

PRESIDENT'S MESSAGE

I hope that you agree that this has been a fruitful year for USAEE. In this, my final letter to you, I will highlight the status of various activities and actions.

First, our annual North American meeting in Philadelphia was quite successful, occurring at a very opportune time. Energy is once again, for various reasons, a 'hot topic'. The theme of "Transforming Energy" focused on the host of changes taking place in the energy sector: deregulation, new products, mergers, market convergence, e-commerce, and paper markets. I've made the point before that bears repeating: we are in an era characterized by Schumpeter's creative destruction. The conference made that point in spades.

Conference attendees heard from and dialogued with the highest quality speakers from the opening session chaired by Jim Sweeney to the closing session chaired by Mike Lynch. Our keynote speakers, Senator Frank Murkowski, Amory Lovins, Kurt Yeager, and Rodger Naill, were all provocative. As always, time will tell how prescient.

The conference could not have come together without the effort and hard work of the Program Chair, Mary Novak (WEFA) and our USAEE Executive Director, Dave Williams. The program committee (Louise Burke, NYMEX; Steve Connors, MIT; Peter Davies, B.P. Amoco; Joe Dukert; Bob King; Mike Lynch, WEFA; Andre Plourde, U. of Alberta; Jim Sweeney, Stanford U.; Steve Warwick, Koch Energy Services; and Jack Wilkinson) in a word, was outstanding. Lastly, a most important element for our annual conferences is financial support. This year we were particularly fortunate in receiving sponsorship from a record setting sixteen organizations.

For some time, USAEE has been offering student scholarships for attendance to our annual meetings. This year, seven students (cited below) received scholarships. The students and council members met over breakfast during the conference to exchange ideas. Everyone agreed that this effort has been successful and believes it will be fruitful for bringing new people into USAEE.

At the conference, Marianne Kah, VP-Chapter Liaison, reported to Council on chapter activities. To assist the chapters, Council decided that USAEE would soon offer a web page to each chapter. I have visited with and spoken to folks from various chapters this year. I wish the best of luck to all of our chapters but especially to Mona Dioun in Austin, Steve Brown in Dallas, and Dave Banko and A.F. Alhajji in Denver with their respective efforts.

One of the most important actions taken by Council at the conference was the adoption of the USAEE mission statement. I propose to you that if there is one manifest thought,

it is that USAEE is an organization whose strength is diversity; diversity of background, membership, and interest. When you pair that with the quality and caliber of our membership, I believe you have one **very** interesting organization.

Our mission statement has already provided an incentive for one new type of activity. Taking the charge to foster dialogue on important energy policy and environmental issues, USAEE initiated and co-sponsored a special workshop on October 16th with MIT's Joint Program on the Science and Policy of Global Change. The workshop focused on the Hansen, et al., alternative scenario of global warming that had appeared in a recent issue of the Proceedings of the National Academy of Sciences.¹ The scenario, as you probably know, subsequently received a number of different interpretations in the media. For your information, we will be posting the presentations on the USAEE website shortly (www.usaee.org). We will also include comments that we received from an earlier e-mail solicitation we issued to the membership.

I am deeply appreciative of all the effort that went into the preparation for the workshop. Jake Jacoby (MIT) recruited the eight presenters (including Hansen, himself) and two moderators. Arnie Baker (Sandia National Lab), Dave Williams, and John Felmy (API) provided most of the conference coordination and planning. Lastly, Will Kohl (John Hopkins University) provided the facilities at the Paul Nitze School of Advanced International Studies. Of particu-

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Editor's Corner

This issue of *Dialogue* includes excellent papers by Jerry Taylor and Peter VanDoren; A.F. Alhajji; and Kurt Yeager.

Messrs. Taylor and VanDoren have addressed the case for renewable energy and the need for government support.

Dr. A.F. Alhajji has provided a summary of the USAEE North American Conference in Philadelphia and the arguments for and against the recent release of crude oil from the Strategic Petroleum Reserve.

The paper by Kurt Yeager is his presentation at the conference in Philadelphia and is a stimulating discussion of innovation in technology.

Please send new articles (or suggestions for articles) and notices for publication in *Dialogue*. Include news of chapter events and appropriate press releases. Items can be

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President's Message (continued from page 1)

lar note was that we were able to pull together the workshop in a short six weeks. I trust that USAEE will organize and conduct other timely workshops for you in the future.

Let me close with a broad 'thank you' to everyone who helped me during my office this year. In particular, I would like to issue 'special thanks' to Mary Novak, Arnie Baker, Cliff Mangano, and Dave Williams.

It has been a privilege to serve you.

Sincerely,

David J. DeAngelo

¹ *Global Warming in the Twenty-first Century: An Alternative Scenario*, James Hansen, Makiko Sato, Reto Ruedy, Andrew Lacis and Valdar Oinas, PNAS Early Edition.

Editor's Corner (continued from page 1)

sent via E-mail (paul-roberts@reliantenergy.com or proberts@alummi.rice.edu), by Fax (713-207-0705), or by regular mail (15709 Singapore Lane, Houston TX 77040-3035). If you have questions, comments, or suggestions, I can be reached by phone at 713-207-5059.

Paul Roberts

USAEE Student Scholarship Fund: A Call for Support

Started in 1997 at the San Francisco North American Conference, the USAEE is proud to continue its student scholarship fund. Funds are used to cover the cost of registration fees for students attending the annual conference of the USAEE/IAEE. Students must submit a written application and letter from their student advisor requesting that funds be granted. At the Philadelphia Conference, seven students qualified to have their conference registration fees waived in an effort to share our conference experience, the field of energy economics and networking opportunities with other students. Further, inviting student participation at our conferences is one of the best mechanisms for recruiting new members to the USAEE.

The student scholarship fund has been generously provided by the support of the following organizations/individuals:

- | | |
|-------------------------|---------------|
| Conoco, Inc. | Joe Dukert |
| Joy Dunkerley | Jack Edwards |
| Exxon Mobil Corporation | Michael Lynch |
| Andre Plourde | |

Recognizing the need for interested and qualified graduates, many funding organizations view the program as supporting education as well as recruitment. The USAEE has started its campaign for scholarship funds for the 2002 North American meeting in Vancouver, British Columbia, Canada, October 6-9. Contributions have ranged from \$50 to \$2500. If you would like to receive information on how your or your company can become a supporter of this program, please contact Dave Williams, USAEE Executive Director at (p) 216-464-2785, (f) 216-464-2768, or usae@usae.org

***** USAEE WEBSITE *****

USAEE is on-line. Come visit us at www.usae.org Some of the features available on the website include the following:

- Overview/Objectives of USAEE
- Council Member Listing & Contacts
- Chapter President Listing & News
- Full Issues of the USAEE Dialogue
- Events/Speakers List
- Calendar of USAEE/IAEE & Other Conferences
- USAEE On-Line Discussion Forum
- Membership Database

Of interest is the Yahoo! USAEE discussion group. We want to foster active discussion within the field of energy economics. Complete instructions on how to get registered for participation in this on-line discuss group are located at the USAEE website.

We're sure that you will find our new site full of up-to-date information. Please feel free to drop USAEE Headquarters an email at usae@usae.org if you have any suggestions on how to improve the site.

**Conference Proceedings
20th North American Conference
Orlando, Florida, August 29 to September 1, 1999**

The Proceedings from the 20th Annual North American Conference of the USAEE/IAEE held in Orlando, Florida, are now available from USAEE Headquarters. Entitled *The Structure of the Energy Industries: The Only Constant is Change*, the proceedings are available to members for \$85.00 and to nonmembers for \$105.00 (includes postage). Payment must be made in U.S. dollars with checks drawn on U.S. banks. To order copies, please complete the form below and mail together with your check to:

Order Department, USAEE/IAEE Headquarters, 28790 Chagrin Blvd., Suite 350 Cleveland, OH 44122, USA

Name _____

Address _____

City, State, Mail Code and Country _____

Please send me _____ copies @ \$85.00 each (member rate) \$105.00 each (nonmember rate).

Total enclosed \$_____ Check must be in U.S. dollars and drawn on a U.S. bank, payable to IAEE.

USAEE Election Results Announced

Michael Lynch, Past President of USAEE and Chair of the 2001 Nominations Committee is pleased to announce the election results for following USAEE Officer and Council positions:

| | |
|------------------------------|---------------------|
| President Elect | Arnold B. Baker |
| Vice President – Conferences | John C. Felmy |
| Vice President – Chapters | Clifford A. Mangano |
| Secretary-Treasurer | Omowumi Iledare |
| Council Member | Hung-po Chao |
| Council Member | Stephen R. Connors |

Other USAEE Officer and Council members for the 2001 calendar year will include Michelle Michot Foss, President; David DeAngelo, Past President; and Lynn McAlister and Mine K. Yucel, Council members.

We Need Your Email Address !!

USAEE will be moving more correspondence to email in 2000. Toward this end, we have discovered that we have fewer than 50% of all USAEE members e-mail addresses. To keep you better informed, please email us your name and email address to usaee@usaee.org

New USAEE Mission Statement

Hard at work, USAEE Council hammered out the new Mission Statement for the organization at the recent Philadelphia USAEE/IAEE North American Conference. This project stemmed from a year of deliberations with the membership and Council.

Below please find your organization's new Mission Statement:

ARTICLE II – Mission Statement

The United States Association for Energy Economics is a nationwide non-profit organization of business, government, academic and other professionals that advances the understanding and application of economics across all facets of energy development and use, including theory, business, public policy, and environmental considerations.

To this end, the United States Association for Energy Economics:

- Provides a forum for the exchange of ideas, advancements and professional experiences.
- Promotes the development and education of energy professionals.
- Fosters an improved understanding of energy economics and energy related issues by all interested parties.

USAEE Council also approved the formal establishment of the Association's Long -Term Strategy Committee led yearly by the President-Elect and the Past-President. A strategy for improving our three major activities will be proposed to Council at the Houston Conference in April.

If you have any recommendations you would like to express to the USAEE Council please send these to either David Williams (e) usaee@usaee.org or Arnie Baker (e) abbaker@sandia.gov

Dialogue Disclaimer

USAEE is a 501(c)(6) corporation and neither takes any position on any political issue nor endorses any candidates, parties, or public policy proposals. USAEE officers, staff, and members may not represent that any policy position is supported by the USAEE nor claim to represent the USAEE in advocating any political objective. However, issues involving energy policy inherently involve questions of energy economics. Economic analysis of energy topics provides critical input to energy policy decisions. USAEE encourages its members to consider and explore the policy implications of their work as a means of maximizing the value of their work. USAEE is therefore pleased to offer its members a neutral and wholly non-partisan forum in its conferences and web-sites for its members to analyze such policy implications and to engage in dialogue about them, including advocacy by members of certain policies or positions, provided that such members do so with full respect of USAEE's need to maintain its own strict political neutrality. Any policy endorsed or advocated in any USAEE conference, document, publication, or web-site posting should therefore be understood to be the position of its individual author or authors, and not that of the USAEE nor its members as a group. Authors are requested to include in an speech or writing advocating a policy position a statement that it represents the author's own views and not necessarily those of the USAEE or any other members. Any member who willfully violates the USAEE's political neutrality may be censured or removed from membership.

IAEE Meeting At the Annual ASSA/AEA Conference

The International Association for Energy Economics will be having its 3rd Annual Session at the Allied Social Science Association in New Orleans, Louisiana, USA January 5 - 7, 2001. If you attend the ASSA meeting please register as a member of IAEE. With more members attending we will be able to increase the number of sessions. We hope to see you there.

Session Title: **Current Issues in Energy Economics and Energy Modeling (Q4)**

Presiding: *Carol Dahl*, Colorado School of Mines

Boris Cournede, Ministry of Economy, Finance, and Industry, Paris, France—The Special Economics of Gas Deregulation on the European Continent.

Prakash Loungani, International Monetary Fund—21st Century Oil Shocks: Will They Occur? Will They Matter? Will We Be Prepared?

Prasad Rao, The Pennsylvania State University—The Choice of Crude Oil Quality in Petroleum Refining

Anne Epaulard and *Stephane Gallon*, Ecole Nationale de la Statistique et de l'Administration Economique, Malakoff, France and Ministry of Economics, Finance and Industry, Paris, France—A Model of Competition Between Nuclear and Gas-Fired Plants Using Real Options Theory to Assess Nuclear Investment Value

For Additional Information Contact:

Dr. Carol Dahl, Professor of Economics & Director CSM/IFP Joint International Degree Program Petroleum Economics and Management Division of Economics and Business Colorado School of Mines Golden, CO 80401 USA P) 303-273-3921; F) 303-273-3416; E) cadahl@mines.edu

24th IAEE INTERNATIONAL CONFERENCE

Hosted by:

United States Association for Energy Economics and the Houston Chapter, USAEE/IAEE

2001: An Energy Odyssey?

Omni Hotel – Houston, Texas - USA

April 25-27, 2001

Conference Objective

A look ahead at the changing energy landscape and the future role of energy economics across fuels, business segments and geographies.

Session Themes and Topics

ENERGY BUSINESS METAMORPHOSIS

Redefining the energy industry, the energy business and the energy economist

Coming to terms with the New Economy

Industry consolidation: What's next?

SUSTAINING DEVELOPMENT

What is sustainable development and how should it be measured?

Market tools for sustainability

Balancing energy and environmental needs

INTERNATIONAL POLITICAL HEARING: SHOULD THE GOVERNMENT STAY OUT OF ENERGY PRICE FORMATION?

Political risk assessment in investment decisions

Techniques for price risk management

Why risk management fails

NEW POLITICS AND ENERGY

Sub-national issues: How do they play in the end game?

New paradigms – markets, regions, corporate roles, NOC roles

The end of the oil era, what would it mean?

TECHNOLOGY TRANSFORMATIONS – EVOLUTION OR REVOLUTION?

Impacts on energy demand

Impacts on energy supply

E-commerce linkages and impacts

***** CALL FOR PROPOSALS / PAPERS *****

Deadline for Submission of Abstracts: December 4, 2000

(Please include your CV when submitting your abstract)

Anyone interested in organizing a session should propose topics,

motivations and possible speakers to Program Co-Chairs:

Les Deman – 713-230-3429 / ldeman@coral-energy.com

Marianne S. Kah – 281-293-2136 / marianne.s.kah@usa.conoco.com

Abstracts (200-1500 words) for concurrent session papers and proposals for concurrent session workshops and dialogues are being accepted. The IAEE and USAEE Councils encourage conference participants to submit innovative ideas for full exploration of energy markets, business development and economic theory and application. At least one author from an accepted paper must pay the registration fees and attend the conference to present the paper.

All abstracts/proposed sessions and inquiries should be submitted to:

David Williams, Executive Director, USAEE/IAEE

28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122 USA

Phone: 216-464-2785 / Fax: 216-464-2768 / E-mail: usae@usae.org

Conference Chair Emeritus: John B. Boatwright * General Conference Chair: Michelle M. Foss

Program Co-Chair: Les Deman / Marianne S. Kah * Arrangements Chair: David L. Williams

AGAIN THIS YEAR: USAEE Best Student Paper Award (\$1000.00 cash prize plus waiver of conference registration fees).

If interested, please contact USAEE Headquarters for detailed application/guidelines.

STUDENT PARTICIPANTS: please inquire about scholarships for conference attendance!

USAAE BEST STUDENT PAPER AWARD GUIDELINES

USAAE is pleased to once again offer an award for the Best Student Paper on energy economics. The award will consist of a \$1000.00 cash prize plus waiver of conference registration fees. To be considered for the USAAE Best Student Paper Award please follow the below guidelines.

- Student must be a member of USAAE or IAEE in good standing.
- Submit COMPLETE paper by January 5, 2001 to USAAE Headquarters.
- Paper MUST be original work by the student (at least 50% of work completed by the student seeking award).
- Submit a letter stating that you are a full-time student and are not employed full-time. The letter should briefly describe your energy interests and tell what you hope to accomplish by attending the conference. The letter should also provide the name and contact information of your main faculty supervisor or your department chair. Also, include a copy of your student identification card.
- Submit a brief letter from a faculty member, preferably your main faculty supervisor, indicating your research interests, the nature of your academic program, and your academic progress. The faculty member should state whether he or she recommends that you be awarded the scholarship funds.

Complete applications should be submitted to the USAAE/IAEE Headquarters office no later than January 5, 2001 for consideration. Please mail to:

David L. Williams, Executive Director, USAAE Headquarters
28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122

NOTE: The recipient of the \$1000.00 cash prize will receive notification of this award and be presented the award at the Houston IAEE International Conference. This individual will also receive a complimentary registration to attend the meeting. Please note that all travel (ground/air, etc.) and hotel accommodations, meal costs in addition to conference-provided meals, etc., will be the responsibility of the award recipient.

For further questions regarding USAAE's Best Paper Award, please do not hesitate to contact David Williams at 216-464-2785 or via e-mail at: usaae@usaae.org

HOUSTON IAEE CONFERENCE STUDENT SCHOLARSHIPS AVAILABLE

IAEE is offering a limited number of student scholarships to the 21st IAEE International Conference. Any student applying to receive scholarship funds should:

- 1) Submit a letter stating that you are a full-time student and are not employed full-time. The letter should briefly describe your energy interests and tell what you hope to accomplish by attending the conference. The letter should also provide the name and contact information for your main faculty supervisor or your department chair, and should include a copy of your student identification card.
- 2) Submit a brief letter from a faculty member, preferably your main faculty supervisor, indicating your research interests, the nature of your academic program, and your academic progress. The faculty member should state whether he or she recommends that you be awarded the scholarship funds.

IAEE scholarship funds will be used only to cover the conference registration fees for the Houston IAEE International Conference. All travel (air/ground, etc.) and hotel accommodations, meal costs in addition to conference-provided meals, etc. will be the responsibility of each individual recipient of scholarship funds.

Completed applications should be submitted to IAEE Headquarters office no later than April 4, 2001 for consideration. Please mail to: David L. Williams, Executive Director, IAEE, 28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122.

Students who do not wish to apply for scholarship funds may also attend the conference at the reduced student registration fee. Please respond to item #1 above to qualify for this special reduced registration rate. Please note that IAEE reserves the right to verify student status in accepting reduced registration fees.

If you have any further questions regarding IAEE's scholarship program, please do not hesitate to contact David Williams, IAEE Executive Director at 216-464-2785 or via e-mail at: iaee@iaee.org

Evaluating the Case for Renewable Energy: Is Government Support Warranted?

By Jerry Taylor & Peter VanDoren*

Introduction

Since the 1970's, the United States government has promoted the use of "renewable energies" - primarily windpower, solar power, biomass, and geothermal power - as a desirable substitute for conventional fossil fuels. Renewable energy (which, for the purposes of this report, does not include nuclear power or hydropower) is widely thought to be not only more environmentally benign than coal or oil but also nearly as attractive economically. Only a few stubborn market failures and the hostility of vested interests were preventing the arrival of renewable energy, it was thought, so only a moderate bit of government intervention was necessary to change the economy for the better.

The state and federal campaign to promote the use of renewable energy, however, has yet to bear significant fruit. Since the establishment of the U.S. Department of Energy in 1978, the federal government has spent more than \$11 billion to subsidize (via investment tax credits, production credits, accelerated depreciation of capital, publicly-funded research and development, and mandatory purchases at avoided cost) wind, solar, biomass, and geothermal power. Yet those fuels have only managed to capture a tiny share of the total energy market and only slightly larger percentage of the electricity market.

Regardless, renewable energy advocates continue to insist that renewable energy is poised to gain significant market share over the next several years. Although renewable energy is still more expensive than conventional energy, production costs have come down significantly over the past 22 years and the gap between the cost of conventional and renewable energy has narrowed substantially. With the increasing pressure on nations to reduce greenhouse gas emissions, environmentalists argue that fossil fuels will become even more expensive than renewable energy because of increased regulatory costs and that renewables will soon be the lowest-cost fuel on the market.

This article examines the economics of renewable energy and the case for government intervention in the market to promote their use. Section 1 examines the economic characteristics of the renewable fuels promoted by the federal government. Section 2 evaluates the contention that the consumption of oil imposes significant negative externalities that are not reflected in consumer prices and that renewable energy subsidies and/or mandates are therefore justifiable remedies for this market failure. Section 3 explores the question of whether impending fossil fuel scarcity justifies government support for alternative energy sources. Section 4 considers the question of whether the volatility of international oil markets (which occasionally give rise to oil price shocks) justify a policy of reduced dependence on oil consumption. Section 5 evaluates the contention that the oil

*Jerry Taylor (jtaylor@cato.org) is Director of Natural Resources Studies at the Cato Institute and Peter VanDoren (pvandore@cato.org) is Editor, *Regulation*, also at the Cato Institute.

industry has benefited from past government subsidies and that offsetting renewable energy subsidies would not only level the playing field but would enhance overall economic efficiency as well. Section 6 examines the argument that renewable energy subsidies would enhance fuel diversity and thus the overall return on energy investments. Section 7 concludes by exploring the impact that greenhouse gas emission reductions might have on energy markets in general and the competitiveness of renewable energy in particular.

We conclude that:

- Renewable energy is not likely to gain significant market share in the foreseeable future absent a substantial increase in government intervention in energy markets;
- The negative externalities associated with oil consumption (primarily environmental damages and military actions necessary to protect foreign oil supplies) are either inconsequential or nonexistent and that renewable energy preferences are an inappropriate remedy regardless;
- Normative arguments for renewable energy subsidies and other preferences are without sound economic foundation; and
- The threat of global warming is speculative and not necessarily deleterious from an economic perspective. Even if greenhouse gas emission restrictions are necessary, replacing conventional energy sources with renewable energy is more costly and less efficient than other emission abatement strategies.

The Economics of Renewable Energy

Although renewable energy is often thought of as an "infant industry" facing an uphill and unfair struggle against "Big Oil" and the coal industry, the truth is that the largest corporate conglomerates in America have long devoted themselves to making renewable energy markets a reality. Starting in the mid-1970's, Exxon, Shell, Mobil, ARCO, Amoco, General Electric, General Motors, Texas Instruments, and Grumman all had in place aggressive renewable energy R&D and development projects.

While many of those projects went bust given the unfavorable economics of renewable energy, the most aggressive renewable energy development initiatives today continue to be undertaken by large multinational corporations. In the United States, Zond Energy Systems, owned by Enron Corporation (the world's largest integrated national gas company with 1997 revenues of \$20 billion), is the largest domestic wind turbine manufacturer and the only manufacturer of large-capacity turbines (those typically installed by electric generating companies). Likewise, 55 percent of the global market for photovoltaic cells in 1997 was dominated by five large multinational corporations; Siemens AG (\$59 billion total revenue in 1997), VIAG AG (\$28 billion total revenue in 1997), Kyocera (\$6 billion total revenue in 1997), Enron, and BP Amoco (\$108 billion total revenue in 1997). Other major players in the solar power industry include Sharp, Royal Dutch Shell, and Sanyo.

To renewable energy advocates, heavy corporate investment in renewable energy technologies is evidence of the potential competitiveness of alternative fuels in the near future. But some perspective is necessary. Total private-sector investment in solar, wind, and biomass in 1995 was

less than 1 percent of total world energy investments. Royal Dutch Shell's highly publicized plan to spend \$500 million over 5 years on renewable energy, for instance, is only half its budget for developing three deepwater off-shore oil rigs in the Gulf of Mexico.

Market Share

As table 1 indicates, solar, wind, geothermal, and biomass energy comprise about 2 percent of total U.S. electricity generation, according to the most recent data available.

Table 1

Net Generation of Electricity from Various Fuels, 1998

| Fuel | Billions kWh | % of Total Electricity Generation |
|-----------------------------------|-----------------|-----------------------------------|
| Non-renewables & Hydro | 3,546.76 | 97.98 |
| Renewable Energy | | |
| Biomass | 33.58 | 0.93 |
| MSW & Landfill Gas | 17.76 | 0.49 |
| Geothermal | 13.85 | 0.38 |
| Wind | 3.46 | 0.10 |
| Misc. Waste Combustion | 3.31 | 0.09 |
| Solar | 0.91 | 0.02 |
| Renewable Energy Total | 72.87 | 2.01 |

Source - Energy Information Administration, Annual Energy Review Interactive Data Query System, <http://tonto.eia.doe.gov/aer/>.

Cost Data

Accurate estimates of the cost of renewable energies are surprisingly hard to come by. Officials at the U.S. Energy Information Administration (EIA) believe that the most reliable data can be found in a 1997 study jointly undertaken by the U.S. Department of Energy and the Electric Power Research Institute. As seen in Table 2, that study reveals that no renewable energy source is competitive today with combined-cycle natural gas turbine technology (the primary source of new electric power capacity), which has a levelized cost of between 2 and 3 cents per kilowatt hour.

Table 2

Levelized Cost of Renewable Energy

| Fuel | Cents per kilowatt hour |
|--|-------------------------|
| Geothermal/Hydrothermal | 3.3-3.9 |
| Wind/Advanced Horizontal Axis Turbines | 5.0-6.4 |
| Biomass | 7.3-8.7 |
| Geothermal/Hot Dry Rock | 10.9 |
| Solar Thermal/Parabolic Trough | 17.3 |
| Photovoltaic/Residential | 37.0 |
| Photovoltaic/Concentrators | 49.1 |
| Photovoltaic/Utility Scale | 51.7 |
| Solar Thermal/Dish Engine | 134.3 |

Source - *Renewable Energy Technology Characterizations*, Office of Utility Technologies, Energy Efficiency and Renewable Energy, U.S. Department of Energy and Electric Power Research Institute, TR-109496, December 1997, p. 7-3.

The levelized cost of renewable energy, however, is distorted by myriad government subsidies and preferences, distortions that serve to mask the true cost of generating electricity from those sources. The impact of those preferences varies by fuel source and facility, but they invariably

deduct at least 2 cents from the true cost of renewable energy production. The most important of those subsidies include:

- a 1.7 cent per kWh production tax credit for specified renewable energies created by the Energy Policy Act of 1992;
- 5-year accelerated depreciation for select renewable energies;
- state-imposed "public benefit charges," which impose taxes on non-renewable energy sources for use to subsidize renewable energy projects; and
- heavy federal subsidy of research and development.

Moreover, it's important to note that the levelized costs shown in Table 2 do not include the costs of transmission because those costs are site-specific and hard to estimate. The cost of transmitting electricity produced by renewable energy, however, can be very high for several reasons. First, the best renewable energy sites are far from urban areas. Second, this problem is compounded by the fact that a great deal of land is necessary to harvest such diluted forms of energy (a point to which we'll return later). Transmission costs – which add significantly to utility costs – will thus also inflate the figures in Table 2 by a variable amount depending upon the distance between the site and consumers.

The above costs, however, are average costs, and renewable energy proponents frequently point-out that new, state-of-the-art facilities are producing power at typically 2 cents per kWh less than the industrial average. While such claims are largely correct, they overstate the near-term potential for renewable energy on a national basis. Production costs of renewable energy vary tremendously by location. As the EIA notes, "To a great extent, renewable generating facilities are very region and site specific ... it is worth reiterating that site-specific conditions are critical to the economic feasibility of renewable electric generating plants." Ideal sites will produce comparatively lower-cost power but the number of ideal sites in the United States (and indeed, in the world) are limited. Moreover, ideal sites (given that they hold the greatest profit potential) will inevitably be developed before higher-costs sites, so the expected trajectory should be rising, not decreasing, costs, all other things being equal.

Prospects for Growth

Renewable energy advocates predict the imminent emergence of renewable energy as a competitive fuel source and the subsequent collapse of the fossil fuel economy. Those predictions, however, are based on anecdotal evidence and the sheerest conjecture. The best unbiased source of analysis, however, has traditionally come from the EIA, a semi-independent agency of the Department of Energy. Their analysis of energy markets is generated by the National Energy Modeling Systems (NEMS), a system that is arguably the most advanced economic-computer model of the energy industry. NEMS forecasts are far less optimistic about the near or midterm prospects for renewable energy than are renewable energy advocates.

Absent significant changes in federal policy, the EIA projects that renewable energy will generate 148 billion

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Renewable Energy (continued from page 7)

kilowatt hours of electricity by 2020, giving renewable energy 3.1 percent of the electricity marketplace (compared to 2.01 percent today). Combined cycle turbine plants, fired primarily by natural gas, are expected to account for 90 percent of new capacity over that same period. Significantly, almost all that additional renewable energy capacity comes not from voluntary purchases in the marketplace but from mandates for purchases imposed by state governments as part of electricity industry restructuring initiatives. To put the projected expansion of renewable energy into perspective, the additional expected power equals the electricity output from three moderately sized coal or nuclear power plants.

Projections of future global market share for renewable energy alternatives under a "business as usual" scenario are far more uncertain. World Bank president James Wolfenson, however, reports that only 1,000 megawatts of new renewable-fired electricity is presently being added annually (the equivalent output of one moderately-sized coal or nuclear power plant annually), compared to the annual global addition of 75,000 megawatts of fossil-fired generation.

The EIA does offer, however, a "high renewables" scenario premised upon a drop in capital costs and greater technological improvements for central station generating technologies for renewable resources than projected in the reference case. Even under optimistic assumptions, however, EIA concludes that renewables will generate no more than 220 billion kilowatt hours of electricity by 2020; a 4.6 percent electricity market share as opposed to a projected 3.1 percent market share.

It is within this context that the U.S. Department of Energy's "Wind Energy Initiative" should be considered. The initiative - which calls for obtaining 5 percent of the nation's electricity from windmills by the year 2020 - is economically unrealistic according to EIA's energy forecasts.

Renewable Energy Portfolio Standards

Adoption of a federal Renewable Energy Portfolio Standard (RPS) could help boost the market share for renewable energies. The Clinton administration's proposed RPS would require retail electricity suppliers to obtain renewable energy credits equal to 7.5 percent of retail electricity sales from 2010 through expiration in 2015 (other proposed RPS's stipulate different percentages and timetables). Under the administration's plan, credits could be obtained by either generating electricity with specified renewables (one credit for every kilowatt hour), purchasing credits from others, or purchasing credits unsupported by generation from the Department of Energy at 1.5 cents per credit. Thus, the administration's plan has a "sunset" date of 2015 and the 1.5 cent offering from DOE effectively sets a credit price maximum, or "price cap," on the price of renewable energy.

An RPS, however, is unlikely to fundamentally improve the competitiveness of renewable energy because most retail suppliers will find it cheaper to buy credits from the Department of Energy than to create them through generation. The EIA projects that adding an RPS with a price cap and 2015 sunset provision to its reference case scenario would boost renewables to only a 3.4 percent market share in 2020. Approximately 82 percent of the 36 billion kilowatt hour

increase in renewable energy would be from the use of biomass for co-firing in existing coal plants. Removing the 2015 sunset provision increases the market share for renewables to 4.2 percent.

The impact of a federal RPS on electricity prices will be small because the credit system spreads the incremental costs of new renewable facilities across all electricity sales. Costs would peak in 2010 under each RPS alternative (up to a 3.2 percent increase in price under a no cap, no sunset RPS), but would fall by about half under each RPS alternative by 2020.

Do Negative Externalities Justify Renewable Energy Subsidies?

The central argument used to justify government intervention to promote renewable energy is that energy markets are riddled with market failures. The main market failure cited by critics is that consumers do not find the price of the substantial environmental costs of fossil fuel or the price of protecting foreign oil supplies reflected in energy prices. Thus, the argument goes, conventional energy supplies are "underpriced" and renewable energy preferences and subsidies are a justifiable remedy to make energy markets more efficient.

Must Renewable Energy be Promoted to Protect the Environment?

The argument that fossil fuel extraction and combustion foul the environment in ways that are incompatible with property rights and markets has some merit. Air and water resources have been treated like a public commons rather than like private property. Renewable energy advocates argue that the air and water exhibit classic market failure; fossil fuel consumers have not had to directly indemnify anyone for the environmental consequences of their consumption and thus prices for fossil fuels are lower than their "true" prices. Consequently, society consumes "too much" fossil fuel. Renewable energy subsidies, it is alleged, would reduce fossil fuel consumption, increase economic efficiency and, ultimately, produce greater economic wealth.

The idea that micromanaging the energy marketplace is the best way to control pollution is certainly compelling on paper. But the belief that governmental agents, not private businessmen, know best how to achieve economic goals such as pollution reduction is dubious. As Adam Smith explained in *The Wealth of Nations*, when consumers seek various goods in the marketplace, market agents arrange themselves to deliver those goods at the lowest possible price. Consumers seek various outputs at the lowest prices, and let entrepreneurs, interacting spontaneously, worry about the inputs.

Thus, government ought to address the problem of air pollution by focusing on goals, not on the means to arrive at those goals. This could be achieved most efficiently either by pollution taxes or emission trading regimes. Thus, even if renewable energy advocates are correct about the need for further efforts against air pollution, their proposed remedy is not necessarily the proper prescription.

But renewable energy advocates are not necessarily correct about the need for further efforts to control pollution. Environmental regulation since the 1970's has imposed large costs on firms, particularly the steel industry and coal-burning utilities, that have largely been passed-on to consumers. So, in a sense, energy consumers *have* had to pay a

premium for the environmental consequences of the fossil fuels they consume. In fact, the costs of compliance with the Clean Air Act through the 1970's and 1980's (the "environmental tax" on fossil fuels) have been about \$25-35 billion annually. The relevant question, then, is whether the \$25-35 billion paid annually by consumers already cover the environmental "cost" of fossil fuel consumption.

Economic efficiency – the explicit goal of renewable energy advocates who cite market failure as a rationale for government intervention – requires that the additional benefits obtained from pollution abatement expenditures exceed the additional costs. Subsidies to renewable energy sources are necessary to correct for the costs of air pollution *if and only if* incremental net benefits would arise from reduced pollution relative to the current status quo. And even then an economically justified subsidy would equal only the *difference* between the existing prices of fossil fuels (which include the cost of existing pollution controls as well as some taxes) and a price that included all pollution damages. Because the prices of some fossil fuels (like gasoline) are already taxed, pollution policies already control emissions, and a reasonable interpretation of the evidence suggests that the additional cost of further exposure reduction exceeds the additional health benefits, the economically efficient subsidy of alternative power sources is probably zero.

Even if current regulatory costs are insufficiently reflective of true environmental costs, they are not so far off the mark to significantly affect consumer decision-making. For instance, when the U.S. General Accounting Office considered the issue as it relates to the electricity industry, it reported that:

The consideration of externalities in the planning process for electricity has generally had no effect on the selection or acquisition of renewable energy sources [because] electricity from renewable energy usually costs so much more than electricity from fossil fuels that externality considerations do not overcome the difference.

The Hidden Environmental Cost of Renewables

The environmental case made for renewable energy is also deficient in that it ignores the very real and very serious environmental costs of renewable energy. While those costs are not yet widely recognized by the public, that's largely due to the fact that renewable energy facilities are so few and far between that the environmental damages caused by renewable energy have been relatively minor thus far. Any major increase in renewable energy market share, however, will surely bring these concerns to the fore.

First, the most profitable sites for renewable energy exploitation are generally located in wilderness areas. The EIA, for instance, reports that "many of the most promising geothermal resources are located in or near protected areas such as national parks, national monuments, wilderness, recreation, and scenic areas." Areas with the best wind conditions are also heavily located in wilderness areas and in sensitive ecosystems. Central station solar power facilities are likewise only potentially profitable in desert ecosystems which are among the last undisturbed wilderness areas in America.

Second, most renewables collect extremely diluted energy, requiring large areas of land masses of collectors to

concentrate. This magnifies both the environmental damages done to sensitive ecosystems and threatens to significantly expand mankind's "footprint" on the land. It would require, for instance, 29.3×10^9 hectares of land to produce enough biomass fuel to replace fossil fuels, a sum twice as large as the entire land area of the earth. In the United States alone, it would require 46 percent of the total land area (including Alaska) that is cropland, meadows, and pasture just to replace the amount of coal consumed in the United States in 1996. Solar power facilities would need 8,685 square miles to provide all the electricity currently being consumed in the United States, an area the size of New Hampshire. Windpower facilities aren't quite as land intensive facilities, but they still require between $\frac{1}{4}$ and 2+ acres of land per windmill. That's about 85 times more land per kilowatt-hour than is required for conventional gas-fired power plants.

Finally, a host of fuel-specific environmental problems haunt windpower. Visual blight and extensive land development results from windpower facilities. Windpower has also been associated with tremendous rates of avian mortality, a problem that appears to be on order with the problem of hydropower with upstream fisheries. Those problems are so severe that a number of environmental and conservation groups have called for a moratorium on new windpower construction.

The same is true with regards to solar energy. Manufacture of photovoltaic cells used for solar collection produces highly toxic waste materials and solvents that require special technology for safe disposal. A 1,000 megawatt solar facility, for instance, would generate 6,850 tons of hazardous waste. A comparable solar thermal plant would generate 435,000 tons of manufacturing waste, 16,300 tons of which would be contaminated with toxic lead and chromium. Moreover, a solar energy system capable of replacing fossil fuels would require at least 20 percent of the world's known iron resources to construct and require over a century to build.

While the environmental problems of renewable energy are not necessarily significant enough to discard renewable energy out-of-hand, those environmental costs must be considered as part of the cost/benefit analysis when comparing renewable energy with conventional energy. Unfortunately, they have yet to be considered in such analyses.

Military Expenditures in the Persian Gulf

Some policy analysts have argued that renewable energies would be more competitive with the costs of fossil fuels if such externalities as the costs of U.S. Persian Gulf military and foreign aid activity were internalized in energy costs. If these costs are added to the price of Middle-East oil on a per barrel basis, the cost is about \$60 a barrel, making the price of Saudi oil \$75 instead of \$15. Thus, it is argued, government intervention to promote renewable energy would make the economy more efficient.

How much would the military budget go down if the United States imported no oil from the Persian Gulf? Given the fact that military forces in the Gulf have several mission objectives, the Congressional Research Service believes that only \$500 million would be saved.

From an economic perspective, however, the key question to ask is whether a reduction in U.S. military and foreign

(continued on page 10)

Renewable Energy (continued from page 9)

aid expenditures would result in an increase in the price of oil? That is, would Middle-East governments produce less oil if the U.S. ended its military and foreign aid? There is little reason to think so.

Even if oil regimes paid for their own military protection, and the protection of their own shipping lanes, would U.S. Middle-East military expenditures really go down? The answer might very well be “no” for two very different reasons. First, the U.S. Middle-East military presence stems from our commitment to defend Israel as well as the oil kingdoms and would not end simply if the Arab oil regimes suddenly defended themselves. Second, bureaucratic and congressional inertia might leave military expenditures constant regardless of Israeli or oil defense needs because of the pork barrel aspects of defense expenditures. In this admittedly cynical view, the importance of defense is not its security role but its role as a provider of jobs and a purchaser of goods and services in congressional districts.

Oil Price Shocks: Justification for Subsidy?

Small changes in oil supply or demand have very large effects on prices. Accordingly, oil prices can be highly volatile and episodic price spikes can impose tremendous costs on the economy. Greater reliance on renewable energy, some argue, would minimize the impact of such spikes.

The inflexibility of oil demand and supply in the short run is not a market failure. It does, however, lead to large transfers of wealth from consumers to firms in times of supply decreases (the Saudi and Texas booms of the 1970's) and firms to consumers in times of supply increases (the Saudi and Texas busts of the 1980's). Both consumers and firms attempt to enlist the assistance of government to prevent these wealth transfers.

Renewable energy subsidies are also rationalized as a method for reducing our use of imported oil, which, in turn, will reduce our vulnerability to the effects of oil shocks. The idea that reducing oil imports will reduce the potential harm caused by OPEC production decisions, however, is sheer nonsense. Changes in oil supplies anywhere in the world affect oil prices everywhere in the world as long as oil is freely traded in markets. Moreover, oil shocks also spill over into domestic coal and natural gas markets. The U.S. would have to isolate its entire domestic energy market from the world energy market in order to eliminate the price effects of supply shocks elsewhere in the world, an economically prohibitive exercise.

Renewable energy cannot realistically substitute in the foreseeable future because renewable energy is primarily used to generate electricity. Only 3.4 percent of electricity is generated by oil in the United States. Given how far electric vehicle technologies have to go before they can compete with the internal combustion engine, increasing renewable energy power generation will have no major impact on oil consumption in the foreseeable future.

Leveling the Playing Field

Do past and present subsidies to conventional energy sources justify subsidies for renewable energy in order to “level the playing field”? First, let's put these subsidies in perspective. The Energy Information Administration reported that energy subsidies in 1990 totaled between \$5-10

billion, only about 1-2 percent of the total energy economy. The size of the preferences are miniscule in relation to the energy industry as a whole.

The oil industry tax preferences most often discussed - the percentage depletion allowance and the expensing of intangible drilling costs - illustrate the lack of importance of tax preferences. While the now largely defunct depletion allowances did encourage more oil production than was optimal, the restrictions on oil production enforced by the Texas Railroad Commission raised domestic oil prices far above what they would have been absent the government-enforced cartel, more than offsetting the countervailing production incentives provided by the depletion allowance. Moreover, in 1990, Congress enacted excise taxes on gasoline that for the first time went to general revenues rather than transportation-related trust funds. These taxes were estimated to be 10 times the value of the remaining tax subsidies to the oil industry in fiscal year 1992.

Thus, tax subsidies of the oil industry over the last 70 years have *not* led to sub-optimal oil prices. The net effect of tax subsidies and taxes places a net *tax* (rather than subsidy) on oil on the order of \$2-3 billion a year as of fiscal year 1992.

Nor have research and development dollars unfairly handicapped renewable energy technologies. Over the past 20 years, renewable energy technologies have received (in inflation-adjusted 1996 dollars) \$24.2 billion in federal R&D subsidies, while nuclear energy received \$20.1 billion and fossil fuels received only \$15.5 billion. To the extent that nuclear power has received heavy favor from government, the primary victim has been oil, gas, and coal - not renewable energy.

Fuel Diversity

Perhaps the strongest argument for renewable energy is the argument for fuel diversity. While renewables cost more than conventional alternatives on a stand-alone basis, they are typically “passive” sources of energy in that they have no state of “on” or “off.” Because they are devoid of systematic (as opposed to random) risk, they may well decrease the risk inherent in any given portfolio of energy sources and in turn reduce the overall cost of electricity.

In this sense, some have argued that a utility's investment in renewable energy is little different from an investor's purchase of low-risk U.S. Treasury Bills (T-Bills) for his/her financial portfolio. T-Bills, like renewable energy, are more costly and yield less than other investments. But textbook portfolio theory suggests that, to optimize returns, portfolios should contain riskless T-Bills because, although their yield is lower, their inclusion serves to increase the expected portfolio return at virtually any given level of risk.

While the inclusion of low-risk energy investments might well make sense, there are alternative energy investments, like nuclear, that likewise have low price risk (high fixed costs and minimally variable marginal costs) that could well accomplish the same thing at reduced cost. Other studies suggest that increases in either coal or natural gas consumption (depending upon the assumptions) will reduce energy portfolio volatility and thus serve to maximize utility return in the same manner that investments in renewable energies would.

Nor should it be forgotten that utilities can also hedge against the price risk of fossil fuels by obtaining long-term

power contracts or by investing in the futures markets.

Regardless, private utility companies struggle mightily to maximize profits and to optimize their energy portfolio. If renewable energy investments are better risk-hedging practices than the alternatives, no government coercion or subsidy is necessary.

Does Global Climate Change Justify Renewable Energy Subsidies?

Will the threat of global warming prove to be the policy “wild card” that leads nation-states to provide the massive dose of taxes and subsidies necessary for renewable energy to supplant conventional energy sources in the 21st Century? While this paper will not provide a thorough review of the scientific disputes surrounding global climate change, it should be pointed out that a scientific consensus has yet to emerge about whether anthropogenic (man-made) greenhouse gases will have a significantly deleterious effect on either the economy or the environment.

Even if the scientific “alarmists” are correct about the causes and effects of anthropogenic greenhouse gas emissions, it is not clear that the benefits of restricting fossil fuel consumption outweigh the costs. Given the large margin by which costs outweigh benefits given mean projections of future warming, it’s hard to envision a scenario in which that calculation would change.

Even so, as table 3 indicates, incremental adoption of renewable energy will simply not have a significant impact on greenhouse gas emissions.

Table 3
Greenhouse Gas Emission Reductions
Under Alternative Scenarios, 2020

| Scenario | Emission Reduction |
|---|---------------------------|
| EIA “High Renewables” Scenario | 12 million metric tons |
| Renewable Energy Portfolio Standard with 1.5 cent price cap and 2015 sunset | 1 million metric tons |
| Renewable Energy Portfolio Standard with 1.5 cent price cap and no sunset | 13 million metric tons |
| Renewable Energy Portfolio Standard without price cap or sunset | 32 million metric tons |

Source - EIA 1999, p. 72.

Thus, even under the most aggressive plausible set of assumptions - a “high renewables” scenario combined with an RPS without cap or sunset - energy-related greenhouse gas emissions would only be 2 percent lower than they otherwise would be in 2020. Since the United States must reduce greenhouse gas emissions by 30-42 percent below where they otherwise would be by 2015 in order to meet the requirements of the Kyoto Protocol, it’s clear that renewable energy - no matter how optimistic we might be about the technology - cannot significantly contribute to Kyoto compliance.

Ultimately, the question of how best to reduce anthropogenic greenhouse gas emissions is best answered in the marketplace via an emissions trading regime, not by government planners through fuel use mandates and prohibitions. In fact, the President’s Council of Economic Advisors argues that, were such an emissions trading program in place, market agents would find it cheaper to reduce emissions by replacing natural gas with coal than by replacing fossil fuels with renewable technologies.

Even if it were possible to achieve all of the greenhouse

gas emissions reductions called for in the Kyoto Protocol through adoption of renewable energy technologies, it would not have much effect on future temperatures. Climatologist Tom Wigley calculates that, if all the nations met their commitments under the Protocol, global temperatures would be only 0.13 degrees Fahrenheit (0.07 degrees Celsius) below where they otherwise would be by 2050.

Actually stabilizing greenhouse gas concentrations at present levels would require a 60-80 percent cut in present greenhouse gas emissions. This would essentially mean the complete or near complete elimination of fossil fuel consumption given that fossil fuels comprise about 80 percent of total greenhouse gas emissions. Such an undertaking is simply not conceivable given the economic and environmental costs of renewable energy.

Conclusion: The Perils of Prognostication

Will a technological breakthrough make some renewable energy sources suddenly competitive with conventional energy? Will catastrophic global climate change compel nations to adopt strict policies to end our reliance on fossil fuels? Will advances in conventional energy technologies suddenly ground to a halt? Will conventional energy reserves suddenly run dry? Such events are unlikely, but of course, they are theoretically possible.

Policy analysts should be warned that, in the game of dueling predictions about the nature of the 21st Century energy economy, clues about the veracity of the opposing analyses can be gleaned by examining both the economic foundations of the arguments and the track record of the various parties pertaining to past predictions. The arguments marshaled to support the hypothesis that a transition to a renewable energy economy is inevitable are riddled with economic errors and thus prove less than compelling. Moreover, past predictions by renewable energy advocates about the future of the energy economy have proven wildly incorrect.

As this report indicates, there is no good economic reason for governmental intervention in energy markets to promote renewable energy. Moreover, government’s record of success when it intervenes in markets is so bad that one suspects that even random chance would have produced a better track record. MIT’s Thomas Lee, Ben Ball, Jr., and Richard Tabors point out rightly that “the experience of the 1970’s and 1980’s taught us that *if a technology is commercially viable, then government support is not needed; and if a technology is not commercially viable, no amount of government support will make it so.*” Heeding that lesson will serve us well as we enter the 21st century.

Notes to this article are available by contacting Paul Roberts at paul-roberts@reliantenergy.com

“New Technology” Dominates Philadelphia’s Conference

*By A. F. Alhajji**

Under the theme “Transforming Energy”, the USAEE held its 21st Annual North American Conference in Philadelphia September 24th through 27th. While participants discussed various traditional energy issues, new technology discussions dominated the conference. Being that President Clinton’s announced his decision to release oil from the Strategic Petroleum Reserve (SPR) two days previous to the conference, the SPR was the focus of hallway conversation. (See the sidebar, “Views on the SPR”.)

New Technology

The focus of the first day was new technologies. Specialists and researchers disagreed about the future of such technologies and their impact on the oil market. In addition, representatives from Toyota and Daimler-Chrysler presented future trends in the automotive industry based on their companies’ perspectives. Toyota focused on hybrid-electric cars while Daimler-Chrysler directed their attention toward vehicles powered by methanol fuel cells. To emphasize the conference theme and to show the contribution of the city of Philadelphia, Kronosport, Inc. demonstrated some of its electric cars during the conference. These were the same cars shown at the Republican Convention, also held in Philadelphia.

While the number of electric and hybrid cars may increase in the future, Larry Weick, Syntroleum’s vice president, cautioned that electric cars will not reduce pollution but only move emissions from one place to another. Therefore, to achieve the objective of lower emissions, fuel design must be emphasized. Designing gas to liquid (GTL) fuels could be the future trend and Syntroleum’s GTL technology is leading the industry.

Conflicting Views on New Technology

In a presentation entitled “The Surprise is Coming: Hypercars, Hydrogen and Distributed Utilities,” Amory Lovins, Co-CEO of the Rocky Mountain Institute, asserted the role of new technology and predicted that new technology

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will dominate very soon, making oil obsolete. John Edwards of the University of Colorado, Boulder, showed the need for such technology because of the lack of oil in the future. He showed that world oil production will peak between 2010 and 2020 and we need new technology in place by 2050.

On the other side, a number of speakers downplayed the role of new technology. A paper by William Pile of TEIR Associates entitled “Transportation Fuels of the Future,” concludes that cleaner gasoline and diesel are the fuels of the near future. Pile concludes that the economic incentives to switch to alternative fuel vehicles will not likely exist in the foreseeable future, except for small niche markets, especially because cleaner reformulated gasoline and diesel is less expensive than other alternative fuels.

In another paper, Susan Haltmaier from Standard & Poor’s Global Industry Insight stated that declining cost of fuel cells may lead to an increase in the number of fuel cell cars, however, the cost of alternative fuel vehicles is still too high compared to cars with gasoline combustion engines.

These views are summarized by the title of Jack Wise’s presentation “Future of Highway Transportation Fuels: Sea Change or Pond Ripples?” He stated, “I do not see a sea change coming in the foreseeable future. The inherent advantages of hydrocarbon fuels with their high energy density coupled with existing infrastructure and slow vehicle fleet turnover preclude a sea change. In the near term I see only pond ripples.”

Dr. A.F. Alhajji went a step further and predicted that fuel cell technology may actually increase the demand for oil. In his presentation, entitled “Fuel Cell Technology and Petroleum: Substitutes or Complements?”, he showed that, “the availability of gasoline infrastructure and partnership with oil companies may force technology to favor gasoline. Even with the use of methanol as a fuel in fuel cells, higher natural gas prices will cause substitution in other sectors. Therefore, fuel cells will not reduce the consumption of oil!”

David DeAngelo, the conference chairman was pleased with the conference. He said in an interview with the Alwatan Newspaper, the largest Saudi newspaper, “We have been very successful. We went for quality of speakers and we achieved that. The papers presented were good as well; we achieved the balance we wanted. I’ve been receiving feedback from participants who noted the quality of speakers and quality of the dialog.”

Conference Proceedings on CD Rom 23rd International Conference Sydney, Australia, 7-10 June, 2000

The Proceedings of the 23rd International Conference of the IAEE held in Sydney, Australia, are now available from IAEE Headquarters on CD Rom. Entitled *Energy Markets & the New Millennium: Economics, Environment, Security of Supply*, the proceedings are available to members for \$95.00 and to nonmembers for \$115.00 (includes postage). Payment must be made in U.S. dollars with checks drawn on U.S. banks. To order copies, please complete the form below and mail together with your check to:

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Views on the SPR from Philadelphia's USAAE/IAEE 21st Conference

By A. F. Alhajji*

Questions to Ponder

Do you remember how you voted on the SPR during the conference? The following views may change your mind. The question at hand is whether or not we should base our decision on legal, political, economic, or welfare issues or all of them? Then which view is correct? Is the "lesser of the two evils" criteria the right way to make a decision? Who really benefited from the release? Did OPEC benefit from the release? Will you support or oppose another releases? Does a second release have different consequences from the first one?

The Opponents' Views:

- 1 The SPR was established to be used in case of emergency and supply disruptions, not to manipulate markets and influence prices. This release was politically motivated in this election year.
- 2 This release will jeopardize U.S. national security in case of real energy crisis or supply disruption and weakens the U.S.' ability to respond to real shortages.
- 3 This release violates U.S. principles of free markets and free trade. It contradicts the U.S. policy of promoting free markets in China and Russia. The oil industry does not want to see a repeat of the 1970s oil disaster when the government intervened in the oil markets.
- 4 This release will not solve problems in the products markets because of limited refinery capacity. U.S. refineries are operating near full capacity and cannot operate at 100% without jeopardizing safety. Crude oil from the SPR will back up other oil and will not affect the availability of heating oil for the coming winter.
- 5 If refiners expect that the government will keep interfering until prices decrease, they will not buy crude now and wait until prices decline. This will exacerbate the situation in the gasoline and heating markets. In this case, the release of the SPR is leading to the opposite of the intended results.
- 6 OPEC may retaliate and cut production. Such cuts may eliminate any effect the SPR may have on oil prices.
- 7 The use of the SPR will reduce privately held reserves, which may cause higher prices in the future.

The Proponents' Views:

- 1 Oil prices continued to increase despite OPEC efforts to increase production and maintain prices within the price band. This may indicate that OPEC lost control of the market. Other measures, such as the use of the SPR, may prove to be helpful in lowering prices. In fact, prices declined by about \$5 per barrel in the week following the president's authorization.
- 2 The release will lead to a decline in product prices be-

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- cause it reduces backwardation in the futures markets. This will encourage refiners to buy crude and refine it to reduce the shortages in the products markets.
- 3 High oil prices started affecting economic growth especially in Europe, the U.S., and the fragile Asian economies. Therefore, government intervention was required in this exceptional case to prevent a downturn.
 - 4 The U.S. does not want what happened in Paris and London to be repeated in New York and Los Angeles. The use of the SPR is the "lesser of the two evils" especially before the election.
 - 5 The use of the SPR forced speculators out of the market and lowered oil prices. Some analysts believe that speculators may increase oil prices by \$4-5/bbl when they hold large number of "long" contracts.
 - 6 The U.S. national security is not jeopardized by this small release. The U.S. still has the ability to whither a real energy crisis because it is still has 540 million barrels in reserves. In addition, the release was a swap, not a sell, which means that the U.S. is building its reserves when the companies return 31.5 million barrels next year instead of the 30 million that was withdrawn from the SPR. Since this swap requires companies to return the oil between September and November, a period of low demand, the swap will stabilize prices.
 - 7 OPEC and its members are highly unlikely to cut oil production in retaliation for the SPR. All OPEC members agreed that a \$37/bbl price is not acceptable, and Saudi Arabia is trying to force an average price of \$25/bbl. In addition, economics will force these countries to keep producing; who is going to cut production at today's high prices to sell that oil later at a lower price?
 - 8 The release will reduce panic, stockpiling, and hoarding. This reduction will contribute to price stability.
 - 9 Governments may increase taxes on oil and oil products if prices stay high, and may wish to punish the oil companies for their failure to reduce prices. The release of SPR may eliminate this possibility.
 - 10 Higher oil prices may force politicians to change the law and create new policies harmful to the oil industry. The release will eliminate this possibility.
 - 11 Historically, higher oil prices were associated with a large amounts of time spent on meetings of committees, press releases, etc.; the use of the SPR will save time and money.

USAAEE

Technology Innovation in the 21st Century

By Kurt E. Yeager*

“The law of human acceleration”, as the historian Henry James noted a century ago, “cannot be supposed to relax its energy to suit the convenience of man.” That law of acceleration is hurtling us into a new century, a new millennium and a new age. The world James lived in contained fewer than two billion people. Today, we add nearly a billion every decade. The Industrial Revolution extended over generations and allowed time for human and institutional adjustment. Today’s Information Revolution is far swifter, more concentrated and more drastic in its impact. Over the past century electricity has become the prime mover for that human acceleration.

For example, Edison is important to us not primarily because he invented the electric light—a commercial product—but because he invented the concept of electrification. The first electricity supply system was, in a sense, viewed as an engineering detail required to make light bulbs salable. Within a decade, however, electricity itself was the product, spawning the birth and development of today’s power industry. But even this was not the result of greatest value. It was the incredible capability of electricity to improve every aspect of our lives and transform modern society. That was the unpredictable, intangible, yet immeasurably valuable outcome of Edison’s innovation.

Today, technology for the power industry is changing at a more profound and faster pace than at any time since Edison’s day at the dawn of commercial electrification. This, in turn is changing every aspect of the electricity enterprise. The change process is likely to accelerate as the opportunities for efficient conversion of energy to electricity more closer and closer to the customer; as power electronics usher in a new age of precision delivery system management; as information technology redefines the boundaries and relationships between producers and customers; and as new electrotechnologies leverage digital control and real-time communications, boosting both industrial and service sector productivity to new heights. All these innovations serve to increase the efficiency and precision advantages of electricity relative to other energy forms.

The broad outline of strategic economic implications from such a profound technical transformation can already be seen. Other industries already dealing with similar change provide us with some clues—e.g., telecommunications, airlines and banking.

- First, the customer is given choice and becomes king. New technology makes the customer, not the supplier, the new focus and controller of the business.
- Second, the business expands to emphasize value-added services to the customer, rather than just providing cost-plus commodities.
- Third, the distinction between previously parallel commodities becomes blurred as services merge. For ex-

*Kurt E. Yeager is President and CEO, Electric Power Research Institute. This keynote address was presented at the 21st annual North American Conference, September 24-27 in Philadelphia, PA.

ample, electricity, telecommunications and natural gas are all becoming intertwined at the user’s end as new service opportunities and creative providers emerge.

- Fourth, the existing industry infrastructure can become economically unstable and by-passable.
- Fifth, the historically well-defined and locally static, business becomes a globally expanding enterprise of new opportunities. The established functions—generation, transmission, and distribution—become only reference points from which to explore and exploit the new “white space” of business opportunity. This space is bounded more by entrepreneurial imagination and will power than by technological limitations.

In recognition of this profound transformation, EPRI has launched the Electricity Technology Roadmap as a collaborative initiative to explore the opportunities for electricity and innovation in the new century. The Roadmap initiative is being conducted through the combined knowledge, vision and imagination of over 150 organizations so far, spanning the range of public and private stakeholders in the electricity enterprise.

An actionable, consensus-based set of five essential goals or destinations for the electricity enterprise in the 21st century is emerging. Transcending these goals is a vision of electricity as much more than just an energy medium. It has become the prime mover of society through the innovations it makes possible, and its power to improve the human condition will continue to escalate in the new century as technology progresses.

The five interdependent goals defined by the stakeholders and supporting this vision are:

- 1 Strengthen the electric power delivery infrastructure to serve the new digital society
- 2 Enable customer-managed electronic service networks
- 3 Boost economic productivity and prosperity
- 4 Resolve the energy/environmental conflicts
- 5 Achieve global sustainability through universal electrification

In the interests of our limited time together, I will focus on a couple of core messages supporting these stakeholder goals that I believe are particularly relevant to the theme of this conference: “Transforming Energy”.

First, the most important characteristic of this marriage of electricity and innovation is its ability to amplify productivity. This reality is of profound importance in the context of the global demographic transformation underway. As a result, today’s economically developed countries represent a rapidly declining minority of the world’s population. Unless we can elevate the productivity growth rate of the world to at least 2% per year – “the 2% solution” – economic development as we know it will be the endangered species. Only by electrifying the world – bringing electricity to at least 100 million people more every year for at least the next 50 years – can we hope to achieve the needed global productivity growth and economic development.

Progress on this front begins at home. Unless we harness the full potential of electricity to transform our own productivity, the world will lack the essential U.S. engine of

innovation and capital formation needed to electrify the world.

It's useful to note a couple of statistics in this regard:

- In the first 25 years after WWII, the fraction of the U.S. population employed remained about constant but real per capita wages doubled. In short, our productivity grew dramatically and enabled corresponding economic growth.
- By comparison, in the next 25 years, the fraction of the population employed has doubled but their real wages have stagnated. We created a lot of lower productivity, lower wage, jobs to sustain economic growth. Only in the last several years have we begun to see a positive change in this pattern.
- As we look forward over the next 25 years the U.S. population will, on average, age significantly and we will be hard-pressed to even keep the size of our current work force constant. As a result, the ratio of retirement age citizens to working age will double over this period, creating a major challenge to our ability to pay for the resulting social infrastructure demands.

The bottom line is that we need to go back to growing the economy the old-fashioned way – by increasing productivity through innovation.

Fortunately, the means to do so are at hand. That is, to accelerate the so-called Digital Revolution. It is beginning to produce dramatic productivity improvements in every business it touches. The productive power of this revolution is its ability to transform the traditional industrial economy, where value grows incrementally, into a network economy where value can grow exponentially as the network's inclusiveness expands. Electricity and real-time information are its lifeblood. The electricity demand for this new economy is growing exponentially and already represents about 15% of the nation's electricity consumption. Within a decade, it will dominate electricity consumption as more and more industry and commerce is transformed.

Every network has two basic ingredients – nodes and connections. Today, digital microchips are becoming cheap and tiny enough to slip into every object and activity we create. Each chip represents a sliver of intelligence able to communicate with others. As a result, the size of the network nodes is collapsing while the quantity and quality of the connections is exploding. These billions – ultimately trillions – of silicon chips linked into high-bandwidth channels are literally becoming the neurons of society. For example, when dumb PC nodes are linked into a neural network they create the intelligence called the worldwide web.

So, what does all this mean for the electric power network? First, given the productivity enhancing potential of the emerging network economy and the urgent need to meet the escalating costs of our aging population, any infrastructure or institution seen as sustaining “digital-divides” in our society is likely to be under considerable pressure to change or risk being bypassed by new technology. Technology challenges the concept of the natural monopoly, and power delivery is no exception. It is already in competition with distributed resources where perfect power quality, not cheapest energy is the primary performance criterion.

Second, the power delivery infrastructure is already a complex, interactive network. But if it is to keep pace with

the Digital Revolution, it too must become much more interactive and complex. Today's infrastructure, composed of relatively few large power plant nodes and limited real-time connectivity, must expand to provide the same precision and efficiency as the boundaryless microchip networks it serves. It is paradoxical that the very electricity industry that made others obsolete (e.g.: gas light and ice refrigeration) in the 20th century, is itself threatened by “disruptive” technological change as we enter the 21st.

This suggests for example:

- a. The incorporation of ever-smaller stationary and mobile power supply and storage nodes. This will result in a seamless electricity/natural gas network infrastructure with power produced and stored at a myriad of locations.
- b. Universal electronic control of the delivery infrastructure to meet the escalating power transaction and ultra-clean power quality requirements of electronic commerce, and to achieve the level of real-time connectivity needed.
- c. Elimination of radiated power quality interferences among end-use devices, and with power conditioning and power supplies.
- d. Creation of Direct Current (DC) microgrids that provide the perfect power quality needed while eliminating the costs associated with AC-DC power conversion and conditioning.

Ultimately, we can envision this electricity/natural gas network converging with communications and even transportation into one inclusive mega-infrastructure integrated around electricity that reaches, and interconnects, all ultimate customers and their agents – the microchips themselves.

The implications for the electricity business as we know it are likely to be equally profound. The historic, supplier-controlled commodity business of selling bulk kWh's is being superseded by a customized mass-service enterprise, bringing together electrons and information to activate unlimited numbers of “smart” chips, while being controlled by those same chips. In this networked economy, where real-time market information is freely accessible, market power is shifting from supplier to customer and transaction costs are relentlessly being driven down. Power grid owners and operators, and most of all regulators, must meet the challenge of assimilating new technology and organizational flexibility to keep pace. If not, they risk being relegated by that same technology into suppliers of last resort.

The electricity delivery reliability initiative, launched last year by EPRI together with over 40 utilities, provides the first step in meeting this challenge. But risk assessment and the application of the best-practices needed to keep the lights on are just the “table stakes” for the commitment that is ultimately required. In addition, the tools to create this robust, adaptive infrastructure for the digital society will require the accelerated development and deployment of an array of new enabling technology platforms and protocols. These include, to name just a few examples:

- Wider bandgap semiconductors for universal electronic grid control and real-time connectivity
- Complex interactive network and power flow management capabilities

(continued on page 16)

Technology Innovation in the 21st Century *(continued from page 15)*

- Superconductive power delivery and storage technology to increase delivery system capacity and efficiency
- Seamlessly interconnected AC and DC distribution network capabilities and architecture
- Control & protection systems and standards for mixed central/distributed power supplies
- Interactive metering and standards supporting real-time service networks.

The continued growth in the role of electricity as the prime mover for society will also create important environmental benefits. For example, a steady decline in the carbon intensity of the world's energy economy that leads to an electricity/hydrogen energy economy. This robust trend has been sustained for over a century and has every promise of being continued through the coming century unless short-sighted energy and environmental policies interfere. Emphasis should therefore be placed on collaborative actions that reflect enlightened self-interest, not rigid targets and timetables that both freeze technology and lead to unacceptable implementation costs.

Continuing this decarbonization trend will require space and time flexibility for innovative technology to effectively resolve the sustainability trilemma. Time is needed to develop new technology innovations and to deploy them as capital stock is replaced. Location flexibility is needed to use these innovations where they will have the greatest benefit related to their cost, given the very large level of capital investment required. Failure to take this path can have severe consequences for U.S. productivity and global competitiveness, and deny people at the margin of subsistence the means to participate in global economic development.

Finally, progress depends on renewed incentives for investment in the R&D engine on which innovation depends, and in the energy infrastructure which must utilize the results. The incentives should be guided by a strategic roadmap for global energy progress, and should promote a sustained collaborative partnership between the public and private sectors. The recent report of the President's Committee of Advisors on Science and Technology (PCAST) entitled *Federal Energy R&D for the Challenges of the 21st Century* sums up the situation well by concluding: "If the pace of scientific and technological progress is not sufficient, the future will be less prosperous economically, more afflicted environmentally, and more burdened with conflict than most people expect."

An effective commitment to build this technological tool kit for electricity-based innovation will require renewed public/private collaboration that recognizes infrastructure excellence as a prerequisite for productivity growth, economic prosperity, and environmental well-being. The Roadmap concludes that a commitment of an additional four billion dollars per year over at least the next ten years is needed to develop these technology platforms to the level of confidence required to keep pace with the opportunities presented by the Digital Revolution. Providing sufficient rates of return to justify infrastructure investment by today's capital markets is an important enabling precursor for this commitment.

The age-old biblical proverb, "Where there is no vision, people perish," has never been more literally true than in the business of electricity for the new century. If we are to electrify the world, we must first transform our own electricity network infrastructure into the arsenal of innovation for the Digital Society. The productivity stakes for the nation are extremely high and the costs of failure intolerable. Please join actively with EPRI to make it happen.

HOUSTON CONCURRENT SESSIONS ENHANCED

To a large extent, the success of any USAEE/IAEE conference is determined by individuals presenting papers on timely energy research topics. There is still time for the submission of abstracts for presentation at the 24th International Conference of the IAEE. The deadline for abstracts is December 4, 2000. If you wish to have your paper considered for presentation, please submit a 200-1500 word abstract giving an overview of the topic to be covered. Submit all abstracts to IAEE Headquarters, 28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122; Fax 216-464-2768; Email iaee@iaee.org. All papers accepted and returned in time will be printed in the conference proceedings. **AT LEAST ONE AUTHOR** from an accepted paper must pay the reduced speaker registration fee and attend the conference to present the paper. Accepted papers require the author(s) to submit their completed paper on grid sheets provided and pay their registration fee for the conference prior to February 1, 2001 (cut-off date for papers to be returned for printing in the conference proceedings CD-Rom). All abstracts should clearly address the theme of the conference and topics listed on the Call for Papers elsewhere in the *Dialogue*.

Based on input from delegates, a number of changes have been made to the structure of Concurrent Sessions. We will consider three types of concurrent sessions. First are sessions with a more "academic" flavor, using discussants to enhance author presentations and provide a richer experience for all participants. It is imperative that papers be completed and sent to discussants well before the conference. A second set of sessions will see more "traditional" presentations, in which authors report on work-in-progress, make short presentations drawn from much longer reports, or even present opinion. Finally, we plan to set up special sessions that will function much more as "discussions," in which a topic will be specified ahead of the conference, and panelists will be expected to lead the audience into a wide-range discussion of the topic.

You are invited to submit papers and proposals for complete sessions for any of these types of sessions, but please note that the organizers may have to move submissions across categories when finalizing the program.

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- **Professional Journal:** The *Energy Journal* is the Association's distinguished quarterly publication published by the Energy Economics Education Foundation, the IAEE's educational affiliate. The journal contains articles on a wide range of energy economic issues, as well as book reviews, notes and special notices to members. Topics regularly addressed include the following:

| | |
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| Alternative Transportation Fuels | Hydrocarbons Issues |
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| Energy & Economic Development | Natural Gas Topics |
| Energy Management | Nuclear Power Issues |
| Energy Policy Issues | Renewable Energy Issues |
| Environmental Issues & Concerns | Forecasting Techniques |

- **Newsletter:** The *IAEE Newsletter*, published four times a year, announces coming events, such as conferences and workshops; gives detail of IAEE international affiliate activities; and provides special reports and information on an international basis. The newsletter also contains articles on a wide range of energy economics issues, as well as notes and special notices of interest to members.
- **Directory:** The Annual *Membership Directory* lists members around the world, their affiliation, areas of specialization, address and telephone/fax numbers. A most valuable networking resource.
- **Conferences:** IAEE Conferences attract delegates who represent some of the most influential government, corporate and academic energy decision-making institutions. Conference programs address critical issues of vital concern and importance to governments and industry and provide a forum where policy issues can be presented, considered and discussed at both formal sessions and informal social functions. Major conferences held each year include the North American Conference and the International Conference. IAEE members attend a reduced rates.
- **Proceedings:** IAEE Conferences generate valuable proceedings which are available to members at reduced rates.

To join the IAEE and avail yourself of our outstanding publications and services please clip and complete the application below and send it with your check, payable to the IAEE, in U.S. dollars, drawn on a U.S. bank to: International Association for Energy Economics, 28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122. Phone: 216-464-5365.

 Yes, I wish to become a member of the International Association for Energy Economics. My check for \$60.00 is enclosed to cover regular individual membership for twelve months from the end of the month in which my payment is received. I understand that I will receive all of the above publications and announcements to all IAEE sponsored meetings.

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USAAE Student Scholarships Program at the Philadelphia Annual North American Conference of USAAE/IAEE

This year, the USAAE continued to offer scholarships for students to attend the North American Conference in Philadelphia. At this year's conference, 7 students qualified under the guidelines for scholarship requests. With the dramatic changes in domestic and international energy markets, industry restructuring and the negotiations on global climate change protocol, energy economics is definitely back on the scene. Inviting student participation at the conferences is one of the best mechanisms for recruiting new members to the USAAE and exposure to our industry.

Of the 7 scholarship students at the conference in Philadelphia several presented papers. Further, several of the students provided us with testimonials of their experience attending the conference. Below please find captions and speech titles of presentations (if provided) from this year's USAAE Student Scholars attending the North American Conference.

Yolanda Abreau

Presentation: *The Behavior of the Brazilian Rates Policies After the "Real Plan" and the Buying Over of Electricity Generating Companies by Private Sectors and Access to Electricity*

Francisco Barnes-Regueiro

Presentation: *The Dynamic Response of the Mexican Energy Sector to Regulatory Policies & Budgetary Restrictions*

Testimonial: *"Participating in the 21st USAAE Annual North American Conference was a very enriching experience and extremely valuable for my research. Presenting in the conference gave me the opportunity of identifying some of the strengths and weaknesses of my work prior to my final thesis defense. Also, having the opportunity to meet people at the forefront of industry, government and academia help to inform me of other pertinent issues within the field. I highly recommend participating in this type of event to other students engaged in energy research."*

John Bower

Presentation: *A Model-based Analysis of Strategic Consolidation in the German Electricity Industry*

Testimonial: *"It was clear that the electric power industry in the US is facing almost exactly the same issues/problems as Europe, namely how to deregulate the industry but in such a way as to control market power and ensure customers benefit with lower prices. I went to both the USAAE/IAEE conference in Philadelphia and the IAEE/SNF conference in Bergen and the tone and questions were identical - in some case the US is ahead in solving the problems and in other cases Europe. Having the two conferences running in parallel in this way, although it may be an accident, is an important contribution to improving communication on these issues across the Atlantic. Hopefully cheaper, better, quicker solutions are even now being found as a result.*

In future, I would like to see more effort put into ensuring that delegates from both continents attend both meetings. Perhaps a discount package offering both meetings for a discount might be a practical way and also perhaps some

twinning of keynote speakers giving the transatlantic view may be another."

Michele Hendrix

Presentation: *Decomposing U.S. Energy Intensity from 1980-1995*

Testimonial: *"I enjoyed the conference in Philadelphia. I was there to present a paper that had been written with my advisor. The Philadelphia conference was the first time I had ever presented my work, so I am extremely grateful that I had the chance to do so. It's great that the USAAE/IAEE allows graduate students to attend, as well as present, by offering the student scholarships."*

Vladimir Starkov

Presentation: *Why are U.S. Electric Utilities Selling their Power Plants?*

Testimonial: *"The USAAE/IAEE conference gave me, a representative of academia, an opportunity to learn the views of the industry and government leaders about the issues of my interest. The conference setting was well suited to make valuable personal contacts as well.*

The program was well organized, with the events running all day long. It is uncommon to find such a rich agenda at most other conferences. Besides the presentations themselves, the most interesting activity to me was the visitation of the Franklin Museum and the opportunity to see and conduct my own scientific experiments.

Finally, I wish to thank the USAAE/IAEE Committee for the honor of being awarded the Student Scholarship."

Other students receiving Scholarship Funds include:

Christopher Jablonowski

Testimonial: *"The general sessions were well organized and informative, and the paper sessions offered something for everyone. In a broader sense, I think the Conference continues to serve as a key vehicle in establishing and maintaining personal networks between researchers and decision-makers in industry. I do not think one party can truly succeed without the other."*

Sona Khanova

Testimonial: *"As an undergraduate student in my senior year, I have certainly benefited from meeting renowned specialists in the field of my interest. The amount and contents of information were overwhelming, yet very insightful in terms of giving me a clear sense of direction in my future career plans. I especially appreciate the warm and encouraging atmosphere, created by all participants. It was very inspiring for an undergraduate like myself to meet in person the authors of the books that I read and to discuss with them my interests. I would certainly like to recommend this kind of experience to all students interested in energy economics."*

We were able to continue the Student Scholarship program this year with contributions from Conoco, Inc., Exxon Mobil Corporation, Joseph Dukert, Joy Dunkerley, Jack Edwards, Andre Plourde and Michael Lynch.

Student scholarship winners and supporting organizations were once again invited to the Student Scholarship networking breakfast. This was well attended by all involved

(continued on page 23)

New Members of USAEE

The follow individuals recently joined the USAEE in the period July 1, 2000 to September 30, 2000. Welcome!!

Seabron Adamson

Frontier Economics

Wa'el Al-Bitlagi

Saudi Aramco

Dwight Anderson

Ospraie Fund/Tudor Invest Group

Rod Azama

The Metro-Herold

Francisco Barnes

Battelle/UNAM

Francisco Barnes-Regueiro

Imperial College

Ronald Batey

Sunoco

Bryan Bezold

Southern Company Services

Doug Biden

Electric Power Generation Assoc

Pam Boschec

Electric Light & Power Magazine

Nathan Boyce

Stanford University

James Brown

Green Mountain Power Corporation

David Buckner

Southern Company Services

Tyler Burton

High Latitude Consultants

Randall Byrne

CMS Energy

Christopher Dabi

Climate Institute

Natalie de La Giraudier

ICF Consulting

Mina Dioun

Lower Colorado River Authority

Robin Duquette

Louis Dreyfus Corp

Anne Dutcher

Groppe, Long & Littell

Ron Erd

Southern Energy

Galip Fezyioglu

PUCO

Alfredo Garcia

The Brattle Group

Timothy Garry

Ark Asset Management

Leonardo Giacchino

National Economica Research Assocs

George Given

Henwood Energy Services Inc

A J Goulding

London Economics

Frank Graves

Brattle Group

Donald Hanson

Argonne National Laboratory

Virginia Hart

Skipping Stone Inc

Scott Hassell

RAND

Udi Helman

Federal Energy Regulatory Comm

David Hunger

Federal Energy Regulatory Comm

Lesley Ingram**Blake Johnson**

Stanford University

Sami Kamel

Colorado School of Mines

Kenneth Kempf

Carolina Power & Light Company

Michael Kennmann

Caterpillar Inc

Brian King

Houston Street Exchange

Peter Kobos

Rensselaer Polytechnic Institute

Stephen Land

Tacoma Public Utilities

Chung-I Li

Univ of North Carolina Chapel Hill

Huagang Li

Lukes Consulting Group Inc

Jennifer Li

Univ of North Carolina Chapel Hill

Keith Little

Conoco Global Power

Jason Loehde

Aquila Energy

Michael Loenen

ACES Power Marketing

Maureen Lorenzetti

Petroleum Argus

Kenneth Medlock III

Rice University

Lori Megdal

Megdal & Associates

Ian Miller

EDS

James Miller

Rice University Economics Dept

Reid Miner

NCASI

Martha Moore

Chemical Manufacturers Association

Fumio Murazeki

Tokyo Gas Co Ltd

Nicole Naassan

Pace Global Energy Services

Daniel O'Connor

ISO-New England c/o System Planning

Patrick O'Loughlin

Dayton Power and Light Company

Larry Parnell

Amerada Hess Corporation

Johannes Pfeifenberger

The Brattle Group

Tim Porter

HSBC Asset Management

Marilyn Radler

Oil & Gas Journal

Brian Ratchford

University of Maryland

Iain Roddick

PPL Corp

Gil Rodgers

Cambridge Energy Research Associate

Walter Rogers

Merrill Lynch

Christopher Ross

Arthur D Little Inc

Charles Rossmann

Southern Company

Branch Russell

Syntroleum Corp

Hiroshi Sano

MIT

Jay Saunders

Deutsche Banc Alex Brown

Gracher Selby

PPL Corporation

Gerald Sheble

Iowa State University

Sharon Showalter

The AES Corporation

Kyle Simpson

Morgan Meguire LLC

Garrett Sonnier

Toyota Motor Sales USA

Laura Speake

Southern Wholesale Energy

Bryan Spratt

Munder Capital Management

Vladimir Starkov

West Virginia University

John Stermole

Investment Evaluations Corporation

Susan Summers

PA – DEP – Air Quality

Linda Sutliff**JL Taylor Jr**

Taylor & Associates

Robert Taylor

MWIS

Dave Trickett

PWI Energy Inc

Scott Ungerer

Eng Tech Capital Partners

Carla Urquhart

Milbank Tweed Hadley & McClay LLP

Ronald Villarin

Carr Futures Inc

Mike Vira

Technology Resource Connection

Thomas Wallin

Energy Intelligence Group

Suzanne Weedman

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Larry Weick

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Kevin Wellenius

Frontier Economics

Ian Sue Wing

MIT Joint Program/Global Change

Ralph Yatsko

Bureau of Labor Statistics

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Scenes from the Philadelphia North American Meeting



Joy Dunkerley with her son, his girl friend and Mariano Gurfinkel. Dunkerley received the USAEE Adelman-Frankel Award.



USAEE student Best Paper Award winner, John Bower and Council member Mine Yucel.



USAEE Council members and recipients of student scholarship funds during the student scholarship breakfast.



USAEE stalwarts Hill Huntington and John Jimison received the USAEE Senior Fellow Award.



Louise Burke leads the NYMEX Expanding Paper Markets session.



Mitch Rothman and Robert Borgstrom chat during the conference.

Scenes from the Philadelphia North American Meeting



Senator Frank H. Murkowski speaks before the Philadelphia Conference.



Carol Dahl "supervises" an experiment at the Franklin Institute.



Dave DeAngelo and Lori Schell at the Franklin Institute.

Dave DeAngelo, Senator Frank Murkoski, Mary Novak and Len Coburn.



Kronosport displayed two of their electric-assist quadracycles during the conference.

Conference Proceedings
22nd IAEE International Conference
Rome, Italy June 9-12, 1999

The Proceedings from the 22nd International Conference of the IAEE are available from IAEE Headquarters. Entitled *New Equilibria in the Energy Markets: The Role of New Regions and Areas*, the price is \$99.95 for members and \$119.95 for nonmembers (includes postage). Payment must be made in U.S. dollars with checks drawn on U.S. banks. Please complete the form below and mail together with your check to: Order Department, IAEE Headquarters, 28790 Chagrin Blvd., Suite 350 Cleveland, OH 44122, USA.

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Kurt Yeager, Dave DeAngelo and Mary Novak at the Philadelphia North American meeting.

Student Scholarships *(continued from page 18)*

and proved to be a good event to learn what is being researched and discovering in the field of energy economics.

USAEE plans to continue the student scholarship program and earnestly seeks your company's and your personal contributions to this fund. Enclosed in this issue of Dialogue is additional information on how you can become involved in this program.

Congratulations again to the above students who qualified for our program and participated in the annual USAEE/IAEE North American Conference in Philadelphia.

Calendar

7-8 November 2000, 15th Annual Autumn European Gas Conference. Edinburgh. Contact: EconoMatters Ltd., Rodwell House, 100 Middlesex Street, London E1 7HD. Phone: 44-20-7650-1430. Fax: 44-20-7650-1431. Email: confs@economatters.com URL: www.gas-matters.com

November 2000, Renewable Energy: Advancing Technology for Industrialisation and Sustainable Development. Brighton, UK. Contact: Robert Pinheiro. Phone: 44-1865-302704. Fax: 44-1865-557368. Email: robert.pinheiro@britishcouncil.org

13-14 November 2000, Capacity and Margins in European Oil Refining. London, United Kingdom. Contact: Phone: 44-20-7252-2222. Fax: 44-20-7252-2272 Email: customer_services@smiconferences.co.uk URL: www.smi-online.co.uk/energy.asp

14-15 November 2000, Natural Gas Conference. Toronto, Ontario, Canada. Contact: Industrial Gas Users Association, Phone: 613-236-8021. Fax: 613-230-9531. Email: igua@magma.ca

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Conference Proceedings
19th North American Conference
Albuquerque, New Mexico, October 19-21, 1998

The Proceedings from the 19th Annual North American Conference of the USAEE/IAEE held in Albuquerque, New Mexico, are now available from USAEE Headquarters. Entitled *Technology's Critical Role in Energy and Environmental Markets*, the proceedings are available to members for \$85.00 and to nonmembers for \$105.00 (includes postage). Please complete the form below and mail together with your check to: Order Department, IAEE Headquarters, 28790 Chagrin Blvd., Suite 350 Cleveland, OH 44122, USA.

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Calendar (continued from page 23)

15-17 November 2000, National Association of Energy Service Companies (NAESCO) 17th Annual Conference. Palm Springs, California. Contact: Mary Lee Berger-Hughes, NAESCO. Phone: 202-822-0954. Fax: 202-822-0955. Email: mlb@dwgp.com

15-16 November 2000, Ziff Energy Group's Canadian Energy & E-Business Conference. Calgary, Alberta, Canada. Contact: Shelley Soles, Conference Director, Phone: 403-234-4284. Email: econference@ziffenergy.com URL: www.ziffenergyconferences.com

15-16 November 2000, Energy North Asia 2000. Seoul, Korea. Contact: IBC Asia Limited, No. 1 Grange Road, #08-02 Orchard Building, Singapore 239693, Phone: 65-732-1970. Fax: 65-733-5087. Email: julia.ho@ibcasia.com.sg URL: www.ibcasia.com/registryform.htm

16-17 November 2000, Moving Energy in the Northeast Markets. Montreal Quebec, Canada. Contact: Ken Truesdell, Phone: 604-244-1672. Fax: 604-244-1675. Email: info@zeco.org URL: www.zeco.org

20-30 November 2000, Predators and Prey in the Power Sector London, United Kingdom. Contact: Phone: 44-20-7252-2222. Fax: 44-20-7252-2272 Email: customer_services@smiconferences.co.uk URL: www.smi-online.co.uk/energy.asp

23-24 November 2000, 4th Annual Africa Downstream 2000. Johannesburg, South Africa. Contact: Global Pacific & Partners International, Houston. Phone: 281-597-9578. Fax: 281-597-9589. South Africa: Phone: 27-11-782-3189, Fax: 27-11-782-3188. Email: babette@global.co.za URL: www.glopac.com

27-28 November 2000, Oil & Gas Investments in Angola. Luanda, Angola. Contact: Andrei Zhirnov, The CWC Group. Phone: 44-20-7704-1126. Fax: 44-20-7704-8440 Email: azhirnov@thecwcgroup.com URL: www.thecwcgroup.com/angola

28-29 November 2000, Commercial Opportunities in the Energy Sector of Central & Eastern Europe. Budapest, Hungary. Contact: CCI, Ltd., 8 Charterhouse Buildings, London EC1M 7AN. Phone: 44-20-7490-3774. Fax: 44-20-7505-0079 Email: www.asi-conferences.com

29 November - 1 December 2000, NARUC-DOE North American Summit on Harmonizing Business Practices in Energy Restructuring. Dallas, Texas, USA. Contact: Ken Malloy, Center for the Advancement of Energy Markets (CAEM). Phone: 703-234-3375. Email: cgray@naruc.org URL: www.energymarkets.org/registration.htm

30 November - 1 December 2000, Responding to FERC Order 2000. Atlanta, Georgia, USA. Contact: The Center for Business Intelligence, LLC, 500 W Cummings Park, Ste. 5100, Woburn, MA 01801. Phone: 781-939-2490, Fax: 781-939-2490.

Email: cbireg@cbinet.com URL: www.cbinet.com

11-12 December 2000, The Deregulation of Spain's Energy Markets Madrid, Spain. Contact: Elizabeth McLaughlin, The CWC Group. Phone: 44-20-7704-6161. Fax: 44-20-7704-8440 Email: emcloughlin@thecwcgroup.com URL: www.thecwcgroup.com

13-14 December 2000, Sub Sea Technology. London, United Kingdom. Contact: Phone: 44-20-7252-2222. Fax: 44-20-7252-2272 Email: customer_services@smiconferences.co.uk URL: www.smi-online.co.uk/energy.asp

15-26 January 2001, Ninth International Training Program on Utility Regulation and Strategy Gainesville, Florida, USA. Contact: Dr. Sanford V. Berg, Public Utility Research Center, 205 Matherly Hall, PO Box 117142, Gainesville, FL 32611-7142. Phone: 352-392-6148. Fax: 352-392-7796. Email: purcecon@dale.cba.ufl.edu URL: www.purc.org

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14-15 March 2001, Keeping the Lights On: Electric Tradition or Innovation? Chatham House, London. Contact: Catherine O'Keeffe, Acting Head, Conference Unit, The Royal Institute of International Affairs, 10 St James's Square, London SW1Y 4LE, United Kingdom. Phone: 44-20-7957-5700. Fax: 44-20-7321-2045. URL: www.riia.org

20-22 March 2001, Electric Power 2001 Baltimore, Maryland, USA. Contact: Heather Haygood, Electric Power Conference & Exhibition, 1220 Blalock Road, Ste. 310, Houston, TX 77055. Phone: 713-463-9595. Fax: 713-463-9997. Email: event@electricpower.com URL: www.electricpowerexpo.com

24-29 March 2001, Middle East Petroleum & Gas Conference Dubai, UAE. Contact: Conference Connection Inc, PO Box 1736 Raffles City, Singapore 911758. Phone: 65-226-5280. Fax: 65-226-4117. Email: info@cconnection.org URL: www.cconnection.org

25-27 March 2001, 24th IAEE International Conference, 2001: An Energy Odyssey? Houston, Texas, USA. Contact: David Williams, IAEE/USAEE, 28790 Chagrin Blvd., Suite 350, Cleveland, OH 44022, USA. Phone: 216-464-5365. Fax: 216-464-2737. Email: iaee@iaee.org URL: www.iaee.org

24-27 July 2001, Increasing Productivity Through Energy Efficiency Tarrytown, New York, USA. Contact: American Council for an Energy Efficient Economy, 1001 Connecticut Avenue, NW, Ste. 801, Washington, DC 20036. Phone: 302-292-3966. URL: www.aceee.org

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