Ten Principles for Creating a New U.S. Clean Energy Policy

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Our nation has debated energy policy on and off for over 40 years, yet the same three problems grow worse. First, the United States needs to reduce its reliance on imported oil to strengthen domestic energy security, reduce the trade deficit, and guard against economically harmful swings in global prices. Second, the military needs to reduce its reliance on liquid fossil fuels, which are targeted for attack by our enemies putting our combat troops at greater and greater risk. And third, humankind needs to reduce its consumption of fossil fuels to limit the impacts of climate change.

Unfortunately, while these problems grow worse, the response from U.S. policy makers remains inadequate. Typically, when energy prices go up, energy policy activism spikes. The response might include incrementally increasing energy R&D investment, incentivizing more domestic oil drilling, expanding energy efficiency programs, and/or subsidizing mature alternatives like ethanol. But these activities are rarely sustained, and are frequently pursued in an ineffective piecemeal approach until energy prices come down and attention turns elsewhere. The debate has become so stale and the solutions so ineffective that even policy makers have taken notice. As President Obama recently pointed out, “Presidents and politicians of every stripe have promised energy independence but that promise has so far gone unmet. That has to change. We cannot keep going from shock to trance on the issue of energy security, rushing to propose action when gas prices rise, then hitting the snooze button when they fall again.”

Instead of the same tried and failed approaches, decision makers would be well advised to learn from nearly a half century of failed energy policies and finally implement a long-term solution: an energy policy that leads the United States down the path to cheap, domestically produced clean energy.
So here we are again. Oil prices are rising, climate change is worsening, hundreds of billions of dollars are flowing annually to overseas oil producers, and the United States is engaged in multiple wars in oil producing regions. The political rallying cry is getting louder: the United States needs a new energy policy. But instead of the same tried-and-failed approaches, decision makers would be well advised to learn from nearly a half century of failed energy policies and finally implement a long-term solution: an energy policy that leads the United States down the path to cheap, domestically produced clean energy. Within this framework, ITIF proposes ten guiding principles that are fundamental to crafting a new policy and meeting our energy challenges:

1. **Policy should seek to make the unsubsidized cost of clean energy cheap.** There is a difference between cost and price. Our clean energy policy today is largely focused on reducing the price of mature technologies through subsidies like tax credits, rebates, payouts, and low-cost financing. Instead, it should be focused on reducing the cost through spurring technological innovations that enable clean energy to be produced more cheaply than coal-powered electricity or gasoline-powered vehicles.

2. **Government support for innovation is central to making clean energy cheap.** Examples of the critical role public support played in driving innovation are pervasive, and government needs to play the same role in clean energy. A key reason is that the private sector regularly underinvests in early stage research, creating a gap that must be filled with government support (through both tax incentives like the R&D credit and direct funding for R&D).

3. **Clean energy innovation means more R&D, but also more transfer, testing, demonstration, and deployment.** Getting the clean energy we need is expensive and faces many obstacles. To go from initial R&D to commercial viability involves bridging multiple “valleys of death.” Government support is needed to bridge these valleys and move low-carbon technologies from the lab to the market.

4. **The public and private sector must both play a role in clean energy innovation.** Conventional wisdom among some holds that business is the lone engine of innovation, and that government should simply get out of the way. But this “wisdom” ignores the critical role public-private collaborations have had over the last century in making many technological transformations possible. We need the resources and insights of both the public and private sectors for a successful clean energy innovation policy.

5. **Clean energy policy should “pick winners,” not by picking national champions, but by broadening the technology menu and then letting the market decide.** It has become an aphorism that the government can’t pick winners, only the market. But in market economies, private firms rightly focus on maximizing private returns alone, which means they will underinvest in socially desirable sectors and technologies. If we thus define “winners” in this way, then only government can identify sectors with large societal returns and foster innovation in them.
6. **Support for clean energy innovation should be viewed as an investment in the future, not wasteful interest-driven spending.** Cutting investments that provide a positive societal payoff under the guise of fiscal responsibility is akin to a parent who refused to pay for their children’s college so that they could leave them a bigger inheritance. In short, cutting clean energy investments is penny wise and pound foolish.

7. **Clean energy policy should reinvigorate, not hurt, U.S. export industries.** The competitiveness of the U.S. economy should be a central goal of any new clean energy policy to make it not only politically but also economically viable. We need to steer clear of policies that would send jobs overseas.

8. **Public investment should emphasize technologies with a clear upside – even if they’re currently unpopular.** Criticisms of many commercialized and experimental energy technologies, such as nuclear power, are often vociferous. However, instead of scrapping them outright, we should ask whether they can be improved through innovation, and what investments are needed to make that happen.

9. **“Cleaner” is not the same thing as “clean.”** Just because some energy sources like natural gas are not as dirty as coal does not mean they’re clean; and just because they are abundant now does not mean they will last forever. To achieve the goal of sustainable zero-emissions energy, we should be careful not to give natural gas or other sources advantages in the short run that could crowd out investments in other, better, cleaner energy technologies in the long run.

10. **A global energy challenge requires a global effort that ensures proper incentives for innovation.** We won’t get the needed levels of innovation if other nations play by mercantilist rules. Forced clean tech transfer, intellectual property theft, and even clean tech export subsidies hurt, rather than help, the global challenge to transition to clean energy, because they reduce the incentives for clean energy innovation.

**1. POLICY SHOULD SEEK TO MAKE THE UNSUBSIDIZED COST OF CLEAN ENERGY CHEAP.**

Too many in the clean energy policy community mistakenly equate reducing the price of clean energy with reducing its cost. Our clean energy policy today is largely focused on reducing the price through subsidies like tax credits, rebates, payouts, and low-cost financing. Instead, it should be focused on reducing the cost through spurring technological innovations that enable clean energy to be produced more cheaply than coal-powered electricity or gasoline-powered vehicles.

In the short term, reducing the price of clean energy through subsidies can make clean energy competitive with fossil fuels, but only artificially, as long as the subsidies are in place and only in states or nations offering the subsidy. Yes, this would increase the market for clean energy. But artificially reducing price is a short-term solution that neglects the long-term goal of making clean energy cheap on its own. Three reasons are most prominent:

Energy is a fungible commodity. Whether it comes from coal or windmills, consumers receive the same thing — electricity.
First, and most important, a strategy of cost-reduction through subsidies fails to address the global need to reduce greenhouse gas emissions. To solve climate change, all nations, both developed and developing, must transition to low-carbon energy. And while developed regions like the United States and Europe might be willing to charge their consumers and businesses more for clean energy, developing nations can’t afford to pay a premium for clean energy, nor should they as they are trying to access any energy. The only way the entire global energy system can transition to clean energy is if its cost, and not just its price, is lower than the price of fossil fuels. It’s not enough for an individual U.S. state or the United States as a whole to move to low-carbon technologies and drastically reduce its emissions, as the world would still need to reduce greenhouse gases to avert climate change. And a subsidies approach means that only rich countries will adopt clean energy. Lowering the cost of clean energy, through innovating next-generation clean energy, is the key to solving global climate change.

Second, relying on subsidies is not even an assured strategy in a developed nation like the United States. To date, the federal government and some state governments have put in place modest, piecemeal subsidies that have resulted in modest, piecemeal adoption of clean energy. But the only way to spur large-scale deployment is through large-scale subsidies. Yet, consumers would resist the increases in taxes (or consumers would resist increases in costs if pursued through clean energy mandates) that any such large-scale subsidies regime would involve. Within this framework, subsidies and mandates are an added cost to society, at least in the short term. In comparison, investing the same limited public funds in innovating advanced new clean energy technologies offers the possibility of increasing economic growth by boosting energy productivity. Emphasizing deployment rather than innovation dooms the United States to strictly lowering the short-term subsidized price of mature clean energy and implementing complex regulations while doing little to drive long-term unsubsidized cost reduction.

And third, subsidies won’t necessarily lead to long-term cost decline. Advocates of subsidies and mandates argue that artificially increasing the demand for clean energy through subsidies and renewable energy mandates will lead to declines in the cost of production (i.e., by moving down the production cost curve). But if subsidies and mandates are the key to long-term cost competitiveness, why aren’t wind, solar, and biofuel technologies competitive after nearly two decades of government largesse? Subsidies won’t lead to lower costs if the technology is already relatively mature. That would be putting the cart before the horse. For instance, emphasizing deployment through subsidies may reduce the price of current-generation batteries, but lithium-ion batteries are already reaching their limits of performance and cost reduction. DOE Secretary Chu got it right when he recently stated, “Right now the installation of solar requires subsidy. By getting the cost down to the dollar a watt target then the energy is comparable to other sources [fossil fuels]. We want this to be competitive without subsidy.” Many mature clean energy technologies don’t promise the long-term cost savings or accessibility many hope for, so more technology innovation is needed.
Current mature solar, wind, battery storage and nuclear energy are expensive and often performance limited. The only path to significant cost reduction and performance improvement is innovation.

Many policy advocates acknowledge the need for clean energy innovation to reduce costs (for who can be against cost-reduction through innovation). But more often than not, they provide only lip service to this goal. For example, Center for American Progress energy analyst Bracken Hendricks outlined a new clean energy approach that acknowledges the need to drive down the cost of clean energy, but then only throws a bone to innovation by mentioning in passing additional public investment in R&D. Instead Hendricks and others focus largely on subsidizing or mandating the use of existing higher cost clean energy technologies.

2. GOVERNMENT SUPPORT FOR INNOVATION IS CENTRAL TO MAKING CLEAN ENERGY CHEAP.

Innovation, as many economics models assume, is not “manna from heaven.” Government plays a key role in driving it. This is particularly true for clean energy. Current mature solar, wind, battery storage and nuclear energy are expensive and often performance limited. The only path to significant cost reduction and performance improvement is innovation. But this needed innovation is not likely to come without a federal clean energy policy, for two reasons.

First, as discussed above, energy is not like most products where new generations can be sold to early adopters on the basis of performance. Early computers were extremely expensive and performance limited, but they provided enough of an improvement in performance that sufficient numbers of people were willing to buy them, allowing industry to reinvest profits into reducing the cost and improving the performance even more (the noted Moore’s Law). But energy is not like this. Consumers have little reason to buy clean energy until its price is cheaper than that of fossil fuels.

Some, including some market-oriented policy advocates, argue that one way to lower prices so that there is consumer demand for clean energy is through a carbon tax, but as we have pointed out in *Inducing Innovation: What a Carbon Price Can and Can’t Do*, it’s unlikely that a carbon tax will effectively spur radical innovation, even at relatively high prices. A carbon tax is simply the inverse of clean energy subsidies. It is focused on relative price, not on cost. The reason is that it is research breakthroughs that spur innovation and dramatic cost reduction. If price were the driver, then why do we not see electric vehicles and battery breakthroughs in Europe, where drivers routinely pay the equivalent of a $400 a ton “carbon tax” on gasoline (through high gas prices)?

Second, history has shown that public support for innovation is a key driver of innovation. In recent reports by ITIF and the Breakthrough Institute, the sources of many of the last century’s breakthrough technologies are traced at least partially to the public sector. Take, for example, gas turbines. The original turbine technology was established for use in military jet engines during World War II. Large-scale military R&D in turbine technology, on the order of hundreds of millions of dollars per year, continued thereafter for decades,
contributing to technical opportunities that the private sector could exploit. Private industry moved into commercial gas power in the 1960s, and other significant contributions from the NASA High Temperatures Technology Program in the 1970s and the Advanced Turbine Systems Program in the 1990s drove down to cost of subsequent generations of the technology.

Examples of the critical role public support played in driving innovation are pervasive. Advancements in high-yield crops were developed in public research laboratories. Government-organized public-private partnerships and military needs were integral in developing advanced technologies laying the groundwork for the modern aviation industry. The military funded development of the modern computer in government labs and universities in the 1940s and 1950s and developed the Internet through DARPA funding over numerous decades until the private sector was capable of exploiting it. And the Air Force and NASA helped create the initial market for microchips, leading to drastic cost reductions that eventually made them cheap enough for consumer markets.

A key reason why government support for research (both through tax incentives like the R&D credit and direct funding for R&D) is important is that the private sector under invests in early stage research, including basic and applied research.

And federal support for clean energy has also paid off in the past. For instance, early wind power research in the United States was carried out by two programs: a large joint NASA/DOE program and a smaller program administered by DOE through the organization that would become the National Renewable Energy Lab (NREL). The larger program was ultimately unsuccessful in producing viable, commercially applicable technology, but did yield some beneficial technical demonstration results. On the other hand, the smaller NREL program found substantial early research success. As Harvard’s Vicki Norberg-Bohm wrote, “Of the 12 key innovations in wind turbine components…seven relied on partial or total public funding, and three were developed in the private sector for other industries and transferred for use in wind turbines.” But investment in clean energy abruptly ended in the 1980s – funding dropped from a high of nearly $10 billion in 1980 to less than four billion by 1985 and less than two billion by the mid 1990s. Once investment was cut, clean energy technology development stagnated.

A key reason why government support for research (both through tax incentives like the R&D credit and direct funding for R&D) is important is that the private sector underinvests in early stage research, including basic and applied research. Studies have demonstrated that the private returns on research investments are normally much less than social returns. Because of this, the socially optimal level of investment in research is higher than what we’d expect private firms to pursue. And risk-averse firms may also be unwilling to commit limited resources to high-risk research and development projects when competitive pressures demand short-term payoffs. In response, the government fills this void by publicly supporting research (either public research institutions, grants or through tax expenditures). However, government support for clean energy research is significantly lacking. Top business leaders and energy experts estimate that the United States should invest between $15 billion and $30 billion in clean energy to spur the breakthrough
technologies we need. According to ITIF’s Energy Innovation Tracker, once Recovery Act funds run out this year, the United States will only invest roughly $4.5 billion, or three times less than what has been deemed necessary.¹¹

3. CLEAN ENERGY INNOVATION MEANS MORE R&D, BUT ALSO MORE TRANSFER, TESTING, DEMONSTRATION, AND DEPLOYMENT.

R&D is fundamentally the most important part of an effective clean energy innovation policy. But by itself it is not enough. Spurring clean energy innovation means supporting innovation from the back-end (basic science and R&D) through the front-end (testing, demonstration, deployment, and commercialization). Clean energy policy should support a robust innovation system from beginning to end, ensuring that all stages of technology development are optimally sustained.

Clean energy innovation includes bridging technologies across the “valleys of death.” The first valley of death – the phase in development between R&D and prototyping the first generation of a technology – is crucially important because it takes the innovation out of the lab and proves its commercial viability. But building the first prototype of a radically new solar installation or demonstrating a new small modular nuclear reactor is capital intensive and risky. Because of this, the private sector has historically provided little support for this stage of development and would rather wait until new technologies yield a higher rate of return. So the federal government has played a significant role in developing many of the last century’s breakthrough technologies through demonstration and test-bed projects. Past breakthrough technologies like the Internet, nuclear power plants, and jet engines were initially built and tested at federal labs and through private sector collaborations with the military. Currently, the United States is just beginning to implement strategies for bridging technologies from the lab to demonstration, such as through the agreement between ARPA-E and the Department of Defense to test advanced energy technologies suitable for the militaries needs. But these policies are not permanent, as they are enforced at the agency level without a national strategy or Congressional mandate.

The second valley of death is the phase in development between tech demonstration and commercialization.¹² Clean energy must compete in an entrenched energy sector filled with significant institutional, political, and regulatory barriers to deployment. But it’s expensive to produce the first generation of technology after development and demonstration, making it a risky and potentially costly business decision for utilities and consumers. Clean energy may need up-front financing to build the first generation of new clean energy technologies and to hurdle barriers to deployment. Without it, the high cost of up-front investment is a significant deterrent for utilities to choose brand new advanced solar, wind, or small modular reactors (SMRs) over well established coal or natural gas plants. New clean energy is stuck in what Coalition for Green Capital’s Ken Berlin calls, “the chick and egg problem.”¹³ Breakthrough clean energy needs first-generation investment after demonstration and testing in order to evolve into lower cost, better understood second- and third-generation tech. But utilities and consumers will only invest in breakthrough tech with greater cost and market certainty. The federal government can and should play a role in supporting this transition or what leading clean energy policy expert Bill Bonvillian
calls “beefing up the back end of clean energy.”\textsuperscript{14} This is different than simply subsidizing deployment of existing mature clean energy technologies with little hope for dramatic price reductions of next generation innovations.

4. THE PUBLIC AND PRIVATE SECTOR MUST BOTH PLAY A ROLE IN CLEAN ENERGY INNOVATION.

There is a conventional wisdom among some in Washington that private business is the lone engine of innovation, and that government should simply get out of the way. Yet all of this received “wisdom” ignores the vital collaborative role that government and the private sector have played together in technological innovation throughout American history.\textsuperscript{15} Amid many technological transformations, the public and private sectors have served as partners, each bringing key resources and insights to the table. A successful clean energy innovation policy will embrace this collaboration.

As we’ve argued above, public research institutions and funding have regularly contributed and supported early-stage research on transformational technologies prior, during, and after market entry. This is especially the case with new, high-risk technologies that aren’t the result of natural, incremental improvements to existing commercial technology in existing markets. An abiding fact of the innovation landscape is that the private sector tends to underinvest in early-stage R&D, and government has a role in helping to fill the investment gap through support and incentives.

But if efforts to develop unproven new technology can benefit from public policy intervention, they cannot be divorced from the private sector either. Fruitful development paths require feedback, partnership, and leadership from those who know the demands of the market best, and that means private industry. The private sector also invests in technology development activities of course, meaning that private firms are an important source of energy innovation and have a wealth of technical knowledge upon which they can draw. Private firms can also troubleshoot technological or market barriers that are not readily apparent to public researchers. Lastly, private firms must be engaged because they’re the ones responsible for producing and scaling up new technology through the markets after the early breakthroughs have been made. Indeed, the process of production itself and “learning-by-doing” can be an important source of private-sector innovation and productivity improvements.\textsuperscript{16}

This knowledge in turn can be an important guide for joint developmental work, especially as technologies are transferred from basic research through to prototyping and demonstration. And once technologies have achieved market entry, learning-by-doing can be enhanced with public support. But the key word to keep in mind is collaboration: without buy-in and participation from both public and private sector actors, along with researchers in academia, any energy innovation program with breakthrough technology as its goal is destined for expensive failure. Public-private partnerships—through Cooperative Research and Development Agreements (CRADAs), cluster development strategies, direct research or financing support, procurement, or other such measures—present the clearest path to success in new technology development efforts where the risk is high but the potential social gains are large.
5. CLEAN ENERGY POLICY SHOULD “PICK WINNERS,” NOT BY PICKING NATIONAL CHAMPIONS, BUT BY BROADENING THE TECHNOLOGY MENU AND THEN LETTING THE MARKET DECIDE.

Critics of federal clean energy innovation policy often accuse proponents of “picking winners,” with the implicit assumption that government should instead “let the wisdom of the market decide.” Depending on who is making the accusation, this can mean different things.

It is important to acknowledge that supporting clean energy innovation is an investment and should not be viewed as spending. The difference is simple: investments spur long-term benefits that outweigh short term costs whereas spending does not.

On the one hand are those who don’t recognize the importance of clean energy, and see government’s focus on the sector itself as a bow to special interests or environmentalists. For them, all industries should be treated the same; in the words of Michael Boskin, former chairman of the Council of Economic Advisers, “It doesn’t make any difference whether a country makes potato chips or computer chips.” But not all industries are created equal. It has always been the state’s job to identify key strategic sectors that drive innovation and U.S. competitiveness – like life sciences, computing, nanotechnology, and semiconductors – and help spur innovation in them. This is about recognizing that, in a technology-driven global economy, some technologies and industries are more important than others for driving technological change, productivity, economic growth, and higher-income employment.

But there is an even more compelling reason for the public sector to pick winning technologies. The scholarly evidence is clear that some technologies have radically different private and societal rates of return. For example, CT scanning technology likely had a close to normal rate of return for its investors, but because of spillovers and other “market failures,” it had a huge rate of return for society. If we rely solely on the market to choose technologies, by definition they will make the wrong decisions because they won’t take into account societal rates of return, especially in the face of climate change, the mother of all externalities. The market will invest in those technologies that maximize private returns and will under invest in those that maximize societal economic returns. Of course, it’s not the market’s job to account for societal returns – that’s why we have government.

This does not mean that government should pick narrow technologies or individual firms, which is the other meaning of the “picking winners” accusations. The government does not know and cannot know what the “right” company will be to develop next generation of batteries, and it doesn’t know what the right battery technology will be (other than it ultimately won’t be lithium ion). But choosing between either letting the market do it all or picking Duracell or other national to fund lithium ion research is a false choice. Government can and should support a wide array of investments in a wide array of companies, labs, and universities to explore a wide array of battery technologies. As ARPA-E Director Arun Majumdar describes their role, “What ARPA-E does best is identify the opportunities and create the competition. And eventually, the market will pick the winners.” No doubt, the private sector bears ultimate responsibility for selecting the
technologies that will work in the marketplace, and therefore must be intimately involved in development. So too, government must avoid preferential treatment of firms or technologies for political reasons. And it’s possible for government to overreach or mismanage technology development, as is evinced by an admittedly mixed record on some federal energy-technology development projects.

Government’s role is ultimately not to “pick winners,” but to contribute to the knowledge base and the early-stage, high-risk R&D that the private sector is frequently loathe to pursue. Managers of public research programs and funding must winnow down technological options to those that offer the best bet. But given that managing risk is a substantial job, policies that support technology development face a risk threshold in the development process after which public support should decline as the private sector takes up full responsibility. An implication is that incremental improvements to proven technologies are best left to the private sector. Government shouldn’t pick firm-level winners in the energy technology realm, but it can pick promising technologies, broaden technological horizons, and narrow the menu options to those that make sense, while also expanding the market for a broad class of clean energy technologies.

6. SUPPORT FOR CLEAN ENERGY INNOVATION IS AN INVESTMENT IN THE FUTURE, NOT WASTEFUL INTEREST-DRIVEN SPENDING.

Pressure for deficit reduction has limited policy makers’ options to increase support for clean energy, and has even led some to call for significant cuts to clean energy innovation programs. Many argue that “everything should be on the table” when it comes to cutting government spending, even investments in sectors like clean energy.20 The first FY2011 budget proposed in Congress this year aimed to severely cut energy by up to 11.5 percent (third largest cut by discipline).21 Further, a recent FY2012 budget proposal would cut energy innovation funding by 70 percent.22

Given this reality, it is important to acknowledge that supporting clean energy innovation is an investment and should not be viewed as spending. The difference is simple: investments spur long-term benefits that outweigh short-term costs whereas spending does not. Therefore, investments that drive productivity, boost competitiveness, and spur innovation are too important to be on the cutting room table. Cutting investments that provide a positive societal payoff under the guise of false fiscal responsibility is misguided. It would be akin to a parent who refused to pay for their children’s college so that they could leave their kids a bigger inheritance when they died. In short, cutting clean energy investments is penny wise and pound foolish. Three reasons stand out:

First, investing in innovation spurs economic growth and is a key long-term solution for reducing the budget deficit and national debt. The Congressional Budget Office estimates that just a 0.1 percent increase in the GDP growth rate would reduce the projected budget deficit by $310 billion cumulatively over the next decade. If we could increase the real rate of GDP growth, we could significantly reduce the current budget deficit.23 Federal Reserve Chairman Bernanke acknowledged as much when he stated, “Investments in human capital, education, research and development, new technologies, energy, and infrastructure were important for long term growth.”24 And Former Director of the CBO and the Office
of Management and Budget Dr. Alice Rivlin concurred, stating the United States must “invest in the skills, research and modern infrastructure that power economic growth.”

Second, supporting clean tech innovation would lead to lower energy prices (and hence higher productivity) and could help reduce our trade deficit, both by enabling fewer oil imports and potentially enabling the exports of clean technology equipment. Clean energy innovation would give U.S. firms a first-mover advantage in new clean energy products and services, expanding exports. The growth of international trade makes it increasingly important for the United States to innovate to remain at the cutting edge of new industries. So, significant clean energy investments by countries like China, Germany, and Japan threaten U.S. international competitiveness.

Third, growth in clean energy exports would also lead to job and income growth. Innovating new technologies would lead to higher productivity, which boosts wages and lowers prices of goods and services, both of which expand domestic economic activity and create jobs. Studies suggest that innovating new technologies could lead to as much as twice as many jobs compared to an equivalent expansion of sales domestically. Kletzner finds that a 10 percent increase in sales due to exports leads to a 7 percent increase in employment (compared to only a 3.5 percent increase in non-tradable industries). Likewise, jobs in exporting industries like clean energy pay 9.1 percent more than jobs in firms that export less.

But spurring innovation, productivity, and economic growth requires more than short-term spending. Instead it takes long-term, strategic investments, such as those being made in clean energy. If disrupted by significant funding cuts, the prospects for innovation decrease, as well as the prospect for future economic growth.

7. CLEAN ENERGY POLICY SHOULD REINVIGORATE, NOT HURT, U.S. EXPORT INDUSTRIES.

In their quest to address energy challenges, many policymakers and advocates favor policies that would raise the price of carbon consumption, either directly through a carbon tax or indirectly through a cap and trade scheme. This approach failed in Congress in part because it would have harmed the international competitiveness of U.S. firms. Exporting industries would face higher costs, putting them at a competitive disadvantage with foreign companies not facing similar government-imposed costs. Exports of traded goods would decrease and imports increase, especially in energy-intensive industries, resulting in job loss and a higher trade deficit. Competitiveness should be a central goal of any new clean energy policy to make it not only politically but also economically viable.

The United States is becoming less competitive. In the “Atlantic Century,” ITIF found that the United States ranked sixth out of 40 countries in innovation capacity and competitiveness, but dead last among those 40 in the rate of improvement over the last decade. Meanwhile, China ranked first in rate of improvement. U.S. manufacturing output, which represents more than 80 percent of exports, has declined from 13 percent of GDP in 1998 to 9.7 percent in 2008, reflecting the offshoring of manufacturing operations
overseas to foreign competitors (even with U.S. productivity growth). This decline is a double-edged sword as it both eliminates jobs as well as weakens our innovation system.

Simply imposing higher net costs on U.S. companies (either through taxes or regulatory requirements) in the hopes that this will encourage them to use less fossil fuel energy in the United States may in fact work. The higher costs may induce them to shift energy-intensive activities offshore. It is possible to spur clean energy innovation without significantly hurting competitiveness. One way is to ensure that any carbon tax policy is revenue-neutral with the monies flowing back to industry in the form of other offsetting tax incentives. But the ultimate way is to drive innovation so that clean energy costs less than dirty and that U.S. firms that adopt it become more cost competitive in global marketplaces.

8. PUBLIC INVESTMENT SHOULD EMPHASIZE TECHNOLOGIES WITH A CLEAR UPSIDE – EVEN IF THEY’RE CURRENTLY UNPOPULAR.

All energy technologies can benefit from innovation, but some offer a higher upside than others. Some might hold the promise of radical breakthroughs that achieve substantial and rapid cost declines and improvements in energy productivity. Others may be limited by resource availability or truly insurmountable technical challenges. Government investment thus needs to be mindful of the breakthrough potential and technological limitations, and be weighted towards those with the greatest upside.

This is not to say that government doesn’t need to worry about innovation across the energy space as a whole. If the goal is to drive innovation to make clean energy cheap, then we need to seek and facilitate innovation wherever we can, on early-stage and mature clean technology alike, so long as there are clear pathways for the technology in question to become cheaper than fossil fuels. Government’s role will change based on the maturity of that industry. For example, innovation in mature technologies and industries may benefit from government efforts to convene industry councils and boost cross-firm learning, ensure a skilled workforce, and remove regulatory barriers that facilitate market entry, deployment, and learning-by-doing, coupled with tax incentives to boost innovative activities. Earlier-stage technology without a market footprint may require more direct support for basic science or applied R&D, carried out by government scientists or through public-private partnerships. Early-stage technology often offers even greater economic potential than existing technologies, and this fact should be taken into account. But whatever the role of government and the state of the technology, actions should not be guided by political preference or the whim of markets, but by clear assessments of the clean technology’s potential to contribute.

Whatever the role of government and the state of the technology, actions should not be guided by political preference or the whim of markets, but by clear assessments of the clean technology’s potential to contribute.

But if technologies shouldn’t benefit just because they’re popular, they also shouldn’t lose out because they’re politically unpopular or flawed in their current iterations. Energy technology is not static: it can evolve towards greater efficiency, safety, or productivity.
Thus, we shouldn’t discard efforts to improve experimental but problematic energy sources just because they’re politically unpopular, when there are clear pathways for competitiveness.

The unfolding debate around nuclear energy crystallizes this logic. Even before the Fukushima reactor disaster, nuclear power was in the midst of a thirty-year gap in construction, due in part to concerns over safety, security, and waste storage, not to mention massive up-front capital costs and competition from cheap natural gas. For these reasons, many clean energy advocates have been reluctant to include nuclear in any clean energy portfolio. The Japanese disaster is causing many to further re-think nuclear power. However, whatever the merits or fallacies of the arguments against current light-water reactors post-Fukushima, nuclear will likely need to remain in the clean energy portfolio in some form if we’re to meet the long-term clean energy challenge. Nuclear offers the potential for emissions-free energy production on a massive scale: a 1000 MWe nuclear reactor can displace more than two million metric tons of carbon equivalent emissions from coal per year. Nuclear reactors can also offer stable baseload generation capacity. And, as in other industry areas, if the United States is able to establish an internationally competitive supply chain for advanced reactor components ahead of others, it could become a source of exports and hence jobs. Given the magnitude of the global energy challenge, we cannot write off an energy source with these major emissions-free characteristics. But nor should we be willing to settle for the current generation of light-water reactor technology, given its clear challenges. An array of new advanced reactor technologies and designs offer potential advantages in improved performance, cost, safety, and fuel usage. Whatever the criticisms of existing nuclear technology, nuclear energy as a power source presents a substantial low-carbon upside if it can be made to work economically.

Similar arguments apply to clean coal power. It is likely that new coal plants will remain cost-competitive in many parts of the world for decades. A carbon price is unlikely ever to become high enough on a global scale to change this equation to any meaningful extent. That, plus a century of proven reserves worldwide, means that coal will likely be with us for a long time, dirty though it may be. But carbon capture and sequestration (CCS) technology still has its doubters. While CCS could allow substantial emissions reductions from coal, iterations are still in the experimental phase, scale-up remains a challenge, and federal programs like FutureGen have been subject to temporary cancellations and cost overruns. The ongoing challenges are obvious – but are no grounds to completely discard efforts at further development. Finding a way to burn coal without polluting the atmosphere must remain a goal if we’re serious about dealing with climate change.

Criticisms of many commercialized and experimental energy technologies are often well-founded, but they need not lead one to conclude that the technology should thus be scrapped. Rather, they should lead to a few key questions: “Can it be improved through innovation, enough to make a meaningful contribution? And if so, how do we invest to make it happen?” Of course, these investments need to be smart, and managers must recognize when technical outcomes make clear that it’s time to pull the plug. And investments need to be balanced: a technology that offers a greater upside should be
prioritized over other technologies. But energy innovation with a clear upside should be sought wherever it can be found.

9. **“CLEANER” IS NOT THE SAME THING AS “CLEAN.”**

The goal of our nation’s clean energy policy should be to achieve emissions-free, sustainable, domestic energy generation, not to lock in suboptimal energy sources that are “almost” clean and “almost” sustainable in the long-term. For example, many in the policy community have embraced natural gas as a low-carbon energy option for electricity generation, and a better alternative to coal. Natural gas is generally cleaner than coal, as the typical natural gas plant produces significantly less greenhouse gas emissions on a per-MWh basis than the typical coal-fired plant. Over the past few decades, technological improvements have led to increasing efficiencies and improved emissions performance, and natural gas is now the dominant source for new power capacity. But just because natural gas is not as dirty as coal does not mean it is clean; and just because it is abundant now does not mean it will last forever.

Recall that to stabilize atmospheric concentrations of greenhouse gases and avoid the worst impacts of climate change, global emissions should be at least halved by 2050. Further, the global population is expected to grow by 46 percent and per-capita income growth is also expected to increase by 129 percent, which together mean that the planet’s economic activity must become 84 percent less polluting to halve emissions. Natural gas is cleaner than coal, but it is not 84 percent cleaner, and emissions from natural gas have been on the rise due to increased use. Shale gas in particular may offer absolutely no emissions advantages over coal, as one recent Cornell University study has found. And like oil and coal, natural gas is not a renewable resource with unlimited reserves. Some argue that, with the new shale discoveries, current natural gas reserves may last through the century, but others are skeptical of these claims. Either way, natural gas is not as clean as it needs to be, and is likely subject to long-term declines in availability and in energy return on investment.

Does this mean natural gas does not have a role to play in the transition to a clean energy future? No. Gas is often cited as a bridge fuel, helping lower carbon emissions while transitioning to better low- or no-carbon energy in the future. It’s also frequently identified as a useful complement to intermittent renewables given its ability to serve as baseload capacity. If the only realistic choices for baseload capacity are between coal and natural gas, as is the current case for many utilities, then natural gas is undoubtedly a better option for gas-rich regions in the short term.

But this won’t always be the case in the medium-to-long term. In fact, a central job of clean energy innovation policy must be to expand the menu of available technology for baseload capacity in the energy portfolio, providing viable options that allow a minimally painful transition away from natural gas as soon as is feasible. A truly robust energy innovation agenda will invest in energy technology that can get us toward the end goal of sustainable zero-emissions energy. In this sense policies that seek to give natural gas an advantage in the short run must also be wary of crowding out investments in other, better, cleaner energy technologies that will be more important in the long run.
10. A GLOBAL ENERGY CHALLENGE REQUIRES A GLOBAL EFFORT THAT ENSURES PROPER INCENTIVES FOR INNOVATION.

The energy challenge isn’t limited to within U.S. borders: even if we as a nation could switch painlessly to clean energy sources tomorrow, three-quarters of global GDP is produced outside our borders, and thus three-quarters of the world economy must still adopt clean energy. This means, as discussed above, that the only way to get global adoption of clean energy technologies is for their costs to fall below those of coal and oil. And that won’t happen unless there is significant investment in innovation from private and public sector alike.

Unfortunately, many current global practices and proposals work against these ends, especially in the realm of technology transfer. For years, many in the developed and developing world alike have argued that technology transfer to developing nations needs to be accelerated with industrialized nations largely picking up the check, due partly to the industrialized world’s responsibility for creating the climate problem in the first place. For example, in a 2008 conference in Beijing, Prime Minister Wen Jiabao called for developed nations to “shoulder their duty” and fund the transfer of clean technologies to less-developed countries. Chinese UNFCCC delegation member Qian Guoqiang said in 2007, “Rich countries are asking developing countries to do more, but at the same time they are being very protective of their technology. This is quite a contradiction… We want to see a substantial fund for technology transfers and development.” In 2010, the G77—which includes China and India—issued an official proposal under UN climate negotiations along these lines, which would accelerate the transfer of public domain and patented technologies alike.

Yet if wealthy nations and firms are forced to transfer or otherwise give away the fruits of their investment, it will reduce the incentives to invest in clean energy innovation. A better solution would be for developed nations to work with developing nations to help them develop their own internal innovative capacity, not unlike the Carbon Trust’s proposal to establish a network of international Climate Innovation Centers.

Other mercantilist policies, including lax IP protection, tariffs on clean tech imports, restrictions on imports, or export subsidies for domestically produced clean tech goods, also reduce clean energy innovation. Yet these practices are growing. For example, China has heavily subsidized its domestic clean energy industry while restricting exports of rare earth elements, which are important in the assembly of wind and solar technology. China has also required that up to 70 percent of components for wind power projects be locally sourced, to the great detriment of foreign firms attempting to expand there. China is not the only nation with such policies, however, as Spain, Canada, and Brazil have all utilized local content requirements.

Some have argued that when foreign nations attempt to make clean technology cheaper through export subsidies and other policies, it actually advances, rather than slows, the fight against climate change. This might be true if the world had all the clean energy technologies it needs. But it doesn’t. Because these mercantilist practices limit resources for
and incentives to support clean energy innovation, they ultimately slow, rather than accelerate, clean energy innovation.

Moreover, these policies can artificially expand the competitiveness of existing technologies, locking in inferior technologies. For example, in a study of offshore optoelectronics manufacturing by Carnegie Mellon Professor Erica Fuchs, cutting-edge next-generation technologies produced by U.S. firms are rendered less competitive than inferior but less expensive technologies manufactured in overseas markets with mercantilist policies. This restricts the potential for long-run overall technology improvement, and makes investments less attractive.45

When foreign nations pursue mercantilist policies, they are attempting to game the system at the expense of other nations who abide by the rules. It thus means reduced growth opportunities for American firms and the workers they employ; but it also means less innovation in the energy space worldwide.

When foreign nations pursue such policies, they are attempting to game the system at the expense of other nations who abide by the rules. It thus means reduced growth opportunities for American firms and the workers they employ; but it also means less innovation in the energy space worldwide. As ITIF has argued, mercantilist beggar-thy-neighbor policies are counterproductive for all.46 A better approach than mercantilism and forced technology transfer is for nations to compete vigorously to drive the kind of clean energy innovation the world needs.

CONCLUSION

These ten principles, taken together, provide a guiding framework for sound, effective national energy policy, not just for the United States, but all nations. A policy package that consistently follows these principles will ensure an effective approach that helps generate the clean energy technologies we need, without relying on outdated economic fallacies or resorting to politically-driven efforts to prop up old, dirty, or uncompetitive energy sources.

Abiding by these principles, however, will not be easy for all participants in the energy and climate debate. Some will have to drop their misguided notions of how technology is developed and evolves, and how government can help or hurt. Others will have to focus more on the long-term and not just on how many megawatts of high cost clean energy we can deploy in the next decade. Still others will have to get past their knee-jerk reactions for or against certain energy technologies. And all will have to take a longer, more serious view of the scale of the energy and climate challenge and the ways to develop meaningful solutions rather than stopgaps and half-measures.

We realize that by urging policymakers to consistently stick to such principles, we may be asking too much. The broader energy debate has for decades been afflicted by recursive amnesia and a “shock-to-trance” approach. This thinking has left behind a legacy of competing, counterproductive policies, short-term thinking, and a dearth of solutions. And energy policy formulation will in many ways always be an aggressively interest-driven endeavor, rather than a sober assessment of what’s best for the nation. But if we as a nation
ever intend to get serious about getting off foreign oil, averting the worst consequences of climate change, and building a competitive clean energy sector, the time to drop old habits and adopt a new set of principles is now. Given the challenges, it should be a matter of when, not if.
ENDNOTES

13. Ibid.
27 Ibid.


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ABOUT ITIF
The Information Technology and Innovation Foundation (ITIF) is a Washington, D.C.-based think tank at the cutting edge of designing innovation policies and exploring how advances in information technology will create new economic opportunities to improve the quality of life. Non-profit, and non-partisan, we offer pragmatic ideas that break free of economic philosophies born in eras long before the first punch card computer and well before the rise of modern China. ITIF, founded in 2006, is dedicated to conceiving and promoting the new ways of thinking about technology-driven productivity, competitiveness, and globalization that the 21st century demands.

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