



## **Energy's Perfect Storm – An Op Ed**

L.D. Carter, July 2011

### **Overview**

Innovative strategies offer new and different opportunities to address job creation, reduce reliance on imported oil, and make meaningful progress on global climate change. This paper describes approaches which can provide jobs for several million Americans, generate over \$15 trillion of new domestic economic activity over the next three decades, substantially reduce our reliance on imported oil, provide a significant reduction in projected global temperature increases by 2050, save millions of lives per year, eliminate 300 million tonnes per year of CO<sub>2</sub> from the atmosphere, and contribute to the development of lower cost technologies to address longer term climate change impacts. And these approaches can be implemented without raising taxes or enacting new regulations. If this sounds too good to be true, invest five minutes in reading this paper to see how a different perspective can change your view of the future.

### **Introduction**

The term “Perfect Storm” has become a metaphor for demonstrating the reinforcing synergy of related phenomenon. The multifaceted roles of energy in the interrelationships between issues associated with the U.S. economy, energy security, and climate change may pose such a perfect storm. Approached independently, potential solutions to any one of these issues can exacerbate one or both of the others, leading to unacceptable outcomes. However, addressing these issues in an integrated manner through innovative energy initiatives may offer extraordinary opportunities. This paper examines a small set of strategies that can enhance current policy options, and meet national goals.

## Areas of Opportunity

An overview of the opportunities for improving the economy, enhancing energy security, and mitigating global climate change is presented below. A more detailed discussion of current strategies for addressing these issues is presented in Attachment A.

### The economy

Economic activity has shown marked improvement since the low point of the 2008 “Great Recession,” but the accompanying decline in unemployment has not met expectations. Accelerated job creation has become the primary goal for economic policy. As described in Appendix A, traditional monetary and fiscal policy solutions have been exhausted, and public confidence in current economic policies is low. Most factors stressing our economy are not energy based. However, changes in our energy policy could create or preserve millions of U.S. jobs.

### Energy security

The U.S. is the 3<sup>rd</sup> largest oil producing nation (behind Saudi Arabia and Russia), but we imported 60% of our petroleum needs in 2009.<sup>1,2</sup> U.S. energy security can be reduced to the basic issue of excessive reliance on imported oil. More than three decades ago, the “Carter Doctrine” committed the nation to protecting its sources of imported oil with force, if necessary.<sup>3</sup> The President also committed us to reduce oil imports.<sup>4</sup> Although we have repeatedly exercised the force of arms to protect sources of oil imports, our efforts to reduce reliance on imported oil have been dominated by rhetoric. In the 30 years since President Carter capped oil imports at 1977 levels, those imports increased from 8.8 million barrels per day (BPD), to 13 million BPD.<sup>5</sup> In 2010 these imports cost the U.S. economy \$324 billion. A focused strategy for reducing oil imports by more than 50% should be the centerpiece of our energy security program.

### Global climate change

In 2009, comprehensive climate change legislation (H.R. 2454) was passed by the House, but rejected by the Senate. Similar legislation has not been introduced in either chamber since 2009. Although Europe remains committed to greenhouse gas (GHG) reductions, both Russia and Japan have indicated that they will not participate in a binding extension of the Kyoto Protocol. Neither of the world’s two largest GHG emitters, China and the U.S., has committed to enforceable limits on national GHG emissions. China has stated that it intends to reduce its

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<sup>1</sup> International Energy Agency reports 59%. ( [World Energy Outlook 2010](#))

<sup>2</sup> USEIA reports 61% for 2009 ([Annual Energy Review 2010](#)).

<sup>3</sup> “An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force.”, President Jimmy Carter, State of the Union address, January 1980.

<sup>4</sup> “This intolerable dependence on foreign oil threatens our economic independence and the very security of our Nation. Beginning this moment, this Nation will never use more foreign oil than we did in 1977—never.”, President Jimmy Carter, Crisis of Confidence Speech, July 15, 1979.

[http://www.cartercenter.org/news/editorials\\_speeches/crisis\\_of\\_confidence.html](http://www.cartercenter.org/news/editorials_speeches/crisis_of_confidence.html) .

<sup>5</sup> [Annual Energy Review – 2009](#), US EIA, DOE/EIA-0384(2009), August 2010, <http://www.eia.gov/aer> .

GHG intensity (emissions per unit of GDP), in a policy reminiscent of President Bush's 2002 climate policy statement.<sup>6</sup>

Moreover, some of the key strategies previously offered to reduce GHG emissions have lost credibility or general acceptance. None of the proffered legislative remedies addresses near term issues, like arctic warming; the remedies are all oriented toward longer term climate problems. Biofuels, a potential strategy to address emissions from the transportation sector, have been shown to cause more harm than help.<sup>7</sup> In addition to being ineffective in mitigating emissions, a report prepared in 2011 for the G20 recommended that: "G20 governments remove provisions of current national policies that subsidize (or mandate) biofuels production or consumption,"<sup>8</sup> because biofuels compete with food production and exacerbate global hunger. Similarly, Canadian researchers, in a recent paper in *Nature Geoscience*,<sup>9</sup> concluded that afforestation, a key strategic element of essentially all GCC efforts (including H.R. 2454), is only marginally effective at mitigating climate change. They reported that 50 years of afforestation on half the world's cropland would yield only a 0.25 °C reduction in warming in the 2081-2100 time period. Finally, promoting a higher cost of energy has been employed as a principal component of most broad climate mitigation programs, such as H.R. 2454. Higher energy prices encourage greater energy conservation, but they can also place a Keynesian drag on the economy, similar to the effect of raising taxes.

## Innovative strategies

### The economy

There is no quick fix to the current slow growth rate of the economy, with unemployment remaining in the 9% range. Most potential solutions are grounded in getting money from somewhere and injecting it into U.S. markets. In the past, "somewhere" has included federal spending from increased debt, increased private sector spending from tax cuts or artificially depressed interest rates, or increased exports of U.S. goods. The above have all been tried, and to some extent were successful, but these options have now been fully exploited. However, reduced imports, the flip side of increased exports, has not been seriously considered. According to the U.S. Census Bureau, the value of U.S. imports exceeds the value of U.S. exports by about \$500 billion per year. In 2010 the bulk of this trade deficit (65%, or \$324 billion) was

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<sup>6</sup> Projected GHG Emissions, <http://www.state.gov/documents/organization/89652.pdf> . The Bush policy was roundly ridiculed by U.S. environmental groups because it would have permitted GHG emissions to increase on a ton per year basis.

<sup>7</sup> Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change, Searchinger, et.al., *Science*, Vol. 319 no. 5867, pp. 1238-1240, February 29, 2008.

<sup>8</sup> Price Volatility in Food and Agricultural Markets, report to the G20 by FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank, WTO, IFPRI, and UN HLTF, June 2, 2011, [http://www.unctad.org/en/docs/2011\\_G20\\_FoodPriceVolatility\\_en.pdf](http://www.unctad.org/en/docs/2011_G20_FoodPriceVolatility_en.pdf) .

<sup>9</sup> Small temperature benefits provided by realistic afforestation efforts, Arora & Montenegro, *Nature Geoscience*, June 19, 2011, <http://www.nature.com/ngeo/journal/vaop/ncurrent/full/ngeo1182.html>

due to oil imports.<sup>10</sup> If one assumes that the petroleum import rate experienced in 2008 (13 million BPD) could be reduced by half, and one further assumes a price for oil reflecting this year's market (\$100 per barrel), then the direct value of that reduction would be \$235 billion per year. Moreover, indirect and induced economic benefits from keeping this money in the U.S. economy increase the total value of this additional domestic oil production by a factor of 2-3. An extra \$470 – 700 billion per year in the U.S. economy may seem small, compared to a \$14 trillion GDP, but recall that the 2009 American Recovery and Reinvestment Act totaled \$787 billion, to be spent over several years. And the extra \$470 – 700 billion per year is not a one-time event like the Recovery Act, but keeps pumping money into the economy for decades. Increasing domestic oil production and reducing oil imports can make a meaningful difference to the economy. Two options for increasing production are described in the next section: Energy security.

Another approach to improving the economy is rooted in our propensity to regulate. According to the Small Business Administration, Americans spend more money on federal regulations (\$1.75 trillion per year)<sup>11</sup>, than on the combination of individual and corporate income taxes (\$1.1 trillion in 2010).<sup>12</sup> Reducing these regulatory costs would have a stimulus effect comparable to a tax cut. Identifying where reductions in federal regulatory costs might be most appropriate is beyond the scope of this paper, but the \$1.75 trillion price tag suggests that the option should be investigated. One potential energy-related approach to economic stimulus relates to the environmental regulation of electricity generation. Currently, about 45% of U.S. power generation comes from coal-fired power plants, and most of those plants are facing a series of new environmental regulations over the next 2 years. The list includes rules limiting interstate transport of air pollutants, hazardous air pollutant regulations, new rules for coal combustion residuals (solid waste) disposal, cooling water intake structure requirements, and standards limiting CO<sub>2</sub> (greenhouse gases) from new and existing power plants. Various (non-government) studies have projected that as much as one-third of the existing coal-fired power plant fleet could simply retire, rather than install additional hardware in the face of uncertainty over still more stringent future regulations. This is important to the economy because we spend about \$400 billion per year on electricity, and replacing a fully depreciated coal plant with any form of new generation will at least double the cost of power entering the distribution grid from the current power plant. Additionally, many of those coal-fired power plants which are not retired will incur substantial additional costs for compliance measures. A potentially attractive alternative to the current wave of individual regulations would be to address these environmental issues with comprehensive legislation which integrates the requirements, provides more certainty for the regulated utilities, and perhaps seeks to balance economic and environmental objectives.

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<sup>10</sup> U.S. International Trade in Goods and Services, U.S. Census Bureau, June 9, 2011, [http://www.census.gov/foreign-trade/Press-Release/2010pr/final\\_revisions/10final.pdf](http://www.census.gov/foreign-trade/Press-Release/2010pr/final_revisions/10final.pdf).

<sup>11</sup> The Impact of Regulatory Costs on Small Firms, N. Crain, Lafayette College, for the Small Business Administration, September 2010.

<sup>12</sup> Historical Tables, Table E-3, "Budget and Economic Outlook: Historical Budget Data," Congressional Budget Office, January 2011.

It is intuitive that some types of efforts to improve the environment lead to higher energy prices, and that higher energy prices adversely impact the economy. The relationship between electricity prices and GDP (and employment) has been quantified by numerous economists in the past, often basing their analyses on past changes in electricity prices versus changes in manufacturing output (and employment). More recently, a paper published by the National Bureau of Economic Research<sup>13</sup> broadened the analysis beyond the manufacturing sector and concluded that the “implied cross elasticity” of full-time employment with respect to changes in electricity prices ranges from -0.16% to -0.10%. Stated perhaps more plainly, that means that a policy resulting in a 10% increase in electricity prices would reduce national employment by 1% to 1.6%. In an economy with 140 million employees, that equates to 1.4 – 2.2 million jobs. Hence, efforts to reduce the cost of regulations impacting the cost of electricity could provide very significant benefits to employment.

### Energy security

As noted above, the U.S. imports about 60% of its petroleum needs. Roughly half of this comes from OPEC members. There are two options to reduce oil imports significantly:

1. Increased offshore production, which is currently prohibited by Federal law (a moratorium on outer continental shelf (OCS) leasing by the Secretary of Interior), and
2. Increased unconventional oil production – enhanced oil recovery (EOR) using CO<sub>2</sub>.

The first option was the subject of H.R. 1231, which was passed by the House of Representatives on May 12, 2011 (263 to 163). The goal of this bill was to increase domestic oil production by 3 million barrels per day (BPD), and to increase domestic production of natural gas.<sup>14</sup> The bill’s advocates stated that the increase in domestic production would create 1.2 million jobs.<sup>15</sup> For comparison, the total U.S. labor force is 153 million persons, of which 13 million are unemployed.<sup>16</sup> Increased offshore oil production has an additional benefit: it would produce substantial (\$20-25 billion per year) federal revenues via royalty payments and taxes which could be directed toward deficit reduction or used to fund energy and environmental initiatives cited in this paper’s recommendations. However, expanded drilling on the OCS is controversial. The White House and a large group of environmental organizations opposed the bill.

The second option was the subject of a January 2011 technical paper published by the U.S. Carbon Sequestration Council (USCSC).<sup>17</sup> The thrust of this paper was that approximately \$10 trillion of economic activity (over 30 years), 2.5 million jobs, and a 30-40% reduction in

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<sup>13</sup> Climate Policy and Labor Markets, O. Deschenes, Working Paper 16111, National Bureau of Economic Research, June 2010, <http://www.nber.org/papers/w16111> .

<sup>14</sup> H.R. 1231 – Bill Summary & Status, Congressional Research Service Summary, <http://thomas.loc.gov/cgi-bin/bdquery/D?d112:1:./temp/~bd58Jk:@@D&summ2=m&|/home/LegislativeData.php> .

<sup>15</sup> “House passes legislation to reverse Obama’s offshore drilling moratorium,” May 12, 2011, <http://dailycaller.com/2011/05/12/house-passes-legislation-to-reverse-obamas-offshore-drilling-moratorium/> .

<sup>16</sup> Employment status of the civilian population by sex and age, US Bureau of Labor Statistics, data for May 2011, <http://www.bls.gov/news.release/empsit.t01.htm> .

<sup>17</sup> Enhanced Oil Recovery & CCS, prepared by L.D. Carter for USCSC, January 14, 2011, [http://www.uscsc.org/educational\\_papers.asp](http://www.uscsc.org/educational_papers.asp) .

imported oil could be achieved by incentivizing expanded EOR production. The additional EOR activity could be made economically viable by using EOR tax revenues to partially offset the cost of CO<sub>2</sub> capture at U.S. coal-fired power plants. An added benefit of this oil production would be the permanent storage of 9 billion tonnes of CO<sub>2</sub> over a 30 year period. U.S. coal-fired power plants emit about 1.8 billion tonnes of CO<sub>2</sub> per year. An important feature of this concept is its “bootstrap” character: the tax revenues used to subsidize the capture of CO<sub>2</sub> would not be realized without the subsidy which makes capture affordable, so the subsidy is “revenue neutral” or even revenue positive.

It should be noted that both of the above options would require several years to reach full potential, so their immediate impact on oil imports, jobs, etc., would not be as great as their average over a decade. Also, note that they are not mutually exclusive. If both were implemented, they have the potential to reduce oil imports by over 50%, an amount which most “experts” would probably consider impossible.

### Global climate change

This paper offers the gloomy view that traditional approaches to addressing climate change are too costly, ineffective in some respects, and take too long to enable avoidance of some near term climate effects. Nevertheless, there are alternative strategies which can provide meaningful reductions in GHG emissions, achieve near term temperature reductions, and reduce other adverse environmental impacts related to energy use. The common feature in all of these options is a shift from strategies based on raising energy prices, to strategies based on reducing mitigation costs. Instead of “raising the bridge,” why not “lower the river?”

The previously cited concept of expanded use of carbon capture and storage (CCS) technology with EOR has the potential both to store large quantities of CO<sub>2</sub> (300 million tonnes per year) as a cobenefit to increased domestic oil production, and to improve current CCS technology in a “learn by doing” process. This could result in a much lower cost carbon capture technology for deployment to a broader network of fossil fuel-fired power plants, and industrial facilities like cement plants, after EOR opportunities have been exhausted. This EOR activity could begin now, and without adoption of emission limiting regulations. The needed change would be a tax policy that diverted tax revenues from the EOR activities to subsidize the cost of CO<sub>2</sub> capture technology. Since these tax revenues would not exist without the subsidized capture facility, the overall process is revenue neutral or revenue positive.

Few would argue that research to develop cheaper solutions to climate change mitigation is not a good idea. A 2004 report by the National Commission on Energy Policy concluded that the aggressive goals for reducing emissions of GHGs could not be met with currently available technologies due to their high cost. NCEP recommended a climate policy that recycled fees from early climate regulation to conduct research on less costly mitigation technologies.<sup>18</sup> The rewards from such research could be quite large. For example, the International Energy Agency concluded that the availability of affordable CCS technology could reduce the marginal cost of meeting GCC targets in 2050 from \$394 per ton to \$200 per ton of CO<sub>2</sub>, a reduction of almost

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<sup>18</sup> Ending the Energy Stalemate, National Commission on Energy Policy, December 2004.

half. The IEA valued the contribution of this single technology at \$1.3 trillion per year.<sup>19</sup> The U.S. DOE has an extensive RD&D program to reduce the cost of CCS technology by a factor of three by 2020 through collaborative research with industry, national laboratories, and universities. But like many worthwhile programs, in the current economy the DOE research is under intense budgetary pressure.

The basic NCEP strategy remains sound, but in the face of potential budget cuts and absent a comprehensive legislative vehicle for generating carbon revenues, a new source of funding may be needed if we are to achieve the economic benefits projected by IEA. One possible source is the additional tax revenue that would result from increased domestic oil production (whether offshore or by CCS-EOR).

Research and early deployment of CCS technology for EOR may be essential to achieving long term climate goals, but additional options are needed to address climate change in the short term. A recent report by the United Nations Environment Programme (UNEP)<sup>20</sup> concluded that strategies aimed at reducing emissions of “black carbon” (BC - basically soot from diesel engines and primitive residential cooking stoves) and methane that generates tropospheric ozone (TO) could provide nearly immediate reductions in global temperature. Unlike CO<sub>2</sub> emission reductions, which are unlikely to have a meaningful impact on atmospheric temperatures before 2100<sup>21,22</sup>, reductions in BC and TO could reduce temperature increases predicted for 2050 by 0.5 °C, or about one half. Warming in the Arctic over the next 30 years would be reduced by about two-thirds, thereby reducing risks of changing weather patterns. Moreover, controlling these emissions is supportable on other merits: eliminating 2.4 million premature deaths per year; reducing crop losses (corn, rice, soybean, wheat) by 50 million tonnes per year (about 2%)<sup>23</sup>. A climate strategy including BC and TO mitigation would effectively buy time for additional research to produce cheaper technologies to address longer term mitigation of CO<sub>2</sub>.

## Summary

Current strategies to revive the U.S. economy, promote energy security, and foster environmental improvement can be strengthened in a revenue neutral manner. Energy is a common factor in all three goals, and an integrated approach to achieving these objectives via energy policy could provide broad benefits to the nation. The following general concepts are

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<sup>19</sup> Energy Technology Perspectives – 2008, OECD/International Energy Agency, 2008, p. 85.

<sup>20</sup> Integrated Assessment of Black Carbon and Tropospheric Ozone, UNEP & WMO, June 2011.

<sup>21</sup> The IEA has concluded that the climate commitments proposed at the 2009 Copenhagen Climate Conference, if they were implemented, would lead to a long term (year 2300) global temperature increase of 3.5 °C, far more than the announced policy goal of 2 °C. World Energy Outlook 2010, International Energy Agency, OECD, 2010, p.384.

<sup>22</sup> Temperature differences in 2050, based on a “Copenhagen” emission scenario versus a business as usual case, can be gleaned from comparing the IPCC’s 650ppm scenario to its 1000ppm scenario. The difference is less than 0.1 °C. Climate Change 2001: The Scientific Basis, IPCC 3<sup>rd</sup> Assessment Report, Figure 26.

<sup>23</sup> Op.Cit., Integrated Assessment of Black Carbon and Tropospheric Ozone.

based on shifting energy strategy from one based on increased energy prices, to one based on achieving goals at reduced costs.

1. Reduce, by more than half, the outflow of U.S. dollars currently paying for imported oil (\$324 billion in 2010) by:
  - a. Allowing expanded production of oil on the outer continental shelf, and
  - b. Subsidizing the capture of CO<sub>2</sub> from energy facilities for use in CO<sub>2</sub>-based enhanced oil recovery. Ensure revenue neutrality by recovering the subsidy from income taxes related to the increased oil production.
  - c. Taken together, these measures could create 3.7 million new jobs, sharply reduce the trade deficit, provide genuine energy security, and create substantial new tax revenues.
2. Replace the costly piecemeal approach to environmental regulation of electric power generation with comprehensive legislation that balances energy, economic, and environmental goals. A 10% improvement in the cost of electricity could save or create 1.4 – 2.2 million jobs.
3. Address climate change with a three-fold strategy:
  - a. Achieve immediate reductions in global temperature increases by a strategy aimed at reducing black carbon emissions, and by reducing methane emissions contributing to tropospheric ozone. This strategy would also provide large reductions in global mortality and crop damage from air pollution.
  - b. Expand research, development, and demonstration on emerging technologies which have broad applicability, particularly carbon capture and storage (CCS) technology for application to fossil fuel combustion processes (e.g., power plants) and industrial processes (e.g., cement production). The goal would be a sharp reduction in the cost of these technologies, so that long term climate goals become affordable.
  - c. Achieve near-term reduction of CO<sub>2</sub> from coal-fired power plants via the profit-driven CCS-EOR program described in Item 1.b., above.

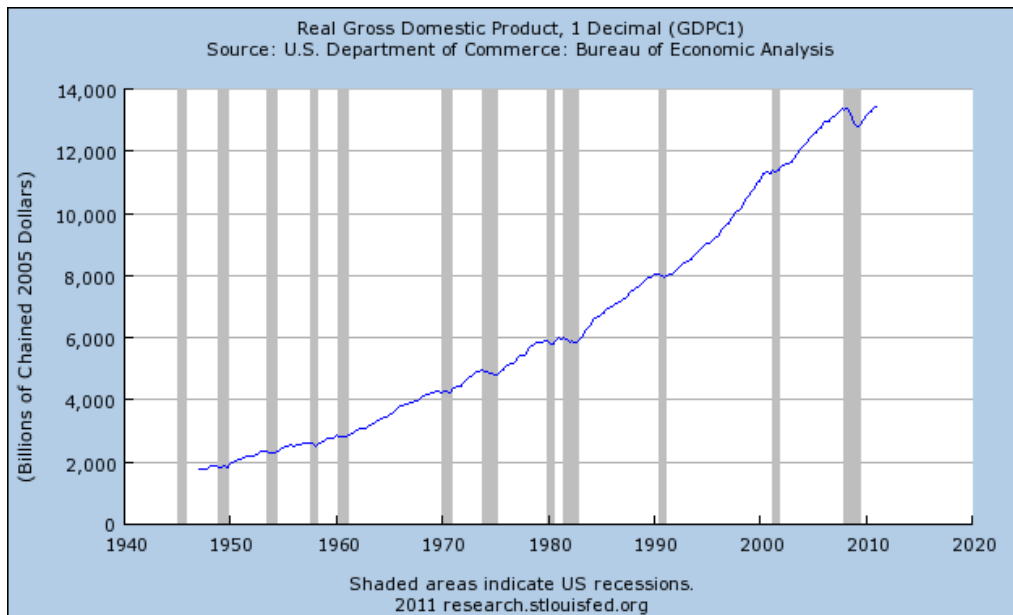
## Appendix A: **A current situation report**

Current strategies to address the economy, domestic energy security, and global climate change are not sufficient to meet stated policy goals. Some of these approaches have produced limited benefits, but now offer diminishing returns. Others were based on assumed relationships which have been proven incorrect by subsequent research and actually provide more harm than help. This appendix discusses the problems and limitations of these current strategies.

### **The economy**

The economy is experiencing a jobless recovery from the 2008 “Great Recession.” The good news is that neither the U.S. nor the world plunged into a Depression in 2008. Domestic GDP is recovering and appears to be assuming its long term trend, as indicated in Figure 1 (shaded vertical bars reflect recessions).<sup>1</sup>

**Figure 1 - Real GDP, 1947 to 2011**

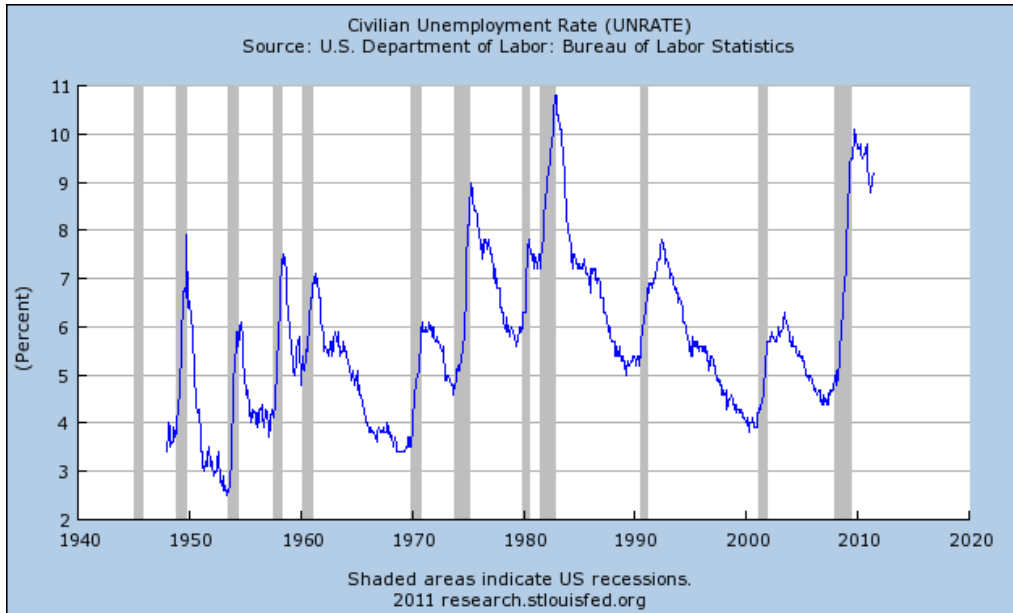


The bad news is that employment has failed to recover. Figure 2 shows that unemployment remains at levels seen only once since WW2, and has failed to exhibit the rapid drop that has typically occurred after a recession<sup>2</sup>.

<sup>1</sup> <http://research.stlouisfed.org/fred2/series/GDPC1>

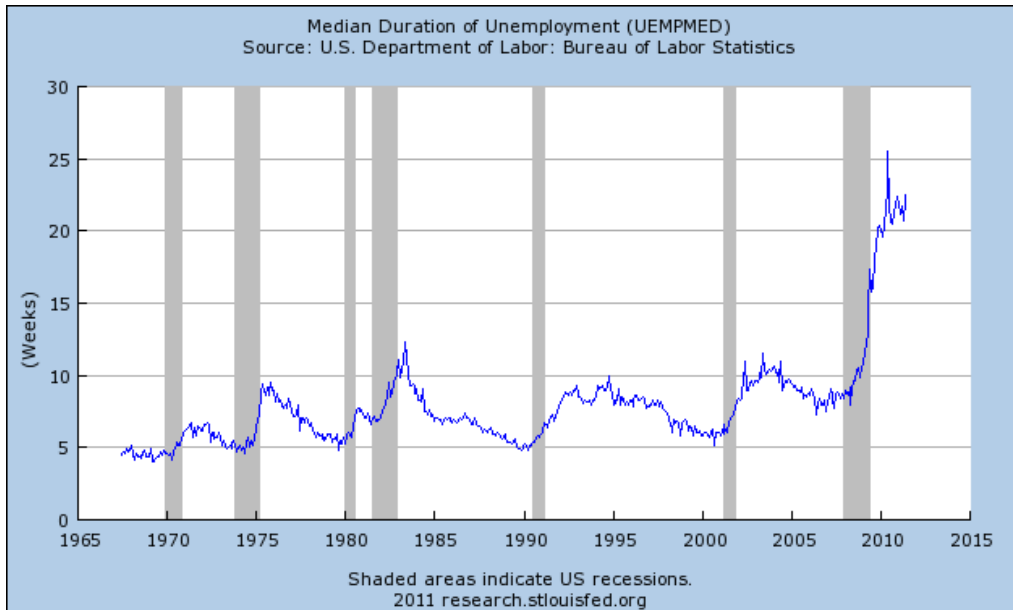
<sup>2</sup> <http://research.stlouisfed.org/fred2/series/UNRATE>

**Figure 2 - Unemployment rate: 1947 to June 2011.**



Moreover, as shown in Figure 3, the median duration of unemployment remains above 20 weeks, more than twice the duration experienced at any time since such data were initially tracked in 1967<sup>3</sup>.

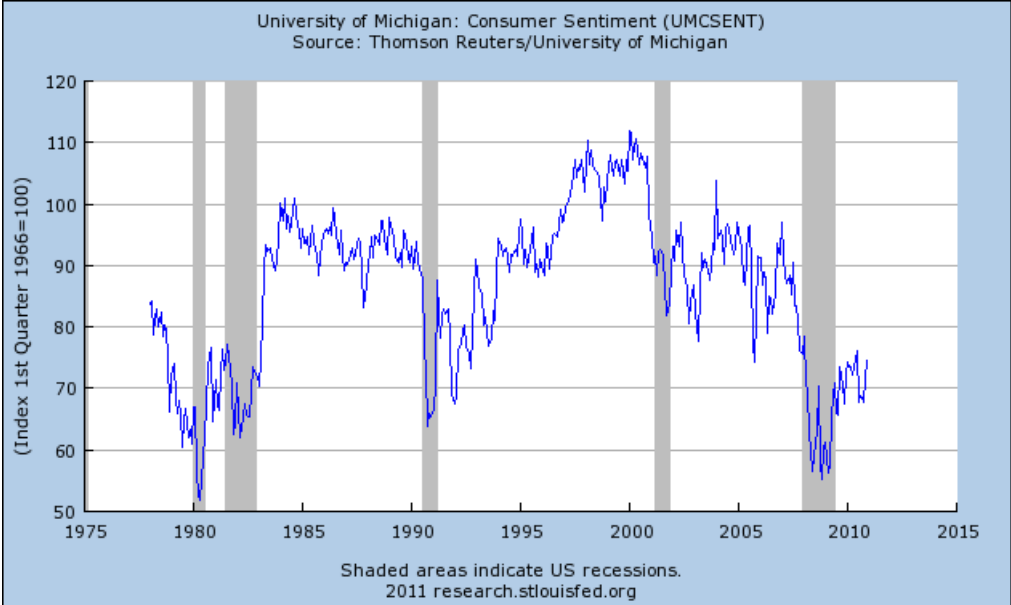
**Figure 3: Duration of unemployment**



<sup>3</sup> <http://research.stlouisfed.org/fred2/series/UEMPMED?cid=12>

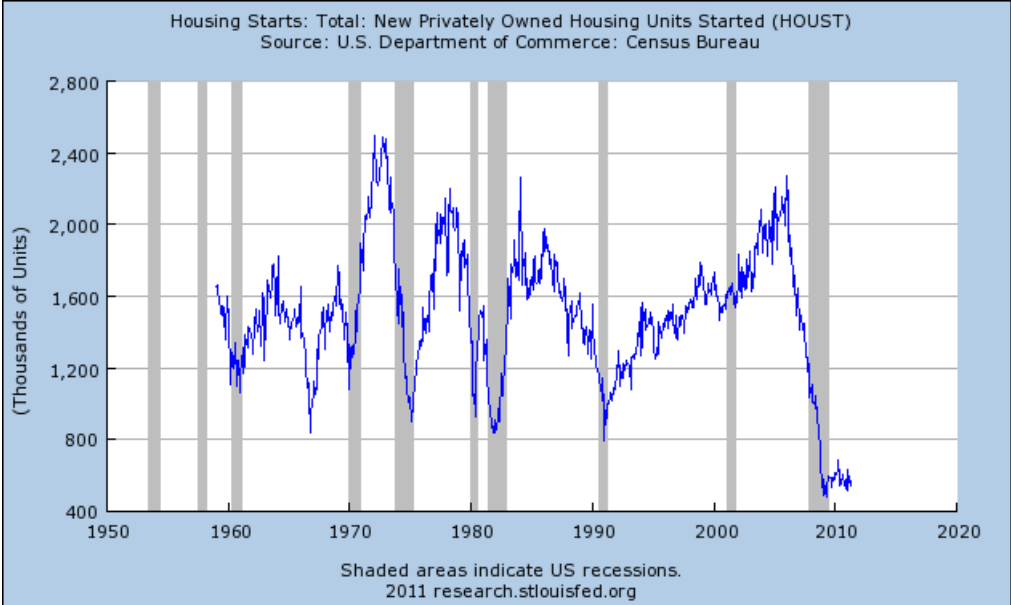
Despite efforts by government to improve the economy, public confidence in the economic recovery remains low, as shown by the University of Michigan Consumer Sentiment index (Figure 4).<sup>4</sup>

**Figure 4: Consumer confidence**



This pessimism has manifested in the housing market, where new housing starts are at a small fraction of average post-WW2 rates, and are a record low for the period post-1959 (Figure 5).<sup>5</sup>

**Figure 5: New housing starts**

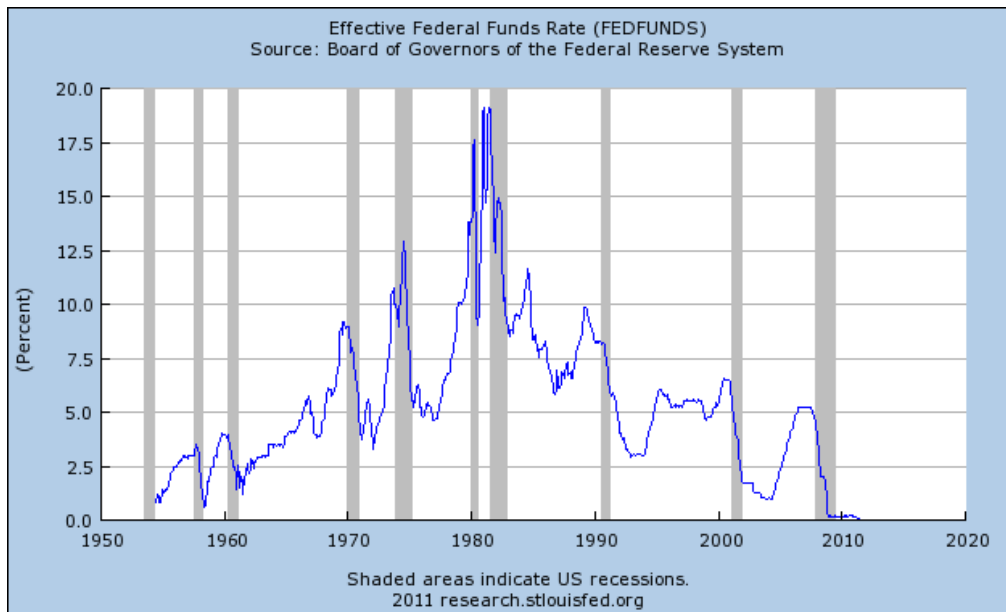


<sup>4</sup> <http://research.stlouisfed.org/fred2/series/UMCSENT>

<sup>5</sup> <http://research.stlouisfed.org/fred2/series/HOUST>

This mixed record comes despite dramatic efforts to stimulate the economy. With respect to fiscal policy, the most notable actions were the \$787 billion American Recovery and Reinvestment Act of 2009 (Public Law 111-5), and the smaller Economic Stimulus Act of 2008 (Public Law 110-185).<sup>6</sup> Both of these laws provided substantial tax relief to individuals, including a home purchase credit of \$8000 to stimulate the housing market. Additionally, the Federal Reserve system exercised monetary policy by dropping the federal funds rate to almost 0% in an effort to encourage banks to place more money in circulation (Figure 6).<sup>7</sup>

**Figure 6: Federal Funds Rate**



With the current focus on national debt, it seems that further fiscal stimulus actions are likely to be limited to emergency situations. Considering that the federal funds (lending) rate is currently 0.09%, there is nowhere to go with further monetary stimulants. In short, the federal policy quiver has no more of the arrows traditionally used to foster economic growth.

Two non-traditional options cited in the body of this report are:

- Measures to create new economic activity and to reduce the U.S. trade deficit by encouraging greater domestic oil production: In 2010, oil imports constituted a \$324 billion drain on the U.S. economy. They will doubtless be greater in 2011, because the price of oil has increased by about one-third.
- Measures to reduce regulatory costs to society: A 2010 report by the U.S. Small Business Administration found that the cost of federal regulations totaled \$1.75 trillion in 2008, or an average of \$15,500 per household.<sup>8</sup> This is slightly more than the sum of

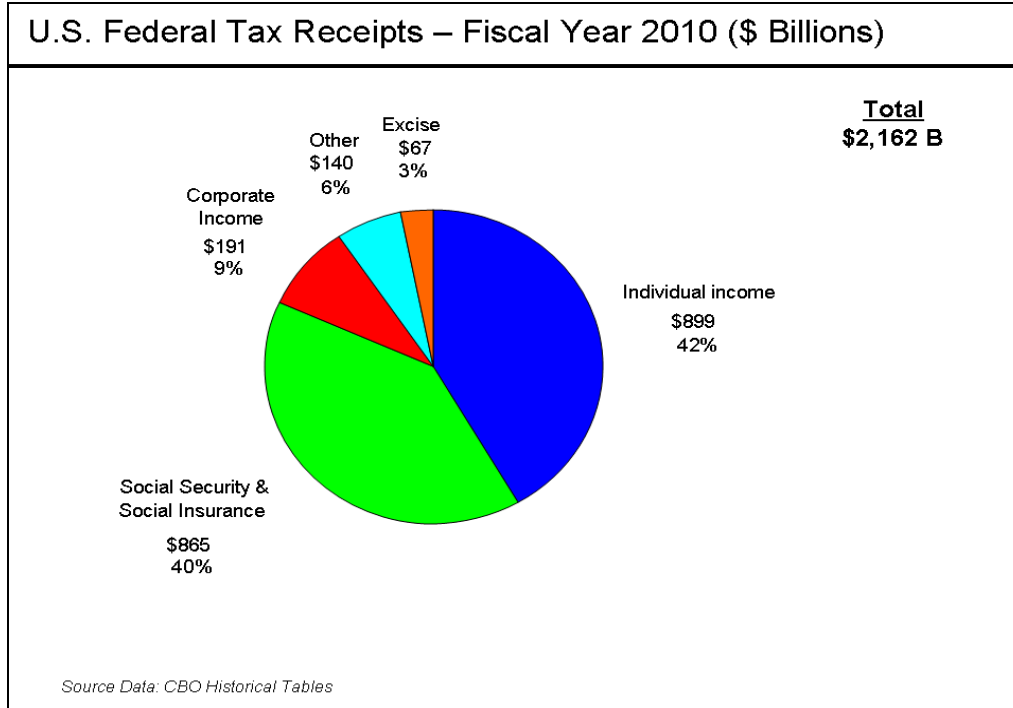
<sup>6</sup> The 2008 Act was projected to inject \$152 billion into the economy, primarily via tax rebates, or about 1% of GDP.

<sup>7</sup> <http://research.stlouisfed.org/fred2/series/FEDFUNDS>

<sup>8</sup> *The Impact of Regulatory Costs on Small Firms*, N. Crain, Lafayette College, for Small Business Administration, September 2010, <http://archive.sba.gov/advo/research/rs371tot.pdf>.

U.S. Government revenues from corporate income taxes, individual income taxes, excise taxes, and other taxes in 2010 (see Figure 7)<sup>9</sup>.

**Figure 7: Federal tax receipts in 2010**



## Energy Security

Energy Security has come to be equated with U.S. policy to minimize our reliance on imported oil. During the 1973 oil embargo by Arab members of OPEC, which lasted about 6 months, the price of oil (in constant 2008 dollars) increased from about \$20/barrel to about \$100/barrel. The stock market crashed in late 1973, and the embargo is recognized as the first negative event since the Depression to have a persistent economic effect.<sup>10</sup> The exercise was repeated following the Iranian Revolution in 1979, when President Carter ordered the cessation of Iranian imports.<sup>11</sup> Figure 8 provides a view of oil prices over time, in nominal dollars, and the incidence of recessions (gray shaded bars).<sup>12</sup> As can be seen from Figure 8, most post-1973 recessions immediately followed a sharp increase in oil prices.

<sup>9</sup> FY2010 U.S. Federal Receipts, <http://upload.wikimedia.org/wikipedia/en/f/f9/U.S. Federal Receipts - FY 2007.png>

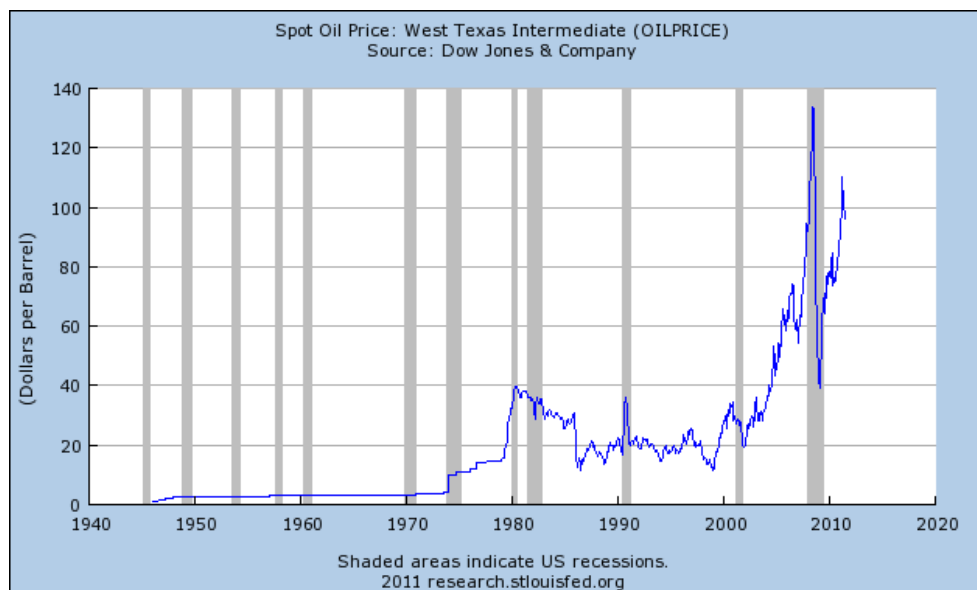
<sup>10</sup> 1973 Oil Crisis, Wikipedia, [http://en.wikipedia.org/wiki/1973\\_oil\\_crisis](http://en.wikipedia.org/wiki/1973_oil_crisis)

<sup>11</sup> 1979 Energy Crisis, Wikipedia, [http://en.wikipedia.org/wiki/1979\\_energy\\_crisis](http://en.wikipedia.org/wiki/1979_energy_crisis)

<sup>12</sup> <http://research.stlouisfed.org/fred2/series/OILPRICE>

More than three decades ago, the “Carter Doctrine” committed the nation to protecting its sources of imported oil with force, if necessary.<sup>13</sup> The President also committed us to reduce oil imports.<sup>14</sup> Although we have repeatedly exercised the force of arms to protect sources of oil imports, our efforts to reduce reliance on imported oil have been dominated by rhetoric. In the 30 years since President Carter capped oil imports at 1977 levels, our oil imports increased from 8.8 million barrels per day (BPD), to 13.5 million BPD.<sup>15</sup> Our strategy for reducing oil imports has not achieved its stated policy goal. President Bush conceded the point in his 2006 State of the Union address by stating that “America is addicted to oil, which is often imported from unstable parts of the world.” In 2010 these imports cost the U.S. economy \$324 billion.

**Figure 8: Price of crude oil**



About 70% of our domestic petroleum consumption is for transportation fuels, with most of the remainder used by industry. Very little oil is used by the residential or commercial sectors, and almost none for electric power generation.<sup>16</sup>

One approach being pursued<sup>17</sup> to reduce oil imports is to substitute liquid biofuels, which are currently produced in the U.S. almost entirely from corn, as ethanol. Most U.S. gasoline now contains up to 10% ethanol by volume, and EPA recently approved the sale of gasoline/ethanol

<sup>13</sup> “An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force.”, President Jimmy Carter, State of the Union address, January 1980.

<sup>14</sup> “This intolerable dependence on foreign oil threatens our economic independence and the very security of our Nation. Beginning this moment, this Nation will never use more foreign oil than we did in 1977—never.”, President Jimmy Carter, Crisis of Confidence Speech, July 15, 1979.

[http://www.cartercenter.org/news/editorials\\_speeches/crisis\\_of\\_confidence.html](http://www.cartercenter.org/news/editorials_speeches/crisis_of_confidence.html) .

<sup>15</sup> *Annual Energy Review – 2009*, US EIA, DOE/EIA-0384(2009), August 2010, <http://www.eia.gov/aer> .

<sup>16</sup> *Annual Energy Review 2009*, US Energy Information Administration, August 2010.

<sup>17</sup> The Energy Independence and Security Act of 2007 (Public Law 110-140) mandates U.S. use of 36 billion gallons of biofuel per year by 2022 (vs 4.7 billion gallons produced in 2007). At least 21 billion of this must come from non-cornstarch sources.

blends up to 15% ethanol. However, ethanol poses its own problems. The most relevant ethanol issue with respect to energy security is that corn ethanol consumes about as much oil as it replaces (more by some estimates). An MIT comparative analysis<sup>18</sup> of four studies of ethanol's energy balance concluded that the most optimistic analysis resulted in a 6% net gain in energy from the production and use of ethanol. The other three results were +4%, -1%, and -30%. The calculated energy displacement value can be improved slightly by placing an energy production value on potential "coproducts" that would derive from using the residual corn material as animal feed.

Another issue associated with corn ethanol production is that it appears to exacerbate global warming. This is counter-intuitive since ethanol is a form of renewable energy. Nevertheless, biofuels have been shown to cause more harm than help.<sup>19</sup> The problem is partly the energy requirements for producing the ethanol, and partly the GHG impacts of land clearing to accommodate the corn acreage. These adverse GHG effects are expected to be much less significant if second generation ethanol technologies (cellulosic ethanol) can be commercialized.

A third issue for ethanol relates to the second: fuel acreage can displace food acreage, and thereby contribute to global hunger. A recent report<sup>20</sup> by experts from a host of international organizations, including the World Food Programme, the International Monetary Fund, the Organization for Economic Cooperation and Development, the UN's Food and Agriculture Organization, concluded that, "*If oil prices are high and a crop's value in the energy market exceeds that in the food market, crops will be diverted to the production of biofuels, which will increase the price of food.*" The report recommended that: "*G20 governments remove provisions of current national policies that subsidize (or mandate) biofuels production or consumption.*"

A fourth problem with ethanol is that current engines may not operate well on higher fractions of ethanol blends.<sup>21,22</sup> EPA has recently concluded that increasing the blend from 10% to 15% (E15) will not harm automobile engines produced after 2001<sup>23</sup>. However, others are skeptical.

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<sup>18</sup> Standardization and comparative analysis of four recent studies on the energy balance of corn ethanol, D. Chavas, MIT, December 8, 2008, [http://www.mit.edu/~drchavas/Corn\\_Ethanol\\_Paper\\_Chavas.pdf](http://www.mit.edu/~drchavas/Corn_Ethanol_Paper_Chavas.pdf)

<sup>19</sup> Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change, Searchinger, et.al., *Science*, Vol. 319 no. 5867, pp. 1238-1240, February 29, 2008.

<sup>20</sup> Price Volatility in Food and Agricultural Markets: Policy Responses, FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank, the WTO, IFPRI, and the UNHLTF, June 2, 2011.

<sup>21</sup> Can E15 Gasoline Really Damage Your Engine?, *Popular Mechanics Magazine*, December 2010, <http://www.popularmechanics.com/cars/alternative-fuel/biofuels/e15-gasoline-damage-engine>

<sup>22</sup> Challenges to the Transportation, Sale, and Use of Intermediate Ethanol Blends, US GAO, GAO-11-513, June 2011.

<sup>23</sup> EPA made two separate findings. In October 2010, the Agency concluded that E15 would not harm engines built in 2007 or later. In January 2011, EPA extended that finding to engines built between 2001 and 2006. EPA's actions do not allow E15 use in older vehicles, or small engines like lawn mowers or motorcycles. Regulations prescribing appropriate fuel pump warnings were promulgated on June 23, 2011.

<http://www.epa.gov/otaq/regs/fuels/additive/e15/>

At a hearing held by the House Science, Space and Technology committee<sup>24</sup>, several witnesses challenged EPA's conclusion. Moreover, statements by Subcommittee members cited studies by the National Academy of Sciences and others which countered the testimony of EPA's witness defending the E15 rule. Ultimately, the EPA witness retreated to a position that, "I will not comment on policies on ethanol," and declined to comment on Rep. Bartlett's statement that she was attempting to make the best of a law that constituted bad policy.<sup>25</sup>

In short, the dominant current policy to reduce oil imports to the U.S. does not significantly reduce imports (and may in fact increase them), exacerbates global climate change, may lead to engine damage, and exacerbates world hunger.

### **Global climate change**

U.S. policy proposals for reducing GCC have centered on restricting the use of fossil fuels and limiting CO<sub>2</sub> emissions from heavy industries such as cement production, refining, and iron and steel production. Those restrictions will increase energy and manufacturing costs and make reduced energy consumption and low carbon alternatives economically competitive with traditional activities. In addition, the cost of reducing emissions will be high enough that industries will elect to fund emission reductions overseas (emission offsets), such as forestry activities. Increased use of domestic biofuels is another key element proposed to reduce GHG emissions from the transportation sector, and possibly from electric power generation. These were the basic elements of H.R. 2454, which passed the House of Representatives in 2009, but which stalled in the Senate. Since 2009, a number of problems have been cited with the basic approach of H.R. 2454, including:

- The increased price of energy needed to modify consumers' behavior has been equated to a "tax" which would place a Keynesian drag on the economy. Both Japan and Russia have indicated that they will not adopt binding post-2012 Kyoto-like constraints on their emissions, presumably due to such adverse economic impacts. Neither the U.S. nor China has agreed to mandatory GHG limits in the past, or for projected emissions.
- As noted under "Energy Security," the use of biofuels has been shown to increase, not decrease, GHG emissions due in large part to emissions associated with clearing land to produce the biofuels.
- Conventional wisdom, as reflected by H.R. 2454, is that afforestation (growing trees) is an effective climate change mitigation measure. However, a recent report<sup>26</sup> concluded the opposite: "Afforestation can therefore result in net climate warming, particularly at high latitudes." The report estimated that, even if half of all current crop land were used

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<sup>24</sup> Hearing: The Science on E15, House Science, Space, and Technology Committee, Energy and Environment Subcommittee, July 7, 2011, <http://science.house.gov/hearing/energy-and-environment-hearing-science-e15>

<sup>25</sup> Ibid., archived webcast, <http://science.edgeboss.net/wmedia/science/sst2011/070711.wvx>

<sup>26</sup> Small temperature benefits provided by realistic afforestation efforts, V. Arora, *Nature Geoscience*, June 19, 2011.

to grow forests for 50 years, the total impact on global temperatures in the 2081-2100 timeframe would be a 0.25 °C reduction in warming.

- Increased use of nuclear power assumed in analysis of H.R. 2454 is highly questionable due to both increases in the cost of nuclear power plants, and to public opposition following the ongoing disaster at the Fukushima generating station in Japan.

“Cap & trade” approaches to climate change, such as H.R. 2454 would have allowed up to 2 billion TPY of emission offsets, primarily via forestry measures. These offsets would have constituted the bulk of mitigation measures for the early decades of the bill. In analyzing an earlier climate bill (S. 2191), EPA concluded that without domestic offsets and international credits, compliance costs would increase 93% in 2030; without nuclear and biomass expansion for power production, compliance costs would increase 82%.<sup>27</sup> In EIA’s analysis of H.R. 2454<sup>28</sup>, only 39% of emission reductions through 2030 came from controlling “covered sources” (power plants, industry, transportation fuels, etc.). The rest was from offsets. Of the 39%, most came from reduced coal use for electric power production: *“Emissions reductions from changes in fossil fuel use in the residential, commercial, industrial and transportation sectors are small relative to those in the electric power sector.”*

EPA has announced that it will proceed to regulate GHG emissions using existing legislative authority. Permitting requirements for major new sources of CO<sub>2</sub> are already in effect<sup>29</sup>, and emission limits on new and existing power plants are scheduled for proposal in September.<sup>30</sup> Depending on the nature and stringency of these regulations, they could exacerbate the already significant burden of regulations on the economy and employment.

Another problem with current climate policy options is that they require several decades, and perhaps centuries, to impact global temperatures. The Intergovernmental Panel on Climate Change (IPCC) evaluated a range of policy options in its 2001 “3<sup>rd</sup> Assessment Report”<sup>31</sup>. They found that whether one pursued a relatively relaxed “1000 ppm” policy, or an extremely aggressive “450 ppm” scenario, temperatures would increase between 1.8 and 2.8 °C in 2100. In other words, the difference in warming was at most 1°C in 2100 (larger temperature differences were projected for the year 2300). The range of temperature increases in 2050 was limited to between 1.1 and 1.35 °C, or a difference between alternative policies of no more than ¼ °C. (See Figure 9, below)

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<sup>27</sup> Offsets and Climate Policy: EPA Perspectives, R. Harvey, Climate Change Division, USEPA, May 16, 2008. Domestic offsets from forestry activities totaled 56% of total offsets in EPA’s analysis.

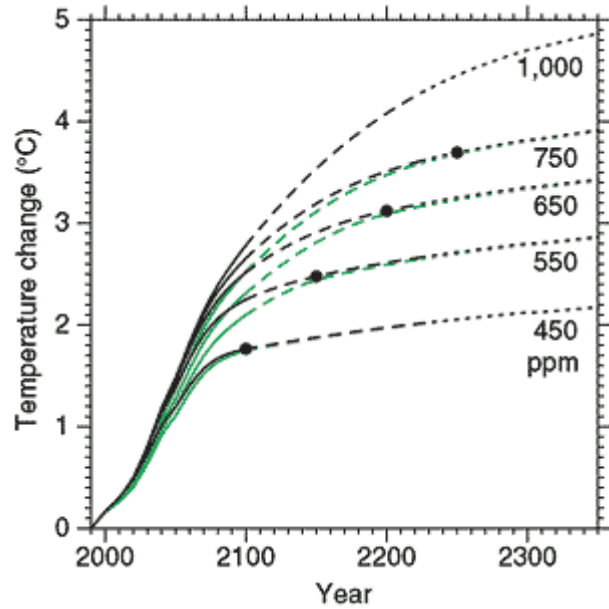
<sup>28</sup> Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009, USEIA, August 2009.

<sup>29</sup> Clean Air Act Permitting for GHGs, USEPA, <http://www.epa.gov/nsr/ghgpermitting.html>

<sup>30</sup> Settlement Agreements to Address GHG Emissions from Electric Generating Units and Refineries, USEPA, <http://www.epa.gov/airquality/pdfs/settlementfactsheet.pdf>. EPA announced on June 13 that proposal of these rules, originally scheduled for July 26, will be delayed until September 30. Promulgation of a final rule continues to be scheduled for May 2012.

<sup>31</sup> Climate Change 2001: The Scientific Basis, UN-IPCC, 2001 (Figure 26).

Figure 9: IPCC projected temperature increases



The above discussion is not intended to suggest that there are no practical options for addressing global climate change. However, it does provide evidence that several basic strategies which seemed to make sense a few years ago are no longer attractive. Alternative strategies that build on approaches to generate greater improvements in global temperature sooner, to store large amounts of CO<sub>2</sub> while producing additional domestic oil (at a profit), and to reduce long-term climate change mitigation costs by renewed emphasis on broadly applicable research are offered in the main body of this report.