

July 25, 2001

Secretary Spencer Abraham
Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

Dear Secretary Abraham:

I am writing to express my concern regarding the Bush Administration's energy policies. The administration has already displayed an unwise preference for older, finite, and environmentally degrading source of energy generation. I, and many other Americans, believe that this strategy will prove damaging to the nation's environment and health, and will ultimately leave the United States no better off in terms of energy efficiency and sufficiency. It will also isolate the US from an increasing interdependent world.

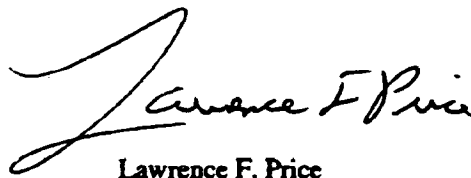
Given the Administration's actions to date, including renouncing both the Kyoto accord and the campaign pledge for carbon dioxide reduction, as well as soliciting little public input for Vice President Cheney's *National Energy Policy*, I am particularly concerned that the Bush Administration will dismantle the *New Source Review*. The National Source Review was designed to address the misuse of a Clean Air Act exemption by owners of coal generating plants. The industry agreed to phase out old plants in return for granting the plants exemptions. Instead, coal fired plants continued to operate thanks to the policy of installing new parts while ignoring the purchase of pollution reducing equipment. Recognizing the stall tactic and cognizant of the continuing damage to air quality and health, the E.P.A., eight states (including New Jersey) and a number of environmental groups used the New Source Review to file suit against the offending companies. Repudiating the New Source Review will simply allow controllable pollution to go unchecked while ignoring long-term energy solutions.

I am also asking that traditional energy producers not be exempted from other safeguards to our nation's environment and health, nor should their already generous benefits such as below-market mining leases continue.

We can not continue to consume so much of the world's resources, pollute so much of our own country, and refuse to acknowledge the dead-end of an overcommitment to fossil fuels. The American people need forward thinking leadership to take us past short-term policies rife with dangers. We need to wean ourselves from the foreign and domestic forces who have their hands on our current energy sources. We need to follow the lead of Japan and Europe in reducing our energy demands while staying economically strong. We need to set policies that encourage new means of energy production. We need to use tax credits that allow business and individuals to use the energy efficient designs and products already available. If we do not, we will soon find ourselves dependent on depleted sources of energy, whether we open all national parks and refuges or not, and will fall to a second-tier world power behind those who were better able to adapt to a new world.

Thank you for your time, I remain hopeful.

Sincerely,



Lawrence F. Price

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Secretary, The

From: (b)(6)
 Sent: Tuesday, July 31, 2001 9:10 AM
 To: Secretary, The
 Subject: Policy

FROM: (b)(6) 018230 2001 AUG -2 A 11: 50
 NAME: Robert E. Rutkowski, Esq.
 SUBJECT: Policy
 ZIP: bb
 CITY: 1
 PARM.1: TO:the.secretary@hq.doe.gov
 STATE: bb
 TOPIC: Energy Policy
 SUBMIT: Send Comments
 CONTACT: email--
 COUNTRY: USA

MESSAGE: Representative Jim Ryun U.S. House of Representatives Washington, D.C. Dear Representative Ryun: Next week the Republican leadership may bring an energy bill to the House floor. While I appreciate their attention to this important issue, I disagree with their solution to our energy problems. The plan is short on vision and offers no long-term solution to our energy problem. Vice President Cheney said it best himself: their policy is to continue extracting fossil fuels and consuming them at an unprecedented pace. In fact, in order to keep up with demand, they argue, we need to build a power plant a week for the next twenty years. Here is a set of principles that should guide Congress as they engage in the energy debate. I believe that we should embrace technology and develop innovative solutions to our energy challenges. I believe that it is outdated thinking to believe that we have to choose between growing our economy and protecting our environment: we can do both. In fact, a growing economy is dependent on a clean, reliable energy source for generations to come. I support market-based incentives and public-private partnerships to address national challenges such as the energy crisis. While I recognize that fossil fuels will continue to be a critical part of our nation's energy supply for years to come, I believe that we need a more visionary plan than one that simply finds and consumes fossil fuels at an unprecedented rate. Conservation and efficiency programs, such as encouraging the building of energy-efficient homes, appliances, and buildings, ensures that our limited supply of fossil fuels lasts longer. It makes no sense to embrace an energy plan based almost exclusively on a finite resource without also aggressively encouraging the conservation of those resources. What will future generations do when the fossil fuels grow ever scarcer? The legislation we will see next week includes drilling in the Arctic National Wildlife Refuge, over \$7 billion in royalty relief, \$30 billion in tax credits weighed heavily towards the fossil fuel industries, and an increase of only 1 mile-per-gallon in the corporate average fuel economy (CAFI) standards. The plan authorizes \$6 billion in R&D investments, which we support, but unfortunately there is no room for those investments in either the President's budget or the Republican budget framework. I understand that a comprehensive energy plan for the future is critical to our nation's long-term prosperity. As our country grows in both population and economy,

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so too does our demand for energy. In the last few decades, we have consumed fossil fuels at an unsustainable rate. We must develop a long-term plan to keep the lights on for our children and grandchildren. And we must act now. Already, states like California are spending billions of dollars of their hard-earned surpluses – surpluses that should go to improve our schools, expand access to health care, and help families afford things like child care and after school programs. We can't allow this crisis to spread, and our prosperity to be squandered on an energy plan that will not address provide sustainable energy resources for the future. I support investment in new energy technologies for conservation, efficiency and renewable energy sources Dick Cheney has said that conservation is merely a "personal virtue" and not an energy policy, and that we shouldn't count on renewable energy sources. As a result, the Administration wants to dramatically reduce conservation, efficiency, and renewable efforts, and instead pursue a policy that will have the United States building one new power plant to consume fossil fuels a week for the next twenty years. I believe there is a smarter, more balanced approach. In the short term, we can harness the power of technology and modernize regulations to make existing fossil fuel sources of power cleaner and more efficient. We can explore, develop, and extract fossil fuels in appropriate areas using environmentally-sensitive methods. What's more, we need to make our fossil fuel sources last longer by aggressively making conservation and efficiency work for all Americans. Consider the difference they could make: According to a study by scientists at the country's national laboratories just released this weekend, if the government takes aggressive steps to encourage energy conservation in homes, factories, offices, appliances, cars and power plants, we could reduce the growth in electricity demand by 20 to 47 percent. That would be the equivalent of between 265 and 610 big 300-megawatt power plants, a steep reduction from the 1,300 new plants that the Bush Administration claims will be needed over the next twenty years. Second, we need to invest in research and development for renewable sources of energy. Encouraging use of solar and wind power would not only conserve our supply of fossil fuels, it would also get some homes and businesses off the already-crowded power grid. Biomass, fuel cells, ocean turbines - these are just a few of the cutting-edge ideas that American scientists and inventors are developing to produce energy. Both Japan and Western Europe are aggressively pursuing development of alternative sources of energy, and if we don't make the same effort, our economy and environment will be left behind as other countries corner the market on new sources of energy. I believe that developing a long-term energy strategy is one of the most important decisions our country will make. A plan so reliant on expanded drilling and mining oil and coal is a step backwards, and squanders the opportunity to invest in new energy technologies to power our economy. As this debate continues, I hope the Republicans will change course, and work to develop an energy plan that is sustainable and grows the economy – an energy plan for the future. Thank you for the opportunity to bring these remarks to your attention. Yours sincerely, Robert E. Rutkowski, Esq. cc: Speaker Dennis Hastert Andrew H. Card, Jr. Secretary Spencer Abraham

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MAILADDR:

Margaret Millard

(b)(6)

July 12, 2001

Spencer Abraham, Secretary of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Mr. Abraham,

It is long overdue that the United States develop a safe and effective energy policy. We will not be able to continue the growth, expansion and our current living standard without reliable and cost effective energy sources. Surely the crisis in California has shown us the tip of the iceberg.

If other countries can build and run safe nuclear energy plants, why can't we. We are leaders in technology and science. How can fear and a few environmental activists rule our future. We need strong and tough leadership in this area, or there won't be much left here to run. Our economy is at stake and this is the specter that is going to bring us down.

I am a collector for a small Michigan bank in a rural area that was faced with horrible propane prices and gas prices. Some of my customers are still digging out and are behind on other loans. Usually they are caught back up by March. This year it was June and July that they were struggling. The automotive industry in Michigan has been affected by the energy crisis. This has caused lay offs and downsizing and firings. Some Michigan business have shut down as you know. It is a domino effect that is pretty scary for those of us with our pulse on the businesses. You know Michigan and many other states depend on energy to run its plants. You must know this is a crisis.

I hope that you will provide strong leadership to bring sanity to our antiquated energy policies. We are in the dark ages and will literally be there soon if we don't do something now.

Sincerely,


Margaret Millard

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Doyle T. Grogan

(b)(6)

July 17, 2001

2001-017434 7/20 P 3:35

Mr. Spencer Abraham
Department of Energy
Forrestal Building
1000 Independence Avenue
Washington, DC 20585

Dear Mr. Abraham:

President Bush is attempting to build support for the National Energy Policy recommendations which is bringing opposition from members of Congress representing states that need energy the most.

In 1952 President Harry Truman's Materials Policy Commission warned that in the 1970's, the U.S. would be dependent on Middle East oil, which could result in a serious energy shortage. It happened. The recommendations from this report are as valid today as 49 years ago and are included in President Bush's energy policy.

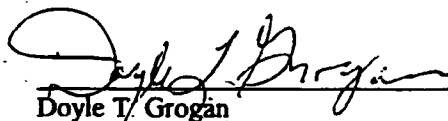
President Richard Nixon in a special message to Congress June 4, 1971, detailed a comprehensive energy policy because of brownouts and shortages of fuel in some areas of our country. The recommendations in this report are incorporated in President Bush's energy policy.

The ultimate objective of a national energy policy should be to ensure the economic and strategic security of energy supplies. It is not good economics to have to pay \$120,000,000,000 per year for imported crude oil and products. Security of supplies cost taxpayers \$60,000,000,000 per year, our military personnel are put at risk and supplies can be interrupted in an instant.

After the oil embargo of 1973, when it was apparent that the U.S. was vulnerable to disruptions in the supply of imported oil, Congress should have agreed on an energy policy. Instead they have spent 28 years in confrontation and political posturing. This has been costly for consumers.

By now it should be obvious and alarming to all our citizens and hopefully to Congress that to be a dominate world leader, with military superiority, we cannot allow foreign countries to control our crude oil, gasoline, jet fuel and other oil supplies.

The lessons are clear. It is imperative that we do everything possible to increase the production of all domestic sources of energy. At the same time, conserve to the utmost. It is time for Congress to put our national interest first.


Doyle T. Grogan

Attachments

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RMT:
7/30/01
DOE

Robert T. Rachal

(b)(6)

20 July 2001

President George W. Bush
The White House
1600 Pennsylvania Avenue
Washington, DC 20500

Dear President Bush;

I am writing to voice my opposition to U.S. plans to funnel more of the world's oil reserves to the United States. I especially oppose efforts that are designed to increase the involvement of U.S.-based energy firms in the petroleum industries of Nigeria, Azerbaijan, Kazashkstan, and the countries of the Persian Gulf. This form of "energy imperialism" can only lead to increased anti-Americanism sentiments overseas and continued energy wars.

The consumption of oil in the U.S. far outpaces any other nation in the world, yet there are no long-term plans to reduce our rate of consumption. The U.S. currently consumes approximately 19.5 million barrels of oil per day and our own government reports project that, with the current energy policy of your administration, consumption will rise to 25.8 million by the year 2020. This means that our import of oil will need to rise by 61 percent to meet this demand. This must stop.

As the last superpower remaining in the world, we should be setting an example of controlled use of the world's limited natural resources and promoting safe alternatives to the use of oil for power. The current energy strategy of the U.S. can only lead to increased U.S. political and military intervention in independent nations around the world. Such a policy is folly for the hope of world peace, something I believe we should be leading the way on.

Please may the appropriate changes in your administration's national energy policy so that we do not face the consequences of threatening protected wildlife areas and further interventions in the autonomous nations of the globe. Your current policy not only threatens the hopes of world stability and peace but also the fragile, ecologically delicate areas of our wildlife refuges. Please re-evaluate your plans and make the necessary adjustments.

Sincerely



The Rev. Rocky Rachal

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CONSULTANT-NONWOVEN/MB Ind

W. John G. McCulloch, Ph.D.
e-mail: [REDACTED]

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TEL: ()
Fax: ()

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July 13, 2001.

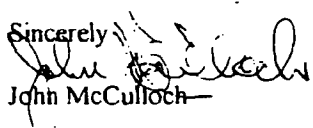
Mr. Spencer Abraham.
Head- US- Department of Energy
1000 Independence Ave, SW.
Washington, D.C. 20585

Dear Mr. Abraham.

I have admired the balanced energy approach that your Department, in conjunction with Vice-President Cheney and President Bush, has developed. I liken it to three legs of a stool- all of which are required for a stable policy. "More" oil discovery, nuclear energy, clean coal, transmission and pipelines -one leg. "Less" energy and water wastage, and less pollution the second leg and "Something Else" in the form of alternative energy sources, as the third leg. It would be very helpful if the Press stopped mis-characterization of your program, and the DNC's reliance on one leg "conservation" (despite the lessons of California) seems to me to be sacrificing our Nation's welfare for political gain.

I have assembled the enclosed information for a future presentation on one aspect of the "Something Else". Since it makes extensive use of DOE publications, I felt your department might have an interest.

Sincerely,


John McCulloch

29902

“Fuel Cells or Not Fuel Cells- That is the Fuelish Question”

By: W. John G. McCulloch, Ph.D.

Introduction.

Although the 20th century is regarded as a century of outstanding technology innovation, the 19th century also had some outstanding energy innovations. In 1800 Alessandro Volta, an Italian, developed the first battery, followed by Sir William Grove, a Welsh physicist's invention of the fuel cell in 1839. Four years earlier, in 1834 the first electric car was tested, 50 years before the internal combustion engine was invented in 1885. Until the 1980s fuel cells, which convert hydrogen and oxygen directly into electricity and heat, had found applications only in niche markets, such as space technology, starting in the '60s. But with easier availability of new materials and manufacturing techniques, efforts to advance this technology have been stepped up on an international scale. In the last decade fuel cells, which offer a virtually pollution-free source of power, have emerged as one of the most promising new/ but old technologies for meeting the Nations, and the Worlds phenomenal increase in energy needs in the 21st century. The first commercial use occurred in 1982, and today there are over 250 fuel cell systems in at least 15 countries, indicating the strong possibility of alternative energy technology versatile enough for cars, homes and power plants.

This presentation will cover the following:

- How a fuel cell works
- Why, and why not, fuel cells
- Types of Fuel Cells
- Applications for fuel cells
- Alternates to fuel cells
- Current status of fuel cell development
- The question of what fuel to use, short and long term
- Possible opportunities for nonwovens
- Conclusions

How a Fuel Cell Works.

The fuel cell is a lean, mean, green machine that utilizes an electrochemical reaction instead of combustion to produce energy (essentially the opposite of electrolysis). It works like a battery that never need re-charging and never goes flat. It is silent, and has no moving parts, similar to a battery, but unlike a battery it contains no hazardous materials and can use a renewable non-polluting fuel source. The heart of a fuel cell is an electrolyte sandwiched between two electrodes. In a proton-exchange membrane (PEM) fuel cell the simplistic steps are tabulated below

- H₂ molecule ionized at porous negative anode to form proton and electron
- Proton passes through the special membrane (PEM)
- Electron cannot, goes to external circuit to provide power
- Electron continues to cathode to convert proton back to hydrogen
- H₂ reacts with O₂ from air (Pt. catalyst) to form water

Overall $2\text{H}_2 + \text{O}_2 = 2 \text{H}_2\text{O} + \text{electricity} + \text{heat}$ (Pretty simple!!!)

A diagrammatic representation of the PEM fuel cell is shown in Figure 1.

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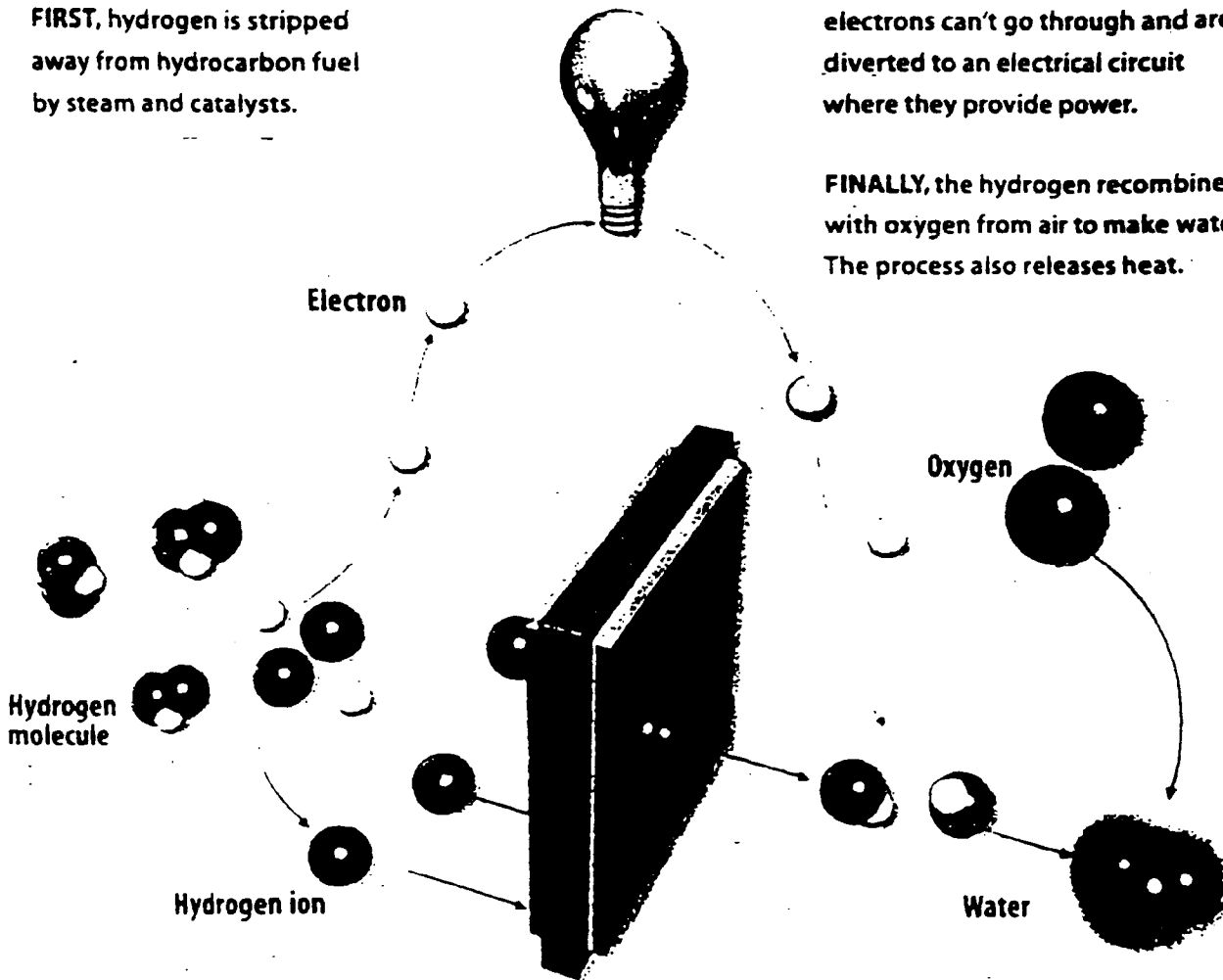
Figure 1

Fuel Cell Fundamentals

FIRST, hydrogen is stripped away from hydrocarbon fuel by steam and catalysts.

NEXT, the hydrogen ions pass through a special membrane; electrons can't go through and are diverted to an electrical circuit where they provide power.

FINALLY, the hydrogen recombines with oxygen from air to make water. The process also releases heat.



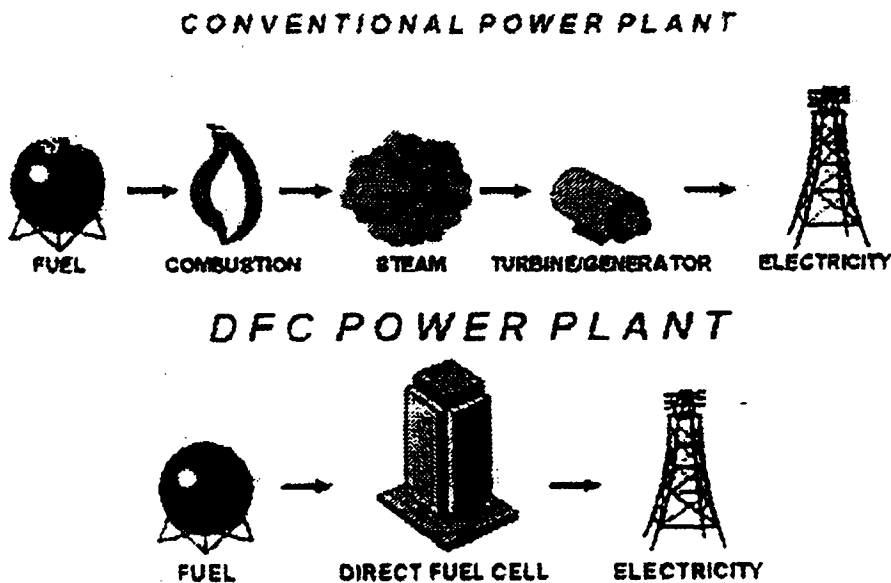
Why, and Why Not Fuel Cells?

The DOE, in promoting fuel cells as a better way to produce and deliver energy to consumers, cites these advantages (1)

- *Fuel cell power plants produce dramatically fewer emissions. (Natural-gas fuel cell power plants have a blanket exemption from California's strict regulations).
- *Fuel cells convert higher proportion of the chemical energy in fuel to electricity (60% without co-generation – nearly twice as efficient as conventional power plants)
- *Can convert high grade waste heat for use in commercial, industrial and residential applications including co-generation, heating and air-conditioning. (Efficiency ~85%)
- *Can readily size plants to meet loads by combining stacks, and the cost/kilowatt is about the same for small plants as for large plants. (can build plants wherever needed)
- *No moving parts, thus very reliable, safe and silent (good neighbors- a 200-kilowatt plant is about as noisy as an ordinary air conditioner)
- *Can use many different types of fuels from hydrogen to hydrocarbons (more later)
- *Many different types of fuel cells to meet different requirements (more later)

A comparison of a fuel cell power plant versus a conventional plant is shown in Figure 2

FIGURE 2.



With this imposing list of advantages, what is holding the industry back.

*The first problem is cost. The DOE (2) has established these cost and performance criteria, for the fuel cell to attain significant market acceptance:

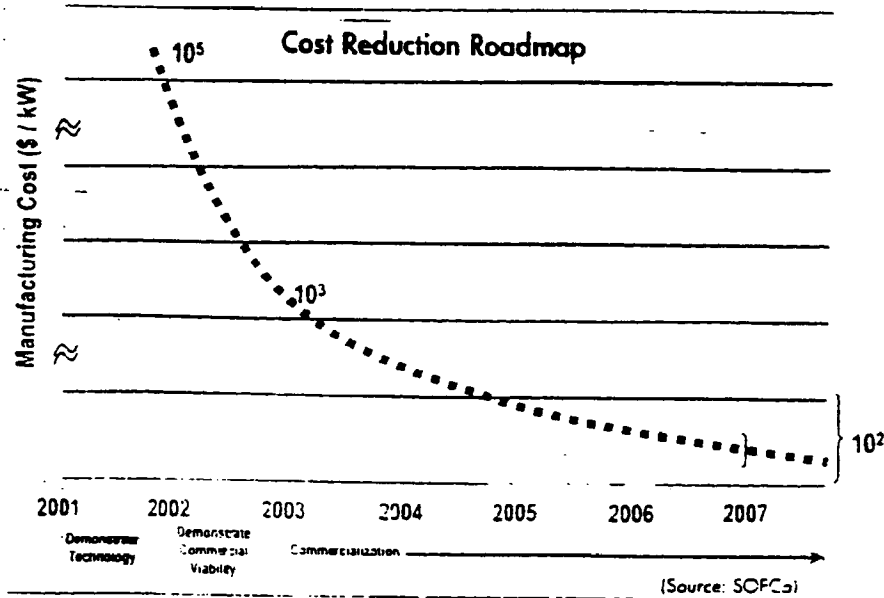
- Fabrication and assembly costs \$100/kW
- System Costs \$400/kW
- Efficiencies 70-80%
- Emissions Essentially zero
- Compatibility with carbon sequestration

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- Overall the cost reduction road map for a 5-kW solid oxide fuel cell (SOFC) is shown in Figure 3 (3).

Economy of scale alone will not meet this target. In addition continuous improvements are needed and are being made in all aspects from lower cost materials, to improved manufacturing processes, to more foolproof operating procedures.

Figure 3.



In addition to cost reduction, as with any new technology, many technical problems must also be solved. The problems differ from one type of fuel cell to another, and within a given fuel cell type, on the particular intended application. There are, however, three main categories:

- * Stationary power for power plants, and for residential use (Distributed Power)
- * Portable power for mobile phones and other.
- * Transportation for buses and automobiles.

Stationary power awaits the completion of several demonstration projects. Ballard Power has delivered its 4th 250 kW PEM stationary fuel cell power generator for field testing to Nippon Telegraph and Telephone to be used in conjunction with an absorption chiller developed by Ebara Corp. to provide cogeneration capability. Fuel Cell Energy, in conjunction with DOE, is designing, constructing and will operate a 250kW Direct Fuel Cell (DFC) utilizing coal mine methane gas at the Harrison Mining Corp. in Cadiz, Ohio. H Power has installed a propane-powered fuel cell residential cogeneration in Shawinigan, Quebec, and a natural gas residential cogeneration fuel cell system in a model home in France. GE MicroGen has recently announced its first two distributors for its line of residential and small commercial-sized FC systems. There are many other similar stationary fuel cell systems now under test for industrial and residential use, and it is anticipated that the "benefits" will justify continual resolution of remaining technical and cost barriers.

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The main problem for portable/ specialty power generation is the ability to produce sufficient power in the very small fuel cells required for recharging of portable cell phones. Manhattan Scientifics is working on a fuel cell using a methanol-water mixture as the fuel, and are experimenting with ethanol. Daido and Enable are introducing NeWave, a small portable PEM fuel cell providing up to 50 watts of electrical power. IdaTech plans to commercialize in 2002, their 1 to 3kW+ system, utilizing an onboard reformer to convert methanol to hydrogen, for use in uninterrupted power supplies, emergency power and portable and stationary applications. Metallic Power has demonstrated its new zinc/air, 1kW+ fuel cell, which they claim is about 30% smaller than other systems, to operate a variety of power tools, landscaping equipment and auxiliary power for trucks and RVs. The outcome of these and related trials will provide the needed answers as to future use of fuel cells for portable power generation.

The initial tests of fuel cells for transportation will probably be in buses where size and fuel infrastructure is not as critical as in automotive uses. Fuel cell powered buses are now being tested out in Beijing, Germany, Canada and California. In addition to cost, the challenges facing their use in automobiles are more substantial and include low cost infrastructure, range, power density, component integration complexity, water control in PEM FCs and customer acceptance (4). Despite these many problems a consortium of automakers, government agencies and energy suppliers have formed the California Fuel Cell Partnership to "advance the awareness and marketability of fuel cells", and two of the largest companies in the world Exxon Mobil and General Motors are cooperating to demonstrate use of gasoline powered fuel cells in automobiles. Recently Scott Memmer (5) observed General Motors' "HydroGen1" fuel cell-equipped Opel Zafira endurance test at GM's Desert Proving Grounds in the Sonoran Desert. The fuel cell van performed flawlessly in five laps around the circular track averaging between 60 and 65 mph, with plenty of power in reserve. GM claimed the vehicle set 15 international records during the test, including covering 1000 km in 11 1/2 hours. According to Memmer, GM plans to make, use and sell their own fuel cells. Allied Business Intelligence has predicted that by 2010 there will be millions of fuel cell powered automobiles, and that by 2020 will essentially replace ICE's (6). Joachim Grosse, head of the PEM fuel cell project at Siemens believes the cost reductions can be achieved by drastically lowering the price of all components ranging from materials through the compressor right up to the electric drive (7), as well as by moving towards an ultralight car(8)

Types of fuel Cells.

Today's many types of fuel cells will proliferate as more and more cells are tailored for use of different fuels, and different end-uses, which will probably exceed the number of different automobile models. The main types of fuel cells, which are primarily determined by the practical operating temperature and useful life of the electrolyte, are discussed below:

* Alkaline (AFCs) were the first to be used in space transport. They use an alkali electrolyte, and have a working temperature of 50-200 C. International Fuel Cells, a unit of United Technology Corp., has been the primary supplier to the aerospace industry since 1965, and now claim to be the worldwide leader in fuel cell production. They claim a 15% higher power density (1.5 kw/liter) than other fuel cells (9). Its subsidiary ONSI

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Corp. has 74 units, each the size of a minivan, in operation in hospitals and remote hotels. Overall IFC plants have reduced 300k tons of CO₂ emissions and reduced NO_x and SO_x emissions by 5k tons

*Direct Methanol Fuel Cells (DMFCs) which use a polymeric electrolyte and operate in the 80 – 200 C range are used for powering portable non-polluting electronic equipment, motor scooters and possibly for providing portable power to soldiers in the field. The JPL-USC development (10) has been patented, and in one development a unit about the size of a thick paperback has run continuously for weeks at a time producing 50 watts of power, as a possible replacement for lithium batteries. A membrane coated with a JPL catalytic coating divides the cell in half with methanol/water fuel on one side and oxygen or air on the other, and runs below the boiling point of water. More development is required to reduce the coated membrane cost and to improve its methanol impermeability

*Phosphoric Acid Fuel Cells (PAFCs), the most mature fuel cell has phosphoric acid electrolyte, operates at 200 degrees, are graphite based and uses platinum as the catalyst. Turnkey 200 kW plants have been installed at more than 70 sites in the USA, Europe and Japan. They can also produce heat for hot water and space heating, and its electrical efficiency is >40%. ONSI, a subsidiary of IFC has installed a 200 kW PAFC unit based on use of natural gas (NGFC) (11).

*Polymer Electrolyte Membrane (PEMs) uses a solid ion exchange membrane, platinum catalyst and operates at 80 degrees, with an efficiency < 40%. The cell hardware is carbon based. The PEM fuel cell appears to be the cell of choice for automobiles and buses. Since 1994, Ballard, Vancouver, B.C., has worked with customers in installing its Mark 700 and Mark 900 fuel cell modules in more than 20 on-road vehicles (12). They recently received orders from Honda R&D (\$16.5m) and from Nissan Motor Co (\$2.2m) for its Mark 900 modules and support services. General Motors is working on their own PEM FC, which they claim is operable down to minus 40 degrees. PEM cells can also be used for portable power, and small scale stationary power applications.

*Molten Carbonate Fuel Cells (MCFCs) are now being tested in full-scale demonstration plants. They operate at higher temperatures (650 degrees), use an alkali carbonate mixture electrolyte, and a nickel catalyst. Unlike the earlier cells where the charge carrier is proton, the charge carrier is the carbonate ion. The cell hardware is stainless steel and the efficiency is 60%, however when the waste heat is used (cogeneration), the efficiency approaches 85%. More detail on the operation of MCFC is available from Delft University of Technology, The Netherlands.

*Solid Oxide Fuel Cells (SOFCs) are currently being demonstrated in a 160kW plant. They offer the stability and reliability of all-solid-state-of-the-art ceramic construction. Operation at 1000 degrees allows more flexibility in choice of fuels. They use a yttria stabilized zirconia solid electrolyte, ceramic cell hardware, perovskites catalyst and oxygen ion as the charge carrier. They have excellent cogeneration capability with efficiencies in the same or higher range to MCFCs. (13) (14). Ceramic Fuel Cells, Australia, completed its experiment in 2000, of a flat-plate SOFC 25kW unit, using liquefied petroleum gas (LPG) to provide data on the operation of larger stacks and system-stack integration. Siemens has completed testing of a 100kW SOFC plant in the Netherlands.

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Applications of Fuel Cells. (15)

The following examples are intended to show the wide diversity of fuel cell applications, and is no means a complete listing, nor do they include those still in the R&D stage.

(Several applications have already been identified in earlier sections.)

- * ZeVco has sold the first fuel cell van for \$47k to London's City Council for upkeep of London's parks - they claim it is 50% cheaper to run than a conventional ICE vehicle.
- * DaimlerChrysler has sold its first fuel cell buses, and will equip up to 30 of its Mercedes-Benz Citaro with new XCELLIS fuel cell engines using Ballard's Mark 900 series fuel cell stacks. Delivery by 2002-2003 for testing in several European cities.
- * Dalian Institute has developed and installed a new fuel cell on a minibus for trial operation in Hubei Province, China.
- * BP Amoco, Daimler join in a JV to bring hydrogen fuel cell buses to London. BP will develop the hydrogen fuel infrastructure and Daimler will provide 3 hydrogen powered buses in 2003.
- * Ballard fuel cells are being used in DaimlerChrysler's NECARs, Ford's P2000 SUV and THINK cars, Honda's FCX V3, Nissan's Xterra, GM's Opel Zafira and in Georgetown fuel cell bus development
- * Two fuel cell cars are being road tested in Japan, the NECAR5 from Daimler and the FC-EX from Mazda.
- * Toyota to introduce a 5-passenger hybrid fuel cell SUV this summer.
- * DCH Technology introduced a fuel cell powered water taxi at the National Hydrogen Associations meeting in Washington, DC, March 2001.
- * Manhattan Scientific joins with Aprilla S.p.A to develop fuel cell bikes.
- ZAPWORLD.com expects to have fuel cell powered electric bicycle by next year.
- * Astris Energi's alkaline fuel cell project completed production of fuel cell powered golf-carts in Czech Republic this March.
- * Fuel Cell Technologies delivered a fuel cell system to Canada's Dept of Defence for use in diving applications.
- * Manhattan Scientific, Electrolux and Lunar will use a 1 kW fuel cell in a fuel cell powered vacuum cleaner to eliminate need for electric cords and A/C wall plugs.
- * Coleman Powermates to offer Ballard's portable FC power generator this year. (16)
- * Fuel Cell Energy installing a 1MW, \$18.8m, power plant in Renton, Washington using municipal wastewater digester gas as the fuel. Start-up 3rd Q, 2002.
- * H Power residential fuel cells to be tested by Long Island Power. Will provide 4.5 kW of power and will demonstrate grid connectability.
- * Siemens to install two 300kW hybrid systems using their tubular SOFC FC coupled with a microturbine generator. One system will be in Germany and one in Italy.
- * IFC to deliver three PC25 fuel cell systems for installation in Brazil.
- * Texas will use DCH's Enable fuel cell for a 3,000 watt FC to power air quality monitoring equipment by the Texas Natural Resources Corp.
- * Ballard has shipped its fifth 250-kW stationary PEM FC power generator to Japan and will use waste gas from an anaerobic digester as fuel.
- * IdaTech and Mosaic will provide fuel cells for residential use, which may reshape home Hvac, and help solve blackouts, brownouts and a/c curtailment.

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Alternate Energy Sources Besides Fuel Cells.

Electrical energy occurs naturally, but seldom in forms that can be used. Energy dissipated as lightning exceeds the world's demand for electricity, but for obvious reasons is not a practical source of energy. The waste heat generated by conventional electrical power plants, and the emissions associated with combustion of fossil fuels represent large environmental concerns. An additional concern is the possible depletion of fossil fuels. Thus alternate energy sources are needed. In addition to fuel cells alternate sources include:

*Nuclear energy - which overcomes the emission problems, but which has problems of radioactive waste disposal and public opposition, (despite being the main source of energy in several countries, eg France-77%, Japan 30%, USA 20%. It is quite safe- at the end of 1998 there were 9012 civilian power reactors worldwide, and the only accident harming people was Chernobyl. Unfortunately, in deference to the counterculture generation, discussion of nuclear energy has been taboo to many politicians and scientists. Such discussion urgently needs re-activation. Resolution of nuclear waste coupled with a breeder reactor would ensure bountiful energy for the foreseeable future. Obviously, however, nuclear powered cars and aircraft are not in the future. (17).

*Solar energy- either in the form of photovoltaic cells (18) which convert sunlight directly into electrical energy, or use of special coatings that absorb sunlight readily, and emit infrared radiation slowly making it possible to heat fluids to 540 degrees, which heat can be converted to electricity. Despite its continual promotion by the environmental zealots it provides a very small percentage of our energy needs. It should however be used wherever it makes economic sense

*Windmills. Advanced designs and more efficient generators make windmill "farms" where rows of windmills are joined together, make this a significant, but minor source of electrical energy in coastal and plains area. The vagaries of the wind and the extensive space requirements make this a difficult large scale, as well as a "bird unfriendly" solution

*Geothermal energy needs to be added to the list of alternative energies to be used where practical

*Super Flywheels produced from carbon fiber composites could be used to power up a car. US Flywheel Systems is now testing a flywheel system for automobiles (19). It is also being used to store energy

*Micro Turbines are being used to energize hybrid electric mass transit, truck and fleet operations worldwide. Capstone also promotes their use for resource recovery of biogas and for oil/gas recovery (20). Technology Review provides insight into their operation in their interesting article "Power to the People"(21) and Figure 4.

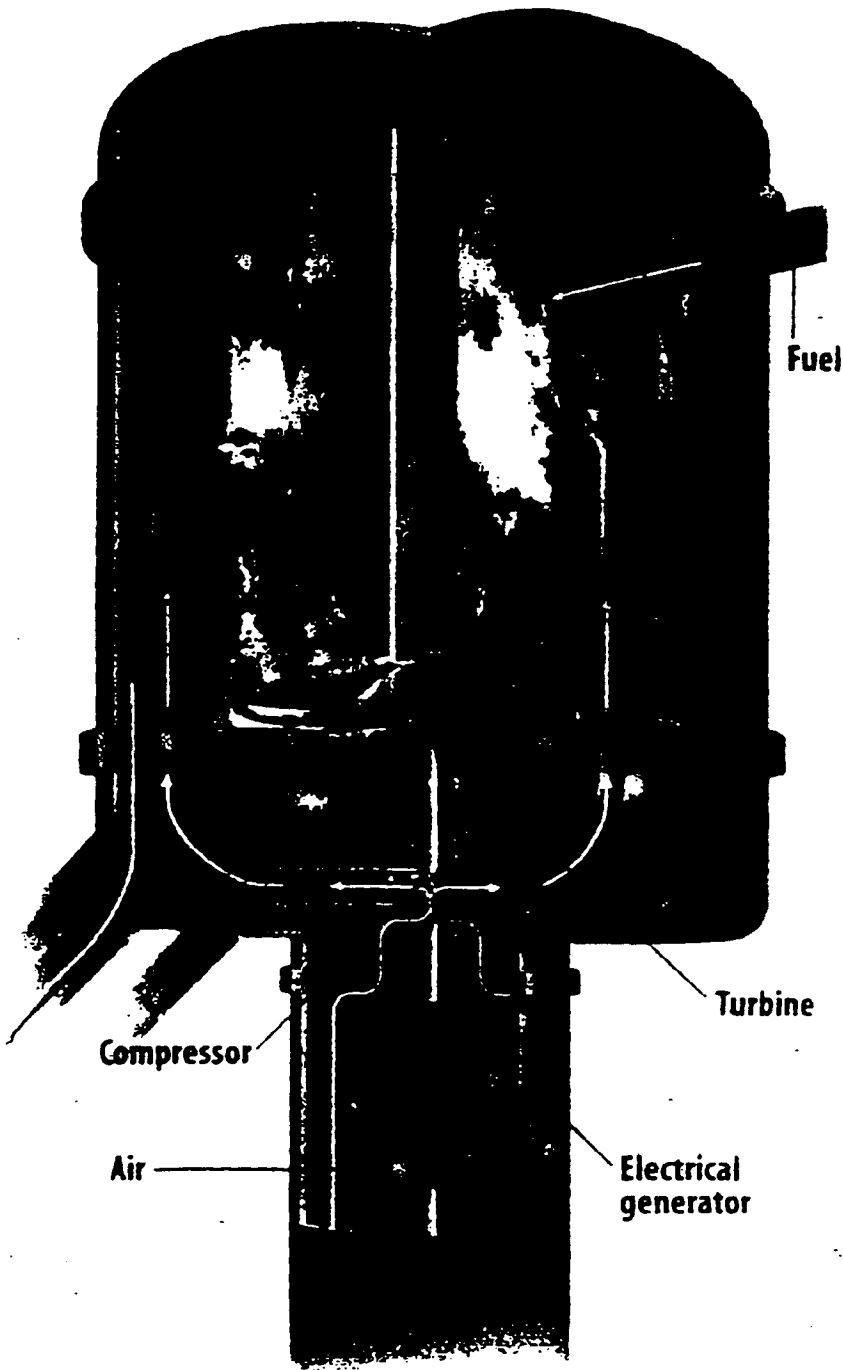
*Ultracapacitors are also used for energy storage and power delivery in a concept vehicle for the US Army that is to be powered by Oshkosk's hybrid electric vehicle using its 2700-farad ultracapacitor. In their press release (22) they describe many other uses, including its use with fuel cells

*Quasiturbine has been developed by experts in Canada which they claim can operate on any fuel and is claimed to overcome the limitations of both the piston engine and the Wankel engine (23)

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Figure 4

Inside a Microturbine



Fuel enters the combustion chamber. The turbine can run on natural gas, gasoline, kerosene—virtually anything that burns.

The hot combustion gases spin a turbine, which is connected to the shaft of an electrical generator. The exhaust transfers heat to incoming air.

Air passes through a compressor and is warmed by the exhaust gases before entering the combustion chamber.

*Unique Mobility is developing, under DOE funding, a modular line of high performance permanent magnet motors for hybrid electric and fuel cell electric vehicles (24).

Status of Fuel Cell Development.

The preceding portion of this paper clearly establishes that, as a result of federal funding, environmental pressures and technical innovativeness, tremendous progress has been made since the mid 1980s in bringing fuel cell technology to the commercialization stage. Stationary power generators have been successfully tested, and black outs and brownouts are accelerating its use for portable power. California's ZEV requirements, plus the desire to limit emissions and the concern of a fossil-fuel based economy, have resulted in fuel cell powered buses being used in several cities from Beijing to San Francisco to Dusseldorf. Additionally, successful road trials have been carried out by General Motors (25), Nissan, Honda and others on fuel cell powered cars, as well as on hybrid fuel cell cars. One of the remaining questions, in addition to cost, is the fuelish question.

The Fuelish Question.

Although fuel cell can run on a number of fuels, the simplest, and possibly best fuel is hydrogen, since it is readily available, renewable, and results in a simple, pollution-free operation. In order for fuels other than hydrogen to be used, they must be reformed to provide a hydrogen-rich gas mixture. This additional step, involving the use of catalysts, adds both complexity to the process, and undesired emissions. The largest challenge with using hydrogen fuel is an infrastructure to produce and store it. Some of the efforts to accomplish this are:

- *Carbon nanotubes and nanofibers can provide a clean, efficient way to store hydrogen. (26) A 25 liter tank of carbon nanotubes is claimed to be able to power a car for 5000km.
- *Greenvolt Power reverse fuel cell, powered by wind or photovoltaic power is capable of splitting water into its components.
- *GM has released a study that concludes that gasoline-derived fuels and fuel cell vehicles present the "cleanest and most efficient combination of fuel and propulsion systems for the near term" and "hydrogen-powered fuel cell vehicles offer the best long-term solution" (www.gm.com)
- *Shell Hydrogen, Hydro-Quebec and Gesellschaft fur Elektometallurgie have established a joint venture for developing, manufacturing and marketing hydrogen storage products.
- *Texaco and Energy Conversion Devices (ECD) have formed Texaco Ovonic Fuel Cell Company to advance the Ovonic Regenerative Fuel Cell Venture utilizing metal hydrides for holding hydrogen. Texaco later has formed Texaco Technology Ventures to manage the project.
- *ExxonMobil and GM have developed a gasoline processor for FC vehicles.
- *Avista becomes a major owner of H₂ fuel to commercialize a new technology for manufacturing hydrogen for fuel cells.
- *IdaTech has received a patent for its new hydrogen purification technology.
- *Argonne National Laboratory is leading an extensive research project to produce hydrogen by use of a nuclear reactor
- *Four companies join California FC Partnership to help build hydrogen fueling stations.
- *Ballard and Millenium Cell have entered into a joint agreement to use Millenium's proprietary hydrogen generation system with Ballard's portable power FC.

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copy for Mr. Abraham -

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President George Bush
1600 Pennsylvania Avenue
Washington, D. C.
20500

July 15, 2001

Dear Mr. Bush,

As a concerned, informed citizen, I am aware of the facts that show there is no new energy crisis. Today only 5% of disposable household income is spent on energy, down from 8% in the 1980's. The plan that you have sets no improved energy efficiency or conservation and offers only modest financing for improved energy technology. Renewable energy programs, conservation and energy efficiency should be one of your top priorities.

Another concern of ours is the need for safe, efficient and clean cars. We are all becoming aware of the fact that the average fuel economy for cars is at a 20 year low. The standard for setting auto fuel efficiency has not been changed for 12 years. The biggest single step in the US can take to curb global warming and ensure a safe-energy future for America is to adopt stronger automotive fuel-economy standards for cars and light trucks. The US emits more CO2 than all four of the following countries...US China, Russia, and Japan. Americans deserve vehicles that are both safe and clean. Improving fuel economy standards would: lessen our addiction to oil, slash carbon-dioxide pollution, reduce pressure to drill in sensitive areas like the Arctic National Wildlife Refuge, enhance national security, and cut Americas trade deficit, to name a few...

I ask that you make the changes necessary to ensure that we have a sound energy policy. Please do not expedite or remove obstacles and environmental protections to energy production. Review and consider all the environmental impact studies that have been used over the last several decades. Do not eliminate or scale back land use restrictions. Our old growth forests need our continual protection from development by mining and timber interests. Environmental reviews are absolutely necessary for power plant upgrades. Air pollution standards and regulations for all refineries and power plants need to be reviewed, upgraded and utilized. The nuclear industries liability should not be limited with respect to nuclear accidents. Power plants need requirements for reducing carbon dioxide emissions as well as the need for standards to make our appliances more efficient.

In New Hampshire, as throughout the country, air pollution threatens our health and environment, causing sickness and poisoning the fish we eat. We know that NH fossil-fueled plants account for 25% of all mercury emitted in our state and are the source of acid rain, killing our fish and damaging our forests. These plants account for 33% of all

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greenhouse gases released in the state. We need your help to make the necessary changes, to use your leadership to direct congress to ensure that we have a sound, safe and healthy energy policy for our country. Please respond and inform me of your plan.

Sincerely,



Nancy Brown

] bb

Copies sent to:
Spencer Abraham
Gale Norton
Christine Todd Whitman
Harry Reid
Paul Gillmore
Billy Tauzin
NH Bob Smith
NH Judd Gregg

29914



Department of Energy
Washington, DC 20585

July 20, 2001

B5-

MEMORANDUM FOR THE SECRETARY

FROM: David L. Pumphrey *David Pumphrey*
Deputy Assistant Secretary for
International Energy Cooperation
Office of Policy and International Affairs

SUBJECT: ACTION: Sign Letter to Mrs. Loyola de Palacio, Vice President of the European
Commission and European Commissioner for Transport and Energy

ISSUE: []

RECOMMENDATION: []

Approved: _____

Disapproved: _____

Date: _____



29915



b6

Department of Energy
Washington, DC 20585

June 22, 2001

Rubin & Irina Cooley



Dear Mr. and Mrs. Cooley:

Thank you for your March 8, 2001, letter expressing your thoughts about the Nation's energy policy.

First, I would like to apologize for not responding earlier. The Department of Energy has received thousands of letters and e-mails since the beginning of the year and it has been impossible to provide timely responses to all of them.

To address the many energy issues facing the Nation, one of President Bush's first acts was to create a National Energy Policy Development Group, headed by Vice President Cheney. This Group was charged with developing recommendations to help the private sector and government at all levels promote reliable, affordable, and environmentally sound energy for America's future. On May 16, Vice President Cheney sent to the President a National Energy Policy report produced by the National Energy Policy Development Group. The report describes a comprehensive long-term strategy that uses leading edge technology to produce an integrated energy, environmental and economic policy. The National Energy Policy it proposes follows three basic principles:

- The Policy is a long-term, comprehensive strategy. Our energy crisis has been years in the making, and will take years to put fully behind us.
- The Policy will advance new, environmentally friendly technologies to increase energy supplies and encourage cleaner, more efficient energy use.
- The Policy seeks to raise the living standards of the American people, recognizing that to do so our country must fully integrate its energy, environmental, and economic policies.

To achieve a 21st century quality of life – enhanced by reliable energy and a clean environment – it recommends 105 actions to modernize conservation, modernize our infrastructure, increase our energy supplies, including renewables, accelerate the protection and improvement of our environment, and increase our energy security.

The President has already taken actions to implement many of the report's



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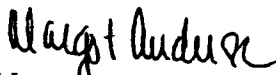
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recommendations. Over the coming months, further actions will be taken by the President, individual Federal agencies and the Congress. These actions, once fully implemented, will help minimize future energy prices, while assuring that energy supplies are reliable and the environment is protected.

A copy of the National Energy Policy report, with the specific recommendations to the President, is available on the White House webpage, www.whitehouse.gov, or on the webpage of the U.S. Department of Energy, www.energy.gov.

I hope this information is responsive to your letter.

Sincerely,



Margot Anderson
Acting Director
Office of Policy

June 22,2001

Secretary Spencer Abraham
Department of Energy
1000 Independence Ave.
Washington,DC
20585

Dear Secretary Abraham:

In my May 20,2001 letter to you I inquired " Now that you have issued your Energy Policy - Where is the Implementation Plan that puts the policy into concrete action?"

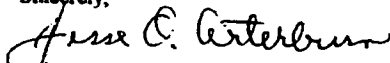
The reply that I received from one of your aides (dated June 13,2001) was strictly perfunctory with no direct answer. This would cause one to wonder if there is a general lack of understanding within DOE about the importance of such a plan to accomplish the recommendations in the Policy Statement.

A well developed plan establishes priorities, goals, funding, and schedules, identifies responsibilities of other agencies, actions required by Congress, and actions that can be taken without action by Congress, and appoints Project Managers for each of the major categories of energy supply.

Have you considered the consequences should the drought in the Northwest and the short-fall of snow in the Sierras persist for several more years? That could be disastrous!

As previously stated-Time is Short to get out ahead of those opposing any increase in energy supply and to provide significant reserves of power to accommodate those potentially unfortunate acts of nature.

Sincerely,


Jesse O. Arterburn

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DOE

[July 25, 2001]

Mr. Andrew Lundquist
Office of the Vice President
Executive Director
National Energy Policy Development Group

Dear Mr. Lundquist:

Thank you for your recent letter together with the Overview Reliable, Affordable, and Environmental Sound Energy. I am pleased your office will consider the suggestion of using nuclear powered vessels as emergency sources of electricity.

Coal is the most abundant source of energy in the US with reserves greater than 290 billion tons. Contaminants SO and NO can be seriously reduced with filters of crushed manganese nodules which will help comply with Kyoto Accords. The US has huge reserves of nodules within our EEZ. The technology is at hand but needs to be adapted to power plants. Enclosed is a paper, **Manganese Nodules: Overcoming the Constraints**, which I wrote and presented in Canada in 1985 covers salient features of this technique. This is a catalytic cleaning system similar to catalytic mufflers on automobiles. US patent 3,330,096 by Kennescott covers this process.

Also, the US has nearly an inexhaustible supply of gas hydrates which burn cleaner than gasoline since they are composed of methane. Development of hydrate is the way to independence from foreign oil. Enclosed is a page from **Offshore Technology Conference 2000** listing pertinent papers on natural hydrates. Complete papers can be obtained from Shyree Latham, Offshore Technology Conference, 972-952-9422, E mail slatham@spe.org

I am well acquainted with these and related developments. For over 20 years, I have been a member of Offshore Technology Conference, Program Committee, Richardson, Texas, 75083. Also, I was Director of Marine Science for Deepsea Ventures, Inc., a major US ocean mining company, until retirement in 1986.

I would appreciate being considered for a position with the National Energy Policy Group. I sincerely believe I could add insight and understanding to some of the problems facing our nation. I would be most pleased to hear from you.

Respectfully,

William D. Siapno

William D. Siapno, PE

Enclosures

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