very difficult to predict over 10 or 25 years. We assumed the market will weed out all biofuels that cost more than petroleum, making biofuels net neutral over 25 years (though shift money from petroleum to agriculture, creating jobs).

Goal 1: Government Incentives are Strong Enough to Ignite Retrofits for Existing Buildings

Most of the American buildings that will exist in 2020 have already been built. Hardly any are cost-effectively efficient; quite a few are decrepit. Yet in our experience of designing or retrofitting upwards of a thousand diverse buildings, the current set of government incentives is not strong enough to spur much building energy efficiency retrofitting, because its financial benefits are offset by several dozen well-known barriers and hassles.



Goals 1, 2 and parts of Goal 17 tackle reducing energy use in buildings, either directly through codes, or by changing the building design and energy reporting systems.

4-year enablers:

- Increase and streamline federal incentives for efficiency retrofits for technologies such as insulation, efficient appliances, and advanced windows; current incentives are inadequate and are too bureaucratically cumbersome to spur significant demand;
- For new buildings, 50%+ energy savings can often be *less* expensive than saving less or nothing, because costly capital equipment (such as air conditioning) can often be made smaller or even eliminated. This benefit of integrative design—yielding expanding, not diminishing, returns to investments in energy efficiency—can often apply to retrofits too, *if and only if coordinated with other repairs, renovations, and upgrades that are occurring anyhow*, such as renewing a building's mechanical equipment or façade. To capture this benefit, a major policy goal should be to help cities build GIS databases like Chicago's that pinpoint each building's size, program, vintage, and energy intensity—then (as Chicago intends to do) overlays the dates when major renovations are due, so a whole-building retrofit can, with due lead time, be sold to the owner in conjunction, slashing total costs. For example, such coordination, in an 20-year-old 200,000-ft^2 curtainwall office tower near Chicago, offered a design energy saving of 75% slightly *cheaper* than the routinely required renovation that saved nothing;
- Absent such multipurpose installations, the first 20% of retrofitted efficiency is often cheaper than the second or third 20%. Many installers stop well short of the total savings available by applying too narrow a marginal-cost approach. But at least Federally aided retrofits should require and reward the maximum savings cost-effective *as a package*. In particular, energy-service companies (ESCOs) often "cream-skim," capturing only the cheapest slice of the efficiency resource in a way that makes the rest economically unavailable. Federal programs should prohibit this;
- In larger buildings and programs that justify statistical sampling techniques or individual post-hoc audits, divide federal tax incentives for efficiency to ensure that predicted savings are actually achieved: pay part the incentive on installation and the rest on verification;
- Require energy scorecards (analogous to the German "energy passport" system) for all buildings to inform landlords, lessors, and buyers. Use this scorecard to determine federal incentive or other financing qualifications. Require that a simple score or its equivalent (like a star system) appear on each "for sale" or "for rent" sign or advertisement, just as cars and appliances now bear efficiency-rating stickers.

Note: a key enabler is also using federal buildings to lead by example for building retrofits. This is discussed in Goal 17: Federal Purchasing Power Spurs the Clean Energy Economy.

Goal 2: All New Buildings Are Constructed on a Path to Exceed the 2030 Challenge

It is significantly easier and cheaper to save greenhouse gases by building them right the first time than by retrofitting them later. The 2030 challenge is a set of aggressive but achievable building energy use goals from Architecture 2030 Challenge.[7] RMI feels that the 2030 Challenge should be the minimum goal for new buildings.

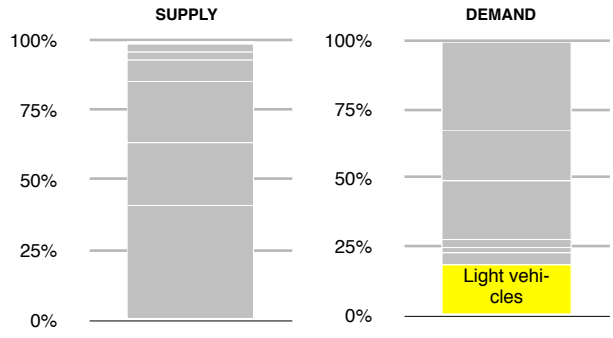
4-year Enablers:

- Immediately implement best-in-class building codes for all new buildings. For minimum energy codes approved by a thorough consensus process, we recommend ASHRAE 90.1-2007 for commercial buildings and IECC 2006 for residential buildings;
- Create minimum benchmarks for new buildings every two to three years, on a pace to meet the 2030 Challenge. Provide incentives for buildings that meet or exceed benchmarks;
- Help consumers make informed energy choices by requiring real-time/online energy use feedback capabilities in new buildings, analogous to a real-time mpg display in a car;
    - Akin to a key enabler of California's Title 24 building standards, implement a national research project to create benchmarks for different building types in different climate zones. Create a point system (an "evaporated computer model" that scores points for each building attribute, like how much area of windows with what insulating and heat-blocking properties are facing in which directions) to predict building performance in a given climate zone. Make this point system transparent and easy to access. Explore the possibility of using it to create progressive incentives such as "feebates" for buildings (see Goal 3 for more on feebates): a new building would pay a hookup fee or get a rebate depending on how efficient it is, and the fees would pay for the rebates. Unlike energy codes, which are obsolete before the ink is dry and give no incentive to do better, feebates drive continuous improvement.
- Fund training and education of architects, building inspectors, engineers, electricians and other relevant professions and trades about more efficient building design, construction practices, and retrofitting. Only a few vocational and technical schools in the country currently teach weatherization; all should.

Goal 3. Federal Feebate Legislation for Light Vehicles, Coupled with a Low-income Scrap-and-Replace Program Accelerates Turnover

A feebate is a simple but powerful, effective, and attractive incentive policy that drives continuous improvement of automotive fuel economy and greenhouse gas emissions. Inefficient vehicles incur a surcharge (FEE-), and efficient vehicles are granted a rebate (-BATE) based on how much less or more efficient the vehicle is than a given "pivot point." The pivot point can be based on fuel economy (mpg) or other metrics such as greenhouse gas emissions per mile. We recommend that the pivot point, fee, and rebate be set separately for each size class, so that buyers are rewarded for choosing a more efficient vehicle of the size they want rather than another size. We also recommend

[7] http://www.architecture2030.org/



Light vehicle use is the largest consumer of liquid fuels. Feebates and accelerated turn-over combined with technologies such as lightweighting and electrification can help get the new fleet to 50 MPGe by 2020.

revenue-neutrality, so fees on inefficient vehicles pay for rebates on efficient vehicles. Feebates are market-based, allowing manufacturers to decide how much efficiency to offer and how; they simply widen the price spread between more and less efficient vehicles so buyers will consider lifecycle fuel savings, not just the first year or two. RMI's and others' analyses show that feebates have the potential to accelerate the production and adoption of more efficient vehicles faster than current CAFE legislation, with wider political attractiveness and higher profits for automakers (as some of them are starting to figure out). Details are in *Winning the Oil Endgame*, pp. 186-190.

Senators Feinstein, Schumer, and Collins have recently proposed a scrap-and-replace bill. We applaud many of the components of this proposal, notably the tiered incentives based on model year and efficiency, and the public transit allowance option. We suggest adding a few components, notably an emphasis on lower-income Americans and fleet purchasing of new vehicles and fuel. A scrap-and-replace program can address lower-income Americans' limited personal mobility and disproportionately burdensome fuel purchases, and their inability both to gain from and to contribute to the prompt benefits of a new generation of efficient vehicles. It also accelerates the adoption of new, more efficient vehicles. Creatively financing low-income households' purchase of very efficient new cars (with bundled insurance and a way to buy price-hedged gasoline piggybacked on DESC's hedges) can greatly increase access to jobs while making basic mobility affordable and reliable in areas with poor or no public transport. Together, these policies would create a new million-car-a-year market from customers who could never previously afford a new car—a way to help struggling buyers and sellers simultaneously. Details are in *Winning the Oil Endgame*, pp. 191-197.

Both of these policies will serve to accelerate vehicle turnover: doubling turnover between now and 2020 will reduce oil use and greenhouse gas emissions more in 2020 than raising CAFE to 50 mpg (without accelerated turnover). Both approaches are necessary to achieve 2050 goals, but the importance of fleet turnover for rapid results is often neglected.

4-Year Enablers

- Initiate a study (in collaboration with automotive OEMs) to optimize feebate mechanisms (size class-based or not, continuous or stepped, revenue-neutral or not, etc.).[8] We recommend that feebates be revenue-neutral, technology-neutral, and size-neutral so as to enhance and not distort customer choice, and that feebates apply the same slope ($/gpm) to each and every new light vehicle without exception, but with a separate pivot point for vehicles based on their size (not weight). The analysis should consider whether feebates will apply at point-of-purchase, point-of-registration, or to manufacturers; should consider how best to update the pivot point annually (and preferably automatically) to drive continuous improvement; and should include analysis of current Canadian and French feebates. The 2008 French system proved such an instant success that the government wants to extend it to 20 other products. After designing and passing feebate legislation, industry and customers will need at least a one-year "trial run" period with virtual (no cash actually exchanged) feebates to prepare and get used to the new structure, and to refine pivot point and ensure revenue neutrality. It may be useful to pilot feebates at a state or regional level before going nationwide;

[8] See http://www.rmi.org/images/PDFs/Transportation/Feebate_final.pdf for detailed calculations on the impact of feebates and contact the authors for details on our collaborative Feebate Forum, held in 2007.

- Authorize NHTSA to extend its size-based metric for CAFE standards from light trucks to new cars. Encourage discussions of this approach with the EU, which unwisely adopted a weight-based standard (thus encouraging the "mass arms race" that in our view will waste more oil, emit more carbon, and degrade highway safety): without harmonization, manufacturers can face two conflicting regulatory philosophies;
- Similarly, feebates overlap but must not conflict with CAFE. We would prefer to see feebates overtake CAFE in effectiveness and thus gradually render contentious CAFE levels moot;
- Scrap: a federal agency defines qualifying levels of inefficiency and provides "cash for clunkers" to pay customers or bounty-hunters who find and scrap these vehicles;
- Replace (1): A federal agency such as GSA procures efficient vehicles at high volumes and lower cost (with fair margin to OEM). It then leases these to qualified non-credit-worthy low-income citizens who agree to scrap their older cars;
    - Potentially this program could bulk-buy price hedged gasoline for participants, akin to many large private fleets.
- Replace (2): For buyers with marginal credit who might not otherwise buy a new car, the government guarantee reimbursement to current auto lenders for incremental defaults on loans made to marginal new-car borrowers, if they agree to purchase very efficiency vehicles.

Goal 4: All New Light-Duty Vehicles Get At Least 50mpg(e)[9]

RMI's research, including major work within the industry, has shown that it is economically and technically feasible for full-line OEMs to achieve a 50 mpg average fuel economy by 2020, even using harmonic (CAFE) averages—without changing the size mix of the fleet—via a mix of conventional improvements plus electrification, and all with a significantly positive ROI equating to an "avoided cost" of gasoline below $2.00 a gallon. Because developing and producing a car takes time, action is necessary today to get efficient vehicles on the road promptly and in meaningful numbers.

4-year Enablers:

- Make capital available to automakers to help develop, retool, buy components and commit purchases for at least 50% more efficient vehicles (raised from 25%). New components (such as batteries) will probably be more expensive than retooling costs;
    - Any additional help to automakers should be accompanied by strong incentives for transformational change in fleet offerings as soon as possible: for example, 50% debt forgiveness if all vehicles produced in 2015 achieve 75 mpg. We recommend a formula be devised that progressively forgives "bailout" debt according to vehicle sales, favoring quicker time to market and bigger mpg gains. The foregone repayments should be rationally related to social benefits achieved. We believe such an incentive structure is vital to support those in the industry who rightly argue that incrementalism is the high-risk strategy, but whose colleagues often view any departure from the survival plan as a risky distraction. We suggest an incentive striking enough to elicit and reward the boldness like Detroit showed when, in 1942–43, it switched in *six months* from making cars to making the materiel that helped win World War II.
- Build domestic manufacturing capacity for key components that include but are not limited to advanced batteries, electronics, and controls;

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[9] Miles per gallon gasoline-equivalent (using NHTSA/EPA's combined city-highway test protocol).

- Retrain workers to manufacture advanced vehicles and their components;
- Show automakers that there will be a predictable minimum demand for these vehicles from the federally owned fleet (and where possible, use the promise of that demand to finance some up-front costs). See Goal 17 for more;
- Build any necessary new refueling infrastructure in advance, and educate consumers about how to use it (see open-source plug-in infrastructure, below);
- With a short (roughly two- to three-year) lead time (since major automakers already make nearly all their Brazilian cars this way at no extra cost), require that all new light-duty vehicles sold in the US be "total-flex," *i.e.* able to burn cleanly and efficiently any fuel from neat alcohol to pure gasoline. (Actual offerings will depend on climate and other regional details as well as on global fuel markets. Total-flex fleets eliminate captive customers and thus exert strong price discipline on alt-fuel providers—a key to the success of Brazilian ethanol.);
- Devise, test, and enact feebates and scrap-and-replace (see above);
- Require fuel economy real-time feedback monitors in new cars to encourage "eco-driving";
- Do not neglect support for public transit and walking/biking, which can save 20–100% of fuel per person-mile;
- Offer model codes to start desubsidizing and unmandating sprawl, and to desocialize the cost of cars and driving. Drivers should get what they pay for but also pay for what they get—a basic equity issue for the one-third or more of Americans who are too old, young, poor, or infirm to drive, yet must still pay for roads and other car-caused costs through their taxes.

Goal 5: A National, Open-Source Plug-in Vehicle Infrastructure Accelerates Penetration

President-elect Obama, major environmental policy groups, and many congressional representatives have all expressed interest in supporting vehicle electrification (from pure battery EVs to PHEVs to EREVs). Electrified vehicles uniquely both reduce demand (by increasing vehicle efficiency) *and* substitute cleaner energy supply. The federal government can support vehicle electrification by building charging infrastructure and incentivizing purchase of plug-ins to ensure its use.[10]

RMI recommends the federal government support local/regional actors to build out most of the enablers below in a manner that best fits their needs and habits, while maintaining national standards, where necessary. This approach will allow for critical flexibility and innovation, while maintaining interoperability.

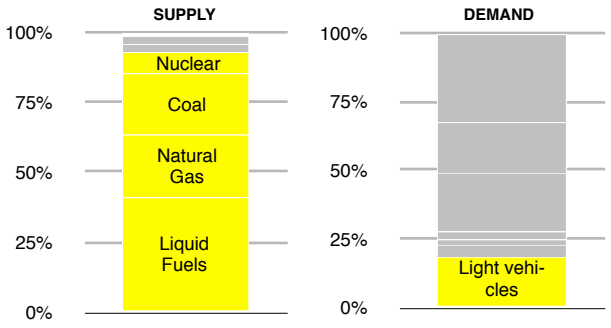
4-year Enablers:

- Provide capital for home charging stations, directly to consumers;
- Provide capital to municipalities and counties for wiring public charge stations (the "last six feet" of connection);
    - Partner with other stakeholders such as utilities and employers to install public charge stations, with a minimum Level-2 charge and adhering to relevant accepted open standards;

[10] For more in-depth discussion of the barriers and solutions related to vehicle electrification, and our vision for integrated grid, building, and transportation energy systems, please see our Smart Garage Charrette report, based on a workshop with 80 leaders in industry: http://www.move.rmi.org/files/smartgarage/SmartGarage_CharretteReport_v1.1beta_11.10.08.pdf

- Support standards and set aggressive targets for organizations working on plug and communication standards to complete their standards. Encourage national adoption of an open-source standard to ensure interoperability, accelerate economies of scale, and foster entrepreneurship (this may mean more federal top-down directives to utilities than are currently the norm);
- Install sub-meters nationally, if not a national Smart Grid (see Goals 13 and 14);
- Fund the writing of an example plug-in ready electric code and guidelines for fast-tracking permitting for charge stations;
- Fund the writing of plug-in vehicle maintenance, crash/fire safety, and service training manuals, and support municipality-based training programs for public safety officials and supporting trades using these manuals;

This goal addresses the following components of supply and demand:

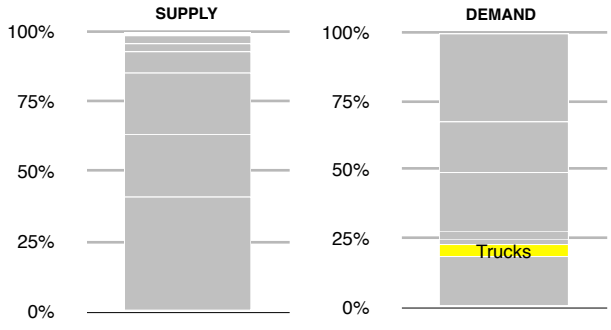


The infrastructure upgrades suggested here not only support improving vehicle efficiency and substituting electricity for petroleum, but also are relevant to leveraging plug-ins for renewables and building the Smart Grid.

- Help regions educate their citizens about why and how to use this infrastructure;
- Accelerate the penetration of plug-ins to utilize infrastructure:
  - Allow consumers to capture all combined relevant incentives (federal, state, home charger installation, etc.) at the point of purchase;
  - Use federal fleet purchasing power to jump-start market, test initial infrastructure, and prove demand to OEMs (see Goal 17);
  - Encourage innovative start-up OEMs by including them in incentives, federal fleet purchases, and ensuring infrastructure is open-source so small OEMs can adopt it too;
  - Encourage utilities to provide favorable (if not free) charging for plug-in vehicles during off-peak hours;
  - Urge PUCs to responsibly allow utilities to rate-base components of the infrastructure;
  - Ensure that government incentives reflect the end-goal of electrified vehicles (greenhouse gas, criteria air pollutant, and oil use reduction), not lesser goals such as battery size.

Goal 6: New Heavy Trucks Get Twice the Fuel Economy of Today's Trucks

The average fuel economy of a heavy truck has virtually flatlined for three decades. RMI's analyses of the heavy trucking sector[11] found many opportunities to increase the efficiency of Class 8 heavy trucks (18-wheelers), at a cost of below $1.00 per gallon of diesel saved. That cost, in theory, is attractive enough to stimulate private investment. However, RMI has seen in practice that the extremely low margins, constrained access to capital, and private risk aversion in the trucking sector all suboptimize or suppress these profitable efficiency investments.



Several policies could significantly reduce energy use in the trucking sector, the fastest growing sector in terms of petroleum use.

4-year Enablers:

- Raise the gross vehicle weight restriction (GVWR) to 110,000 lbs, the same as the European limit. This could cut fuel per ton-mile by 15–30%, as well as emissions and congestion[12], without damaging safety, roads, or bridges;
- Increase the truck standard from five to six axles (as in Canada and Europe) to improve efficiency per ton-mile and reduce the number of containers and depots;
- Provide incentives (either cash or fuel economy requirements) for truckers to use fuel-saving technologies, such as aerodynamic retrofit or original design improvements, wide-base tires and tire pressure controls, auxiliary power units, 55% thermally efficient engines (DOE's 2012 goal), and electrification for some heavy and more medium-duty trucks;
- Redirect government commercialization programs (*e.g.,* DOE's *Future Truck*) around creating at minimum a profitable, doubled efficiency truck around the principles of RMI's *Transformational Truck* analysis.

Goal 7: Distributed Generation (Including Combined Heat and Power) Competes Fairly

"Distributed" (decentralized) electrical resources such as small-scale solar panels, recapturing heat from industrial processes, and microturbines (natural gas) can save costs and reduce emissions from the electricity sector.[13] Properly recognizing their economic benefit will require regulatory and policy shifts, and should include valuing improvements to system planning, utility construction and operation (especially of the grid), and service quality, and avoided societal costs.

4-year Enablers:

- Have FERC create uniform national standards for distributed generation interconnect, akin to Texas's "plug-and-play rule" so any distributed generator whose interface meets the com-

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[11] See *Winning the Oil* Endgame, p. 73, and "Transformational Trucks: Determining the Energy Efficiency Limits of a Class-8 Tractor-Trailer," www.rmi.org/images/PDFs/Transportation/RMITransformational_Truck_Study_080709compressed.pdf.

[12] When Michigan raised its internal limits to 165,000 lbs, its biggest food-grade tanker fleet increased load per daily trip by 2.5, equivalent to raising efficiency from 5 to 12 mpg, *without* any of the technical improvements mentioned here.

[13] For details, see RMI's book *Small is Profitable*, www.smallisprofitable.org.

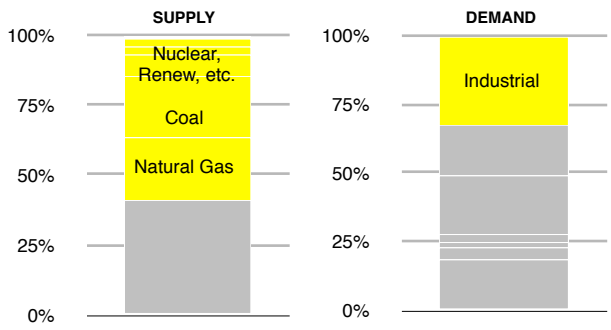
patibility and safety standards (UL, NEC, and IEEE 1547) may connect to the grid with no further utility requirements;

- Allow distributed resources (including demand-side bidding for negawatts) to participate in wholesale markets, as in the New England Power Pool today, and in ancillary service markets;

  - Increase access to information on the transmission system and wholesale markets.

- Remove discrimination against legitimate cogeneration projects—the U.S. badly lags in adopting combined-heat-and-power, long a standard practice in much of the world, and therefore throws away waste heat at its power plants that exceeds Japan's total energy use;[14]

This goal addresses the following components of supply and demand:



Distributed generation will enable many renewables to come on-line more easily, improve the efficiency of the electric grid, and improve efficiency for industrial applications.

- Enable distributed power producers to construct and use private wires to distribute power directly to their customers (currently a factory that pays to discard huge amounts of wasted heat, and could very profitably use it to make power and sell it over the fence to a neighboring factory, is prohibited by the utility's monopoly power from doing so, and must therefore sell at a low price to the utility, which resells to the neighbor at a high price, vitiating the potential value of the fuel-saving opportunity and erecting a needless barrier to competition);
- Create siting, permitting, and air quality processes that are appropriate to small-scale distributed generators (especially in air-quality non-attainment areas). Create use-specific (peaking *vs.* baseload) emissions standards for distributed generation;
- Clarify ownership rights to pollution (including CO_2) credits created by distributed generation;
- Change utility tariff structures to recognize the benefits distributed generation brings in deferred distribution capital costs, voltage support and reactive power, and improved reliability;
- Support locational marginal pricing for distributed resources (supply- and demand-side) so they can earn a "Dristan credit" by freeing up scarce grid capacity for other transactions;
- Provide incentives for the large-scale manufacturing of distributed generation technologies, such as wind, solar, stationary fuel cells, and microturbines (always following the principle, learned a great cost over the past few decades, of rewarding developers for producing energy, not for spending money);
- Provide incentives for the installation of distributed generation (differentiated to prefer cleaner and renewable options), or, preferably, require FERC and encourage state utility regulators to count all quantifiable "distributed benefits" in comparing projects;
- Prohibit utilities' widespread fine-print conditions that vitiate "net metering" by charging customers a higher rate for buying electricity than the utilities pay for buying it back at the same time and place;

[14] For more, please see *Small is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size.* www.smallisprofitable.org.

- Direct FERC and DOE to consider new policies to enhance energy security and avoid the serious risks that recently led the Defense Science Board[15] to recommend that all CONUS military bases get off the utility grid to obtain sufficiently reliable power by making it themselves; *e.g.*, distributed resources should be designed and run to be "islandable" (able to keep powering their loads with or without the grid) using consensus standards like IEEE 1547; real-estate developers should be encouraged or required to wire critical loads separately and in a way easily connectable to uninterruptible supplies such as rooftop photovoltaics (even if added later); and major new transmission lines (a major source of vulnerability) should be required to pass a "least-cost" test so they are not built if demand-side or distributed resources can do the same job cheaper and with equal or better security and reliability;
- Compensate utilities fairly, but not more, for providing standby and reliability services.

Goal 8: Industrial Efficiency is Incentivized, Slowing Off-shoring

Industry is a large user of energy and generator of waste. We recommend shifting the industrial sector towards a model informed by Industrial Ecology and Life Cycle Assessment, focused on closing cycles for materials, water, and energy. European countries have taken great strides in this direction, to producers' and consumers' great advantage, and we recommend study of their programs.

4-year Enablers:

- Revise tax code to allow investments in industrial energy efficiency to be expensed, rather than capitalized. This will put such investments on a financial level playing-field with the energy costs they save, and should be net-stimulative of the micro- and macroeconomies;
- Demonstrate and encourage performance-based fees for engineers, rewarding them for saving energy rather than for spending money;
- Require manufacturers to take life-time responsibility for their products, then let the market figure out how to meet most profitably their mandate to take care of products at the end-of-life (as in Germany): about 99.98% of the massflow in the U.S. economy is wasted either before or after use, and only 1% ends up in durable products—a vast business opportunity;[16]
- Identify, expose, and eliminate subsidies that encourage wasteful material use; this can indirectly save large amounts of energy for extracting, processing, moving, and using materials.

Goal 9: A Stable Market for Renewables Enables Growth

As with any industry, a consistent regulatory framework and market certainty is critical for rapid growth of the energy efficiency and renewable energy sectors. The boom-bust cycle experienced three times in the wind industry over the past decade is an excellent example of the barriers created by inconsistent policy, and shrank the once-dominant U.S. windpower industry to minority market share.

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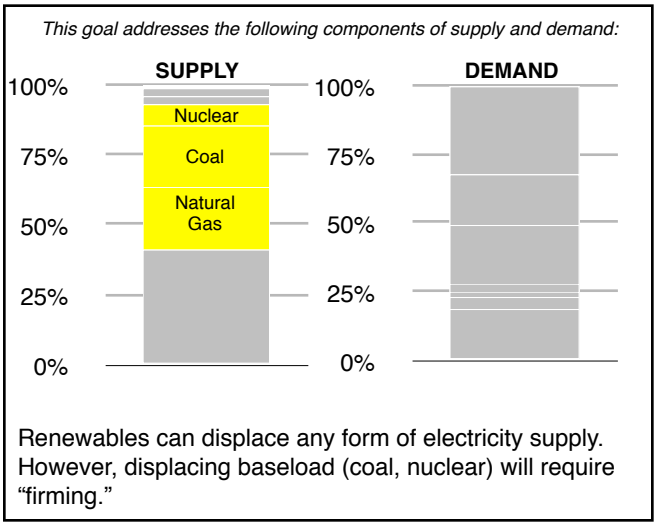
[15] Please see: *More Fight—Less Fuel,* Defense Science Board, 13 Feb. 2008, www.acq.osd.mil/dsb/reports/2008-02-ESTF.pdf

[16] *Natural Capitalism* (www.natcap.org)

4-year Enablers:

- Establish access to patient, low-interest capital for renewable energy or energy efficiency capital improvement projects repayable from energy savings at a social discount rate;
- Create *both* a National Energy Efficiency Resource Standard (EERS) *and* a separate National Renewable Portfolio Standard to provide consistent demand for both necessary resources. These mechanisms could be designed to allow entities to buy and sell energy efficiency and renewable energy credits, encouraging pursuit of all least-cost opportunities.
- Help educate utilities that (as shown by the International Energy Agency) such portfolio standards *reduce* long-run costs and business risks.



Goal 10: Variable Renewables are Seamlessly Integrated onto the Grid

Variable renewable generation—such as wind, photovoltaics, and wavepower—add weather-driven variability to the conventional grid system. Grid operators and utilities are used to variable demand, but variable supply is a new frontier[17], widely supposed to incur major costs and technical challenges. Not one of hundreds of U.S. and foreign studies supports that view. On the contrary, a host of options, including changes in operational or market structure, changes in utility planning and cooperation, and new technologies, would lead to the smarter, more efficient integration of renewables to maximize their energy, climate, and security value. The federal government has a unique responsibility and opportunity to achieve those benefits.

4-year Enablers:

- Establish networks of high-tech anemometers and other weather sensors on federal lands and aggregate their signals to form open-source wind (and solar) forecasting networks;
- Fund utilities to participate in integration studies for variable renewable options at high levels of penetration (*e.g.*, 20%, 35%, and 50%), with proper diversification (technological and geographic), forecasting, and integration with existing demand- and supply-side resources;
- Invest in transmission (765kV and HVDC) not only to bring renewable energy sources to load centers, but also to capture the benefits of geographic dispersion of variable renewable sources, thus mitigating variability with less capacity. But don't overbuild transmission; first consider how it competes with efficiency, demand response, and distributed generation;
- Through NERC and FERC, broadly communicate the need for proactive and cooperative planning among utilities, balancing areas, and regions. Educate the electric utility community on the need for flexible operation, including sub-hourly energy markets and dynamic loads.

[17] Intermittent supply, caused by forced outages of power plants, is not new; utilities routinely manage it via reserve margin. Utilities should apply parallel principles to managing variable supply. Early indications are that *less* storage and backup may be needed in a well-run grid dominated by variable renewables.

Goal 11: Perverse Incentives That Hinder Energy Efficiency Are Eliminated

Efficiency is the most cost-effective energy resource, but perverse incentives currently hinder efficiency investment and implementation in both the energy and capacity markets. While some states have made great progress in using efficiency as a supply resource, other states lag far behind. We recommend creating a concentrated investment in energy efficiency, which will keep US dollars in the US economy, encourage technology deployment, and stabilize electricity rates.

Decoupling and shared savings is the biggest single lever in the whole economy for saving electricity and natural gas. By the end of 2008, it was adopted (docketed) or being considered by 28 states for electricity and/or natural gas[18], and was spreading rapidly—the faster the better. These reforms are endorsed by the Edison Electric Institute, American Gas Association, and Wal-Mart, and led by Natural Resources Defense Council.

Enablers:

- Provide federal incentives for states that decouple utility profits from the quantity of electricity sold and then let the utility keep a modest part of whatever money it saves for its customers. In short, encourage states to reward utilities for cutting your bill, not selling you more energy. This has dramatically raised utilities' enthusiasm for investing in efficiency;
- More broadly, reward states with policies that either encourage utilities to invest in energy efficiency or apportion a percentage of utility revenues to a third-party administrator or government entity to deliver efficiency (as in Vermont).

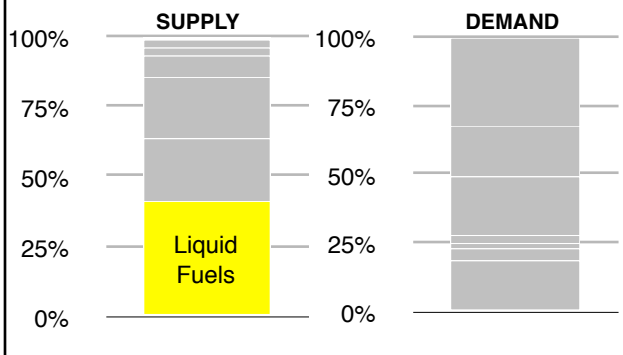
Goal 12: The United States only uses biofuels that do not degrade soil fertility.

Biofuels can quickly displace petroleum and, if grown appropriately, reduce greenhouse gas emissions from liquid fuels. Biofuel can also offer a use for agricultural waste products, and create new rural jobs. However, when produced inappropriately, biofuels can degrade natural ecosystems.

4-year Enablers

- Create a national low carbon fuel standard (LCFS), a technologically neutral policy to reduce the carbon emitted by fuels by mandating the reduction of their GHG intensity, or emissions per unit of energy, across their entire life cycle. It is critical to include emissions from both direct and indirect sources, including land use change, that result from fuel production or combustion. A certification program for all fuels, including biofuels, will certify the GHG intensity across the lifecycle.
- Further require that all biofuels used in the U.S. must be produced in a way that does not degrade natural ecosystems by adversely affecting soil fertility, water quality, or air quality.
- Provide funds to build on the progress already made by EPA and the California Air Resources Board to develop the metrics, databases, and verification tools necessary for implementation.

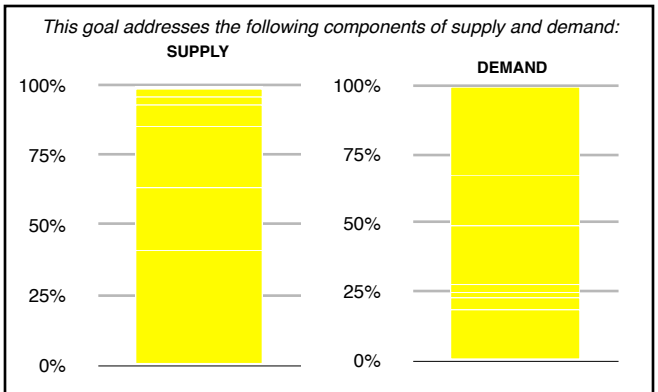
This goal addresses the following components of supply and demand:



Biofuels can rapidly displace large amounts of liquid fuels, however, potential negative environmental impacts of biofuels must be carefully studied and avoided.

[18] See NRDC's decoupling map for updates: http://switchboard.nrdc.org/blogs/lburt/momentum_grows_for_economic_re_1.html

Goal 13. The Smart Grid is installed, enhancing energy security, enabling distributed resources, and integrating electrified vehicles.



The enabling goals underpin many of the suggestions listed above. For example, sub-metering is key for an electrified vehicle infrastructure.

The Smart Grid holds the key to several of the goals listed in this document: from demand response, to bringing renewables online, to performance-based contracting, to supporting electrified vehicles, and beyond. A Smart Grid brings the technologies and methodologies of the Internet to the electricity grid. It will enable two-way flows of electricity and information and support dynamic balance of supply and demand—simultaneously saving money, enhancing security and reliability, and reducing emissions. Two key barriers currently hinder the Smart Grid: lack of alignment on what it includes, and funding. Smart Grid has been estimated to cost between $65b (Smart Grid Alliance) and $400b (Alliance for Climate Protection). (Such estimates are often ambiguous as to whether they're true marginal costs; utilities need and routinely buy extensive grid upgrades anyhow.)

4-year Enablers:

- Help stakeholders agree on a clear and detailed definition of Smart Grid. It should include:
  - Two-way, digital, real-time (or nearly real-time) communication between millions of loads and suppliers, including electrified vehicles;
  - The ability for the utility/grid operator to ramp supply and demand up and down rapidly;
  - Variable pricing (based on real-time and lookahead supply and demand conditions);
  - Self-healing capabilities that can routinely or automatically detect, analyze, respond to, and restore grid elements or network sections to maintain reliability, security, affordability, and power quality;
  - Advanced metering and submetering (see below);
  - Net-metering and other enablers for distributed generation;
  - More knowledgeable control centers;
  - Fuller application of advanced electrical storage techniques where cost-justified;
  - Incentives for grid-operating regions and utilities to develop and share a national communication protocol or operating standard—offering great benefits but requiring a shift toward either more collaborative interstate and interregional relationships or greater federal standardization.
- Provide funds for utilities to retrofit their service territories and retrain installers, operators, operators and analysts. Tie funds to key enablers such as common communication protocols and regulatory policies such as truly symmetrical net metering;
- Explore incentives based on ease of permitting and right of way, instead of cash.

Goal 14. Better Electricity End-Use Data Available

Although end-use data can be considered part of the Smart Grid, we've made it a distinct goal because such data, currently sparse, are critical enablers of the Smart Grid. In buildings, end-use data enabled by sub-meters and smart appliances let buyers or renters easily compare energy performance, incentivizing owners to improve it. Such data can also enable accurate and sophisticated billing and charge management for electrified vehicles. Finally, for the grid, end-use data enable valuable demand response and other dynamic load management.

4-year Enablers:

- Create a national task force to figure out what level of granularity for end-use real-time data is feasible at high volume and low cost;
- Based on task force findings, create end-use data requirements for all new buildings and a strategy for retrofitting existing buildings with at least basic data acquisition systems;
  - Provide capital/incentives for smart appliances and/or cheap, easy-to-install, wireless metering devices for a variety of end-uses, coupled with on-the-wall real-time monitors;
  - Encourage and assist tenant energy bills to be based on actual usage, not prorating;
- Create easily accessible, regularly updated national and regional benchmarks[19] to help users interpret their measurements of total energy use and cost for each building;
- Ensure that submeters use nationally compatible communication protocols to optimize national Smart Grid operation as that infrastructure is built in parallel.

Goal 15: A New Energy Corps is Trained to Power the Clean Energy Economy

The need for a well trained workforce cannot be overstated. The market for energy-efficient improvements, sustainable corporate strategy, and renewable energy installation has been constrained by the lack of skilled workers, causing higher costs and lower growth. The federal government can and must help tackle this problem.

4-year Enablers:

- Create an energy corps, granting student loan forgiveness while also training skilled workers who can meet a variety of clean energy jobs. In our experience, the lack of skilled workers in the following areas is especially acute:
  - Energy auditors, installers for building/home energy efficiency retrofits, energy modelers, building commissioning experts, building energy management professionals, thermal load experts, advanced HVAC and controls engineers, advanced lighting designers and retrofitters, and workers experienced in such energy-saving enterprises as sustainable food and materials production.
- Partner with established Energy Service Companies (ESCOs) and clean energy firms to develop necessary curriculum for training, internships and job-placement;

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[19] The EPA's Energy Star Portfolio Manager is one potential benchmarking tool. Washington DC's Clean and Affordable Energy Act of 2008 requires benchmarking using Energy Star Portfolio manager:
http://www.bcap-energy.org/files/DC_Clean_Affordable_Energy_Act_2008.pdf

- Working with vocational colleges and high-school shop programs, retrain workers displaced by the new energy economy.

- Dedicate funding for universities to establish accredited degree programs in clean energy engineering. Such programs draw from a mix of applied science, technology, engineering, mathematics and green curricula. Only 1–2 vo-techs train weatherizers, and only 1–2 universities educate broad-based energy experts.

Goal 16: The Current Energy System is De-subsidized: All Remaining/new Subsidies are Consistently Reviewed, Transparently Displayed, and Thoroughly Addressed.

Current energy policies send large and pervasive subsidies, directly and indirectly, to the energy industry—many tens of billions of dollars a year through scores of programs, some dating back nearly a century. Some of these subsidies are not transparent; many are permanent. This prevents all energy technologies from competing on a level playing field. We recommend a goal of complete desubsidization, advanced through transparent and consistent scrutiny that exposes all subsidies for wide public consideration. In general, it is better public policy to pay for energy at the meter or pump than through taxes.

4-year policy enablers:

- Appoint an independent agency or commission (including GAO and CBO) to document, publish, and annually update every direct and indirect subsidy currently going to the energy sector (currently mandated assessments are often distorted by sectoral interests);
- Strategically assess each subsidy and remove those deemed to make the energy playing field too unlevel, or those that are contrary to national energy use, greenhouse gas, and oil reduction goals;
- Whenever a new energy subsidy is proposed, consider the alternative of correspondingly desubsidizing competitors;
- Thus create the database necessary for those seeking a stronger economy, greater energy security, and a cleaner environment to expose, shame, and eliminate energy price distortions.

Goal 17: Government Purchasing Power Spurs the Clean Energy Economy

Many of the goals outlined above can be spurred if a market-making entity steps up to guarantee purchases, demonstrate technologies and methodologies, and make future demand more transparent. The many branches of the government can be just such a market-maker. Here we outline specific suggestions for government purchases:

1. Building Retrofit Industry: Building retrofits save the most at the least cost when efficiency upgrades are coordinated with scheduled equipment replacement or façade renewal. The federal government is ideally suited to spur the retrofit industry while demonstrating a cost-effective "right steps in the right order" approach, coordinating building retrofits with these replacement cycles and optimizing integrative designs for deep energy savings while minimizing or reducing capital expenditures beyond those already budgeted;

- Provide funding to cities/states/agencies to create retrofit master-plans using GIS that categorize buildings based on replacement needs and timing for upgrades. Categories could in-

clude: 1 - Minor re-commissioning/tune ups, 2 - Major re-commissioning, 3 - Major retrofits, 4 - Wait/Do nothing;

- Employ energy service companies (ESCOs), engage newly created nonprofit ESCOs, and/or train energy corps volunteers to audit, design, and implement diverse projects;
- Use standardized field reports to document the cost and savings from energy efficiency improvements, ensuring transparency and usefulness for private-sector retrofits;
- Create a database for energy use in federal buildings that includes detailed reporting by end-use broken out by building type *and* region (to achieve more granularity than CBECS);
- Convene a real-estate-industry/government task force to devise model lease riders that equitably share retrofits' costs and benefits between landlords and tenants, at least in the commercial sector, without disturbing the underlying lease terms already in place;
- Reward efficiency providers for performance, not just paper claims.
  - For larger federal building or retrofit projects, require two-part design fees: part one for basic design or auditing costs, part two paid on a sliding scale based on measured achievement of performance goals.

2. Efficient Vehicles: The federal government should institute very high and market-adaptive standards for vehicle efficiency requirements for all federal fleet vehicles (*e.g.*, buying only the top decile of offerings suited to the task), with adequate additional upfront financing to incorporate any higher capital costs (based on expected future fuel savings) and ensure that these standards are upheld, and that any alternatively fueled vehicles have the infrastructure to use alternative fuel.

- Use the federal fleet (GSA + USPS + non-tactical DoD), aggregated with state, county, and municipal purchasing where feasible, to provide secure contingent purchase orders for the early generations of efficient vehicles at a price-point that is viable for automakers yet incentivize individuals and consumer fleets to do the same (see *Winning the Oil Endgame*, pp. 197-203, for details of this proven "Golden Carrot" technique).

3. Renewable Energy: Provide a sustained, consistent demand for onsite renewable energy sources, such as solar and wind, through an established target for Federal facilities. This could be accomplished through an auction system or by issuing an RFP.

4. Defense: Fully and aggressively implement all recommendations of the Defense Science Board's 13 Feb. 2008 report *More Fight—Less Fuel* to spur innovation and commercialization of efficient technologies and resilient electrical supplies (in which DoD is already the federal leader). Great spinoff benefits back to the civilian economy can be expected to accelerate total national oil savings and increase national energy security.