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Paper on
**Governance Options for
Federal Credit for Innovative Energy Technology**

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ABSTRACT

Innovative energy technology is considered by many to be vital to both national environmental and energy security goals, such as reducing oil imports from unstable sources. We import half our oil now. Yet newer energy technologies face great difficulty attracting private financing, particularly debt in the wake of the credit crisis. According to EIA, replacing and modernizing North American energy infrastructure with higher efficiencies and lower emissions requires nearly \$2 trillion per decade now. Alternative or enhanced financing approaches, such as federal credit support provided by the DOE Loan program (with \$36 Billion in loan commitments), can be used to foster wider commercial adoption in this essential technology sector, but the governance can be re-structured to provide better management. The credit crisis leaves us with large market gaps in financing innovative, but riskier, projects

The energy sector already faces multiple levels of government intervention by most governments around the world and for many decades. Some argue that there is more intervention in this sector than in any other sector, particularly so by other national governments, who do not “just leave energy to the market” -- for example, with the OPEC cartel controlling oil supply. Several issues must be addressed:

1. Why is federal financial support of innovative energy technologies justified and useful?
2. Why are federal loans or credit support effective, rather than other types of subsidies (e.g., grants)?
3. How should such a federal credit program be administered – within the DOE or as a standalone entity, like the Overseas Private Investment Corporation (OPIC)?
4. Which funding options given fiscal constraints could be feasible for capitalizing the entity?

An independent federal enterprise, ultimately with a “full portfolio” of fuels, would offer the broadest impact with the best accountability across the full energy sector and the various U.S. regions.

[Based on a paper developed first by the author with Nick Andrews, Manik Damera, and Scott Wetzel, GMU-SPP]

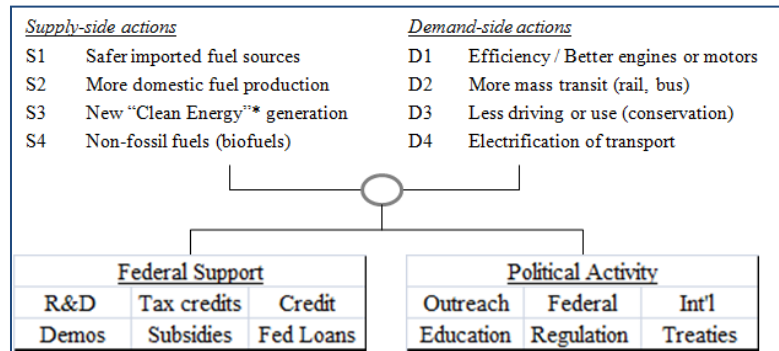
1. Executive Summary: Federal Credit for Innovative Energy Technology

Innovative energy technology is considered by many to be vital to national environmental and energy security goals, including curbing imports. Better use of energy requires more rapid adoption of innovative technologies to bolster efficiencies, competitiveness and enhance economic growth, while reducing emissions and pollution. According to IEA, modernizing North American energy infrastructure with higher efficiencies and lower emissions requires nearly \$2 trillion per decade now. However, newer energy technologies face difficulty attracting private financing, particularly in the wake of the credit crisis. Alternative financing approaches, such as federal credit support provided by the Department of Energy (DOE) Loan program, can foster wider commercial adoption in this essential technology sector, but the governance can be structured to provide better management.

The energy sector already faces multiple levels of government intervention, for many decades, and by most governments around the world. Some argue that there is more intervention here than in any other sector. This is particularly so by other national governments. Therefore:

1. Why is federal financial support of innovative energy technologies justified and useful?
2. Why are federal loans or credit support effective, rather than other types of subsidies (e.g., grants)?
3. How should such a federal credit program be administered – within the DOE or as a standalone entity, like the Overseas Private Investment Corporation (OPIC)?
4. Which funding options given fiscal constraints could be feasible for capitalizing the entity?

Different U.S. regions face different energy needs. Several options are outlined to promote supply-side and demand-side actions in addressing energy security and reduced emissions, and federal credit support offers a much lower budget impact than direct grants or tax credits. Loans typically score at a level that is 80% lower than grants.



Moreover, the DOE Loan Program Office (LPO) aims to promote wider use of innovative technologies. LPO could continue to operate in DOE or be spun out to a new federal entity to boost accountability. *An "equity call" to states and other investment sources could initially fund the entity.*

The new entity could focus more narrowly on renewable energy sources (RE) and efficiency (EE) projects, leaving nuclear, fossil, and grid projects within the current DOE LPO. Those larger, complex projects could be transferred in stages. *An independent enterprise, ultimately with a "full portfolio" of energy sources would offer the broadest impact with the best accountability across the full energy sector and the various U.S. regions.*

DOE LPO GOVERNANCE	Unit within DOE	Separate Government Corporation [like OPIC]
ALL FUEL SOURCES; "Full Portfolio"	(A1) [Mode now in DOE] - An internal board reviews program under DOE Sec'y - Under DOE appropriations - OMB reviews each project	(A2) ["Full Portfolio"] - Autonomous board appointed by President and Congress - OMB would review portfolio
DOE Loans focused on EE/RE	(B1) [Internal EE/RE] - Reports to the Office of the Secretary (rather than CFO) - Subject to DOE rules, practices	(B2) [External EE/RE] - Autonomous board, management - Multi-year appropriations - More flexible organization

Projected Outcomes include: More innovative energy facilities sooner; more private sector investment mobilized with job growth; and lower emissions with reduced imports of fuels from unstable sources.

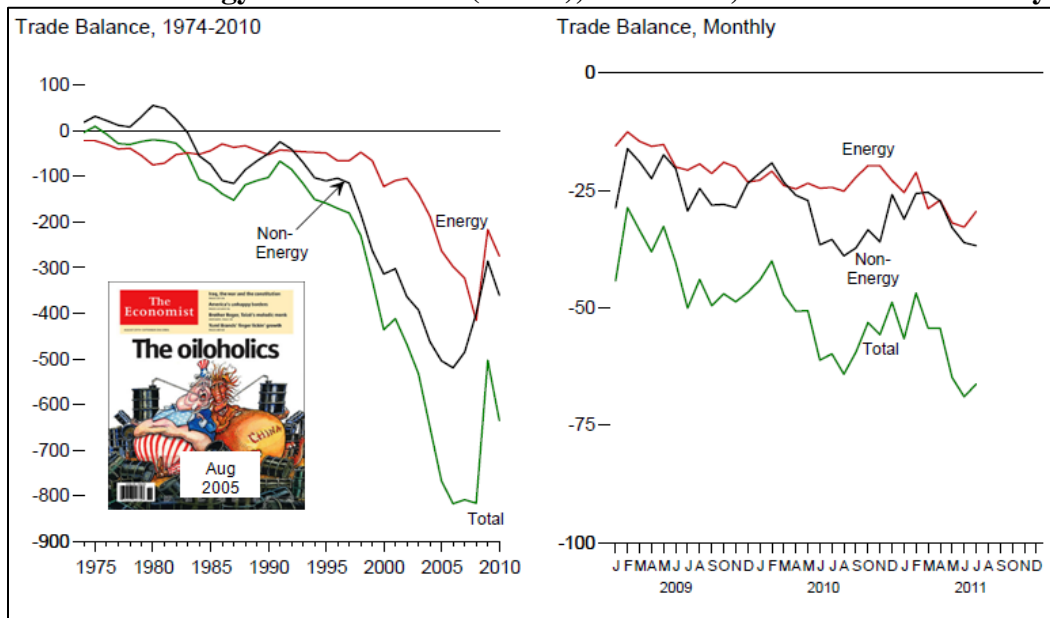
2. Introduction; Discussion of the Energy Security Problem¹

Since the first “oil shock” (OPEC embargo) in 1973, every American president has vowed to reduce our vulnerability and dependence to imported oil from unstable or even hostile sources. Energy pervades the U.S. economy and is essential across sectors for basic survival and a healthy economy:

“Energy is at the heart of economic development in every country. It moves us and powers our factories, government and office buildings, schools, and hospitals. It heats homes and keeps perishable foods cold... Energy is the source of wealth and competition, the basis of political controversy and technological innovation, and an epochal challenge to our global environment.”²

Yet, since the mid-1970s, the execution of supply constraints by the OPEC cartel of oil exporting nations America’s dependence on imported petroleum doubled, exceeding 60% in 2005³. We have failed in this public policy goal. A patch work of compromised policies, severe regional differences in end use, climate zones, urbanization, and access to different energy sources, and a “leaving it to the market” mentality have all increased our dependence on unstable foreign sources over four decades.

EIA: U.S. Energy Trade Balance (deficit), 1975-2011, since first oil shock by OPEC cartel



EIA Monthly Energy Review, September 2011; Economist magazine, August 2005

President George W. Bush, a former fossil energy executive and governor from oil-rich Texas, supported a federal mandate for biofuels, among other measures within the Energy Policy Act of 2005 (EPAAct 2005), and lamented our collective “addiction to oil” in his 2006 State of the Union address. With President Bush signing EISA in 2007, the national biofuels mandate was raised again.⁴

¹ Eugene Bardach’s, A Practical Guide for Policy Analysis, provided a framework for this paper (in Appendix p.XIII)

² Energy Security: Economics, Politics, Strategies, and Implications (p. 1), Ambassador Carlos Pascual and Jonathan Elkind, editors, Brookings Institution Press

³ EIA: since 2005, the protracted recession, more use of biofuels and efficiencies put imported fuels at 50% in 2010.

⁴ EIA: U.S. renewable fuel standard now set at 20.5 billion gallons by 2015 (nearly 15% of consumption), 3 billion of that goal from cellulosic feedstocks (non-food); and 36 billion gallons for 2022 (about one-fourth of projected consumption), 16 billion of cellulosic fuels by 2022. EISA is the Energy Independence and Security Act of 2007 (P.L. 110-140).

Importantly, within EAct 2005 Congress put forward a new energy loan guarantee program, known as Title XVII, entitled “Innovative Technology,” to be administered by the Department of Energy (DOE). In vital public deliberations about energy policy, both parties noted market defects associated with lack of adequate financing specifically for innovative energy technologies (See Quotes from Congress on EAct at Appendix V). Republicans held majorities in both chambers of Congress in 2005, and EAct 2005 passed handily with bipartisan support⁵.

3. Policy landscape and Data

The combination of over dependence on imported energy and on unreliable or unstable energy sources, such as OPEC, creates strategic vulnerabilities for the country. Even though the US physically receives less than 20% of its oil from the Middle East, any attack disrupts price *globally*, and with our allies. The vulnerability to price or supply disruption, or both, is further compounded by a lack of financing for innovative energy technologies. Such technologies include not just renewable energy sources, but for energy efficiency (e.g., combined heat and power systems or better lighting; see Appendix p. IX for energy usage areas.), and for advanced nuclear plants with improved safety systems, or for advanced fossil-based systems with lower emissions (i.e., higher efficiency or CO₂ capture).

Nuclear plants operate at the highest capacity factors (over 90% run time, regardless of weather), so they function as “baseload” or “on first” units in dispatching power on the electrical grid. With no greenhouse gas emissions and their “24/7” capability, new reactors could offset baseload coal units scheduled for retirement. Solar and wind cannot replace coal in the main due to inherent intermittency. According to the U.S. Greenhouse Gas Inventory report⁶ by U.S. Environmental Protection Agency (EPA), coal provides 45-50% of U.S. electricity – much more in the Midwest and Southeast states. Coal-fired power plants emit nearly 40% of U.S. CO₂ emissions each year, and most of the regulated hazardous air pollutants (SO_x, NO_x, Hg, PMs), which contribute to asthma and river pollution as market externalities, or “spillover effects that have reached critical magnitude”⁷.

The lack of debt capital for innovative energy technologies is especially evident in the wake of severe market turmoil in U.S. and global credit markets since 2008. Losses from sub-prime mortgages and lack of liquidity in the banking system, disrupted financing for energy systems in the USA and worldwide (as shown in the IEA bar graph below). This crisis triggered urgent legislation, the Emergency Economic Stabilization Act of 2008, carrying unprecedented intervention in the banking system by the U.S. Treasury, totaling \$780 billion in “bailout” funding (TARP). Financial markets continue to be severely stressed:

“The financial crisis in Europe has begun to spill over into US bank lending, according to the latest survey of loan officers by the US Federal Reserve. Only five domestic banks out of 50 say that they relaxed their standards for lending to large companies. Two banks had tightened conditions. There was also a sharper retrenchment by US branches of foreign banks: 23 per cent of such operations tightened their lending terms, raising their interest rate spreads and cutting back on the amount and period for which they are willing to lend. Of the foreign banks that tightened their lending conditions in the US, all nine pointed to a weaker economic outlook, while a majority said they had a lower tolerance for risk, that their own liquidity position was weaker, and that it was harder to sell loans on the secondary market”⁸.

⁵ Bipartisan vote on EAct -- HOUSE (4/21/2005): AYE (249): 208Rs / 41Ds and NAYs (183): 161 Ds / 22Rs -- SENATE (7/29/2005): AYE (74): 52Rs / 22Ds and NAYs (26): 20 Ds / 6 Rs. Also see quotes in Appendix p. V.

⁶ U.S. EPA: <http://epa.gov/climatechange/emissions/usinventoryreport.html> (April 2011)

⁷ Lindblom, Charles; *The Market System* (2001), p. 148

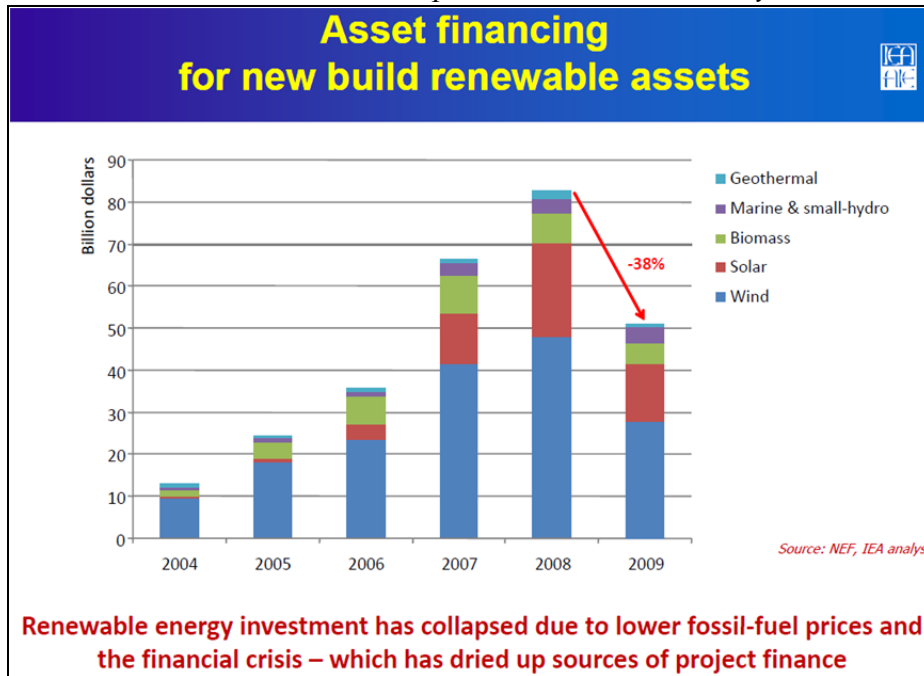
⁸ European crisis hits US bank lending, Financial Times, 8 November 2011

www.ft.com/cms/s/0/46e1277a-0990-11e1-a20c-00144feabdc0.html#ixzz1dX55Kn00

Amid the credit crisis, in 2010 IEA pointed to the collapse of financing for energy technologies and infrastructure needed to provide progress toward energy and environmental goals worldwide:

IEA: Asset financing disrupted by credit market turmoil

Source: IEA President Tanaka's presentation to G8 in May 2010.



The collapse in the credit markets chilled financing so deeply in the energy sector that the U.S. Treasury instituted the “Treasury Grant” program, Section 1603 of the American Recovery and Reinvestment Act of 2009 (ARRA), to provide cash to renewable energy projects in lieu of those projects waiting to establish cash flows to claim investment or production tax credits. This initiative provided essential liquidity given the severe capital market failures.

Due to the lagging economy the Section 1603 program was extended by Congress an additional year to December 2011. The Treasury Grant program made funds available much earlier in project lives, thereby injecting vital cash that the private markets were not providing. According to Treasury, as of October 2011, applicants since 2009 from 22,000 projects (mostly very small rooftop solar projects), invested \$23 billion of private capital, and had claimed \$9.6 billion in treasury grants. Of that total \$7.2 billion was allocated to wind farms in about ten states⁹. Biomass and geothermal projects each garnered less than \$300 million. Private markets would not have provided this capital; hence, unprecedented intervention by Treasury was merited.

Importantly, *none* of the other government financing entities (e.g., OPIC, Export-Import Bank, Small Business Administration) are geared towards financing advanced and inherently riskier systems with innovative technologies in the volatile energy sector. In addition, because the energy sector wields a unique bearing on our economy and national security position (e.g., dependence on reliable electricity; management of a nuclear navy; and half our transport fuel is imported), government involvement is essential. In fact, the DOD recently has also been ramping up clean energy programs aimed at encouraging use of more innovative technologies, such as through the DOD Installation Energy Test Bed¹⁰, and the Navy’s “Green Fleet” initiative (<http://greenfleet.dodlive.mil/home/>).

⁹ www.treasury.gov/initiatives/recovery/Documents/P%20Status%20overview%202011-11-03.pdf. Renewable energy projects qualify for tax credits of 30% of invested capital, or a production tax credit of roughly two cents per KWh generated once production starts. With the “1603 program”, those tax credits are converted to a cash grant, available earlier.

¹⁰ www.serdp.org/Featured-Initiatives/Installation-Energy

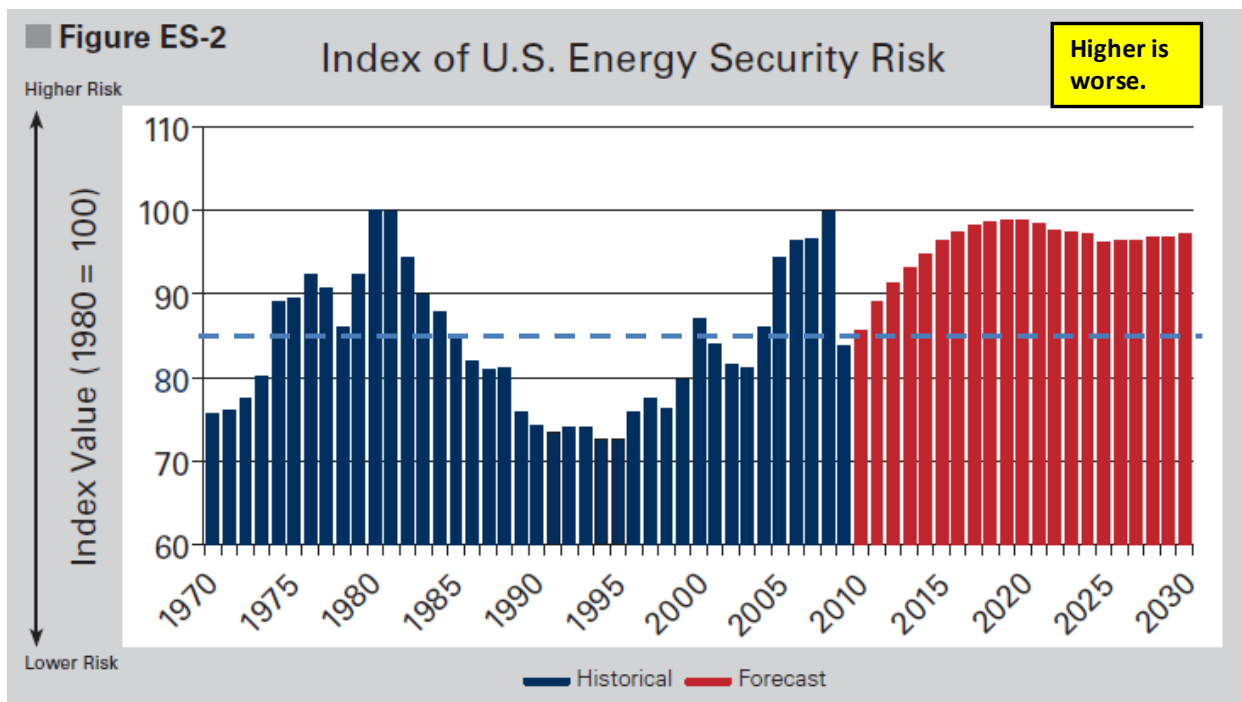
Index of U.S. Energy Security Risk (U.S. Chamber: 2011 Edition)

http://www.energyxxi.org/themes/energyxxi/pdfs/ESRI2011_Highlights.pdf

“Since the early 1970s, Democratic and Republican presidential administrations and other policymakers have made energy security a priority. Yet, we have lacked a tool to regularly measure our nation's progress and thus assess the impact of policy decisions on America's energy security. Indeed, energy is still recognized today as among the top challenges to our future prosperity and way of life.”

“Looking over the next 25 years to 2035, there is no reprieve from relatively high risk levels.

- EIA's latest projection shows future risks starting high and remaining high. Indeed, our energy security situation is forecast to remain exceedingly risky, with the high risk levels experienced in the 1970s, early 1980s, and late 2000s forecasted to be the norm.
- Rising energy costs and expenditures related to increasing costs for oil are factors that could increase future energy security risks. In addition, EIA's is now forecasting less crude oil output from the Gulf of Mexico and Alaska, which will reduce overall U.S. crude oil output by 1.3 million barrels per day below previous expectations and add to the insecurity of future oil supplies.
- Factors dampening future risks include increased natural gas supplies primarily from shale gas, greater energy efficiency, a decline in energy expenditures as a share of GDP, and ongoing de-carbonization of energy supplies.
- The current Index calculates a future overall risk of averaging 93.9 over the entire 25-year forecast period from 2011 to 2035, a level exceeded only eight times in the historical record.”



Though the recent shale gas boom increases domestic energy supply, very little of the infrastructure and engines are in place to utilize it to replace dependence on imported crude oil.

“Besides providing a historical look at U.S. energy security, the Index can be used in several ways:

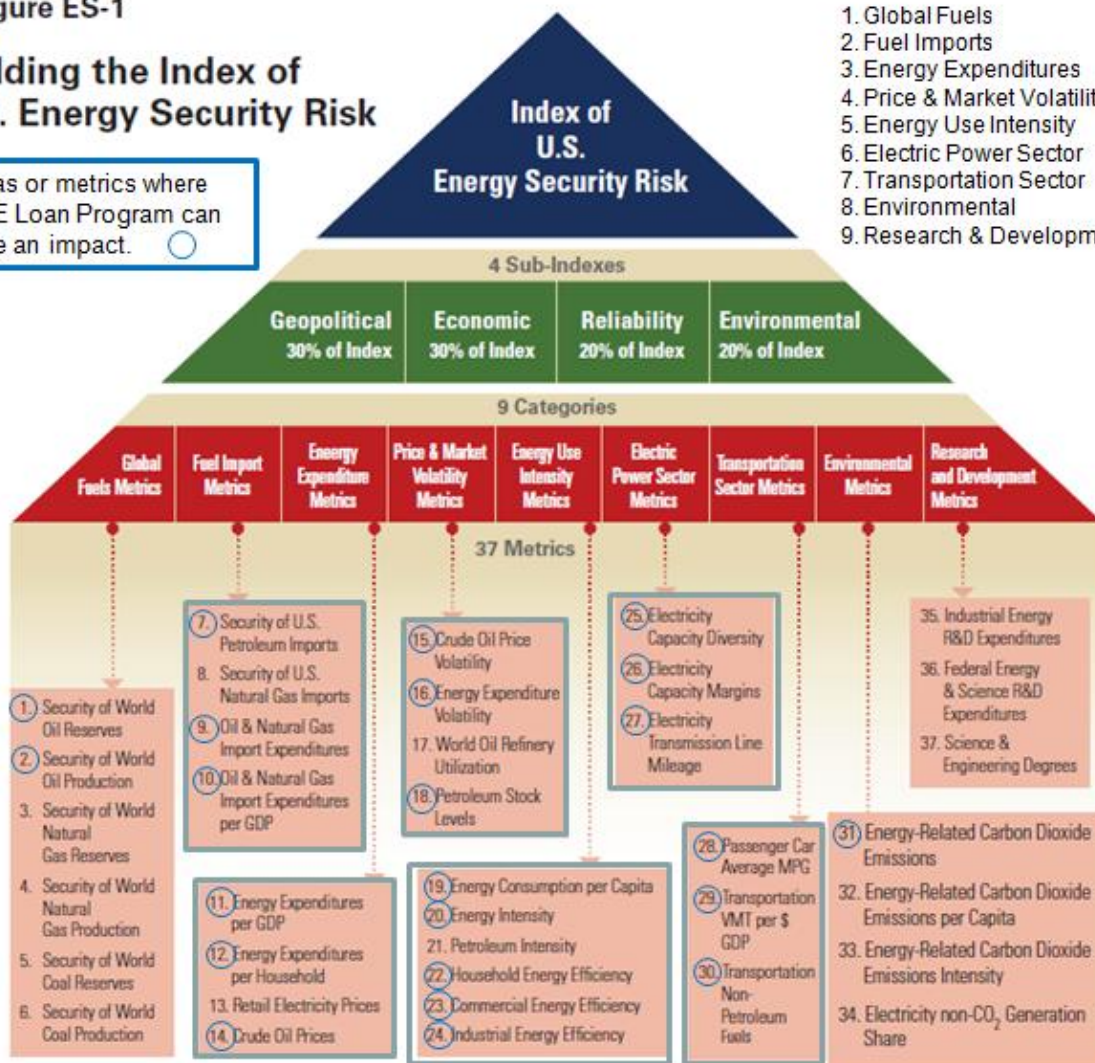
- First, it can use recently collected and published data to help explain whether our energy security is trending better or worse. Historical data of U.S. energy security over the years shows that, had this Index been available in the past, the warning signs of impending threats to our energy security would have been unmistakable. With the Energy Institute’s Index, shifting trends can be spotted.
- Second, the Index can be used to assess the potential impact of new policies on U.S. energy security. Although current projections do not bode well for U.S. energy security, different policies scenarios can lead to measurably different futures.
- Third, various analytical and statistical techniques can measure the aspects of energy security that have had, or are likely to have, the greatest impact on energy security risks (through the 37 metrics) and thus provide insights on where policies should be focused.”

■ Figure ES-1

Building the Index of U.S. Energy Security Risk

Areas or metrics where DOE Loan Program can have an impact. ○

1. Global Fuels
2. Fuel Imports
3. Energy Expenditures
4. Price & Market Volatility
5. Energy Use Intensity
6. Electric Power Sector
7. Transportation Sector
8. Environmental
9. Research & Development

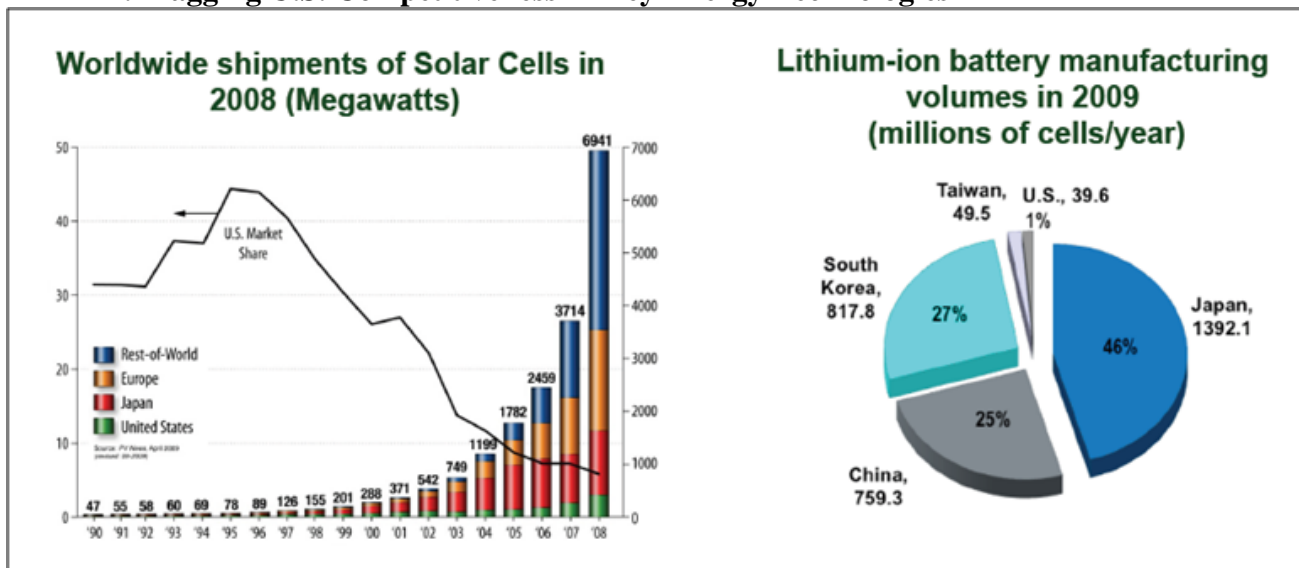


The DOE Loan Program supports progress on energy security among the majority of factors.

Given the multi-layered nature of the U.S. market economy, and heavy intervention and regulation by many other national governments in energy markets, including outright ownership of most energy assets, the notion of “leaving it to the market” would be tantamount to unilateral disarmament in energy technologies. In fact, electricity rates are regulated in nearly half the U.S. by state commissions. Innovations will be vital to future economic growth and geopolitical leverage in a competitive global landscape. Promoting energy security and curbing emissions globally involve collective goods not well accounted for in market prices. Individual actors lack incentives to pursue larger global goals, like energy security or lower GHG emissions, and so become “free riders”, so little progress is made.

According to testimony by Dr. Arun Majumdar of ARPA-E to Congress,¹¹ the U.S. is lagging in competitiveness in several critical technologies: “The nation that successfully grows its economy with more efficient energy use, a clean domestic energy supply, and a smart energy infrastructure will lead the global economy of the 21st century. In many cases, we are lagging behind.”

ARPA-E: Lagging U.S. Competitiveness in Key Energy Technologies



Source: ARPA-E

Energy Secretary Stephen Chu testified to the House Oversight and Investigations Subcommittee¹² on Nov. 17, 2011 specifically about the DOE Loan Program and energy sector subsidies:

“Investments in clean energy reached a record \$243 billion last year [globally]. Solar photovoltaic systems alone represent a global market worth more than \$80 billion today. In the coming decades, the clean energy sector is expected to grow by hundreds of billions of dollars. We are in a fierce global race to capture this market. The China Development Bank has offered more than \$34 billion in credit lines to China’s solar companies. China is not alone: To strengthen their countries’ competitiveness, governments around the world are providing strong support to their clean energy industries. Germany and Canada operate government-backed clean energy lending programs, and more than 50 countries offer some type of public financing for clean energy projects... **When it comes to the clean energy race, America faces a simple choice: compete or accept defeat. I believe we can and must compete.**”

¹¹ Arun Majumdar, Director-ARPA-E, testimony to House Science & Technology Committee, January 27, 2010 <http://gop.science.house.gov/Media/hearings/full10/jan27/Majumdar.pdf>

¹² Secretary Chu testimony <http://energycommerce.house.gov/hearings/hearingdetail.aspx?NewsID=9090>

Energy markets, in particular, suffer chronic challenges in bringing on new supply, with inadequate market information on electricity pricing (e.g., principal-agent separations; muted price signals), and poor consumer response to price signals on the demand side. Much energy use, in fact, is not discretionary, but essential to survival at basic levels, and hence “inelastic”¹³. In a heat wave or winter cold spell, energy prices rise, but so does demand! Consumers don’t curtail use much based on price; weather and commuting are bigger factors. In evaluating approaches, energy security actions can promote supply alternatives and expand demand side efforts and measures, as outlined below:

Supply side actions for Energy Security

- S1. *Alternative external fuel sources*: Identifying sources of fuel from more stable or allied countries, e.g., Canada or Brazil, rather than from OPEC sources, for example, that are facing more civil turmoil and potential conflict, or in some cases are inimical to U.S. interests. However, little innovation is stimulated by substituting one fossil fuel source for another. It is a stopgap action.
- S2. *More domestic fuel production*: Some domestic sources face moratoriums, or permitting gauntlets that are prohibitive or uncertain to a point that defeats investment. Whether from near-shore oil or gas, or domestic coal, or biofuels, domestic sourcing reduces our trade deficit. Yet, more drilling or mining does not lead to better use of innovative technologies; it continues conventional fuel use.
- S3. *Clean energy production*: Many non-fossil sources of energy inherently reduce energy dependence, or at least curb pollution and GHG emissions: biofuels displace fossil transport fuels; solar and wind power do not, but could offset some fossil production in remote, off-grid areas. Expansion of nuclear energy or CCS could replace some coal or gas production (thereby curbing GHG emissions), and reactors are the only non-fossil source that can provide baseload power, “24/7”, regardless of weather, *at similar scale* (i.e., >300 MW per plant). Cleaner energy sources entail significant use of innovative technologies, and also allow the country to garner energy sources away from areas prone to disruption from major storms and hurricanes (recall 2004, 2005).
- S4. *Non-fossil fuels*: Most biofuels are domestically produced¹⁴, and advances are being made to produce ethanol and biodiesel from non-food sources, such as from switchgrass or other cellulosic materials, or from rapeseed oil for biodiesel, embodying the use of catalysts and other innovations.

Demand side actions

- D1. *Promote efficiency, better engines and motors*: More widespread and rapid deployment of more efficient motors and engines, furnaces and HVAC units leads directly to fuel savings and lower emissions across industrial, commercial and residential end uses, as would better insulation and windows, and less energy intensive LED lighting. Vehicle engine standards were raised in 2007.
- D2. *Encourage mass transit*: Usage of bus and rail reduces congestion, not just mileage, thereby reducing fossil fuel use somewhat. However, mass transit is truly available only in urban corridors, and in terms of passenger-trips has not caught up to its peak usage in the 1950s (see APTA statistics on ridership; www.apta.com).

¹³ EIA uses short run demand price elasticity estimates at less than 20%, meaning that a 100% (doubling) in price of fuels would lead to just a 20% drop in use, or less. www.eia.gov/oiaf/analysispaper/elasticity/

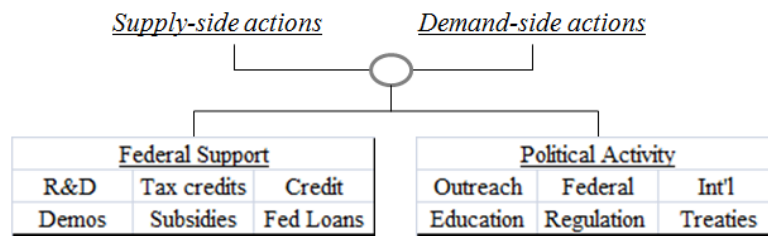
¹⁴ S4: Sugar cane fuels could be imported from Brazil or Caribbean countries, as one exception to domestic production, but it would be from a friendly source in our own hemisphere. Sugar cane is a more efficient source of ethanol than corn.

D3. *Less driving and conservation:* Since the oil shocks of the 1970s, states and cities have used a variety of programs, including car-pooling, HOV lanes, and tele-commuting to conserve fuel use.

D4. *Electrification of transportation:* Accelerating the adoption of plug-in hybrid vehicles or electric cars enables broader substitution of electrical energy for fossil fuels, curbing import dependency. Whether this source curbs pollution and GHG emissions depends more on the electricity profile of the states where a vehicle would be re-charged. The West Coast and New England use much less coal (i.e., <20%), while Midwest states and the Southeast use coal much more (>60%, and >85% in some states and rural areas). Still, from a security standpoint, all coal is domestically mined.

Policy Options with Impact on Supply and Demand

Federal fiscal support can generally be provided, (a) via government grants (DOE, USDA) for R&D and demonstrations, (b) via tax credits or subsidies, and (c) via credit support such as federal loans and loan guarantees as embodied now in the DOE Loan Program (under EAct 2005). In parallel, additional non-fiscal measures *without direct budget impact or subsidies* include: (d) outreach and consumer education; (e) federal regulation, such as building and appliance standards or emission permits; and (f) international treaties or cooperation related to foreign sources.



A matrix relating the approaches for broadly addressing energy independence via federal support and non-fiscal political actions is shown below (and in larger format at back):

STRATEGIC OPTIONS			Federal Support			Political Activity			
Enhancing energy security	Level of Innovation		R&D	Tax credits	Credit	Outreach	Federal	Int'l	Also curbs
[XXX = level of government activity]			Demos	Subsidies	Fed Loans	Education	Regulation	Treaties	GHGs ?
Federal budget cost ==>			High	Very high	Medium	Low	Low	Low	
<i>Supply-side actions</i>									
S1	Alternative external fuel sources	Low						XXX	No
S2	More domestic fuel production	Medium		XXX			XXX		No
S3	New clean energy generation	High			XXX	XX	XXX	X	Yes
S4	Non-fossil fuels (biofuels)	High		XXX	XX		XXX	X	Yes
<i>Demand-side actions</i>									
D1	Efficiency / Better engines or motors	High	XXX	XXX	XXX	X	XXX	X	Yes
D2	More mass transit (rail, bus)	Low		X		XX	X		Yes
D3	Less driving or use (conservation)	Low				XX	X		Yes
D4	Electrification of transport	High	XXX	XXX	XXX	X	XXX		Some

Source: Matrix developed for this paper [© Andrew Paterson], as encouraged by the Bardach policy analysis approach.

A row in the matrix above is shown noting relative budget cost for each action, and level of innovation for S1-4, D1-D4, and whether an option would also curb greenhouse gases (GHGs), another public policy objective that correlates closely with reducing dependence on fossil fuels.

The level of innovation runs highest in S3 Clean energy generation, S4 Non-fossil fuels, D1 Better engines and motors and efficiency technologies, and in D4 Electrification of transportation (e.g., car batteries). These are the exact areas where federal loans and credit enhancement, such as loan guarantees, can be most effective in mobilizing capital investment for innovative technologies. Hence, a focus on the DOE Loan Program *and its governance options* deserves more intensive consideration.

Also highlighted in the matrix are the relative budget costs of the specific federal support options and political measures. Grants and tax subsidies incur a budget cost at “dollar for dollar”, according to Congressional Budget Office (CBO) budget scoring rules. Tax subsidies see greater *volumes* than R&D grants because commercial projects are larger (>\$100 million) than grants for R&D projects (<\$100 million). Federal loans, by contrast, are scored according to the Federal Credit Reform Act (FCRA 1990), based on a credit assessment of a loan’s probability of default, net of recoveries in liquidation or operation – in essence, repayment prospects given default. Therefore, the budget cost of loans is less than 100%, typically less than 50%, or often below 20% of the loan value for stronger projects. So, \$100 million in tax subsidies or a grant for an energy project would be “scored” by CBO at \$100 million; whereas, a loan by DOE of \$100 million could be valued at 20% (+/-10%), depending on the features and risks of the project. Note that some larger projects could actually present *better* credit risk profiles. A better profile could entail, for example, being built in regions with regulated (assured) electricity rates or committed off-take (revenues), by big utilities with solid balance sheets with stable feedstock supplies, and built by experienced engineering firms. Budget costs of government agency activities, such as regulations or outreach programs, entail just the administrative costs of such programs, since no subsidies or loans are involved; hence the budget costs are low; however, direct impact on innovation may also be limited. The DOE Loan Program has offered \$36 billion in loan commitments through 2011, up from none at the end of 2008. Meanwhile, the DOE annual budget runs about \$26-28 billion per year, but less than half of it related directly to energy. More than half of DOE’s budget is devoted to the Nuclear Security Administration and the weapons complex¹⁵.

4. Criteria for Measuring Outcomes

Given the public policy goals and options for improving the nation’s energy security position and public policy interest in running an effective and more accountable loan program with transparent decision-making, several criteria¹⁶ for weighing governance options reflect these goals:

1. Accountability; Ease of administration and flexibility (hiring, procedures, etc.)
2. Budget impact relative to other types of support or subsidies
3. Effectiveness in promoting innovation or correcting market defects
4. Regional balance or equity (e.g., variance in different U.S. regions)
5. Support in diversification among fuel sources, for energy security

1. *Accountability and transparency*: Given the intense scrutiny put on the Loan Program Office (LPO) in 2011 after the bankruptcy of solar panel maker Solyndra, the most important criterion will be accountability, with ease of administration and transparency of reporting. Currently, the DOE LPO is bound by DOE bureaucracy, employment and salary grades, making it difficult to recruit the expertise

¹⁵ DOE Budget: www.cfo.doe.gov/budget/12budget/Content/Orgsum.pdf

¹⁶ For the policy analysis process by Eugene Bardach, utilizing Criteria and Projected Outcomes see Appendix p. XIII

and experience needed for more sophisticated analysis of complex energy financings. It was thought initially that placing the LPO within DOE would enable the program to startup sooner, abide by appropriations procedures with DOE, and take advantage of technical expertise within DOE for evaluating innovative technologies. However, the LPO took more than three years to offer its first conditional loan commitment. A separate corporation, like OPIC, with clear accountability through a distinct board of directors and executive staff offers more transparent governance, coupled with an annual reporting to Congress. Congress can mandate reporting to both House and Senate committees of jurisdiction. Such an entity would carry a singular focus, unlike the multiple missions of DOE. For comparison, in 2008, OPIC had \$6.2 billion in total assets, and for FY2010, requested \$52.31 million to support program administration, and \$29.00 million in credit subsidy funding. Offering loans, credit support and insurance, not focused on energy, OPIC generated nearly \$500 million in revenues.

2. *Budget impact:* In the current negative fiscal landscape, “budget impact” would be a very high criterion. Nuclear and fossil projects would be bigger (>600MW), requiring larger loans, but could also bring a lower risk profile on other project features than some renewable projects. In any case, loans repaid would incur much lower budget costs than tax subsidies or outright grants that score at dollar for dollar. In terms of “bang (or MW) per buck”, it must be noted that a wind farm may be listed at 300 MW when installed, but since the wind blows intermittently, the effective capacity is only ~100 MW.

Funding: Initial capitalization can be provided either by Congress, as was and is the case with OPIC. \$10 billion was suggested by Senator Jeff Bingaman (D-NM), chair of the Energy & Natural Resources Committee¹⁷. Or an “equity call” could be made to states seeking credit support for projects benefitting their regions. States could decide to provide a base level of equity (perhaps using a formula tied to population and energy usage), and consider another “preferred” level of equity for additional funding as they see fit since different states face much different energy mixes, weather, and urbanization. States not supporting such financing need not “pay to play”. Importantly, the budget scoring would be nil given gridlock in a divided Congress facing severe budget deficits. Collectively, states as equity holders would not favor funding sub-standard projects because as equity holders, they would be invested in the overall success of the enterprise. Such an entity could provide debt, not venture capital, to near commercial-ready systems. States and Congress would decide on a board of directors and terms, with staffing out of relevant agencies. According to their periodic update by the National Commission of State Legislatures (NCSL), state budgets are recovering from their stressed situation of 2009-2010¹⁸.

3. *Innovation:* The initial purpose of Title XVII (“Innovative Technology”) in EAct 2005 was to promote innovative energy technologies and overcome market defects, such as a collapse of credit markets, particularly in relation to riskier energy technologies. Innovative technologies are inherently riskier with more first-of-a-kind uncertainties, particularly in systems engineering, but offer gains in efficiency, emissions performance, and possibly environmental permitting, once proven.

4. *Regional balance:* Some “geographic equity” across the country deserves consideration (perhaps with less weighting than budget impact), so the lending is not overly concentrated in just a few states.

5. *Fuel source diversity:* Similar to geographic range would be diversification across fuel sources. Again, the original intent of the legislation in EAct 2005 was to promote innovation across many fuel

¹⁷ Funding proposed for “Clean Energy Deployment Administration (CEDA)” within S.1462 in 2010.

¹⁸ NCSL State Budget Update: www.ncsl.org/?TabId=23588

sectors, including nuclear and advanced fossil projects (i.e., fossil-fueled systems with a lower emissions profile than current technology, such as CCS), not just renewable sources and energy efficiency with better motors or in buildings. Oil or gas powered turbines would be examples of systems not considered innovative, and excluded by EPO Act Title XVII, the authorizing legislation for the DOE Loan Program.

5. Projected Outcomes

Projected outcomes in the larger energy sector and economy are fairly straightforward:

- Better energy facilities financed and completed, incorporating more innovative technologies
- More private sector investment mobilized on innovative energy technologies (quantifiable)
- Lower emissions (SO_x, NO_x, Hg, GHGs), measured by emitters, verified by EPA
- Reduced imports of fuels by use of bio-fuels, or electrification of transport or efficiencies

In terms of Measurements and Projected Outcomes, the following would be illustrative relative to the criteria outlined above in Section 4:

1. *Accountability: Ease of administration, flexibility, and transparency.*

- Measurement: Efficiency in processing loans. Since DOE took more than two years to administer their first loan, a separate government entity will be able to process them more rapidly and more effectively (quality), since they will only be focused on the loan program, and because an entity independent of DOE can hire people better suited for credit analysis (see Senate ENR testimony, 2/12/09).

- Outcomes: Innovative technologies adopted faster (number of projects) and energy facilities financed and completed, incorporating better performance features.

2. *Budget impact “or leverage” relative to other types of support or subsidies.*

- Measurement: Grants are not repaid; loans are. The credit quality and default prospects (e.g., 20%) of each loan are determined, providing a basis for “scoring” or measurement. In any case, loans always score lower than grants or tax credits, and accompany private equity investment at risk.

- Outcomes: More private capital mobilized for innovative energy technology.

3. *Effectiveness in promoting innovation or correcting market failures.*

- Measurement: Number of projects and production totals of the projects each year (MWs, MWhs, gallons of fuel, emissions savings, etc.), with comparison to USA's new production totals against other nations, like against China, EU.

- Outcome it relates to: Reduced imports of fuels by use of bio-fuels, or electrification of transport or better efficiencies, as compared to a baseline of a specific year (e.g., 2005 or 2008).

4. *Regional balance or equity (e.g. variance in different U.S. Regions)*

- Measurement: Dollars invested by region, and production or outputs.

- Outcome it relates to: Lower emissions relative to fossil fuels, verified by EPA or state agencies.

5. *Support in diversification among fuel sources, for energy security.*

- Measurement: Monitor funding for projects by fuel source, very straight forward and can be monitored quarterly at the board level without creating much bureaucracy.

- Outcome it relates to: New energy facilities with more innovative technologies financed and completed, incorporating more innovative technologies; Reduced imports of fuels; Lower emissions.

6. Assessment of Possible Solutions and Opposition

The White House review¹⁹ of the DOE Loan Program Office (LPO) announced in late October 2011 offers an opportunity to improve implementation of the program, rather than scrapping it, given the vital importance of promoting innovative energy technologies going forward.

Governance of the program drives options for restructuring, transparency, and future performance. The DOE LPO can continue within DOE with some internal adjustments to reviewing projects (A1), or it could be spun out into a separate government investment corporation (A2) like the Overseas Private Investment Corporation (www.opic.gov), which is ruled by its own board of directors and executive team, and can receive multiple year appropriations to provide more predictable funding. It remains subject to oversight by Congress, and is audited also. That external audit and the process of providing independent financial statements could enhance the transparency and management of the DOE LPO.

DOE LPO GOVERNANCE	<u>Unit within DOE</u>	<u>Separate Government Corporation [like OPIC]</u>
ALL FUEL SOURCES; Encompasses all energy sources & technologies, aka, a “Full Portfolio” (i.e., use of nuclear, advanced fossil with CCS)	(A1) [Current manifestation in DOE] <ul style="list-style-type: none"> - Managed separately from other DOE programs; Labs consulted - An internal board reviews program and project mix with Congress. - Nuclear and Fossil projects get more extensive NEPA review. - OMB reviews each project - Subsidy cost for RE projects paid by DOE from appropriations (1705) 	(A2) [“Full Portfolio” of technologies] <ul style="list-style-type: none"> - Autonomous management; DOE consulted on technology issues - Autonomous board appointed by President and Congress; reviews portfolio progress with Congress. - Nuclear, fossil projects pay loan subsidy costs upfront. - OMB would review portfolio, rather than each project.
LIMITED; DOE Loans focused on Renewable sources (RE) and Energy efficiency (EE)	(B1) [Internal EE / RE Focus] <ul style="list-style-type: none"> - Reports to the Office of the Secretary (rather than CFO) - Transparent board oversight - Funding via congressional appropriations - Funding compliant with FCRA - Subject to DOE employment rules, practices, and bureaucracy 	(B2) [External EE / RE Focus] <ul style="list-style-type: none"> - Autonomous management - Autonomous board - Multi-year congressional appropriations possible - Leaves Nuclear and Fossil projects within DOE - Funding compliant with FCRA - Can set salaries more flexibly

In addition to an internal versus external dimension, the organizational spin out could focus initially on renewable energy and efficiency technologies only (B2), which are inherently smaller projects than the nuclear and advanced fossil projects that entail billions in project costs and much more complex permitting and scale of engineering. Utilities and energy companies associated with nuclear and fossil projects are much more familiar with the extended timelines, procedures with federal agencies and iterations associated with these projects and the grid projects often linked to them. So, the second dimension for defining governance would be a “full portfolio”, including nuclear and advanced fossil projects with lower emissions and CCS; or a narrower mission focused on just EE / RE (B1).

¹⁹ www.bloomberg.com/news/2011-10-28/white-house-orders-review-of-energy-department-loan-program-1-.html

Opposition

Opposition to DOE loans has intensified among Republican Congressmen in the wake of scandal around solar-panel maker Solyndra's bankruptcy, encompassing its \$535 million loan from DOE. Drawing support from groups favoring limited-government, such as CATO, the Heritage Foundation, and "Tea Party" activists, Republicans on key committees have led the charge against further credit support or loans for investment in energy deals, and have turned such lending with allegations of "sweetheart deals" to campaign donors ("cronies") into a partisan campaign issue. Specifically, Republican leadership has worked via hearings and the media to tie the DOE Loan Program to debates about the effectiveness of the American Recovery and Reinvestment Act (ARRA 2009). All but three moderate Republican senators voted *against* ARRA, with nearly \$790 billion in spending, including \$6 billion to expand the DOE Loan program. Opponents use several arguments to bolster their cause:

- Opposition to increasing federal debt: "deficit spending is akin to drunk driving"
- Rejection of government selecting "winners and losers", rather than the marketplace; and
- Shutting down "Crony Capitalism." (e.g., favoring campaign donors or political allies)

To reduce the federal budget deficit many Congressional Republicans oppose any expansion of federal government programs. While there are legitimate concerns about controlling federal debt and inflation, under certain situations government is justified in taking an active approach to alleviate market failures and address national security issues. The DOE loan program attempts to compensate for several private market failures. Additionally, a principled belief in reducing debt becomes counter-productive if the action sets the country on an unsustainable (and costly) path of energy consumption, or vulnerabilities. And, ending the DOE loan program now would generate no or minimal budget savings, according to Bloomberg and other sources. Moreover, Republican opponents of federal spending in the renewable energy sector have been silent on the long history of government involvement in the oil, gas and nuclear industries. In a recent study²⁰ on energy subsidies, the Environmental Law Institute (ELI), profiled subsidies in the 2002-2008 time period and found that fossil sources garnered \$72.5 billion while renewable sources received just \$12.2 billion and corn ethanol benefitted from \$16.8 billion in subsidies, most of it in tax credits¹⁶. The notion of a "level playing field" in energy is a mythical landscape.

Several Republican Congressmen have stated "the government should not be picking winners and losers," an oft-used argument on Capitol Hill. However, some of those same members have derided the program while also seeking help for individual projects that would directly benefit companies in their home states.²¹ Despite the partisan rhetoric, promotion of "winning" projects continues among congressional members of both political stripes.

Politicians and government watch groups have labeled the Solyndra loan as "Crony Capitalism," meaning illegal or unethical influence is at play or at least decisions are made without transparency. However, in sworn testimony to the House Oversight & Investigations Subcommittee, Energy Secretary Chu clearly stated that political contributions bear no influence on DOE loan decisions.²² Furthermore, there has been scant evidence *directly* tying campaign contributions to any of the projects selected by the DOE, and many campaign contributors backing projects received no loans whatsoever.

²⁰ ELI: www.eli.org/pdf/Energy_Subsidies_Black_Not_Green.pdf

²¹ NYT: republicans Sought Clean-Energy Money for Home States. www.nytimes.com/2011/09/20/us/politics/republicans-sought-clean-energy-money-for-home-states.html

²² LA Times: Energy Secretary Refuses to Apologize over Solyndra loan. www.latimes.com/business/la-fi-chu-solyndra-20111118.0.7894161.story

7. Evaluation for Performance of the Recommendation

Again, based on Bardach's policy analysis approach (see Appendix XIII), projected outcomes include several results that improve the country's energy security position with progress on environmental goals:

Projected Outcomes (from Section 5)

- Better energy facilities financed and completed, incorporating more innovative technologies
- More private sector investment mobilized on innovative energy technologies (quantifiable)
- Lower emissions (SO_x, NO_x, Hg, GHGs), measured by emitters, verified by EPA
- Reduced imports of fuels by use of bio-fuels, or electrification of transport or efficiencies

Taking into account the proposed recommendation for an independent government enterprise and the resulting projected outcomes, several criteria make sense for evaluation of the enterprise's performance:

- Accountability and efficiency resulting from the newly established independent government enterprise. A key metric for this evaluation being the period of time taken to apply for a loan, its review process, and final approval, while remaining transparent throughout the process and given oversight by Congress. Overall credit quality of negotiated loans is important as well.
- The amount of financing being quantifiably leveraged as more private sector investment is mobilized on innovative energy technologies. This is easy to measure.
- The impact resulting from the given focus on renewable energy (RE) and energy efficiency technologies (EE). It is projected that better energy facilities will be financed and completed, incorporating more innovative technologies. The result of these innovative technologies needs to be measured in the overall number of projects undertaken with its production totals compared against foreign nations (i.e., China, the European Union).
- The lower emissions (SO_x, NO_x, Hg, GHGs) resulting from new projects measured by emitters, further verified by the EPA. Ideally, as more innovative technologies are proven and risks better managed, subsequent deployments can occur with lower levels of subsidy. Federal credit is particularly important for wider adoption with large, capital intensive projects like nuclear plants and advanced fossil projects with CCS²³ (carbon capture and storage, or utilization).
- Overall reduction in the importation of fuels by use of bio-fuels, or electrification of transport or engine efficiencies, as derived from deals funded via the program, and a reduced trade deficit.
- Domestic economic impact measured by the amount of dollars invested by region in the United States, while additionally being analyzed for its overall production results.

²³ For further discussion of risks and finance issues with CCS see www.ccsalliance.net/materials/

8. Conclusion and Recommendation

By reviewing the governance options above in light of criteria, it becomes clearer that the current operation can benefit from restructuring to a more independent, focused, and accountable entity:

	Governance structure →	Internal DOE Unit		Separate Federal Corp.	
	CRITERIA	A1	B1	A2	B2
Weight	Energy Sources →	Full	EE / RE	Full	EE / RE
4	Accountability; Ease of administration and flexibility (hiring, procedures, etc.)	Current mode Most complicated, within DOE	Smaller, but complicated within DOE	Transparent, with larger projects	Most direct, and smaller projects
3	Budget impact relative to other types of support or subsidies	More costly	Less costly	More costly	Less costly
2	Effectiveness in promoting innovation or correcting market defects (e.g., credit crisis)	High; all energy sources	Medium; limited to EE / RE	High; all energy sources	Medium; limited to EE / RE
1	Regional balance or equity (e.g., variance in different U.S. regions)	Balanced, driven by larger projects	Balanced by access to RE	Balanced, driven by larger projects	Balanced by access to RE
1	Support in diversification among fuel sources, for energy security	Fully diversified	Limited to RE, EE	Fully diversified	Limited to RE, EE
		34	37	42	45
		Worse	Limited	Good	Better

Source: matrix developed for this paper by ADPaterson

- A separate government corporation would offer more direct and transparent accountability than a program rooted in the DOE bureaucracy, where DOE must address many different complex objectives, including safe-guarding the nation’s nuclear arsenal. Even a separate “energy unit” within a proposed National Infrastructure Bank²⁴ would offer much more transparency. A government enterprise is still subject to oversight and reporting to Congress, and board members may be appointed or serve ex officio from government agencies. DOE technical experts can be consulted easily. For jurisdiction, Congress can also mandate that such an entity report to the appropriations committees directly.
- The budget impact of loans is lower than direct subsidies²⁵, but pursuing a “full portfolio”, including nuclear reactors and advanced fossil projects, would entail much larger credit commitments per loan.
- Likewise, a full portfolio of technologies offers the greatest span of effectiveness in promoting wider market adoption of innovation, and in addressing market defects across the *entire* energy sector.
- Regional balance is also supported most by a full portfolio of technologies and fuel sources.

²⁴ www.cfr.org/united-states/congressional-research-service-national-infrastructure-bank-overview-current-legislation/p26939

²⁵ See “Overview of Federal Credit versus other types of Subsidies and Policy Actions” at Appendix I

In our interview with the first director of the DOE Loan Program, he offered this perspective:

“Standing up any new Federal program, particularly one of this complexity, with various energy sources and market niches, requires the patience and broad support of many disparate elements: Congress, several administrations, OMB, CBO, the public, established commercial interests, etc. A federal credit program is a risky, challenging prospect, particularly in the energy sector. Day to day staffing, legal and decisional authorities are paramount to the success of the effort. Based on my experience, such an operation could be better run outside of any existing Federal agency, as a stand-alone, quasi-Federal Agency, like OPIC, and it would improve its accountability.”

Interview with Walter S. Howes, First Director DOE Loan Program (2006-2007).

Furthermore, as a review of the program by Bloomberg asserted, “*Cutting the program won’t help the budget* [ital. added]. Ending DOE’s loan-guarantee authority would have no budgetary impact and may jeopardize the remaining projects under review. The commitments from the program aren’t included in the federal budget, which only encompasses direct expenditures.”²⁶

One advantage of an independent *and accountable* government enterprise is it could start with a focus only on renewable sources (RE) and energy efficiency technologies (EE) – *option B2* – leaving nuclear, fossil with CCS, and grid projects within the current DOE LPO. Those larger and more complex projects could be brought over after management and procedures are in place, as merited. Different U.S. regions face different energy needs (see Appendix p.VIII), so the mix of energy fuel sources and technologies varies widely by region. For example, many states in the Southeast and Midwest rely on coal to power better than 50% of electricity, while coal provides less than 20% of power in New England and on the Pacific Coast. Solar is available most in the Southwest; wind in the Plains States, not in the Southeast. *An independent enterprise, ultimately with a full portfolio, would offer the broadest impact across the full energy sector and the various U.S. regions with the best accountability.*

Economist Albert Hirschman might put it, “Voice is the better recuperative mechanism than exit.”²⁷ Stakeholders can use Voice [engagement with Congress, DOE] to restructure the program as recommended. Abandoning the DOE loan program, would encourage more “exit” by investors and by innovators in energy technologies, leaving a gap in addressing multiple market failures, particularly with the credit crisis still plaguing financial markets. Other countries remain fully engaged in energy markets and technologies, while we would be losing market share and be leaving our collective energy security in peril, vulnerable to disruption and new price spikes.

In weighing what economist Jeffrey Sachs cites as “the Price of Civilization”²⁸, a well run federal energy loan program anchored in a more transparent entity to foster broader innovation is a bargain with much less budget impact, particularly if funded initially via an equity call among states seeing value in such federal financing.

²⁶ <http://calcef.org/2011/12/02/10-things-you-should-know-about-the-doe-loan-guarantee-program/>

²⁷ Hirschman, Albert O. *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States*. Cambridge, Mass.: Harvard University Press, 1970, p.53

²⁸ Sachs, Jeffrey, Columbia University, *The Price of Civilization: Reawakening American Virtue and Prosperity*, Random House (October 4, 2011)

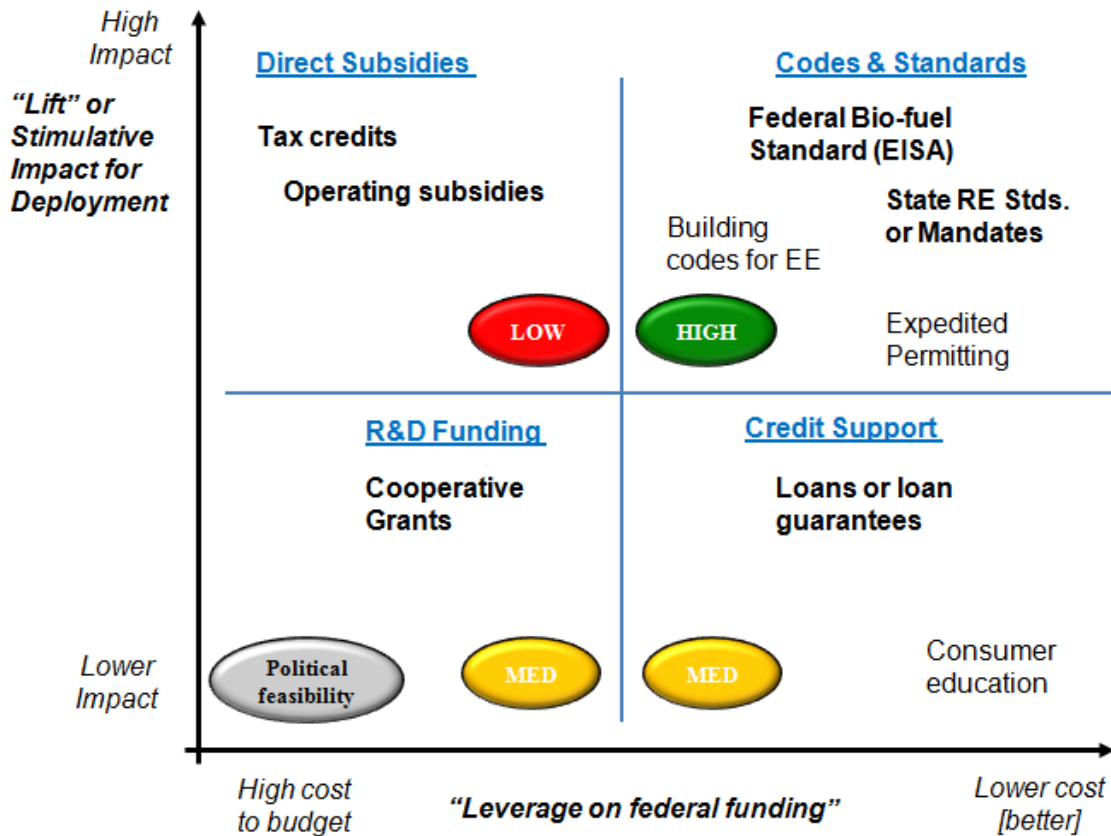
APPENDICES

- I. Outline of Appendices
- II. Client: DOE Loan Program Office, Congress
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Overview of Federal Credit versus other types of Subsidies and Policy Actions:

[Based on discussion with Verdigris Capital: Walter Howes & Andrew Paterson]

Subsidies offer stimulative impact for deployment, but budget cost must be negotiated in Congress via appropriations. Lower cost subsidies, like loans, offer more “leverage”, or bang per buck.



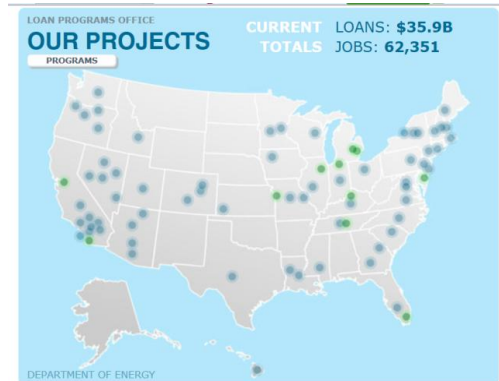
Tax credits and subsidies are the favorite of energy lobbies, *but they cost the most.*

APPENDIX – II/III: Clients and Stakeholders

The DOE Loan Program garners interest from many clients and stakeholders at the national, state, and local levels that are likely to be impacted by action or inaction by the federal government’s involvement in the energy market. Stakeholders include energy industry associations (several listed below), energy-producing states worried about revenues, job growth and economic development, as well as energy consuming states worried about prices, pollution, and other “spillover” effects, or externalities. The DOE Loan Program itself, the Administration (e.g., OMB, Treasury) and relevant committees in Congress are immediate clients for the analysis from this study.

Potential Client Groups

- DOE / OMB / White House (Executive Branch)
U.S. DOE LPO <http://lpo.energy.gov/>
- Key Committees in Congress (Energy, Commerce, Finance, Environment)
- Energy Industry Associations (e.g., ACORE, NEI, EPRI, SEIA, NRECA)
- Banks, Financial institutions, State pension funds, Private equity



Example Stakeholders

- Governors and State Energy Agencies (e.g., NGA, NASEO)
NASEO runs a State Energy Program administered by the DOE which helps States improve their energy efficiency there by creating “energy savings.”
- State Legislatures (energy and environmental committees)
- State Electricity / Utility Commissions (e.g., NARUC)
The grant funds from EPA and DOE help NARUC’s members determine Natural Gas Supply constraints, improve power plants and electric transmission system enhancements
- Regional Compacts (e.g., SSEB, WGA, SGA)
SSEB oversees projects such as American Energy Security (AES) which focuses on ways to lower our dependence of foreign fuels.
- Environmental groups / NGOs (e.g., NRDC, EDF, Clean Air Task Force)
The Clean Air Task Force is dedicated to lessening pollution throughout the world by changing current environmental policies, mainly from thorough research conducted by their experienced staff and consultants.
- Trade Unions (energy project construction jobs), e.g., AFL-CIO, Chemical Workers

Opposition:

- House and Senate members against further federal indebtedness
- Organized groups against specific fuel sources (e.g., against coal or nuclear)
- Organized groups against further federal spending

DOE Loan Program Office

<http://lpo.energy.gov/>

“An Emerging Sector in Need of Support

Restoring the United States to a position of global leadership in clean energy is a critical national priority, with implications for our economic competitiveness, national security, and environmental legacy. This goal can only be achieved through widespread and large-scale deployment of new and innovative clean energy technologies—an undertaking that will require massive, sustained investment by the private sector.

Yet, to date, the private sector has not invested in clean energy at the scale needed to meet our national goals. Part of this shortfall can be attributed to the recent domestic financial crisis and global economic downturn. But much of it is due to the unique features of large-scale energy projects, which make traditional financing difficult to find—even in flush economic times.

Helping to Mitigate Risk

The Department of Energy’s Loan Program—administered by LPO—enables DOE to work with private companies and lenders to mitigate the financing risks associated with clean energy projects, and thereby encourages their development on a broader and much-needed scale.

The Loan Programs consist of three separate programs managed by two offices, the Loan Guarantee Program Office (LGP) and the Advanced Technology Vehicles Manufacturing Loan Program Office. LPO originates, guarantees, and monitors loans to support clean energy projects through these programs.

The programs are:

- Section 1703: Under Section 1703 of Title XVII, DOE LGP is authorized to guarantee loans for projects that employ new or significantly improved energy technologies and avoid, reduce or sequester air pollutants or greenhouse gases.
- Section 1705: Under Section 1705 of Title XVII, added by the American Reinvestment and Recovery Act (ARRA), DOE LGP is authorized to guarantee loans for certain clean energy projects that commenced construction on or before September 30, 2011. The Section 1705 program expired, pursuant to statute, on September 30, 2011 and will actively monitor projects that previously received loan guarantees under the 1705 program. *LPO will no longer issue new loan guarantees under the 1705 program.*
- Advanced Technology Vehicles Manufacturing (ATVM): Under Section 136 of the Energy Independence and Security Act of 2007, DOE is authorized to provide direct loans to finance advanced vehicle technologies.”

List of Conditional Commitment / Loans Offered (<http://lpo.energy.gov/>)

Program	Technology	Loan Guarantee Amount	Jobs (permanent/ construction)	Date of agreement	Locations	Status
1703						
AREVA	Front-end Nuclear	\$2 billion	310/1,000	May-10	Idaho Falls, ID	Conditional Commitment
Georgia Power Company	Nuclear Generation	\$8.33 billion	800/3,500	Feb-10	Waynesboro, GA	Conditional Commitment
Red River Environmental Products, LLC	Energy Efficiency	\$245 million	70/500	Dec-09	Coushatta, LA	Conditional Commitment
SAGE Electrochromics, Inc.	Energy Efficiency	\$72 million	160/210	Mar-10	Faribault, MN	Conditional Commitment
1705						
1366 Technologies, Inc.	Solar Manufacturing	\$150 million	70/50	Sep-11	Lexington, MA	Closed
Abengoa Bioenergy Biomass of Kansas LLC	Biofuel	\$132.4 million	65/300	Aug-11	Hugoton, KS	Closed
Abengoa Solar, Inc. (Mojave Solar)	Solar Generation	\$1.2 billion	70/830	Sep-11	San Bernardino County, CA	Closed
Abengoa Solar, Inc. (Solana)	Solar Generation	\$1.446 billion	60/1,700	Dec-10	Gila Bend, AZ	Closed
Abound Solar	Solar Manufacturing	\$400 million	1,200/400	Dec-10	Longmont, CO and Tipton, IN	Closed
AES Corporation	Battery Storage	\$17.1 million	30-May	Aug-10	Johnson City, NY	Closed
Beacon Power Corporation	Energy Storage	\$43 million	14/20	Aug-10	Stephentown, NY	Closed
BrightSource Energy, Inc.	Solar Generation	\$1.6 billion	86/1,000	Apr-11	Baker, CA	Closed
Caithness Shepherds Flat	Wind Generation	partial guarantee of \$1.3 billion	35/400	Oct-10	Gilliam and Morrow Counties, OR	Closed
Cogentrix of Alamosa, LLC.	Solar Generation	\$90.6 million	Oct-75	Sep-11	Alamosa, CO	Closed
Exelon (Antelope Valley Solar Ranch)	Solar Generation	\$646 million	20/350	Sep-11	Lancaster, CA	Closed
Granite Reliable	Wind Generation	partial guarantee of \$168.9 million	6/198	Sep-11	Coos, NH	Closed
Kahuku Wind Power, LLC.	Wind Generation	\$117 million	10/200	Jul-10	Kahuku Oahu, HI	Closed
LS Power Associates (ON Line – formerly known as SWIP-S)	Transmission	\$343 million	15/400	Feb-11	Ely to Las Vegas, NV	Closed
Mesquite Solar 1, LLC (Sempra Mesquite)	Solar Generation	\$337 million	7/300	Sep-11	Maricopa County, AZ	Closed
Nevada Geothermal Power Company, Inc.	Geothermal	partial guarantee of \$98.5 million	14/200	Sep-10	Humbolt County, NV	Closed
NextEra Energy Resources, LLC (Desert Sunlight)	Solar Generation	partial guarantee of \$1.46 billion	15/550	Sep-11	Riverside County, CA	Closed
NextEra Energy Resources, LLC (Genesis Solar)	Solar Generation	partial guarantee of \$852 million	47/800	Aug-11	Riverside County, CA	Closed
NRG Energy (California Valley Solar Ranch)	Solar Generation	\$1.237 billion	15/350	Sep-11	San Luis Obispo, CA	Closed
NRG Solar, LLC (Agua Caliente)	Solar Generation	\$967 million	10/400	Aug-11	Yuma County, AZ	Closed
Ormat Nevada, Inc.	Geothermal	partial guarantee of \$350 million	64/332	Sep-11	Jersey Valley, McGinness Hills, and Tuscarora, NV	Closed
POET, LLC.	Biofuel	\$105 million	40/200	Sep-11	Emmetsburg, IA	Closed
Prologis (Project Amp)	Solar Generation	partial guarantee of \$1.4 billion	42/Over 1,000	Sep-11	28 States	Closed
Record Hill Wind	Wind Generation	\$102 million	8/200	Aug-11	Roxbury, ME	Closed
SolarReserve, LLC (Crescent Dunes)	Solar Generation	\$737 million	45/600	Sep-11	Nye County, NV	Closed
SoloPower	Solar Manufacturing	\$197 million	450/270	Aug-11	Wilsonville, OR	Closed
Solyndra Inc.	Solar Manufacturing	\$535 million	N/A/3,000	Sep-09	Fremont, CA	Closed
US Geothermal, Inc.	Geothermal	\$97 million	10/150	Feb-11	Malheur County, OR	Closed

ATVM Program	Loan Amount	Jobs (created/ saved)	Date of agreement	Number of Projects	Status
Fisker Automotive	\$529 million	2,000	Apr-10	2	Closed
Ford Motor Company	\$5.907 billion	33,000	Sep-09	13	Closed
Nissan North America, Inc.	\$1.448 billion	1,300	Jan-10	2	Closed
Severstal Dearborn, LLC	\$730 million	260/2,500	Jun-11		Conditional Commitment
Tesla Motors	\$465 million	1,500	Jan-10	2	Closed
The Vehicle Production Group LLC	\$50 million	900	Mar-11	1	Closed

Quotes on Energy Policy Act 2005

From Joe Barton (R/TX-6), Chair – House Energy & Commerce Committee, April 5, 2005

<http://republicans.energycommerce.house.gov/News/PRArticle.aspx?NewsID=6386>

"First, we seek stability in an unstable world. In the last several years, global demand for energy has grown exponentially. And, unfortunately, so has political instability. We are at a point now where dependence on any single source of energy, especially a foreign source, is beginning to leave us vulnerable to price shocks, shortages, and even blackmail. These are the uncertainties that plague mankind. If we don't want America to be subject to them, American energy suppliers must be able to have and maintain control over their businesses. We also need to find more energy from different sources, and to modernize the way we find it, develop it, and produce it. Technology offers us the chance to do just that. Doing so will provide a cleaner, healthier, and more beautiful America. This country has a responsibility to its children to provide a future with not only stable energy supplies, but also a clean and safe country in which to grow up. This legislation will finally help us fulfill that obligation. But we must also be realistic about our mix of energy sources. Americans must explore new technology."

Senator Jeff Bingaman (D-NM) on the Signing of the Energy Policy Act of 2005, August 8, 2005

"Today, the President signed the first comprehensive energy law in 13 years, after four years of work by Congress. The new Energy Policy Act of 2005 takes positive steps towards improving energy supplies, boosting energy conservation and developing the new energy technologies that we will need in the future. I congratulate the President and all members of the Senate and House who worked hard to see this legislation enacted."

Chairman Senator Pete Domenici's statement (R-NM), October 27, 2006:

http://energy.senate.gov/public/index.cfm?FuseAction=PressReleases.Detail&PressRelease_id=957a9e80-1ec0-4495-b160-fc4d6614c910&Month=10&Year=2006

"By creating this loan guarantee program, Congress provided an important opportunity for bringing clean technologies to market that will make a real difference in reducing carbon emissions. The loan guarantee program complements the goals President Bush outlined in his Advanced Energy Initiative. The private sector is excited about the promise this program offers to emerging technologies. I have heard from scores of interested companies throughout the energy sector, ranging from car companies to utilities. While I am frustrated by the delay, I hope it will result in an even stronger program implementation."

The Hill, October 4, 2011:

Bingaman, who helped develop the 2005 energy law that first authorized DOE loan guarantees, told reporters Monday that the Solyndra bankruptcy shouldn't be used to cut clean-energy investment.

"I think there are clearly a bunch of people here in Congress who don't support the idea that the government should partner with industry to help ensure that the U.S. has these types of projects," Bingaman said Monday. "I think it made good sense as national policy then and I think it still does."

<http://thehill.com/blogs/e2-wire/e2-wire/185411-sen-bingaman-planning-hearing-on-clean-energy-investment>

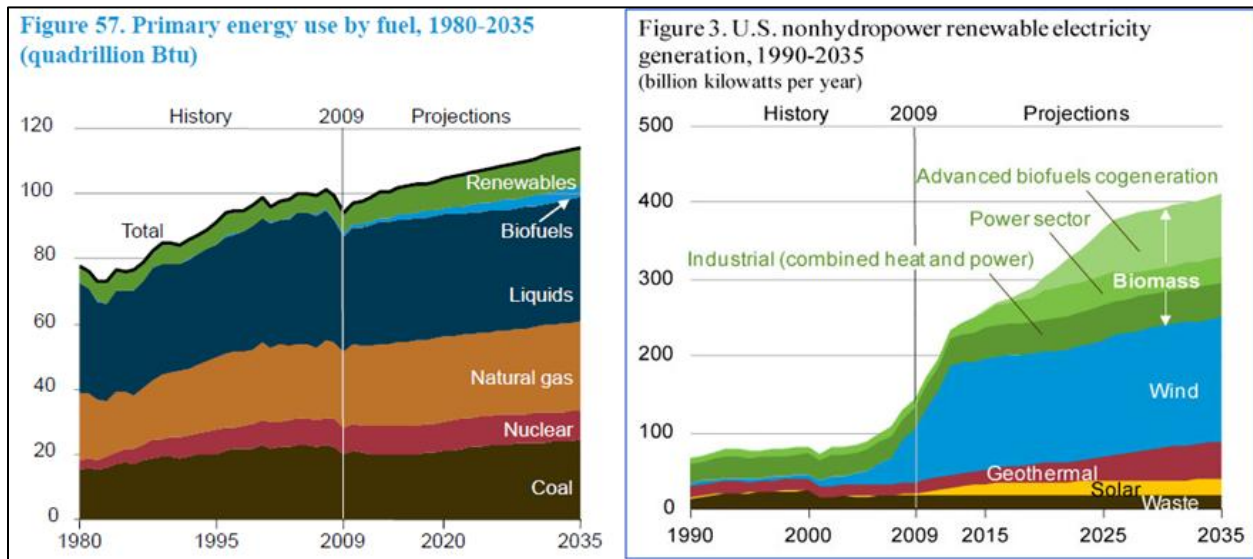
Other notes: Republicans lobbying for loans on projects in their districts (2011).

<http://thinkprogress.org/report/clean-energy-cons/>

Additional Data

EIA U.S. Energy Use by Source to 2035, based on current energy policies in place.

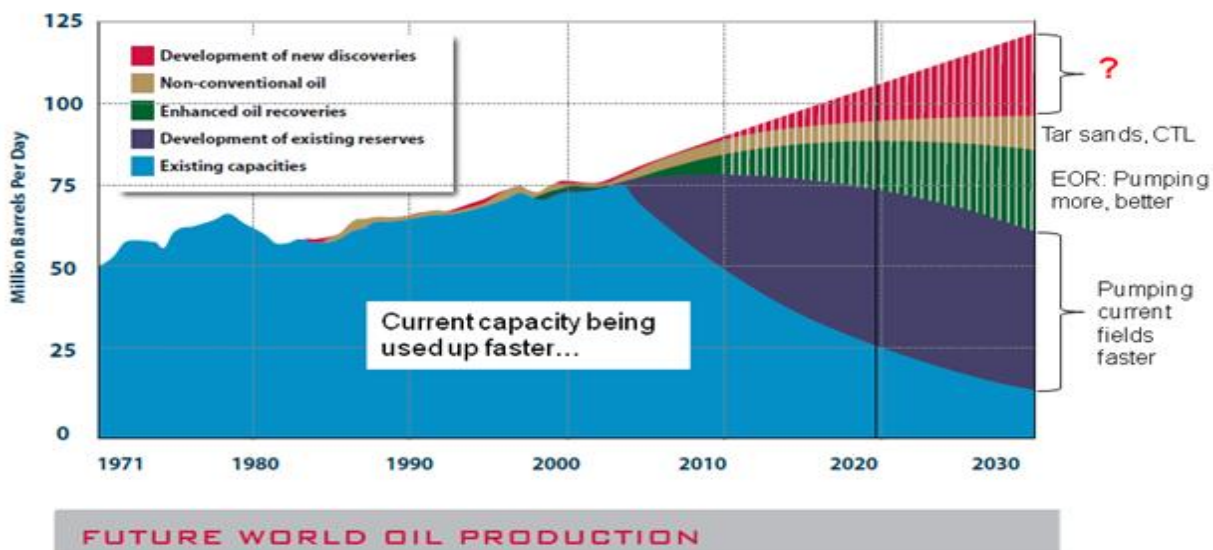
- Fossil sources still provide ~60% of consumption by 2035.
- Biggest Renewable Energy gains are in power, biofuels
- Assumes natural gas prices \$6-\$8 / MBtu
- Significant new supply from shale gas, in North America
- Current nuclear units relicensed, some additional units built



Source: EIA Annual Energy Outlook 2011

IEA: Future World Oil Production

Current sources are declining, so more discoveries and better recovery are needed.



SOURCE: International Energy Agency - World Energy Outlook, p. 103

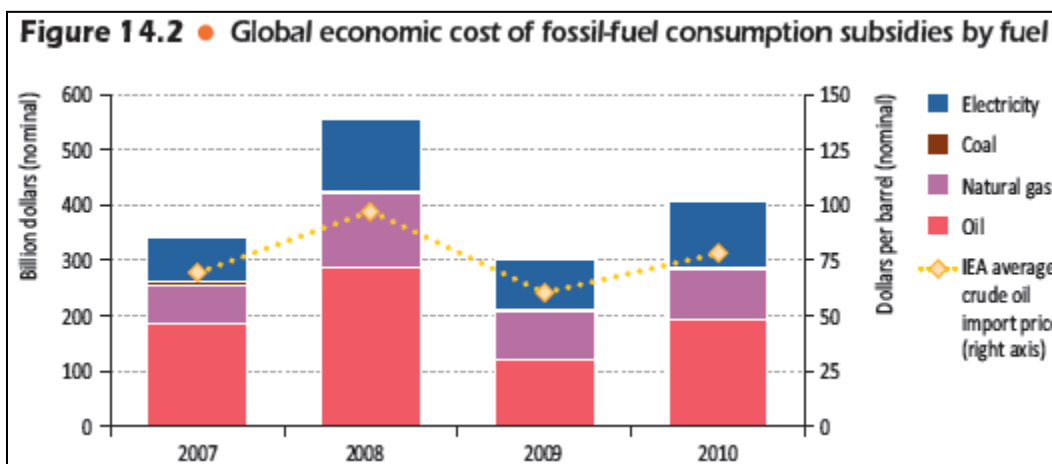
IEA: Level of Energy Subsidies globally runs >\$400 billion annually

IEA: “Fossil-fuel subsidies are often employed to promote economic development or alleviate energy poverty, but have proven to be an inefficient means of fulfilling these objectives, instead creating market distortions that encourage wasteful consumption and can lead to unintended negative consequences. Moreover, rising international oil prices made their total cost insupportable to many oil-importing countries in 2010. Volatile energy markets and the prospect of higher fossil fuel prices mean that fossil-fuel subsidies threaten to be a growing liability to state budgets in the future. This prospect has created a strong impetus for reform, strengthened by other associated benefits, including energy savings, lower carbon-dioxide (CO2) emissions and improved economic efficiency. But fossil-fuel subsidy reform is notoriously difficult as the short-term costs imposed on certain groups of society can be very burdensome and induce fierce political opposition. In the case of fossil-fuel consumption subsidies, rising international fuel prices have frequently outpaced the rate at which domestic fuel prices have risen and presented governments with difficult choices about whether to proceed with reform plans or protect consumers. If removing these subsidies were easy, it would probably already have happened.”

Table 14.1 • Estimated energy subsidies, 2007-2010 (\$ billion, nominal)

	2007	2008	2009	2010
Fossil fuels (consumption)	342	554	300	409
Oil	186	285	122	193
Gas	74	135	85	91
Coal	0	4	5	3
Electricity*	81	130	88	122
Renewable energy	39	44	60	66
Biofuels	13	18	21	22
Electricity	26	26	39	44

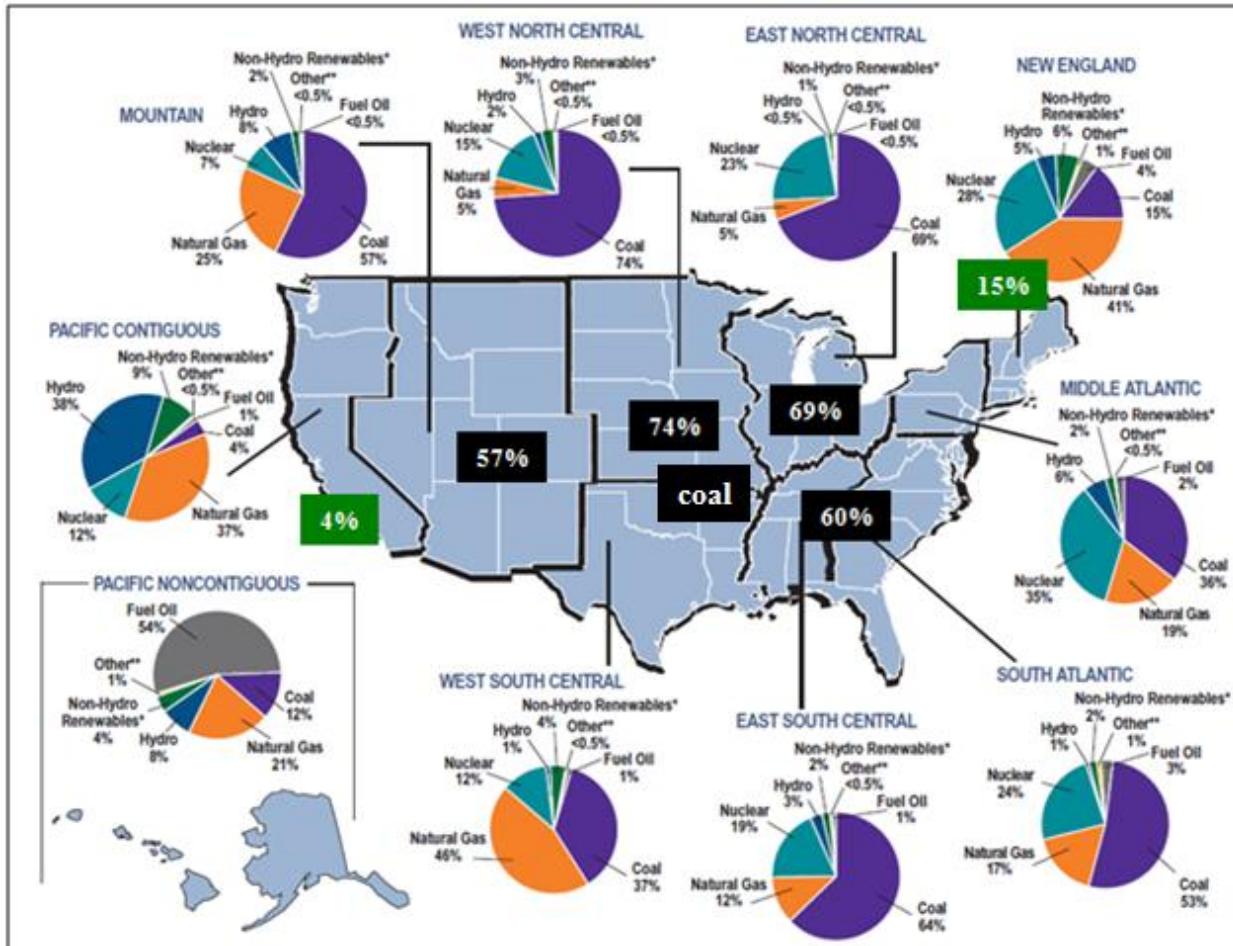
*Fossil-fuel consumption subsidies designated as “electricity” represent subsidies that result from the under-pricing of electricity generated only by fossil fuels, i.e. factoring out the component of electricity price subsidies attributable to nuclear and renewable energy.



IEA World Energy Outlook 2011

EEl: Regional fuel mix for electricity varies widely:

Different regions utilize much different fuel mixes for power, which complicates consensus on energy policy nationally. Differences are driven by access to different resources, pricing, level of regulation, weather patterns, urbanization, etc.



Source: Edison Electric Institute, 2009 (based on EIA data)

Any national federal program would need flexibility to address the scale of regional differences.

EIA: Energy end-use patterns and electricity supply sources

Energy use by end-use sector (residential, commercial, transportation, industrial) changes slowly over time, driven in part by the high capital intensive nature of energy infrastructure (e.g., power plants, buildings, office towers, engines, factories) with long-lived assets that turnover *only by decades*, rather than years. Extensive, multi-layered regulatory regimes also hinder rapid turnover.

Electric Power Sector, Major Sources, 2010

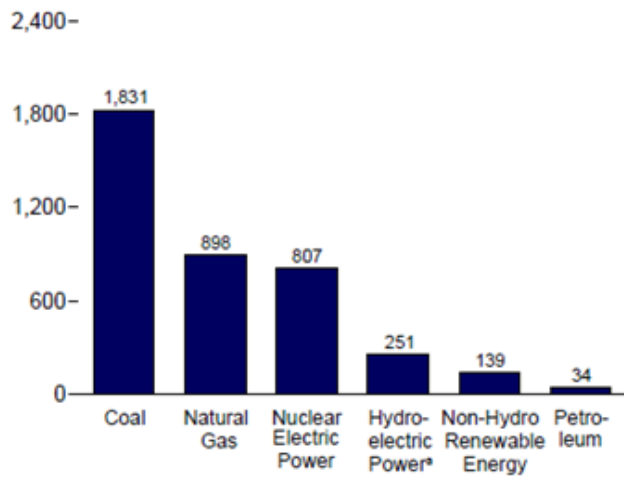
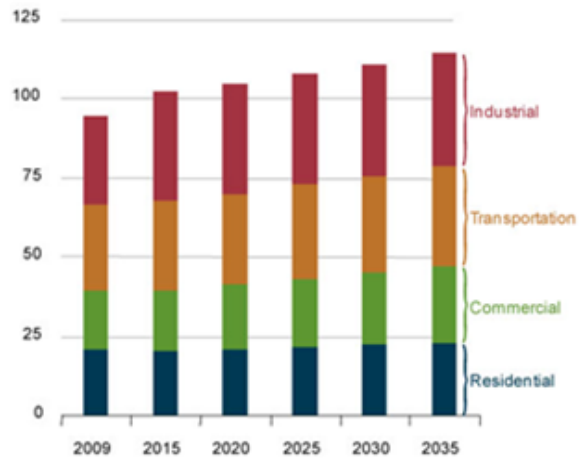
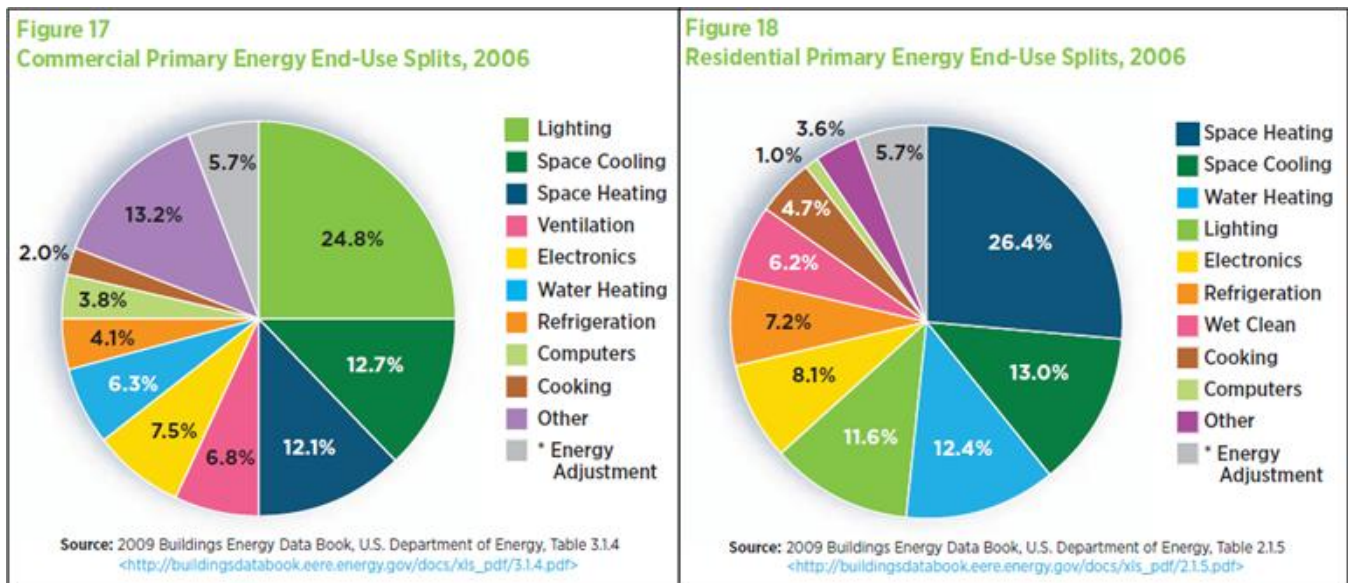


Figure 56. Primary energy use by end-use sector, 2009-2035 (quadrillion Btu)



Source: EIA Annual Energy Outlook 2011

Energy Efficiency and End-use in Commercial and Residential Buildings, 2009



Source: DOE, Energy Efficiency Trends in Residential and Commercial Buildings (Aug. 2010)

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Adaptation of Bardach’s Policy Analysis approach to the policy of addressing: “Governance Options for Federal Credit for Innovative Energy Technology”

Eugene Bardach, emeritus professor of public policy at the Goldman School of Public Policy, the University of California, Berkeley, has notably constructed a method for policy analysis used explicitly in the preceding analysis. A foundation for developing and implementing policy analyses, The Eightfold Path, detailed at length in *A Practical Guide for Policy Analysis: The Eightfold Path to More Effective Problem Solving*, institutes an analysis structure practical for its logical criteria used toward promoting a conclusion. Widely applicable to a broad range of public policy issues, the construction is followed through a logical progression, and iteration is strongly encouraged.

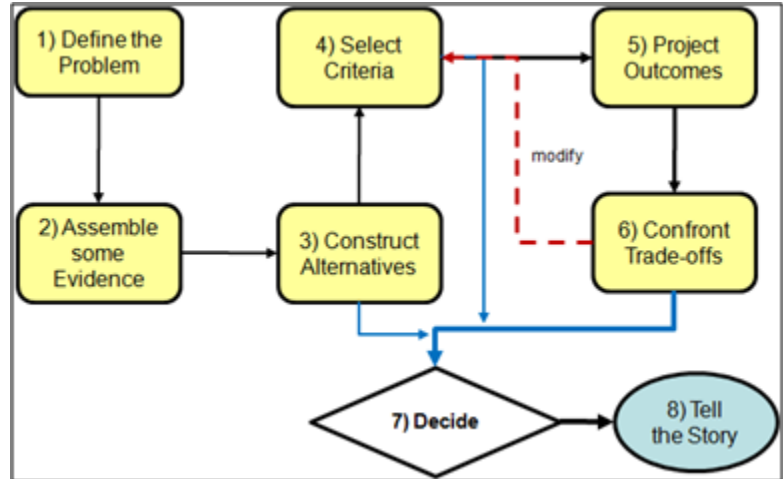


Diagram adapted by Andrew D. Paterson from: Bardach, Eugene. *A Practical Guide for Policy Analysis*, CQ Press, 2009.

1. *Define the Problem:* Over dependence on imports or on unreliable or unstable energy sources with a lack of financing for innovative energy technologies, as well as a loss of industrial competitiveness (e.g., loss of market share) in several key energy technologies.

2. *Assemble Evidence:*

- Widespread, deep intervention in energy markets at multiple levels [e.g., OPEC, government owns energy assets, energy use regulations, state electricity supervision, EPA rules]
- Importance of energy for the economy; U.S. geopolitical standing related to national security
- Fossil fuel imports aggravate trade deficit and currency imbalances
- Loss of competitiveness by US in key energy technologies (e.g., batteries, fuels, RE, nuclear)
- Global credit crisis remains (might worsen); lenders averse to new, riskier technology
- IEA: Scale of needed energy infrastructure investment (trillions) requires debt capital.
- National energy security can be threatened by actions abroad, not just by domestic events. Innovative technologies enable better use of domestic sources, e.g., EE/RE, or electrification of transportation with plug-in hybrid vehicles.

<u>Supply-side actions</u>			<u>Demand-side actions</u>		
S1	Safer imported fuel sources		D1	Efficiency / Better engines or motors	
S2	More domestic fuel production		D2	More mass transit (rail, bus)	
S3	New “Clean Energy”* generation		D3	Less driving or use (conservation)	
S4	Non-fossil fuels (biofuels)		D4	Electrification of transport	

○					
<u>Federal Support</u>			<u>Political Activity</u>		
R&D	Tax credits	Credit	Outreach	Federal	Int'l
Demos	Subsidies	Fed Loans	Education	Regulation	Treaties

3. *Construct Alternatives for Governance*
 Going forward the DOE Loan Program Office could:

A1: Continue as a unit or Office within DOE for a “Full Portfolio” (all fuel sources, including nuclear, advanced fossil with CCS)

A2: Spin out as a Separate Government Corporation (like OPIC)

B1: Retrench to focusing on EE/RE within DOE to focus the program.

B2: Spin out as a separate entity, focused only on EE/RE to start, leaving larger, more complex nuclear and fossil projects within DOE, which can be brought over later as necessary.

DOE LPO GOVERNANCE	Unit within DOE	Separate Government Corporation [like OPIC]
	(A1) [Mode now in DOE]	(A2) [“Full Portfolio”]
ALL FUEL SOURCES; “Full Portfolio”	- An internal board reviews program under DOE Sec’y - Under DOE appropriations - OMB reviews each project	- Autonomous board appointed by President and Congress - OMB would review portfolio
	(B1) [Internal EE/RE]	(B2) [External EE/RE]
DOE Loans focused on EE/RE	- Reports to the Office of the Secretary (rather than CFO) - Subject to DOE rules, practices	- Autonomous board, management - Multi-year appropriations - More flexible organization

4. *Select Criteria* (for weighing alternative governance options)

- 1) Accountability: Ease of administration, flexibility (hiring, procedures, etc.), and transparency
- 2) Budget impact relative to other types of support or subsidies
- 3) Effectiveness in promoting innovation or correcting market defects
- 4) Regional balance or equity (e.g., variance in different U.S. regions)
- 5) Support in diversification among fuel sources, for energy security

5. *Forecast Outcomes*

- Better energy facilities financed and completed, incorporating more innovative technologies
- More private sector investment mobilized on innovative energy technologies (quantifiable)
- Lower emissions (SOx, NOx, Hg, GHGs), measured by emitters, verified by EPA
- Reduced imports of fuels by use of bio-fuels, or electrification of transport or efficiencies

6. *Confront Trade-offs*

Trade-offs involve incurring debt and risk to promote outcomes, but loans incur less budget impact than do grants or direct tax subsidies. In addition, limiting the portfolio to EE/RE would potentially reduce risks to government, but would also limit the impact on the U.S. energy economy and overall objectives for national security, reduced emissions, and lower fuel imports.

7. *Decision*

An independent enterprise, ultimately with a “full portfolio” (all fuel sources), offers the broadest impact across the full energy sector and the various U.S. regions with the best accountability.

8. *The Story*

Forecasted Outcomes provide a beneficial story with widespread positive impact: Better energy facilities with more innovative technologies; more private sector investment mobilized; and lower emissions with reduced imports of fuels from unstable sources.

APPENDIX - VI

Editorial: An Independent Energy Loan Program boosts Energy Security

Congressional Republicans have recently lambasted the Department of Energy's (DOE) energy loan program over its funding for Solyndra, a California solar panel manufacturing corporation that filed for bankruptcy. Republicans seized on the Solyndra scandal as a rationale to dismantle the DOE's Loan Programs Office (LPO), and attack the Recovery Act. This is shortsighted; the Loan Program can be a vital arm in addressing energy security issues, such as dependence on imports for half our oil appetite, and reducing emissions.

DOE's LPO was created under EPCA 2005 *with a Republican-led Congress* to provide federal guaranteed loans to industrial projects utilizing *innovative* clean energy technologies. Private lenders shun innovative projects, which are inherently more risky. With successful deployment government guaranteed loans help widen commercial acceptance of these potentially innovative technologies that deliver more efficient performance and reduced emissions. DOE's loan program has flaws; however, meeting our country's diverse energy needs should not involve scrapping this vital program. The United States must take bold steps now to fund projects that will promote more energy efficiency and renewable technologies, enable baseload nuclear units to replace out-moded coal-fired units, and move us away from our dependence on imported fuels from unstable sources, all while mobilizing more private capital.

Critics of the LPO argue that government should not take part in the innovative energy technologies market. These projects, while bearing the potential for substantially improving energy security, are often simply too risky for private sources of credit in the wake of the credit crisis. Moreover, China, as one example, has already offered over \$34 billion in credit to their solar companies. Without public-private financing, we continue to lose competitive position in key energy technologies. IEA estimates that energy subsidies by governments globally exceed \$400 billion annually. Oil flows are subject to the OPEC cartel, where state enterprises (government-owned) control the vast majority of oil resources. Furthermore, consumers don't react well to price signals for gasoline and electricity. Demand is "sticky" (or inelastic). Consumers complain about prices, but consumption is driven more by weather (heat waves or ice storms) and by general commuting patterns that are not altered quickly.

Continuing the Energy LPO should be one key piece in a strategy for energy security. A more effective and transparent structure could be established. In addition to fallout over the Solyndra scandal, the LPO has been hampered by the Agency's cumbersome bureaucracy and inadequate expertise in credit evaluation. Instead, Congress can restructure or spin out the LPO as a new government entity, independent from DOE. As a model, the Overseas Private Investment Corporation (OPIC), established in 1971, is a federal entity that cultivates private capital to help US businesses take part in riskier emerging markets. OPIC is self-sustaining, has generated approximately \$74 billion in US exports and has helped support over 275,000 jobs. An independent energy lending entity can receive multi-year appropriations to avoid disruptions, and is fully accountable to Congressional oversight and audits, similar to other Federal agencies, and under the Federal Credit Reform Act of 1990. Alternatively, it could be funded initially via an "equity call" to states. A restructured Federal Energy Investment Corporation (FEIC) could potentially play a critical role in finally moving us away from, as President Bush put it in his 2006 State of the Union speech, "our addiction to fossil energy", away from imports from unstable or even hostile sources of fuel via progress in efficiency and more reliable and secure sources. Modern civilization bears a price; this effort is a bargain in a *trillion* dollar U.S. energy sector.

Abbreviations / Acronyms

ACORE: American Council on Renewable Energy (Founded in 2001)
APTA: American Public Transportation Association
ARPA-E: Advanced Research Projects Agency for Energy (within DOE)
CBO: Congressional Budget Office (arbitrates budget values of subsidies and loans)
CCS: Carbon Capture and Storage (or “CCUS” with “utilization”)
DOE: U.S. Department of Energy LPO (Loan Program Office)
EDF: Environmental Defense Fund
EEI: Edison Electric Institute (lobbying arm of the U.S. power utility sector)
EESA 2008: Emergency Economic Stabilization Act of 2008 (aka “banking sector bailout”)
EIA: U.S. Energy Information Administration (source of Annual Energy Outlook)
EISA: Energy Independence and Security Act of 2007
EPA: Environmental Protection Agency
EPA 2005: Energy Policy Act 2005
EPRI: Electric Power Research Institute
Ex-Im Bank: Export-Import Bank (a separate federal corporation since 1945)
FCRA: Federal Credit Reform Act 1990
GHGs: Greenhouse Gases (CO₂, CH₄, and other exotics)
Hazardous Pollutants: SO_x (sulfur dioxide), NO_x (nitrous oxides), Hg (mercury), PMs (particulates)
IEA: International Energy Agency (publishes World Energy Outlook)
NARUC: National Association of Regulatory Utility Commissioners (Founded 1989)
NASEO: National Association of State Energy Officials (founded in 1986)
NEI: Nuclear Energy Institute
NRDC: Natural Resources Defense Council (founded in 1970)
NRECA: National Rural Electric Cooperative Association
NGA: National Governors Association (founded in 1908)
NGO: National Government Organization
OPEC: Organization of Petroleum Exporting Countries
OPIC: Overseas Private Investment Corp. (established in 1971)
SBA: Small Business Administration (formed in 1953 as an independent federal agency)
SEIA: Solar Energy Industry Association (established in 1974)
SGA: Southern Governors Association
SSEB: Southern States Energy Board (created in 1960)
TARP: “Troubled Asset Relief Program”, enacted in Oct. 2008 within EESA
WGA: Western Governors Association

Andrew Paterson, Principal – Environmental Business International

Mr. Paterson brings nearly three decades of experience to projects in the energy and environmental industries, focused on commercial market and policy analysis focused on energy technology and finance. He is a board member and principal with Environmental Business International, and its financing affiliate, Verdigris Capital, LLC. With Econergy, a private equity developer of clean energy and carbon resource projects with electricity generating assets and carbon offset projects focused in North and South America, he served as director for Energy & Finance Consulting in North America for 2007-2008 (acquired in December 2008 by GDF-Suez). Mr. Paterson speaks at numerous industry conferences and is a skilled moderator in energy policy forums, and speaks on policy developments each year at the Environmental Business Summit (www.ebiusa.com). He works with several industry groups: EPRI, NARUC, NASEO, SSEB, IEA, WRI, and CSLF.

Previously, he served as principal directing a variety of public - private partnership engagements focused on financing innovative energy sector technologies:

- Financial advisory work on \$150 million wind farm in New England with Verdigris Capital
- Extensive work and analysis for a \$400 million DOE Loan to a solar manufacturer in CO.
- Utility scale solar project investment analysis for EPRI and several utilities (2008-09)
- CSLF Investment Task Force Financing Framework report (2009-11) for Energy Ministerial
- EPA – NACEPT Venture Capital Report for Environmental Technologies (2008)
<http://nepis.epa.gov/EPA/html/DLwait.htm?url=/Adobe/PDF/P1000JVB.PDF>
- “Risk Framework for Financing Clean Energy”, for World Energy Congress (Rome, Nov 2007)
- Financial and investment analysis for the Dept. of Energy Loan Guarantee Program (2005-7)
- Co-Founder – “CCS Alliance” with Hunton & Williams, NRECA for evaluation of risk management and finance approaches on advanced fossil projects with carbon capture (2007-11)
- Business Case for Co-production of fuels and power for DOE (2006-7), financial model
- Policy Options and Incentives Analysis for a variety of energy sectors and power projects and technologies for DOE (2001-06), related to the Energy Policy Act of 2005

Specific to the U.S. Dept. of Energy, Mr. Paterson has conducted a wide variety of technical and industrial analysis over two decades, including a five-year stint on the DOE Environmental Management Advisory Board Technology Committee. These engagements included:

- Advisory engagements for DOE loan guarantees and DOE grants for energy technology projects
- “Business Case” reviews and decision modeling for DOE energy RD&D programs, since 2000
- A biennial review of renewable energy and distributed generation markets with EBI

Environmental Business International (1993-current): Principal in Energy Consulting
SoCalTEN (1984-1992), Technology Executives Network (now ABL.org): Regional Director
Price Waterhouse (1979-84): Entrepreneurial Technology Consulting Services Group

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Federal fiscal support can generally be provided, (a) via government grants (DOE, USDA) for R&D and demonstrations, (b) via tax credits or subsidies, and (c) via credit support such as federal loans and guarantees as embodied now in the DOE Loan Program. Non-fiscal measures without direct budget impact or subsidies include: (d) outreach and consumer education; (e) federal regulation, such as building and appliance standards or emission permits; and (f) international treaties or cooperation related to foreign sources.

STRATEGIC OPTIONS			Federal Support			Political Activity			
Enhancing energy security	Level of Innovation		R&D Demos	Tax credits Subsidies	Credit Fed Loans	Outreach Education	Federal Regulation	Int'l Treaties	Also curbs GHGs ?
[XXX = level of government activity]									
Federal budget cost ==>			High	Very high	Medium	Low	Low	Low	
<i>Supply-side actions</i>									
S1	Alternative external fuel sources	Low						XXX	No
S2	More domestic fuel production	Medium		XXX			XXX		No
S3	New clean energy generation	High			XXX	XX	XXX	X	Yes
S4	Non-fossil fuels (biofuels)	High		XXX	XX		XXX	X	Yes
<i>Demand-side actions</i>									
D1	Efficiency / Better engines or motors	High	XXX	XXX	XXX	X	XXX	X	Yes
D2	More mass transit (rail, bus)	Low		X		XX	X		Yes
D3	Less driving or use (conservation)	Low				XX	X		Yes
D4	Electrification of transport	High	XXX	XXX	XXX	X	XXX		Some

A row in the matrix above is shown noting relative budget cost for each action, and level of innovation for S1-4, D1-D4, and whether an option would also curb greenhouse gases (GHGs), another public policy objective that correlates closely with reducing dependence on fossil fuels. The level of innovation runs highest in S3 Clean energy generation, S4 Non-fossil fuels, D1 Better engines and motors and efficiency technologies, and in D4 Electrification of transportation (e.g., car batteries). **These are the exact areas where federal loans and credit enhancement, such as loan guarantees, can be most effective in mobilizing capital investment for innovative technologies.**