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U.S. COAL RESERVES KEY TO NATIONAL AND ENERGY SECURITY

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Our nation's reliance on imported energy sources undermines our national and economic security. While we need to pursue new sources of energy, especially using technology, it is important to note that America has an abundance of coal. There are new and old technologies that make coal more efficient and more environmentally sound to use. In this Article, I outline the economic and national security risks of our reliance on imports, note the extent of our coal reserves, describe various advances in improving coal use, and focus on the special benefits of coal-to-liquid technology.

Energy is a crucial resource: it fuels our transportation, powers our factories, and heats our homes. As the economy and population of the United States grow, so does the demand for energy.

Throughout most of its history, the United States has produced as much energy as it has consumed. That started to change in the 1960s, with the United States importing more of its energy needs. Some states like California and Florida have gone through the same transformation.[1]

The United States is addicted to fossil fuels, with petroleum leading the way. A breakdown of the sources of energy consumed in the United States reveals fossils fuels (petroleum, coal, and natural gas) at the top accounting for 85.9 quadrillion British thermal units (BTUs), dwarfing nuclear energy (8.1 quadrillion BTUs), followed by renewable energies including hydroelectric, biomass, geothermal, solar, and wind (a combined 6 quadrillion BTUs). Petroleum alone accounts for 40.4 quadrillion BTUs a year consumed in the United States.[2]

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1. Energy Information Administration, Energy in the United States 1635-2000, http://www.eia.doe.gov/aer/eh/frame.html (last visited Mar. 3, 2008). (The Energy Information Administration (EIA) is an agency of the U.S. Department of Energy).

2. EIA, ANNUAL ENERGY REVIEW 3 (2005), *available at* http://www.eia.doe.gov/aer/

The United States is addicted to imported petroleum. Increasingly, we are also reliant on imported natural gas. Our nation is the world's largest importer of oil; we currently rely on other countries to provide 10 million barrels per day.[3] By 2030, America will get 16.4 million barrels per day (61% of its oil) from overseas.[4]

The growth in the economies of other nations will continue to increase the global demand for oil, tightening supplies and raising prices. Domestic and world demand for oil will likely increase rapidly in the next two decades. "Between 2004 and 2025, U.S. demand is projected to grow 24 percent (from 21 to 26 million barrels per day) and total world demand is expected to increase by 34 percent."[5]

With oil prices projected to steadily increase and with our imports rising, our economic situation is set to deteriorate as we send even more hundreds of billions of dollars overseas every year ($1 trillion every three years). This reliance on imported oil is a growing economic hindrance. In 2006, the United States spent $217 billion on imported oil, and over half of that money went to OPEC nations such as Saudi Arabia, Venezuela, Nigeria, Iraq, and Algeria.[6]

In addition, this dependency entails serious national security threats. The Middle East is rich in petroleum resources, and some 40% of the world's oil supplies move through the Persian Gulf, including 20% destined for America. In addition to its oil and natural gas wealth, the Middle East is a region of conflict and instability. The ongoing war in Iraq, Iran's nuclear ambitions, unrest in Lebanon, and radical Islamic movements all undermine regional security.[7]

In February 2006, terrorists with ties to al-Qaeda failed in an attack to destroy the Abqaiq processing facility in Saudi Arabia, which each day processes 6.8 million barrels of oil (two-thirds of all Saudi production) for export.[8] Ex-

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pdf/aer.pdf.

3. Energy Information Administration, Crude Oil and Total Petroleum Imports Top 15 Countries, http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/company_level_imports/current/import.html (last visited Mar. 3, 2008).

4. ENERGY INFORMATION ADMINISTRATION, ANNUAL ENERGY OUTLOOK 2007 WITH PROJECTIONS TO 2030, at 95, 97 (2007), *available at* http://tonto.eia.doe.gov/ftproot/forecasting/0383(2007).pdf.

5. *Energy Security and Oil Dependence: Hearing Before the S. Comm. on Foreign Relations*, 109th Cong. 4 (2006) (statement of Jason Grumet, Executive Director of the National Commission on Energy Policy).

6. U.S. CENSUS BUREAU & U.S. BUREAU OF ECON. ANALYSIS, U.S. INTERNATIONAL TRADE IN GOODS AND SERVICES 35 (2007), *available at* http://www.census.gov/foreign-trade/Press-Release/current_press_release/ft900.pdf.

7. ARIEL COHEN, HERITAGE FOUND., THE NATIONAL SECURITY CONSEQUENCES OF OIL DEPENDENCY (2007), *available at* http://www.heritage.org/Research/NationalSecurity/upload/hl_1021.pdf.

8. JOHN M. DEUTSCH ET AL., COUNCIL ON FOREIGN RELATIONS, INDEPENDENT TASK FORCE REPORT NO. 58, NATIONAL SECURITY CONSEQUENCES OF U.S. OIL DEPENDENCY 23 (2006), *available at* www.cfr.org/content/publications/attachments/EnergyTFR.pdf.

perts have noted that a successful attack on Saudi oil facilities could reduce production to four million barrels per day or less for several weeks, "which would have disastrous results for the global economy."[9] Clearly, terrorists understand the nexus between global security and oil security.

Global reliance on oil also results in shifting geopolitics and the formation of new alliances. In an effort to enhance access to oil supplies, China has developed relationships with Iran and Sudan, global pariahs. France and Germany, looking at their energy imports from Russia, are less confrontational with their neighbor to the east.[10] The same problem is emerging with respect to natural gas supplies, with the prospect of a natural gas cartel under the control of Russia, Iran and Qatar.[11]

The global community has turned a blind eye toward the transgressions of oil-rich nations as a matter of convenience. In addition, the Middle East continues to dominate the world oil markets, providing a major role in global economic and global security to a troubled region.

This, then, is our situation: we send hundreds of billions of dollars overseas to feed our oil habit. These funds enrich hostile nations and place global security in peril. Reducing our reliance on imported oil and natural gas would enhance our economic and national security. There are many other sources of energy that would reduce our foreign dependency, both the proven and the experimental.

However, in looking at the energy sources of the future, we need to be cognizant of the current situation, which will be slow to evolve. As we move toward innovative fuel sources, fossil fuels will continue to dominate in supplying our energy needs for decades to come.

As other nations are rich in petroleum resources, so is the United States wealthy in coal reserves. It is often said that the United States is the Saudi Arabia of coal. According to the U.S. Department of Energy, this nation has recoverable coal reserves of 267 billion tons, 27% of the world's reserves. At current consumption rates, that is enough coal to meet future demand for 250 years.[12]

It is especially beneficial that our coal reserves are distributed widely across the nation, making this important energy supply difficult to disrupt by weather or terrorist attacks. In fact, coal production reaches across the country, from the Appalachia region near the east coast, to the Midwest extending into

9. COHEN, *supra* note 7, at 4.

10. DEUTSCH ET AL., *supra* note 8, at 27.

11. ARIEL COHEN, HERITAGE FOUND., WEBMEMO NO. 1423, GAS OPEC: A STEALTHY CARTEL EMERGES (2007), *available at* http://www.heritage.org/Research/EnergyandEnvironment/upload/wm_1423.pdf; Russell Gold & Gregory L. White, *Russia and Iran Discuss a Cartel for Natural Gas Potential Clout Alarms Big European Buyers*, WALL ST. J., Feb. 2, 2007, at A1; *A Bear at the Throat*, ECONOMIST, Apr. 14, 2007, at 37.

12. *Coal Liquefaction: Hearing Before the S. Comm. on Energy & Natural Res.*, 109th Cong. 2 (2006) (statement of C. Lowell Miller, Director, Office of Sequestration, Hydrogen and Clean Coal Fuels, Office of Fossil Energy, U.S. Department of Energy).

Kentucky, to west of the Mississippi River, to the Rocky Mountain region. In addition, there is limited production on the west coast and in Alaska. Wyoming produces the most coal followed by West Virginia.[13]

Not only is coal abundant in our nation, it is also cheaper than oil and natural gas. On average, coal costs one to two dollars per million BTU, compared with six to twelve dollars per BTU for oil or natural gas.[14]

Because of these plentiful and cost effective coal reserves, power plants fueled by coal account for more than half of this nation's electricity production. Although cheap and abundant, coal burned to generate electricity emits pollution.[15]

Over twenty years ago, the U.S. Department of Energy initiated joint programs with the states and with industry to demonstrate new pollution-reducing technologies. These early efforts largely concentrated on reducing acid rain. In the twenty-first century, other concerns have arisen such as greenhouse emissions, the effect of microscopic particles on respiratory systems, and mercury emissions. In response, the President developed his Clean Coal Power Initiative, which provides federal funding for new coal technologies that will reduce harmful emissions by 70% by the year 2018.[16]

I helped develop H.R. 6, the Energy Policy Act of 2005, which was signed into law. H.R. 6 contains important support for developing our coal resources. In total, the energy legislation will provide more than $9.3 billion in new tax breaks and spending programs for the coal sector; nearly all of these tax relief provisions and funding benefit clean coal technologies, including gasification of coal.

Specifically, the Energy Policy Act authorizes $200 million annually through fiscal year 2014 for clean-coal research and coal-based gasification and combustion technologies. A provision of the law requires that at least 70% of the funds go toward the coal-based gasification technologies. This law clearly underscores that Congress realizes the importance of coal and the technologies necessary to expand its use.[17]

In the following paragraphs I will touch upon some of the promising coal technologies that make the fuel more efficient and more environmentally

13. ENERGY INFORMATION ADMINISTRATION, ANNUAL COAL REPORT 2005, at 13 (2006), *available at* http://www.eia.doe.gov/cneaf/coal/page/acr/acr.pdf.

14. *Clean Coal Technology—Science, Technology, and Innovation: Hearing Before the S. Comm. on Commerce, Sci. & Transp.*, 110th Cong. 3 (2007) (statement of Gregory J. McRae, Professor of Chemical Engineering, Massachusetts Institute of Technology).

15. Fossil Energy Office of Commc'n, U.S. Dep't of Energy, Advanced Combustion Technologies, http://fossil.energy.gov/programs/powersystems/combustion (last visited Mar. 3, 2008).

16. Fossil Energy Office of Commc'n, U.S. Dep't of Energy, Clean Coal Technology & The President's Clean Coal Power Initiative, http://fossil.energy.gov/programs/powersystems/cleancoal (last visited Mar. 3, 2008).

17. Energy Policy Act of 2005, Pub. L. No. 109-58, § 311(c), 119 Stat. 594 (codified at 15 U.S.C. § 717b).

friendly.

The Electric Power Research Institute, in addition to developing new technologies, is leading an aggressive advanced coal technology research, development, and demonstration program designed to improve the full range of current technologies. In recent testimony, the role of increased power plant efficiency that lowers emissions and costs was described.[18] The joint private-government technology initiative covers both pulverized coal plants and coal based Integrated Gasification Combined Cycle (IGCC) power plants.

One of the advanced clean-coal technologies being pursued is gasification. This process involves applying heat, air or oxygen, and a carbon-based feedstock, such as coal. The resulting thermal and chemical reactions yield a synthetic gas of carbon monoxide and hydrogen. After processing the synthetic gas to remove impurities and contaminants like sulfur and mercury, the resulting gas may be burned directly as fuel or converted to high quality transportation fuels, synthetic natural gas, fertilizer, or chemical feedstock. Current research focuses on improving the efficiency and economics of the conversion process.[19]

Gasified coal, as well as hydrogen, biofuel, propane, or gasoline, can also be used for fuel cells. These fuel cells are conversion devices that use a carbon-based or hydrogen-based fuel sources and air to generate electricity. Fuel cells are emission-free, produce little or no noise, and offer greater efficiency than conventional combustion-based electricity generation.[20]

These fuel cells can operate nearly anywhere and provide power for homes and businesses, as well as auxiliary power at power plants during peak hours. The Department of Energy believes that its fuel-cell research partnership could save the nation $100 billion by 2025 through lower fuel costs resulting from increased efficiency and reduced pollution.[21]

Turbines powered by steam from burning coal, natural gas, uranium (in nuclear reactors), wind and water are the primary sources for electrical generation. The clean synthetic fuel from coal gasification could be used to drive advanced turbines. In this case, the technology is applied to fueling turbines by creating hydrogen and capturing carbon dioxide. Successful capture will reduce the environmental impact of burning coal for electricity generation to near zero

18. *The Future of Coal Under Carbon Cap and Trade: Hearing Before the H. Select Comm. on Energy Independence and Global Warming*, 110th Cong. 5 (2007) (statement of Stuart Dalton, Director, Generation Electric Power Research Institute).

19. Nat'l Energy Tech. Lab., U.S. Dep't of Energy, Gasification: Advanced Gasification Program Element, http://www.netl.doe.gov/technologies/coalpower/gasification/adv-gas/ (last visited Feb. 25, 2008).

20. NAT'L ENERGY TECH. LAB., U.S. DEP'T OF ENERGY, FUEL CELLS POWERING AMERICA 2 (2007), http://www.fossil.energy.gov/programs/powersystems/fuelcells/seca/SECA_Brochure_8_29_06.pdf.

21. *Id.*

emissions.[22]

One of the coal technologies of great interest to me involves transforming solid coal into a liquid fuel. As noted, coal's main use in our nation is for generating electricity. However, our transportation fleet overwhelmingly runs on petroleum products. According to the Federal Highway Administration, 136.5 million automobiles were registered in this nation in 2005.[23] Americans used 180 billion gallons of motor fuel last year.[24]

Using coal to fuel a portion of America's cars, trucks, and buses would decrease our dependence on imported oil. Fortunately, there are proven techniques for converting coal to liquid fuel for vehicles.

During World War II, Germany became reliant on synthetic fuels, much of which was derived from coal. "More than 92 percent of Germany's aviation gasoline and half of its petroleum during World War II had come from synthetic fuel plants. At its peak in early 1944, the German synfuels effort produced more than 124,000 barrels per day from 25 plants."[25]

Even before the war, Germany was producing synthetic fuels. At the start of the global conflict on September 1, 1939, Germany was producing 240,000 metric tons per year by the Fischer-Tropsch methods, turning coal into a liquid fuel.[26]

In 1923, Professors Franz Fischer and Hans Tropsch developed the Fischer-Tropsch (FT) process, a chemical process that transforms coal into a liquid fuel. The FT process works by passing a cobalt or iron catalyst by a synthesis gas largely made up of carbon monoxide and hydrogen, which produces hydrocarbon chains and water. "In the most basic form, the synthesis reaction is written as $CO + 2H_2 > CH_2 + H_2O$. The liquid hydrocarbon product from the FT synthesis is high quality, with almost no sulfur, nitrogen and aromatic impurities, making it an ideal hydrogen-rich source for producing low-emission, clean-burning fuels."[27]

The synthesis gas used as feed in the FT process can be based on numerous carbon resources such as coal, coke, and even solid biomass wastes.[28] Greater

22. U.S. DEP'T OF ENERGY, DOE/EIS-0394D, DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR FUTUREGEN PROJECT, at S-50 (2007), *available at* http://www.eh.doe.gov/nepa/docs/deis/eis0394D/index.html.

23. FED. HIGHWAY ADMIN., U.S. DEP'T OF TRANSP., HIGHWAY STATISTICS 2005: TABLE MV-1 (2006), *available at* http://www.fhwa.dot.gov/policy/ohim/hs05/pdf/mv1.pdf.

24. FED. HIGHWAY ADMIN., U.S. DEP'T OF TRANSP., HIGHWAY STATISTICS 2005: TABLE MF-21 (2006), *available at* http://www.fhwa.dot.gov/policy/ohim/hs05/pdf/mf21.pdf.

25. Fossil Energy Office of Commc'n, U.S. Dep't of Energy, The Early Days of Coal Research, http://www.fossil.energy.gov/aboutus/history/syntheticfuels_history.html (last visited Mar. 3, 2008).

26. Arnold Kramer, *Fueling the Third Reich*, 19 TECH. & CULTURE 394, 403 (1978).

27. Fact Sheet, Rentech, Inc., Environmental Performance Characteristics of Fischer-Tropsch Fuels (2007).

28. NAT'L ENERGY TECH. LAB., U.S. DEP'T OF ENERGY, INCREASING SECURITY AND REDUCING CARBON EMISSIONS OF THE U.S. TRANSPORTATION SECTOR: TRANSFORMATIONAL

efficiency and stability comes from a more consistent carbon source, making coal an ideal feedstock for this process. And after the synthesis gas is converted to FT liquids, various refining methods can render the liquids into a nearly sulfur-free, low-pollutant premium diesel fuel and even jet fuel.[29]

As for the environmental impact of converting coal to liquids, this technology will produce a fuel that is cheaper, cleaner, and more efficient than those we use today. For example, "fuel scientists at the University of Kentucky have demonstrated that carbon dioxide and sulfur can be readily captured and safely stored in a coal-to-liquids (CTL) facility. In short, we can produce more fuel and improve air quality at the same time."[30]

The growth in coal supply will be dominated by western coal which is surface-mined. The Clean Air Act, the Clean Water Act, and the Surface Mining Control and Reclamation Act strictly regulate coal mining. The transportation infrastructure, the underpinning for the entire U.S. economy, includes rail, barge and truck. A 2006 National Coal Council study found that the U.S. mining industry and transportation infrastructure could be expanded to accommodate growth in coal production.[31] It will be necessary to continue to invest in both rail and barge infrastructure. Class I railroads spent $60 billion from 1994 to 2003 for capital improvements. Coal accounts for 20% of total revenue. Water transportation upgrades will require spending $1.6 billion over the next ten years according to the Inland Waterways Users Board. Barge operators pay a user tax into the Waterways Trust Fund to support U.S. Corps of Engineers projects.[32]

Various studies show that coal-to-liquids technology can replace large amounts of imported oil. A study by the Southern States Energy Board estimates that coal can be converted into 5.6 million barrels per day by 2030. Using the captured carbon dioxide in enhanced oil recovery can produce another 2.8 million barrels per day. This means we could reduce our oil imports by some 50% in twenty-five years.[33] A Business Roundtable study indicates that coal can be converted into a replacement for natural gas that could nearly eliminate imported liquefied natural gas (LNG) by 2030.[34]

ROLE FOR COAL WITH BIOMASS 3 (2007), *available at* http://www.netl.doe.gov/energy-analyses/pubs/NETL-AF%20CBTL%20Study%20Final%202007%20Aug%2024.pdf.

29. CAL. ENERGY COMM'N, PUB. NO. CEC-600-2005-029-FS, GAS-TO-LIQUID FUELS IN TRANSPORTATION (2006).

30. Frank Clemente, *Coal Can Take Place of Oil, Help State Economy*, ANNISTON STAR, June 25, 2006, *available at* http://www.annistonstar.com/opinion/2006/as-insight-0625-0-6f23s1913.htm.

31. NAT'L COAL COUNCIL, COAL: AMERICA'S ENERGY FUTURE 98 (2006), *available at* http://www.easterncoalcouncil.com/2006%20Volume%201%20REVISED.pdf.

32. *Id.* at 107, 111.

33. SOUTHERN STATES ENERGY BD., AMERICAN ENERGY SECURITY: BUILDING A BRIDGE TO ENERGY INDEPENDENCE AND TO A SUSTAINABLE ENERGY FUTURE 133 (2006), *available at* http://www.scag.ca.gov/rcp/documents/SouthernStatesReport.pdf.

34. BUS. ROUNDTABLE, MORE DIVERSE, MORE DOMESTIC, MORE EFFICIENT: A VISION

If natural gas imports are also taken into account, the incentive is even more substantial. The additional cost of imports will be from $35 billion to $45 billion by the year 2030. If the Energy Information Administration projection of high LNG imports (9.8 trillion cubic feet vs. 4.5 trillion cubic feet) is correct, the bill for imported natural gas could double to $90 billion per year.[35]

The cost of just one year of displaced oil and gas imports will amount to roughly $200 billion. This is ample incentive to make the necessary investments in technology and infrastructure if we have the national will.

Coal-based fuels will continue to be a hot topic during the 110th Congress. Lawmakers from coal producing states of both parties have proposed a variety of financial incentives for companies to build coal-to-liquid plants.

Among the most influential members who have introduced coal-to-liquid legislation are House Resources Committee Chairman Nick Rahall of West Virginia, Energy and Air Quality Subcommittee Chairman Rick Boucher of Virginia, and Senator Barack Obama of Illinois. President Pro Tempore of the United States Senate, Senator Robert Byrd of West Virginia has also argued in support of benefits of coal-to-liquid legislation, noting that the United States has the world's largest supply of coal, which is much cheaper than petroleum or natural gas. "It's right here, like acres of diamonds under our feet," he said.[36]

However, environmental groups who adamantly oppose coal-to-liquid programs, because they believe such technology produces twice as much greenhouse gas as petroleum-based motor fuels and would greatly expand coal mining, remain confident that House Speaker Nancy Pelosi will continue to oppose coal-to-liquid technology. Speaker Pelosi has placed curbing global warming high on her congressional agenda and is highly unlikely to support any legislative proposal other than those regarding the capture and storage of carbon emissions as part of a more comprehensive global warming agenda.

To conclude, here are the facts: America imports 10 million barrels of crude oil per day, and by 2030 will import a total of 16.4 million barrels of crude oil per day (61% of our oil supply). In 2006, we spent $217 billion on imported oil, with the cost for imports estimated to increase to between $300 and $500 billion (measured in 2005 dollars) by 2030. However, we have abundant coal reserves to meet our current needs for 250 years, and the technology needed to convert this coal into clean-burning liquid fuel. Coal-to-liquid technologies mean enhanced national economic and energy security, an improved balance of trade, and a cleaner environment. This is a win-win situation that our nation should embrace as we strive toward energy self-sufficiency.

FOR AMERICA'S ENERGY FUTURE 26 (2007), *available at* http://seechange.businessroundtable.org/Media/PDF/2007_BR_Energy_Report.pdf.

35. ENERGY INFORMATION ADMINISTRATION, SUPPLEMENTAL TABLES TO THE ANNUAL ENERGY OUTLOOK 2007: TABLE D11 (2007), *available at* http://www.eia.doe.gov/oiaf/aeo/supplement/pdf/sup_t2t3.pdf.

36. 153 CONG. REC. S7846, S7848 (daily ed. Jun. 19, 2007) (statement of Sen. Byrd).