United States Association for Energy Economics

USAEE Dialogue

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PRESIDENT'S MESSAGE

We have made significant progress on a number of USAEE actions since the April ***Dialogue***. I will report below on the status of our USAEE mission statement, our long-term strategy efforts and our September North American conference.

First, however, allow me to digress on a recent personal experience and a corollary observation. Earlier this year, while on a business flight to Boston, I scanned the monthly publication the airlines provide to their customers. Appearing within was a discussion of Malcolm Gladwell's, The Tipping Point – How Little Things Can Make a Big Difference. (The book is currently on the Wall Street Journal's Business Best Selling Books list.) Subsequently, I purchased and read the book itself. I must say it is insightful and entertaining. The book is about social change and presents a 'new way' of understanding why change so often happens quickly and unexpectedly. Of particular interest to me was Gladwell's description of the central role that three personality types – connectors, mavens and salesmen - can play.

Focusing on connectors, Gladwell observes that "…just as there are people we rely upon to connect us to other people, there are also people we rely upon to connect us with new information." When I read this, I concluded that it describes USAEE to a "T". Over the years, USAEE has repeatedly provided me with extra value. If I have needed information on particular energy subjects, I had the option of either contacting a USAEE member that was an expert (a 'maven' in Gladwell's terms) or contacting one of USAEE's many 'connectors' who was able to provide the appropriate contact. I have come to appreciate this potential and I hope you have experienced similar benefits from your USAEE membership. I cannot say that other organizations do not also have 'connectors', but from my experience, USAEE and IAEE have a higher proportion of them.

During May, a USAEE draft mission statement was mailed to you for review. A number of you took the opportunity to comment. Most comments were favorable; several addressed style and some corrected our grammar. One message that came across both during the drafting process and from the comments was that many feel strongly that energy policy discussions should become a major focus for USAEE. As a result, 'energy policy' has been included explicitly in the mission statement. Further, we recognize that it will have to be addressed in Council's next major effort – developing a long-term strategy.

For your background, both USAEE and IAEE are engaged in long-term strategy efforts. USAEE and IAEE councils coordinate their efforts throughout the year. Peter Davies will report on the status of the IAEE strategy in the August issue of the Newsletter. Two major strategy efforts for USAEE this year have been the Membership Survey that Mike Lynch reported on in the April ***Dialogue***, and the USAEE Mission Statement that I have cited above. A third effort has been targeted marketing of the North American Conference to the groups and individuals that have entered the field of energy over the last several years. In the next ***Dialogue***, I will describe what strategic issues USAEE will be pursuing in 2001.

In the April ***Dialogue***, you received preliminary details on the major topics, etc. of our Transforming Energy conference in Philadelphia. The final details of the conference appear below. Everyone on the program committee has devoted significant effort in preparation and organizing. I want to take this opportunity to publicly thank them. I am sure that you will agree they have lined up an exceptionally qualified list of key session speakers. The response to our earlier solicitation for abstracts was robust and we will round out the program with some 20 paper sessions. I urge you to take advantage of the early registration discounts. I look forward to seeing you in September in Philadelphia.

David DeAngelo, President, USAEE

Editor's Corner

This issue of ***Dialogue*** includes excellent papers by Stephen P.A. Brown and Daniel Wolk, Murray Sim, David L. Williams, Jr., and Gerry Westbrook.

Messrs. Brown and Wolk address the question of "Natural Resource Scarcity and Technological Change" in an article which originally appeared in ***Economic and Financial Review***, a publication of the Federal Reserve Bank of Dallas. Jim Barlow of ***The Houston Chronicle*** reviewed this article and commented, "All the doomsayers use the same approach. They take past and present consumption and population levels and project them into the future. The math shows, without a doubt, that catastrophe will come. … New technology has always trumped the doomsayers and will do so as long as we turn to it. Remember that when someone rails against its use." (***Houston Chronicle***, June 2, 2000)

Murray Sim's article, "Stand and Deliver: Making Strategy Happen", provides insights into the internal struggles which many organizations are facing as they strive to adapt to new market structures, especially in electric markets.

Dave William's article, "Your Annual Conference: Dates, Rates, Space and Location", describes the complexities of organizing conferences such as our USAEE Annual Conference. There are many more issues to be considered than most of us recognize!

Gerry Westbrook provides additional information relative

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Editor's Corner *(continued from page 1)*

to the continuing debate relative to global climate change and the drivers of such change. This is a supplement to articles which Gerry provided for the December 1997 and April 1999 issues of ***Dialogue***. It's interesting to note that, in the mid-1970's, the major climate concern was the potential for dramatic cooling of the earth's climate. (Review the reprint of an article which appeared in ***Newsweek*** in 1975 at the ***National Post*** website at www.nationalpost.com / search / story.html?f=/ stories / 000621 / 323013.html.) Just as we now find the premise of dramatic climate cooling highly unlikely, we should view the current paranoia about global warming with similar cynicism.

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 sent via E-mail (proberts@alumni.rice.edu), by Fax (713-207-9962), 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 WEBSITE ***

USAEE is on-line. Come visit us at www.usaee.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 usaee@usaee.org if you have any suggestions on how to improve the site.

USAEE Student Scholarship Fund: A Call for Support

The USAEE is proud to continue its student scholarship fund, started in 1997 at the San Francisco North American Conference. 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 Orlando Conference, six conference registration fees were waived in an effort to share our conference experience, the field of energy economics and networking opportunities with 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:

American Petroleum Institute
Conoco, Inc.
Exxon Corporation
Joe Dukert
Jack Edwards

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 2000 North American meeting in Philadelphia, Pennsylvania, September 24-27. Scholarships range 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 Mine Yucel, USAEE Secretary-Treasurer at (p) 214-922-5160, (f) 214-922-5194, or mine.k.yucel@dal.frb.org or Dave Williams, USAEE Executive Director at (p) 216-464-2785, (f) 216-464-2768, or usaee@usaee.org

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

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 & Environmental Markets*, the proceedings are available to members for $85.00 and to non members 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
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Please send me ____ copies @ $85.00 each (member rate) $105.00 each (non member rate).
Total enclosed $_____ Check must be in U.S. dollars and drawn on a U.S. bank, payable to IAEE.

!!! MARK YOUR CALENDARS — PLAN TO ATTEND !!!

Transforming Energy

21st USAEE/IAEE Annual North American Conference – September 24-27, 2000
Philadelphia, Pennsylvania, USA – Wyndham Franklin Plaza Hotel

If you're concerned about the future of the energy industry and profession, this is one meeting you surely don't want to miss. The 21st USAEE/IAEE Annual North American Conference will detail current developments within the energy field so that you come away with a better sense of energy supply, demand and price. Five plenary sessions will be followed by concurrent sessions designed to focus attention on major sub-themes. Industry participants, bringing sharp focus to the emerging analytical challenges the industry faces, will lead these sessions. Ample time has been reserved for more in-depth discussion of the papers and their implications. Key sessions and themes of the conference are as follows:

New Vehicle Technologies and the Energy System: Sea Change or Pond Ripples?
Evolving Electricity Markets: From Ratebase to Revenue – The Roles of Technology Investment
Power, Fuels and E-Commerce: Maximizing Opportunities as Markets Converge
Paper Markets: Expanding their Scope and Impact on Energy Markets
Charting the Path: Forces and Forecasts

Economic upheaval, globalization, privatization and regulatory reform are having significant impacts on energy markets throughout the world. All of the major energy industries are restructuring through mergers, acquisitions, unbundling and rebundling of energy and other services. This conference will provide a forum for discussion of the constantly changing structure of the energy industries, with insights into the causes and likely outcomes of the restructuring efforts that are now underway.

At this time, confirmed speakers include the following:

William Babcock, Hagler Bailly	Janet Kremer, US Environmental Protection Agency	David Buckner, Southern Company Services
Amory Lovins, Rocky Mountain Institute	Louise M. Burke, New York Mercantile Exchange	James V. Mahoney, PG&E Generating
Carol. Butler, National Clean Cities	Ken Malloy, Center for the Advancement of Energy Markets	Thomas R. Casten, Trigen Corporation
David Marquardt, Enron Energy Information Solutions	Michael A. Crew, Rutgers University	Senator Frank H. Murkowski
Peter A. Davies, BP Amoco, plc.	Roger Naill, AES Corporation	Lawrence E. DeSimone, PPL EnergyPlus, LLC
Pat O'Loughlin, DP&L	Ron Erd, Southern Energy	Richard P. O'Neill, Federal Energy Regulatory Commission
Claude C. Gravatt, Jr., Department of Commerce	Bruce Radford, Public Utilities Reports, Inc.	Stephen Halliday, Wood Mackenzie
David Rodgers, US Department of Energy	Jamie Heller, PHB Hagler Bailly	Christopher Ross, Arthur D. Little
John B. Heywood, MIT	Fereidoon P. Sioshansi, Menlo Energy Economics	Youssef Ibrahim, BP Amoco, plc.
Edward Tirello, Deutsche Banc Alex Brown	James T. Jensen, Jensen Associates, Inc.	Scott Ungerer, EnergTech Capital Partners
Blake Johnson, Stanford University	Debbie Wernet, Coral Energy	Vincent Kaminski, Enron Corp.
John Wise, Mobil Research and Development Corp.	David Knapp, International Energy Agency	Kurt E. Yeager, Electric Power Research Institute

The final session of the conference may become a standard for the new millennium. Peter Davies, President of the International Association of Energy Economists and Chief Economist of BP Amoco Plc., will host a plenary session on "**Charting the Path: Forces and Forecasts**." Dr. Davies has invited experts from industry and academia to discuss what the new energy market may look like a decade from now, and provide their insight into what are expected to be the key drivers in the transformation. This session is expected to be particularly insightful as energy markets stand on the cusp of a technological revolution.

In addition, 25 concurrent sessions are planned to address timely topics that affect all of us specializing in the field of energy economics. Sessions include:

Fuels and Vehicles: Driving the System	Electric Markets: Wholesale and Retail Market Pricing	Environmental Challenges
The Road to Alternative Fuel Vehicles	Crude Oil: Evolving Market Behavior	International Developments: European Markets
Retail Competition – Delivering Value to Consumers	Natural Gas Markets: Transportation	Electric Markets: Transmission & Bulk Power Systems
International Developments Mexico/South America	International Developments: Middle East & Africa	Global Warming
Electric Markets: Restructuring Continues to Evolve	Electric Markets: Market Power	E-Commerce and the New Economy
International Developments: Japan, China & Asia	Natural Gas Markets: Supply	Energy and Economic Development

The 21st USAEE/IAEE Annual North American Conference provides a unique opportunity for leading experts from business, government, universities, and research institutions to discuss and debate the future of energy markets in this era of commodization, decentralization, and internationalization. The meeting will emphasize the applicability of the most recent, cutting-edge analysis for helping private and public organizations frame decisions and choose appropriate strategies.

Philadelphia, PA is a wonderful and scenic/tourist place to meet. Single nights at the Wyndham Hotel are $150.00 (contact the Wyndham Hotel at 215-448-2000, to make your reservations – ask for the USAEE/IAEE North American meeting room block). Conference registration fees are $500.00 for USAEE/IAEE members and $600.00 for non-members.

For additional information on this meeting visit www.usaee.org/conferences/index.asp or return the tear-off below for program materials to be sent direct to your attention.

Transforming Energy

21st Annual North American Conference of the USAEE/IAEE

Please send me further information on the 21st USAEE/IAEE North American Conference.

_____ *Registration Information* _____ *Sponsorship Information*

NAME: _____
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Email: usaee@usaee.org

Global Warming and the World's Oceans

Part II

*By Gerald T. Westbrook**

A previous essay, based on a paper given at the 1998 Offshore Technology Conference (OTC), was reported[1] on last year in ***Dialogue***. This current essay, is based on papers[2] given at the OTC in '99 and 2000 and will provide additional inputs on this issue. The following areas will be discussed:

- The Hydrosphere - Cloud Cover
- Sea level Rise - A new benchmark
- Ice Sheets, Ice Shelves and Sea Ice
- The Thermo-haline Circulation

The objective of this paper is to demonstrate that the global warming sciences are still very far from complete and are inadequate to base global treaties on. The consequence of ignoring the status of this science and proceeding ahead with a full implementation of the Kyoto Treaty will be noted.

The Hydrosphere

Cloud Cover, Cosmic Rays and the Sun

In previous writings, treatment of cloud cover was identified as one of the major weaknesses in the coverage of the hydrosphere. This section reviews this subject and it's amazing couple to cosmic rays.

The most studied solar phenomenon is that of sunspots. These appear 'freckle like" and represent areas where the temperature is lower than surrounding material due to presence of strong magnetic activity. They grow in number over a roughly 11 year solar cycle.

The 1999 OTC presentation reported on a link between sea surface temperature (SST) and solar activity. Several scientists research was reported on. For example Reid[3], in 1987 plotted 11 year running averages of global SST variation and sunspot number. The two curves look related and have enough similarity to lead one to speculate there is a couple. Newell[4], in 1989, noted that results from a harmonic analysis of global marine temperatures suggested a 22 year period related to the solar magnetic cycle. In 1996 White and Cayan[5] compared North Pacific SSTs versus a record of the 11 year solar irradiance cycle compiled by Lean and Foukal. Reaction: "They just nailed each other. You could not tell them apart". They found all three oceans were warming and cooling in time with the 11 year solar variations.

Reports on solar activity and climate change have continued in spite of criticism that the changes in solar irradiance, over the 11 year solar cycle (0.1% over a typical cycle) are too small to have any impact on climate. However the Earth's climate is a function of how solar radiation is handled by the Earth's systems. Any changes in the solar output and / or in the atmospheric composition, including cloud cover, will impact the energy balance and will have an impact on climate.

Leading Edge, but Controversial Science

One of the scientific accomplishments of the 1990s was the emergence of astrophysics as a key science on the global warming issue. Research has progressed with a multiplicity of hypothesis explored. There is controversy however in this area as reported in Table 1.

Table 1
Sources of Controversy on the Solar Climate Couple to Global Warming

1. The multiplicity of cycles and possible interactions is confusing (See Table 2).
2. Some of this work is being progressed on the non peer reviewed Internet.
3. Some proponents are convinced the changes are too small to have an impact.
4. Some proponents of the basic global warming theory are unwilling *to give this new kid on the block the time of day*.

Table 2
Solar Cycles and Potential Sources for a Solar Climate Couple

1. Change in solar irradiance over 11 year sunspot cycle.
2. Correlation of polar temperatures vs sunspot count when the Quasi Biennial Oscillation is in it's west phase only.
3. Change in the stratospheric ozone concentration.
4. Change in the UV portion of the solar spectrum over the sun-spot cycle.
5. Long term change in solar irradiance over cycles of 80 to 90 years.
6. Long term change in solar irradiance over cycles of 150 to 250 years. The Maunder Minimum. The Little Ice Age.
7. Changes in the sunspot cycle length.
8. Changes in the rotation rate of the Sun.
9. Changes in the magnetic flux in the Sun.
10. Earth's magnetic field. Polar drift.
11. Expansion / contraction of solar coronal holes over the 11 year sunspot cycle.
12. Changes in forces due to solar and planetary alignment.
13. Changes in cosmic rays, changes in penetration.
14. Changes in the Earth's magnetosphere.

The 1999 and 2000 OTC papers reported on an emerging area, namely the correlation between the Earth's cloud cover and galactic cosmic ray activity. The mechanism has been defined as follows:

+ Galactic cosmic rays (GCR) continuously bombard our atmosphere and catalyze the ionization of air and water molecules. These ionized species assist in cloud formation.
+ This cosmic ray penetration is modulated by the Sun's magnetic field and the Solar heliosphere. For example when the system is near a solar maximum, and with the solar magnetic field at a maximum, the cosmic ray penetration would be at a minimum and ionization would also be at a minimum.
+ In turn, cloud formation would be at a minimum. An observed variation in global cloud cover, of 3 - 4 %, was found[6] to be highly correlated with cosmic ray flux (See Figure 1). This in turn is inversely correlated with solar activity.

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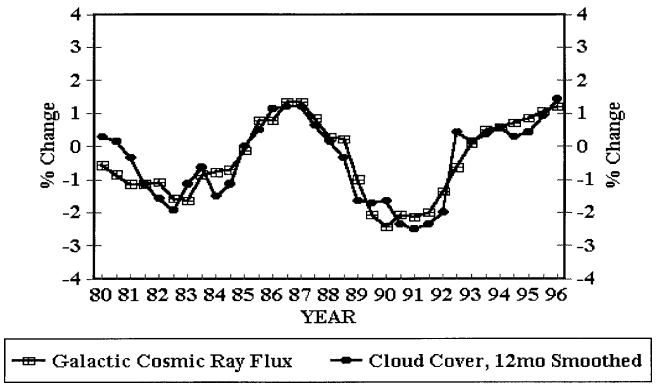
* Gerald T. Westbrook is the president of TSBV Consultants in Houston, TX. This paper is based in part on papers presented at the 1999 and 2000 Offshore Technology Conference. Those papers are copyrighted by the Offshore Technology Conference.

See notes at end of text.

Figure 1: %Ch in Clouds; Cosmic Rays

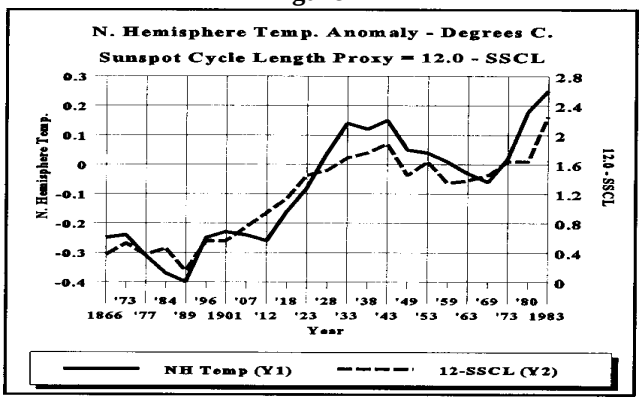


The report noted this cloud forcing is about four times that for solar irradiance. The T due to the 11 year solar changes has been reported as 0.1 ºC. The cloud forcing would add a second T of 0.3 - 0.5 ºC. Thus this combined effect has the potential of explaining all of the 0.3 - 0.6 ºC. surface temperature change of the past century.

Sunspot Cycle Length

This correlation between cosmic ray flux and cloud cover may also be of help in explaining the correlation between the sun spot cycle length (SSCL) and temperature. A comparison of these two variables was included in a 1997 USAEE paper[7]. It is included here for convenience, as Figure 2. The SSCL varies from about 9 years up to about 14 years. Stronger solar cycles will also tend to be shorter ones.

Figure 2

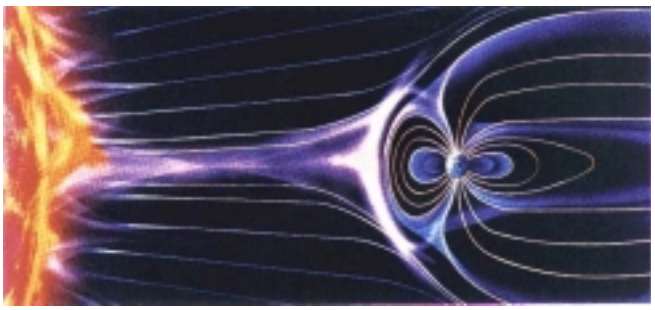


However, the correlation between SSCL and temperature has suffered due to lack of a well defined mechanism. The current work gives a hint on why it is relevant to our climate. The solar cycle can be viewed as a measure of the processes occurring within the sun, of admittedly unknown origin, which show themselves in the solar activity within the heliosphere that modulates GCR flux.

Status of Solar-Terrestrial Science

Besides sunspots and solar radiation, there are a variety of other solar attributes of import. These include solar flares, corona maximum ejections, the solar wind, the overall magnetic flux within the sun and finally the UV part of the solar spectrum. Research has indicated that this solar magnetic flux has more than doubled[8] this century. Since this activity is clearly coupled to sunspot activity and to the strength of the solar radiation hitting Earth, this flux could also be involved in the warming of our planet.

Figure 3
The Solar Wind and the Earth's Magnetosphere



Note Sun to Earth distance is severly distorted

In summary, astrophysicists see a multiplicity of evidence - from hard data to educated hunches - that our climate is impacted by solar, stellar and galactic phenomena. It must be fairly obvious that our understanding of the Solar magnetic flux, the behavior of the Sun's heliosphere, the Earth's magnetosphere and galactic cosmic rays are at the *embryonic* end of the investigation spectrum, not *the science is done* end.

Sea Level Rise

Background

The previous paper reported on an observed sea level rise (SLR) of 10 to 25 cms over the past century, and an estimated SLR of from -19 to +37 cms. Clearly these numbers spell out huge uncertainties in both our ability to measure SLR and to estimate it. Note that the ratio of the estimated range to the observed range is nearly 4 / 1. This does not give much confidence about the ability to predict the future.

A New Sea Level Benchmark

A recent development has come to light that raises the uncertainty level even higher for the observed values of sea level rise. A British Ordnance Survey Benchmark, engraved on a cliff in an Island near Port Arthur, Tasmania, has been recently uncovered[9]. This mark, known as the Ross-Lempriere mark[10] was chiseled into the cliff in 1841. It was found in 1985 and has been under study since then. This benchmark is believed to be the oldest known such mark in the world. Further it is positioned in possibly the most ideal location for such a reference point.

This benchmark is believed to represent the mean sea level in 1841, although there is some debate on this definition. It was based on about three years of very meticulous meteorological readings. It's significance today is that it is about 30 cms above the current mean sea level. An alternative definition (and one that does not seem to make much sense) was that it represented the high tide mark (or near high tide mark) on the day it was cut. If this latter definition holds it means the observed sea level has only come up about 8 cms versus the 10 - 25 cms noted earlier. On the other hand if this mark indeed turns out to be the mean sea level in 1841, it means the sea has not risen in the interval, but has actually decreased by this 30 cms. This is food for thought and surely raises the flag of uncertainty to new levels.

The Cryosphere

Three areas are singled out to illustrate the distortion that

(continued on page 6)

Global Warming *(continued from page 5)*

is continuously introduced into this discussion. These are the Larsen Ice Shelves, the West Antarctic Ice Sheet, and Arctic Sea Ice. The reader should note the difference[11] here between an ice shelf, an ice sheet and sea ice.

The Larsen Ice Shelf

This ice shelf is situated next to the Antarctic Peninsula, the body of land that stretches north towards the southern cone of Chile and Argentina. As an ice shelf, it is not grounded on the rocky basin of the Antarctic continent. Rather, it is floating on the ocean, but frozen tight to the peninsula.

There have been many articles about loss of a piece of the Larsen B Ice Shelf. One example was a report by the Washington Post, published in the Houston Chronicle. Consider the following emphasis by the Chronicle:

- Headline: *Antarctic Ice Shelf loses a big section*.
- Sub headline: *Break may be related to global warming*
- Box: *this may be the end for this ice shelf — there may only be a few more years before the whole sheet disintegrates*.

As a country that lives by the headline, this is the message that the vast majority of readers would capture. Yet if one digs into this article the writer states that, "*…it is unknown whether global warming caused the new break or it's predecessors*." It goes on to state that, "*…it is possible that internal ice dynamics could be a more important factor*." The reader has to get down to the fifth paragraph before learning that this breaking off of pieces of the Antarctic Ice Shelf has been going on for decades. (Indeed an EPA report[12] indicates that the ice reservoir in Antarctica is in a continuous state of flux. For the whole ice sheet the annual accumulation amounts to over 2000 billion tons, essentially balanced by 500 billion tons of melting and 1500 billion tons of iceberg calving.) Further down the article, the writer indicates this latest break, while 24 miles long and 3 miles wide, was nowhere close to the largest known break. Indeed, it was only 3% of the size of the largest known break. Further, one of the scientists quoted in the Washington Post story noted that the amount of the *ice shelf lost to breakage was less than one-tenth of 1 percent of the total ice cover in the area.*

WAIS - the West Antarctic Ice Sheet

A similar story exists on the treatment of studies on the WAIS. Compare, for example how Science magazine[13] rewrote the first sentence of a paper on the WAIS as the title. The headline was:

- *Rapid Sea-Level Rise Soon from WAIS Collapse?*

However the first sentence, as written by the scientist, was:

- *Will world wide sea level soon rise rapidly because of a shrinkage of the WAIS?*

In short, they converted a legitimate question to a conclusion with a "?" at the end. This totally changed the emphasis that a reader would obtain by a review of this paper.

Charles Bentley, the scientist / writer of this article, noted that the question of WAIS stability is one of major controversy. While a complete meltdown of the WAIS would indeed raise the sea levels by 16 to 19 feet, the key question is how likely is it that a rapid change of sufficient magnitude could occur over say the next 100 years or so. Such a rapid change could only come about via a massive instability in the ice sheet. Bentley concludes that "global warming, whether it is natural or anthropogenic based, is unlikely to affect the ice sheets any time soon. The small scale and short term changes seen on this ice sheet are too small — by at least two orders of magnitude — to have any serious effect on ice flow and sea level rise. A major catastrophe would be required on this ice sheet to have even a modest effect on world wide sea levels and there is no convincing evidence that such a catastrophe is imminent".

One of the more distressing aspects of this story is how little the public is made aware that an ongoing debate exists in the scientific community on this subject. It seems that the headlines always come down on the side of man made global warming as the villain. But the real cause of any instability could just as likely — no, more than likely — be natural, due to the presence of geothermal heat, miscellaneous hot spots, and even volcanos at the base of the ice-sheet. For example, there is a lake under the ice-sheet, called Lake Vostok[14]. This lake is 2½ miles below the ice surface. It is about the size of Lake Ontario and is very deep — over 1500 feet. The lake exists due to geothermal energy and possibly by frictional interactions with the ice-sheet under very high pressures.

It is the considered opinion of this writer that the odds are much higher that WAIS instability, if it exists, will turn out to be nature based. This conclusion is based on the remarks by Bentley above, by the conclusions of the IPCC95 report and by others[15,16]. The IPCC95 conclusions included that *estimation of the odds of collapse is not yet possible and if collapse ever occurs it will probably be due more to climate changes over the last 10,000 years rather to any contemporary global warming.*

Sea Ice

A third area of distortion is that of sea ice. The hype on sea ice comes in several forms. One writer will bemoan that sea ice is forming later than usual, or it is thinner than it used to be. Another one will note that sea ice is breaking up sooner each year. Another will report that sea ice extant is smaller. Finally others will note the presence of icebergs.

Now, all of the above may be true, but seldom, if ever, is this put into perspective. The fact that change has occurred in our climate, or in a very specific area of our climate, such as sea ice, is not news. Change has always occurred. Three examples are cited, from totally different time frames, to highlight this fact.

Table 3
Heinrich Events: Iceberg Armadas

Event	Range* of Dates KYBP	Notes
H6	66-70	
H5	50-54	
H4	36-40	
H3	27-28	
H2	21-24	
H1	14.5-16	
H0	11.5	This is the Younger-Dryas era , which is a Heinrich like event.

*Refers to range of estimate, not the duration of the event.

Example 1. 10KY to 100 KYBP. Geologic evidence indicate periods of massive iceberg discharges[17], called the Heinrich events, have occurred at least six times over this Last Glacial interval. These discharges (Table 3), where armadas of icebergs have flowed deep into the Atlantic, have occurred

over intervals from 16KYs down to 4KYs. In addition this evidence shows prominent increases in iceberg calving[18] occurring at shorter intervals of 2 to 3KYs.

Example 2. Current back to 20KYBP. This example is the location of the boundary, in the Atlantic Ocean, between water of Gulf Stream origin and the polar ocean current. The changes in the ocean surface are greatest at the boundaries of different currents and where there is a shift in the boundaries of ice on polar seas. The biggest temperature changes are found near the farthest advances of the cold water or ice.

A recent book[19] on climate changes presented a map of Europe showing the location of this boundary over time. Five different boundaries are noted in Table 4. These varied from 66ºN, falling between Greenland and Iceland, south to about the 40th N. latitude, due west of Portugal. Clearly, this boundary is subject to a multiplicity of variables, with ocean circulation in the forefront. It is of major importance to the climate of Europe.

Table 4
Variation in Boundary between the Gulf Stream and Key Arctic Currents

Time Period	Boundary at Long. 30ºW	Shape	Nearby Land at 10ºW
17-20 KYBP	41ºN	~Flat	W of Portugal
8,300 BC	51ºN	~45º	W of Scotland
7-8,000 BC	63ºN	~45º	S of Iceland
1675-1700AD	64ºN	~Flat	S of Iceland
20th Century*	66ºN	~45º	N of Iceland

* Defined as warmest years

Example 3. 1978 to 1998. This example reviews sea ice cover in the Odden area of the Greenland Sea, an area right at the interface between ice and water. More specifically it summarizes the magnitude of year to year changes in sea ice cover north of Iceland. It also raises a flag of caution when dealing with news items that simply contain a single percent change statistic.

The variation in sea ice coverage in the Greenland Sea / Odden Sea was recently reported[20] on. The sea cover varies from 2.4 to 29.4 Mkm^2 days. The percent change is even more dramatic, covering a range from -56.4% to 332.3%. Hence, percent change statistics over a single year or even a few years are meaningless without an understanding of the subject and the context the percent change represents.

The Thermohaline Circulation - The THC

As noted above, ocean circulation may well be involved in the status of sea ice. In turn, sea ice may influence ocean circulation. Other variables that may be involved would include SST, cloud cover, and melt water pulses to the oceans. It was also noted in the prior paper that we may be experiencing a shift towards a stronger Atlantic Ocean THC.

This is clearly an important area. The emergence of the crucial role of oceanography and the THC is surely equal to that of the emerging role of astrophysics in importance in understanding our climate. Indeed the overall weather for most of Europe is dependent on the THC. There seem to be very complex cycles involved here. For example, Broecker[21] noted that a seesawing of deep water production between the North Atlantic and the southern oceans may be at the center of the 1500 year ice-rafting cycle. He notes that *one of four tasks is to gain a better understanding of the Little Ice Age and its demise* and to confirm or refute that it was due to changes in the THC. Note that in Table 3, the Little Ice Age is included in a listing of 150 to 250 year cycles.

Do we understand why the THC has changed? Surely not in adequate detail. *Although short term variability in Atlantic climate is thought to be relatively well understood[21] both the patterns and the mechanisms of variability on decadal to century scales are as yet poorly known.*

Summary

The Year of the Hype

The year 2000 should see maximum hype on this subject. Consider some developments underway or scheduled. These are:

Event 1: Ad campaign.

Proponents are now in the midst of a $11 million advertising campaign to convince the masses that man-made global warming is real and deadly. This has included a major ad in Time amongst several initiatives. There appears to be an orchestrated effort underway to bring this issue, or some extreme weather event, to the evening TV news every day.

Event 2: IPCC Report release.

The new IPCC 2000 report will be released this year. The 1995 report[15], or more specifically the 1995 Executive Summary, turned out to be highly controversial. One can expect the 2000 report will also be controversial. It is very likely that key passages will be extracted and used over the balance of the year in the overall media campaign.

Event 3: COP6, The Hague, 11,13-24, 00.

Negotiations for the Kyoto Protocol were scheduled to end at COP6. It well may be that the build up to this meeting will be used as a litmus test for the acceptable candidate in an attempt to influence our election.

Event 4: The U. S. election.

This coming election may well be crucial for this issue. One can expect Al Gore will try and ride this issue into to the White House. Hence, expect this issue to play a prominent role in the presidential campaign. And that campaign will likely greatly exceed the current media program in volume and in hype. If Al Gore wins, one would suspect he would proceed with vigor to pursue a variety of initiatives on this issue. It is not out of the realm of possibility that this could lead to the formation of the *CPA - the climate protection agency*. In contrast if the Republicans win, this issue will revert to research status and the Kyoto Treaty itself would pass into history.

Conclusions

Climate scientists, reinforced by buoy, computer, satellite and other technologies, are beginning to understand their subject, but substantially more research is needed. Areas where new inputs have confirmed this view are summarized in Table 7.

(continued on page 8)

Global Warming *(continued from page 7)*

Table 7
Inputs: The Science is Not Done

Area	Comments
Clouds-Solar Couple	The spectrum of natural cycles in Table 2, along with our depth of knowledge in each one, would say we are at the starting blocks in this field.
Sea Ice	What caused the 6 to 16 KY events? What caused the 2 to 3 KY events? Are these coupled to the 1.5 KY ice rafting cycle?
Sea Level	The uncovering of the Ross- Lempriere bench mark increases uncertainty on the change over the past century.
The THC	One writer stated we need to gain a better understanding of the Little Ice Age and it's end. Another noted that the decadal to century scale forces that control the North Atlantic climate are poorly known.

Unfortunately, the global warming debate boils down to a horse race between the patient, professional practice of science versus the hegemony of the fear peddlers. Some say that the science of global warming is done and it is time to move on to policies, treaties, legislation and regulations. On the other hand there is a growing body of skeptics who believe the scientific base to this issue is surely very incomplete and most likely very weak. One suspects this issue's staying power is more in the political science area and less in the physical sciences area.

Even if one accepted that the status of the global warming science was adequate to move on, the current policy pathway advocated, namely the Kyoto Treaty, is seriously flawed. As noted[23,24] in 1999, a perfect Kyoto would reduce forecasted warming by only 0.07°C by 2050 and another 0.13°C by 2100. These are trivial values and are surely values that are not even measurable. Yet the proponents expect society to invest billions, maybe even trillions on this issue without any hope of knowing if these investments are ever doing any good.

Nomenclature

CPA - A hypothetical new federal agency - - - The Climate Protection Agency Agency?
COP - Council of Parties (Rio Convention).
EPA - Environmental Protection Agency.
GCR - Galactic cosmic rays.
IPCC - Intergovernmental Panel on Climate Change.
KY - Kilo Years.
KYBP - Kilo Years Before Present.
OTC - Off Shore Technology Conference.
SLR - Sea Level Rise.
SSCL - Sun Spot Cycle Length.
SST - Sea Surface Temperature.
THC - Thermohaline Circulation.
WAIS - West Antarctic Ice Sheet.
UV - Ultra Violet radiation.

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10. Thomas Lempriere was the Deputy Comm. General of Her Majesty's Penal Colony at Port Arthur, Tasmania for several years prior to 1841. Part of his duties included preparing daily records of the weather and tide. He had, as a result of this activity, become an amateur meteorologist and developed a reputation for his precision and diligence. Sir James Ross, a famous Antarctic explorer (the Ross Sea in Antarctica was named after him) and commander of important exploration ships, spent 2 - 3 months in Tasmania in 1841, and met frequently with Lempriere. In the course of their meetings they developed a project to make a permanent standard Ordnance Survey Benchmark. J. L. Daly believes this mark would be at the mean sea level, as no other level would have anywhere near the relevance. Others believe it was the high tide mark.

11. The reader should note the difference here between three types of ice in the cryosphere. These are:

Ice sheet - represents the complete ice reservoir over land. This represents nearly 90% of the Antarctic reservoir area and over 97% of the ice volume.

Ice shelf - ice floating at the edge of, but attached to an ice sheet and/or the land mass. Further, melting of an ice shelf would contribute zero to any sea level rise as ice shelves are already displacing an equal volume of water.

Sea ice - ice floating, but now it is not attached to an ice sheet or to land, but free to move with the currents.

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(continued on page 24)

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Natural Resource Scarcity and Technological Change

*By Stephen P. A. Brown and Daniel Wolk**

In 1972, an interdisciplinary research group called the Club of Rome predicted worldwide catastrophe by 2050 (Meadows et al. 1972). They based their prediction on three trends they thought they observed: increasing scarcity of nonrenewable natural resources, increasing environmental degradation, and continuing population growth. They saw the combination of these trends as unsustainable and economic misery as inevitable.

The Club of Rome was not original in its pessimism about the future. English economist Thomas R. Malthus raised similar concerns in 1798. His analysis led him to conclude that misery was the inevitable state of humans (Malthus 1798). According to Malthus, if per capita income were above subsistence, population would expand until per capita income was reduced to subsistence level. (See the side bar entitled "An Overview of Malthus' Principle of Population.") At the time Malthus was writing—the early stages of the Industrial Revolution—poverty was widespread in English cities, so perhaps his pessimism was understandable.

Fortunately for us, Malthus was wrong. Since at least the late 1800's, per capita income in Western society has generally increased. Technological change occurred at a rapid pace, causing per capita income to rise even as the population grew. In fact, per capita income rose so much, the Club of Rome's pessimism seems hard to understand, except that Malthus' original analysis did not take into account natural resource scarcity or environmental degradation.

This essay examines whether the potential scarcity of nonrenewable natural resources is a reason for concern. Previous research (Barnett and Morse 1963, Jorgenson and Griliches 1967, Nordhaus 1973, Brown and Field 1978, Fisher 1979, Hartwick and Olewiler 1986, and Schmidt 1988) is mixed, but it generally has found that the economic evidence is inconsistent with the increasing scarcity of nonrenewable natural resources. In fact, technological change driven by free market forces has increased natural resource availability. Given the time elapsed since the previous research was conducted, however, it is appropriate to reexamine the evidence.

What is a Natural Resource Scarcity?

Nonrenewable natural resources, such as aluminum and crude oil, exist in fixed amounts on Earth. When we use up all the crude oil on the planet, we will have no more of this resource. In addition, we tend to use the most easily obtainable natural resources first. Over time, natural resources become more difficult to extract. For example, at the beginning of the California gold rush, people were picking up gold off the ground.

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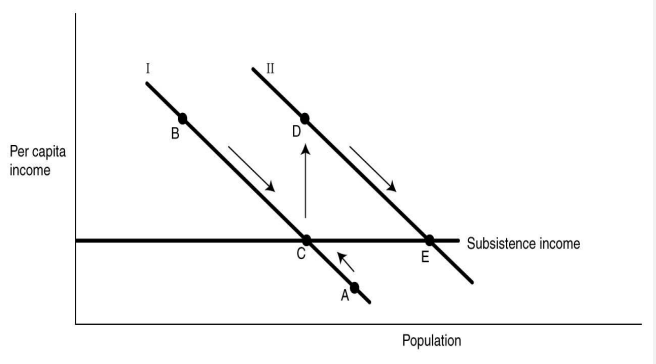
An Overview of Malthus' Principle of Population

Malthus thought an increase in population would reduce per capita income. His conclusion followed from the law of diminishing marginal productivity: as population increases, each worker has less land with which to work. Curve I in the figure represents this proposition for a given amount of land and level of technology. Curve II represents this proposition for a higher level of technology and/or greater acreage. The subsistence level of income is also represented in the figure.



For a given amount of land and level of technology, Malthus argued that a population would tend toward a subsistence level of income. If per capita income were below the subsistence level (as illustrated by point A on curve I), starvation would reduce the population. If per capita income were above the subsistence level (as illustrated by point B on curve I), people would have more children and population would grow. In either case, population would adjust until income just reached the subsistence level (at point C on curve I). Therefore, he concluded that misery was the inevitable state of humankind. This conclusion is often referred to as the "dismal theorem" and may be the historical basis for calling economics "the dismal science."

Malthus' analysis is similar to that now made by ecologists studying animal populations and ecosystems. For example, if the deer population is smaller than a given ecosystem can support, the deer will reproduce and multiply in number. If the population is greater than the ecosystem can support, the weak will die off and the population will be reduced. The deer population tends toward a subsistence level of nutrition.

Malthus further argued that—without moral restraint in human reproduction—improved technology or increased resources would only increase human misery in the long run. An increase in technology or land temporarily increases well-being (as shown by a shift from point C on curve I to point D on curve II). Eventually, however, the increased capacity of the economy will lead to population growth, which will only be checked when per capita income reaches subsistence (point E on curve II). Hence, Malthus concluded that increased technology or land availability would result in more people living at subsistence, not an improvement in living conditions. This conclusion is often referred to as the "utterly dismal theorem."

[1] See notes at end of text.

Toward the end of the gold rush, they were blasting the mountains with water, using much more capital and labor.

Geophysical scarcity may be irrelevant, however, if technological change increases resource availability. Consequently, economists prefer to measure scarcity in economic terms—that is, through market prices. Economists are interested in whether the prices of nonrenewable natural resources reflect increasing scarcity. In other words, are the real prices of natural resources rising to reflect increasing scarcity?

The economics perspective can be illustrated by examining a production function for the overall economy:

$$(1) \qquad Q = Q(K, L, NR)$$

where Q is output, K is capital, L is labor, and NR is natural resource use.[1] We expect normal economic conditions for production, which mean a positive marginal product for each input:

$$(2) \qquad \frac{\partial Q}{\partial K} > 0, \quad \frac{\partial Q}{\partial L} > 0, \quad \frac{\partial Q}{\partial NR} > 0.$$

For each input, output increases with its use, as is shown by the positive first derivative.

Normal economic conditions for production also mean a diminishing marginal product for each input:

$$(3) \qquad \frac{\partial^2 Q}{\partial K^2} < 0, \quad \frac{\partial^2 Q}{\partial L^2} < 0, \quad \frac{\partial^2 Q}{\partial NR^2} < 0.$$

For each input, output increases at a decreasing rate with increased use of the input, as is shown by the negative second derivative.

Economic theory also suggests how the increased provision of capital, labor, and natural resources affects the productivity of each other input. For instance, the productivity of capital and labor is expected to increase as natural resource use increases:

$$(4) \qquad \frac{\partial^2 Q}{\partial K \partial NR} > 0, \quad \frac{\partial^2 Q}{\partial L \partial NR} > 0.$$

In words, the marginal product of capital and the marginal product of labor increase when more of the natural resource is used.

Similarly, the productivity of the natural resources increases if either capital or labor increases:

$$(5) \qquad \frac{\partial^2 Q}{\partial NR \partial K} > 0, \quad \frac{\partial^2 Q}{\partial NR \partial L} > 0.$$

In words, the marginal product of natural resources is greater when either more capital or more labor is used.

If we take increasing natural resource scarcity to mean natural resource availability decreases over time, then as capital and labor grow the production conditions described above can explain the economic manifestation of natural resource scarcity and why it might be expected to limit economic growth. The conditions expressed in inequalities 4 and 5 show that if natural resource use declines while capital and labor grow, the marginal productivity of natural resources will rise and the marginal productivity of capital and labor will fall. Hence, increasing natural resource scarcity would imply that natural resource prices rise relative to wages and the return to capital.

The economic conditions described above also suggest that in a world without technological change, output cannot keep pace with population growth unless natural resource use and capital grow at the same rate. In fact, if natural resource use grows more slowly than capital and labor—as greater natural resource scarcity would imply—output must grow more slowly than capital and labor unless there is technological change.

Another Perspective on Natural Resource Scarcity

Hotelling (1931) develops a model to explain how the prices of nonrenewable natural resources—such as oil, natural gas, coal, copper, nickel, bauxite, zinc, and iron—would evolve over time in the absence of technological change. Hotelling's analysis exploits the proposition that the quantity of nonrenewable resources is fixed. The consumption of the resource today reduces the amount available for future consumption, and the owner of such a resource must decide how to distribute its use over time.

In an economy in which other investments earn a market rate of interest, individuals saving nonrenewable natural resources for future periods also must expect to earn the market interest rate (including the appropriate risk premium). If the expected return to saving a nonrenewable natural resource for future periods is less than the market interest rate, managers of that resource will save less of it for the future. This will make the resource more plentiful today and less plentiful in the future, which will lower today's price, raise future prices, and increase the expected return to saving the resource for future periods.

On the flip side, if the expected return is greater than the market interest rate, managers will save more of the resource for future periods, making it less plentiful today and more plentiful in the future. This will raise today's price, lower future prices, and decrease the expected return to saving the resource for the future. Only when the expected return is equal to the market interest rate will managers of the resource consider their production plans finalized. Under these conditions, the difference between the price and marginal cost of producing a nonrenewable natural resource will rise at the market interest rate unless production costs are affected by resource depletion (Solow 1974):

$$(6) \qquad P_{NR,t} = C_{NR,t} + \lambda e^{rt},$$

where $P_{NR,t}$ and $C_{NR,t}$ are the price and marginal cost of producing the natural resource at time t, respectively, r is the market interest rate, and λe^{rt} is the value of holding an additional unit of the resource off the market until a future period (a practice economists call "user cost"). The relationship described by Equation 6 is commonly called the "Hotelling rule."

With $C_{X,t}$ representing the effects of cumulative production on the cost of producing the natural resource at time t, Peterson and Fisher (1977) show

$$(7) \qquad \dot{\lambda} = -e^{-rt} C_{X,t},$$

which means λ is constant over time and the user cost grows at the interest rate unless production costs change with

(continued on page 12)

Natural Resource Scarcity *(continued from page 11)*

cumulative extraction ($C_{X,t} \neq 0$). If production costs rise with cumulative extraction ($C_{X,t} > 0$), the user cost rises more slowly than the interest rate.[2] The price of the natural resource is expected to rise over time, however, whether or not production costs rise with cumulative extraction ($C_{X,t} \geq 0$).[3]

Financial markets and forecasts of future prices are generally consistent with theory reflecting expectations that prices for nonrenewable natural resources will rise over long periods of time.[4] In fact, the Hotelling rule is best interpreted as a market efficiency condition describing how current and expected future prices for these resources are simultaneously determined by current market conditions and expectations about future market conditions. For nonrenewable natural resources, current prices and expectations about future prices depend on the information and technology available at the time.

Market-Induced Technological Change

As demonstrated above, if a nonrenewable natural resource is expected to become more scarce in an economic sense, its price will be expected to rise. In a market system, expectations of higher prices increase the incentive to find new technology that will offset geophysical scarcity. When they expect higher prices, consumers have an incentive to look for new technology that lets them use less of a natural resource. When they anticipate higher production costs, producers have an incentive to develop new technology to lower costs. In short, the very mechanism that signals increasing economic scarcity of a nonrenewable resource helps stimulate the technological change that will offset that scarcity.[5] Whether technology advances rapidly enough to prevent a rise in the prices of the resources, however, is a question best left to the evidence.

What is the Evidence?

The conditions described above form a basis to test whether nonrenewable natural resources are becoming more scarce in an economic sense or whether technological advance is making them more plentiful. Rising real prices for nonrenewable natural resources would provide evidence that technological advance has not offset increased geophysical scarcity; constant real prices would indicate that technological advance has just offset increased scarcity; and falling real prices would signify that technological advance has more than offset increased geophysical scarcity.

In this article, we examine trends in the real prices of twelve nonrenewable natural resources—aluminum, anthracite coal, bituminous coal, copper, iron, lead, natural gas, nickel, crude oil, silver, tin and zinc—and one basic manufactured product, steel, to determine whether technological change is outpacing geophysical scarcity for nonrenewable natural resources. To obtain real prices from the nominal ones, we deflate the time series in two ways. The first method, suggested by the Hotelling rule and used by Fisher (1979) and Hartwick and Olewiler (1986), uses an overall price index, such as the U.S. Consumer Price Index (CPI), to deflate the prices of individual natural resources. This approach is the standard method for converting nominal prices to real prices and provides a conservative estimate of the extent to which technological progress has reduced the scarcity of nonrenewable natural resources.

The second method, suggested by the production function and used by Nordhaus (1973), deflates the prices of individual natural resources with the average manufacturing wage. This approach shows how much human effort is required to produce a given commodity and provides an aggressive estimate of the extent to which technological progress has offset resource scarcity.

An Overview of the Price Data

Under the conservative approach of deflating natural resource commodity prices by the CPI, most series generally decline, as shown in Table 1.[6] All but three of the commodities—anthracite coal, natural gas, and tin—had lower real prices in 1998 than they did in the first year for which data are available. In 1998, the prices of anthracite coal and tin were 22.07 percent and 9.43 percent above their respective initial values. The price of natural gas was 157.2 percent above its 1919 value. The prices of steel and bituminous coal were 0.44 percent and 3.68 percent below their initial values, respectively. The prices for the remaining eight commodities declined by more than 40 percent from the first year for which we have data to 1998. Most notable are nickel and aluminum prices, which in 1998 were

Table 1
Natural Resource Prices Deflated by the Consumer Price Index

	Year													
Commodity	**1870**	**1880**	**1890**	**1900**	**1910**	**1920**	**1930**	**1940**	**1950**	**1960**	**1970**	**1980**	**1990**	**1998**
Aluminum	*	*	*	55.71	33.92	23.21	20.27	18.96	10.46	12.48	10.51	13.12	8.20	5.87
Anthracite coal	100.00	87.95	91.90	103.42	117.74	140.26	177.33	164.84	214.19	152.98	161.58	298.63	177.85	122.07
Bituminous coal	100.00	81.90	69.67	79.04	76.00	118.75	64.60	86.40	128.07	100.89	102.92	224.38	135.58	96.32
Copper	100.00	132.27	103.56	116.08	82.45	52.28	47.43	49.21	53.65	65.35	89.50	73.52	57.43	29.64
Iron	100.00	112.49	79.15	91.99	71.52	93.41	47.98	71.10	86.47	98.13	83.42	113.36	*	*
Lead	100.00	105.67	102.15	107.87	96.31	81.72	67.42	75.88	113.06	82.23	82.74	105.46	73.34	58.38
Natural gas	*	*	*	*	*	97.78	94.86	66.87	56.26	98.50	91.76	401.75	277.63	257.20
Nickel	100.00	97.25	71.47	59.38	42.41	20.78	20.78	24.74	18.53	24.77	32.93	35.58	31.05	13.11
Oil	100.00	31.91	28.08	46.86	21.45	50.37	23.43	23.91	34.27	31.96	26.92	86.05	51.30	22.52
Silver	100.00	113.30	111.11	70.86	55.10	48.57	21.71	23.81	29.32	29.31	43.48	238.64	35.83	30.64
Steel	*	*	*	162.63	128.97	125.84	87.37	129.27	121.53	161.71	151.56	165.62	134.21	99.56
Tin	*	100.00	110.51	166.75	169.80	112.24	88.39	165.32	184.67	159.39	208.72	477.54	140.11	109.43
Zinc	100.00	102.96	110.58	95.54	104.69	70.57	49.94	81.43	104.66	79.56	71.42	82.20	105.35	58.67

*All commodities indexed to 1870=100 except aluminum (1895=100), natural gas (1919=100), steel (1897=100), and tin (1880=100).

SOURCE: Authors' calculations using data from Bureau of Labor Statistics, Department of the Interior, Department of Energy, and Manthy (1978).

Table 2
Natural Resource Prices Deflated by Manufacturing Wages

Commodity	Year 1870	1880	1890	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	1998
Aluminum	*	*	*	55.71	29.99	15.19	11.06	7.24	3.14	2.94	2.19	2.67	1.75	1.24
Anthracite coal	**100.00**	67.12	65.30	68.04	68.49	60.40	63.64	41.41	42.33	23.70	22.14	40.05	24.92	16.98
Bituminous coal	**100.00**	62.50	49.50	52.00	44.21	51.14	23.18	21.70	25.31	15.63	14.10	30.09	19.00	13.39
Copper	**100.00**	100.94	73.58	76.37	47.96	22.51	17.02	12.36	10.60	10.12	12.26	9.86	8.05	4.12
Iron	**100.00**	85.85	56.24	60.52	41.61	40.22	17.22	17.86	17.09	15.20	11.43	15.20	*	*
Lead	**100.00**	80.65	72.58	70.97	56.03	35.19	24.19	19.06	22.35	12.74	11.34	14.14	10.28	8.12
Natural gas	*	*	*	*	*	96.78	78.25	38.61	25.56	35.08	28.90	123.85	89.41	82.21
Nickel	**100.00**	74.22	50.78	39.06	24.67	8.95	7.46	6.21	3.66	3.84	4.51	4.77	4.35	1.82
Oil	**100.00**	24.35	19.95	30.83	12.48	21.69	8.41	6.01	6.77	4.95	3.69	11.54	7.19	3.13
Silver	**100.00**	86.47	78.95	46.62	32.05	20.92	7.79	5.98	5.80	4.54	5.96	32.00	5.02	4.26
Steel	*	*	*	162.63	114.04	82.37	47.66	49.36	36.51	38.08	31.57	33.76	28.58	21.04
Tin	*	100.00	102.88	143.75	129.43	63.33	41.56	54.41	47.83	32.36	37.48	83.92	25.72	19.94
Zinc	**100.00**	78.57	78.57	62.86	60.90	30.39	17.92	20.45	20.68	12.33	9.79	11.02	14.76	8.16

*All commodities indexed to 1870 = 100 except aluminum (1895 = 100), natural gas (1919 = 100), steel (1897 = 100), and tin (1880 = 100).
SOURCE: Authors' calculations using data from Bureau of Labor Statistics, Department of the Interior, Department of Energy, and Manthy (1978).

13.11 percent and 5.87 percent of their initial real prices, respectively.

Under the more aggressive approach of deflating natural resource commodity prices by manufacturing wages, we see stronger evidence of downward trends, as shown in Table 2. By 1998, all the commodities had lower real prices than they did in the first year for which data are available, and over half the commodities had prices that were less than one-tenth of their initial values. The 1998 prices of anthracite coal, natural gas, and tin, which show gains in the CPI-adjusted series, were 16.98 percent, 82.21 percent, and 19.94 percent of their initial values, respectively. The real 1998 prices of steel and bituminous coal stood at 21.04 percent and 13.39 percent of their initial values, respectively. The prices of nickel and aluminum were 1.82 percent and 1.24 percent of their first reported prices.

Because commodity prices vary over the business cycle, we also analyze data that coincided with peaks of both U.S. and world business cycles. We find substantially similar price trends to those reported in Tables 1 and 2.

Table 3
Estimated Trends in Natural Resource Prices Deflated by the CPI, 1870-1998

Commodity	Constant	Trend growth rate
Aluminum	0.73**	-0.022**
Anthracite coal	1.75**	0.007**
Bituminous coal	1.26**	0.006**
Copper	-0.54**	-0.007**
Iron	4.65**	0.001
Lead	-1.75**	-0.003**
Natural gas	-3.34**	0.020**
Nickel	0.98**	-0.012**
Oil	1.16**	0.001
Silver	1.05**	-0.007**
Steel	1.50**	0.002**
Tin	-0.26**	0.006**
Zinc	-1.67**	-0.003**

** Denotes significance at the 95 percent confidence level.
SOURCE: Authors' estimates using data from the Bureau of Labor Statistics, Department of the Interior, Department of Energy, and Manthy (1978).

Table 4
Estimated Trends in Natural Resource Prices Deflated by Manufacturing Wages, 1870-1998

Commodity	Constant	Trend growth rate
Aluminum	1.71**	-0.041**
Anthracite coal	2.66**	-0.012**
Bituminous coal	2.18**	-0.012**
Copper	0.38**	-0.025**
Iron	5.65**	-0.019**
Lead	-0.83**	-0.022**
Natural gas	-2.64**	0.004
Nickel	1.89**	-0.031**
Oil	2.08**	-0.017**
Silver	1.97**	-0.025**
Steel	2.48**	-0.017**
Tin	0.67**	-0.013**
Zinc	-0.75**	-0.021**

** Denotes significance at the 95 percent confidence level.
SOURCE: Authors' estimates using data from the Bureau of Labor Statistics, Department of the Interior, Department of Energy, and Manthy (1978).

Econometric Tests of Resource Scarcity: 1870-1998

Although prices for most nonrenewable natural resources generally fell from the first year for which data are available, they also exhibited considerable volatility. Over short periods, price data may reflect a number of market conditions other than resource scarcity and technological advance, such as monopolization, cartelization, taxation, and regulation. To abstract from possible short-term fluctuations, we test for time trends in the prices of resources, using annual data from 1870 through 1998 as follows:[7]

$$\ln P_i = \alpha_i + \beta_i t + e_{t,i} \quad (8)$$

for each nonrenewable natural resource i, where P_i is the real price of resource i, t is time, $\hat{\alpha}_i$ and $\hat{\beta}_i$ are parameters to be estimated, and $e_{t,i}$ is a normally distributed error term. As before,

(continued on page 14)

Table 5
Estimated Trends in Natural Resource Prices Deflated by the CPI, 1870-1945 and 1946-1998

1870-1945 Commodity	Constant	Trend growth rate	1946-1998 Commodity	Constant	Trend growth rate
Aluminum	1.32**	-0.033**	**Aluminum**	-0.48**	-0.010**
Anthracite coal	1.64**	0.010**	**Anthracite co**	2.39**	0.000
Bituminous coal	1.43**	0.000	**Bituminous c**	1.29**	0.006**
Copper	-0.26**	-0.016**	**Copper**	-0.41*	-0.007**
Iron	4.92**	-0.008**	**Iron**	3.82**	0.012**
Lead	-1.71**	-0.006**	**Lead**	-0.37*	-0.016**
Natural gas	-0.22	-0.028**	**Natural gas**	-5.55**	0.041**
Nickel	1.54**	-0.030**	**Nickel**	-0.51*	0.003
Oil	1.52**	-0.010**	**Oil**	0.49	0.009**
Silver	1.60**	-0.024**	**Silver**	-0.50	0.009**
Steel	1.84**	-0.006**	**Steel**	1.80**	-0.001
Tin	-0.25**	0.005**	**Tin**	0.50	-0.001
Zinc	-1.54**	-0.007**	**Zinc**	-1.53**	-0.004**

** Denotes significance at the 95 percent confidence level.
* Denotes significance at the 90 percent confidence level.
SOURCE: Authors' estimates using data from Bureau of Labor Statistics, Department of the Interior, Department of Energy, and Manthy (1978).

Natural Resource Scarcity *(continued from page 13)*

we measure real prices for each of the thirteen commodities by two methods—deflating with the CPI and deflating by average U.S. manufacturing wages.

Estimating Equation 8 for the more conservative, CPI-adjusted data yields mixed results, as shown in Table 3. Prices for five of the commodities—anthracite coal, bituminous coal, natural gas, steel, and tin—show significant positive annual trend rates of growth, varying from a low of 0.2 percent for steel to a high of 2 percent for natural gas. Prices for iron and crude oil show no significant trends. Prices for the other six commodities—aluminum, copper, lead, nickel, silver, and zinc—show significant negative annual trend rates of growth, varying from -0.3 percent for lead and zinc to -2.2 percent for aluminum.

Estimating Equation 8 for the more aggressive, wage-adjusted data yields stronger declines in commodity prices, as shown in Table 4. With the exception of natural gas, all the commodity price indexes show significant negative trends. Annual rates range from -1.2 percent for anthracite and bituminous coal to -4.1 percent for aluminum. Natural gas has no significant trend.

To control for potential variation of commodity prices over the business cycle, we also estimate Equation 8 by including measures of world and U.S. GDP. Although business cycles are shown to be significant in a few of the real commodity prices, the signs and significance of the trend coefficients are substantially similar to those in Tables 3 and 4.

Econometric Tests of Resource Scarcity: Subperiods

When working with such a long time series, breaks in the trends are possible. Casual observation suggests the possibil-

Table 6
Estimated Trends in Natural Resource Prices Deflated by Manufacturing Wages, 1870-1945 and 1946-1998

1870-1945 Commodity	1946-1998 Constant	Trend growth rate	Commodity	Constant	Trend growth rate
Aluminum	2.59**	-0.057**	**Aluminum**	-0.71**	-0.017**
Anthracite coal	2.58**	-0.008**	**Anthracite co**	2.16**	-0.007**
Bituminous coal	2.36**	-0.017**	**Bituminous c**	1.07**	-0.001
Copper	0.68**	-0.034**	**Copper**	-0.64**	-0.014**
Iron	5.85**	-0.026**	**Iron**	4.32**	-0.003
Lead†	Lead†				
Natural gas	1.37**	-0.057**	**Natural gas**	-5.78**	0.033**
Nickel	2.48**	-0.048**	**Nickel**	-0.74**	-0.004*
Oil	2.45**	-0.028**	**Oil**	0.26	0.001
Silver	2.53**	-0.042**	**Silver**	-0.73*	0.002
Steel	3.14**	-0.030**	**Steel**	1.57**	-0.008**
Tin†	Tin†				
Zinc	-0.61**	-0.025**	**Zinc**	-1.75**	-0.011**

** Denotes significance at the 95 percent confidence level.
* Denotes significance at the 90 percent confidence level.
† Authors chose not to estimate this series in two periods because there was no break in trend.
SOURCE: Authors' estimates using data from Bureau of Labor Statistics, Department of the Interior, Department of Energy, and Manthy (1978).

Table 7
Summary of Trends in the Real Prices of Nonrenewable Natural Resources

Commodity	Whole perio	Post-World War II
Aluminum	Falling	Falling
Anthracite coal	Rising to falling	Unchanged to falling
Bituminous coal	Rising to falling	Rising to unchanged
Copper	Falling	Falling
Iron	Unchanged to falling	Rising to unchanged
Lead	Falling	Falling
Natural gas	Rising to unchange	Rising
Nickel	Falling	Unchanged to falling
Oil	Unchanged to falling	Rising to unchanged
Silver	Falling	Rising to unchanged
Steel	Rising to falling	Unchanged to falling
Tin	Rising to falling	Rising to falling
Zinc	Falling	Falling

SOURCE: Authors' estimates using data from the Bureau of Labor Statistics, Department of the Interior, Department of Energy, and Manthy (1978).

ity of such breaks for most price series around the end of World War II. To test formally for breaks in the individual series, we conduct Chow tests using data from 1870 through 1945 in the first period and 1946 through 1998 in the second period.[8] The results show that, at the 95 percent confidence level, every price series, except lead and tin deflated by manufacturing wages only, has a significant break between 1945 and 1946.

Armed with this information, we repeat the econometric exercises described in Equation 8 for two periods—from 1870 through 1945 and from 1946 through 1998. For most of the commodities, strong downward trends in prices are found from 1870 through the end of World War II, but price declines moderate or reverse in the postwar era.

With the CPI-deflated commodity prices, ten of the thirteen pre-1946 series trend downward (Table 5). Anthracite coal and tin trend upward, and bituminous coal shows no price trend. After 1945, however, price declines moderate. Five of the commodity price series show significant positive trends, four show no significant trend, and four show significant negative trends.

With the wage-deflated commodity prices, all eleven of the pre-1946 series trend downward (Table 6). As with the CPI-adjusted data, price declines moderate after 1945. Four of the commodity price series show no significant trend, and six show significant negative trends. Only natural gas shows a significant positive trend after 1945.

As we did for the entire sample period, we control for potential variation of commodity prices over the business cycle in the subperiods using measures of both world and U.S. GDP. Although business cycles are significant in a few commodity prices, the signs and significance of the trend coefficients are substantially similar to those in Tables 5 and 6.

Econometric Tests of Resource Scarcity Reconsidered

Econometric tests conducted for the entire period or subperiods generally suggest similar results for samples that include the post-World War II data. Using the more conservative CPI-adjusted data, we find that real prices for some nonrenewable natural resources have positive trends while others have negative trends. Using the more aggressive wage-adjusted data, we find no significant upward trends in commodity prices. Breaking the series into two periods, however, we find evidence that price declines for nonrenewable natural resources may have moderated (or reversed for some CPI-adjusted price series) since World War II.[9] Predicting future price increases from this moderation is unwarranted, however.[10]

At issue is whether the more conservative or the more aggressive approach to analyzing the price data is more appropriate for assessing resource scarcity. The CPI-deflated price data measure the scarcity of the nonrenewable natural resources relative to a given basket of goods. Because improved technology increases the availability of all goods, the CPI-deflated measures of prices tend to underestimate the effect of technological change in increasing the availability of the resources.[11]

Deflating the price data with manufacturing wages captures technological change that increases the availability of all goods, but it also reflects the rising educational attainment of manufacturing workers from 1870 to 1998. As such, the wage-deflated price measures tend to overestimate the effect of technological change in increasing the availability of nonrenewable natural resources. The relevant real price—and the correct assessment—lies somewhere between those found with the two measures. Table 7 presents a summary of what we can conclude from the relevant measures of the real prices of the nonrenewable natural resources in question. (Also, see the appendix available on the Federal Reserve Bank of Dallas website: http://www.dallasfed.org/htm/pubs/pdfs/efr/efr0001.pdf.)

Summary and Conclusions

Some observers remain concerned that increasing natural resource scarcity will limit future economic growth and human well-being, while others remain optimistic that technological change will overcome geophysical scarcity. Reliance on free markets can promote the requisite technological change. The increasing scarcity of a natural resource increases its price. When they expect higher prices, consumers look for technology that lets them use less of a natural resource. Producers turn to technology that lowers production costs in expectation of higher profits.

The question is whether technological change can outpace geophysical scarcity, and economic theory suggests a test. Rising real prices for nonrenewable natural resources would provide evidence that technological advance has not offset increased geophysical scarcity; constant real prices would indicate that technological advance has just offset increased geophysical scarcity; and falling real prices would signify that technological advance has more than offset increased geophysical scarcity.

Using econometric tests to examine the trends in the real prices of thirteen commodities, we find little evidence of increased natural resource scarcity from 1870 through 1998. For none of these commodities do we find conclusive evidence that the relevant real price has risen. Our results indicate that the relevant real prices could have risen or remained unchanged for natural gas; could have risen or fallen for anthracite coal, bituminous coal, steel, and tin; could have remained unchanged or fallen for iron and crude oil; and have fallen for aluminum, copper, lead, nickel, silver, and zinc.

Although we find evidence that price declines for nonre-

(continued on page 16)

Natural Resource Scarcity *(continued from page 15)*

newable natural resources may have moderated (or reversed for some CPI-deflated price series) since World War II, we find little evidence of increased scarcity. For only one of the thirteen commodities—natural gas—do we find conclusive evidence that the relevant real price has risen. The real price of tin could have risen or fallen. The real prices could have risen or remained unchanged for bituminous coal, iron, crude oil, and silver; could have remained unchanged or fallen for anthracite coal, nickel, and steel; and have fallen for aluminum, copper, lead, and zinc.

In short, the evidence suggests that over the past century, new technology driven by free market forces has overcome the geophysical scarcity of nonrenewable natural resources. Increased reliance on markets during the closing decades of the twentieth century is cause for optimism that these trends will continue in the twenty-first.

Notes

[1] For illustrative purposes, we assume constant returns to scale for the world economy—that is, a doubling of all inputs doubles output.

[2] If $C_{X,t}$ is negative, the user cost rises more rapidly than the interest rate.

[3] For extremely high values of $C_{X,t}$, the user cost and price of the natural resource would fall over time. These conditions do not generally exist. See Dasgupta and Heal (1979).

[4] Futures markets for nonrenewable natural resources occasionally go into backwardation, reflecting short-term supply constraints and the cost to users of stocking out.

[5] Of course, technological advance may occur without such stimulation, but a historical comparison of the rates of technological growth in free market economies with those occurring in the Communist-bloc countries demonstrates the importance of incentives to technological change.

[6] The 1980 prices show evidence of the commodity price explosion in the 1970's, as prices for most commodities rise dramatically, then begin to fall.

[7] Price data for aluminum, iron, natural gas, steel, and tin cover the periods 1895-1998, 1870-1981, 1919-98, 1897-1998, and 1880-1998, respectively.

[8] The data may show additional or more-optimal breaks than between 1945 and 1946, but exhaustive testing of breaks is of relatively low power econometrically.

[9] The commodity price explosion in the 1970s may have contributed to the break in trend. Residuals for trends estimated over the entire period and the 1870-1945 subperiod are white noise, but residuals for most trends estimated over the 1946-98 period are not.

[10] Using CPI-adjusted data, Slade (1982) uses a quadratic time-trend to predict that prices for nearly all nonrenewable natural resources would eventually begin rising. Berck and Roberts (1996) show that other specifications are preferred and that Slade's conclusions are unwarranted.

[11] Consider the case in which technology changes in such a way that all goods and services, including nonrenewable natural resources, could be produced with half as much effort. The CPI-deflated measure of prices for nonrenewable natural resources would suggest no change in availability.

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Stand and Deliver: Making Strategy Happen

*By Murray Sim**

Prompt and high-quality execution of strategy will separate the great companies from the also-ran.

The strategic planning process has always been a challenge to energy industry executives:

1. Agreeing on the right strategy for the new deregulating markets,
2. Maintaining this strategy through change, both external and internal, and
3. Effectively implementing strategy.

As a management consultant, I talk to many executives about these issues - about developing strategy, building shareholder value, inventing new financial and economic methods, etc. In the past, these conversations focused on basic strategy:

"What do we want to be when we grow up?"

"How do we take advantage of deregulating global energy markets?"

"What should our strategic focus be?"

Today, conversations with CEOs, business unit chiefs, and any other kind of executive with a "C" or "VP" in his or her title run a little differently: "Strategy? We have enough strategy. What we need is execution!"

The focus used to be on creating strategy to take advantage of new market opportunities. Now it is on the frustration and seeming inability to get strategic initiatives effectively implemented.

The Problem

So what is wrong? It seems like very little is wrong - the best of all worlds is upon the energy industry. Energy markets are deregulating all over the world. Opportunities exist in all facets of the energy value chain. The number and breadth of opportunities seem endless. Figure 1 shows the range of market plays available in global energy markets.

The energy industry has many smart people, with many good ideas, who are chasing many opportunities in an ever-expanding market. Some companies are pursuing a power production and trading strategy. Others are focusing on Transmission and / or Distribution alone. Still others are carving up the retail commodity and energy services market.

With so many opportunities and new ideas to attack these opportunities, there is a danger of ending up "running around like a chicken with its head cut off" – always studying the next great opportunity, evaluating state-of-the-art technology or e-commerce application, or researching the latest idea.

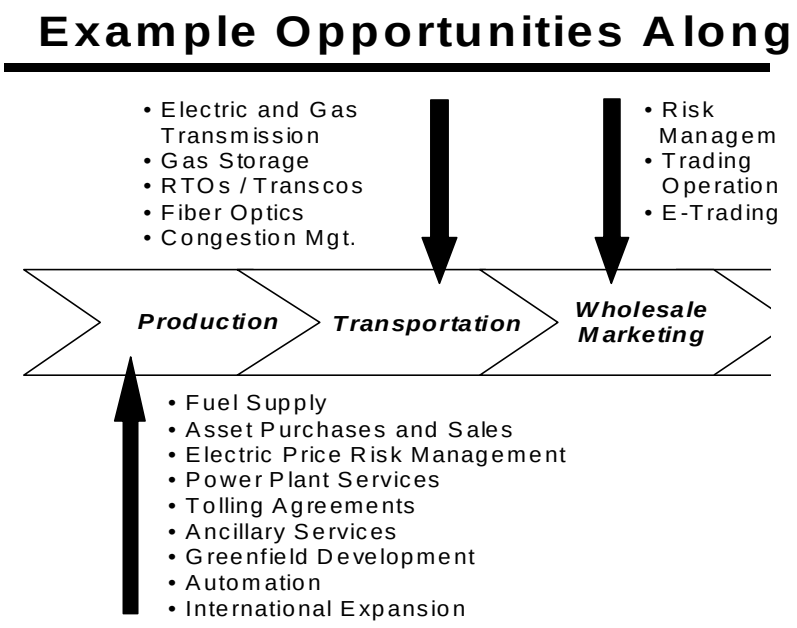
Some are stuck in this endless search for the perfect strategy with few results to show for their work. However, most have chosen their course. Prescient CEOs, industry thought leaders, successful competitors, and investors have generally helped each company funnel the scatter diagram of strategies into a coherent and organized approach to the market.

With all the opportunities in the market, Boards of Directors and the financial community want to see results – not hear the latest strategic plan. The words "strategic initiative" now sound more like "program of the month" to many outsiders.

As shown in Figure 2, most companies have focused their strategies and funneled them into a coherent, logical plan. Many of these companies have prioritized strategic initiatives ready for implementation. However, few are executing these strategic initiatives well.

So, now is the time to deliver on promises made. The key

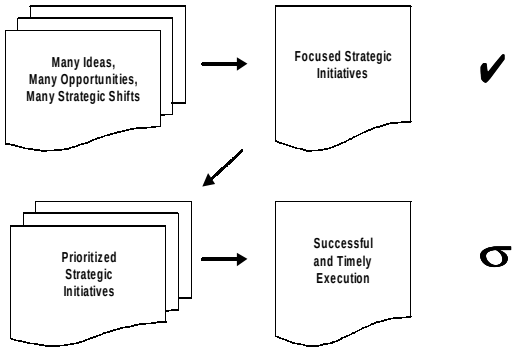
Figure 1



* Murray Sim is an Independent Consultant. Contact the author: msim56@aol.com, phone 630-208-9163.

Figure 2

Strategic Problem Set



questions for upper management are now becoming:

"How can we best execute our existing strategy?"

"What is the fastest and most effective way to turn our strategy into business results?"

The problem isn't creation of strategy–the problem is the effective execution of strategy. The word seems to be out: "Stand and deliver on promises, or see your share price tumble."

The Strategy Execution Process Defined

The strategy execution process, in its simplest form, consists of the following steps:

- Strategic Planning, where the strategy is developed, tested and communicated.
- Implementation Planning, where the detailed plans for investment, marketing, merger and acquisition, divestiture and restructuring are made.
- Project Planning, where the implementation plans are deconstructed into specific projects.
- Business Design, where the various projects are completed and the new business is constructed (or reconstructed).
- Testing and Startup, where the basic business design is tested, modifications are made, and the initial rollout occurs.

Each step is broken down into multiple elements–which can vary in number and complexity. A typical strategy execution process map is shown in Figure 3.

Broken Links in the Execution Process

The strategy execution process is like a chain with each major step an interconnected link to the next. This chain must support the weight of future business success–the creation of shareholder value. As with any chain, the greater the strain, the stronger the links need to be. Weak links tend to break or snap - causing the load to come crashing down.

By the time the execution process reaches the startup / rollout step, the number of micro-decisions and poor quality course corrections can cause the strategy ship to veer into the wind, dismasting the vessel. Figure 4 shows how this can happen:

Successful execution of strategy depends upon the strength of the bonds at each link in the chain. The winds of

(continued on page 20)

Figure 3

The Strategy Execut

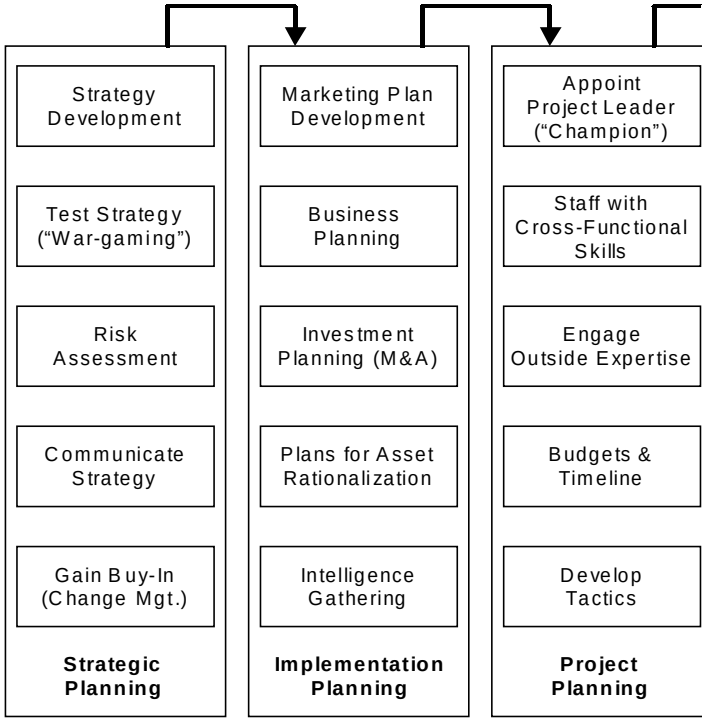
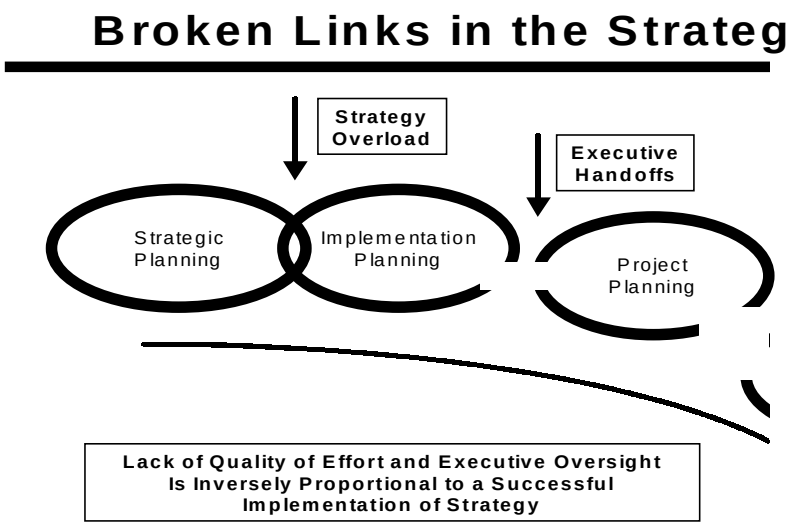


Figure 4



Making Strategy Happen *(continued from page 19)*

change will work to weaken the links and, in some cases, break them apart. Therefore, executive oversight of the process from beginning to end is important. Knowledge of the potential problem areas is critical. The problems tend to fall into five main areas:

- Strategy Overload, where too many strategic initiatives need to be implemented by too few high-quality resources.
- Executive handoffs, where pressing matters of the day tend to distract the attention of the executive team from implementation.
- Internal Resistance, where the current state sometimes overpowers the chances of success for the new strategic initiative.
- Compromised Design and Tactics, where the "fit" with the existing organization and business processes requires change and compromise of the new way.
- Lack of Testing, Premature Startup, where a poor design is rolled out and eventually sinks.

Each problem area will be discussed below.

Strategy OverLoad

The breakdown in the execution process seems to start right away with strategy overload. Too many strategic initiatives need implementation with too few high-quality resources available to execute the tasks. This is a long-time problem in the software business. To steal a solution from Silicon Valley, "version control" might help.

Version control is the software industry's way to implement strategic initiatives. High-tech executives use version control to prioritize and compartmentalize the features and product build-out necessary to meet customer requirements and beat competitors to the market. It is also used to manage budget, time and resource constraints. With low barriers to entry (like the future energy business?), a software company can only protect itself by rolling out new products and remaking existing business lines quickly and efficiently. If a version doesn't work – either due to bugs or competitive failure of a feature – a fix is promptly moved to the top of the priority list (e.g., Version 1.1 vs. Version 1.0).

Major subsequent versions (e.g., Version 2.0, 3.0, 4.0) are enhancements to strategy and prioritized as strategic initiatives. While the general public sees the result as a new set of product features, behind-the-scenes great strategic thought processes are at work. Each prioritized strategic initiative is then staggered so that budget, people resources and competitive position can be timed appropriately to maximize efficiency and market success.

Failure of good version control typically undermines the success of software companies. Many of these companies tend to find their way into stronger hands – either through acquisition or by defection of people and ideas.

Version control might be a great way to think about management of strategic initiatives in the energy business to avoid strategy overload and bring a more rigorous discipline to the implementation and execution process. A typical diagram of version control is shown in Figure 5.

Without some form of version control, strategic initiatives tend to pile up at the starting gate or get mired down somewhere in the strategy execution process.

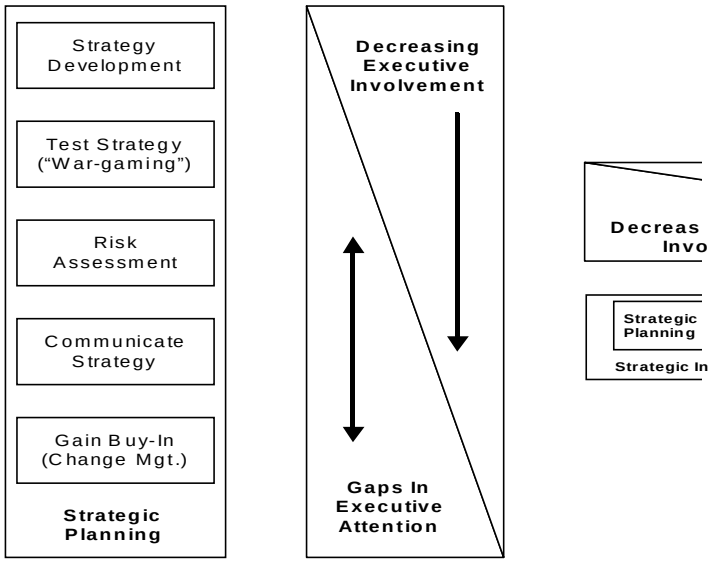
Executive Handoffs

The execution of strategy is simple. Just clearly state the strategy and maybe how it should be implemented, then hand it off to a manager to execute - right? Wrong. Continued oversight is needed throughout the strategy execution process.

The strategic plan is only the first of thousands of deci-

Figure 5

The Need for Increased Ex



sions needed to fully implement it. As reengineering and empowerment have been fully implemented in the utility industry over the last 10+ years, executives feel that they are micro managing if they get too involved in the implementation process. Many utility executives follow the Kennedy and Reagan leadership philosophy of "hire a bunch of smart people and set a bold course," (and the project managers will make it happen). However, Kennedy and Reagan paid close attention to their key strategic initiatives and each put a top-notch executive steering committee in place to oversee the strategy execution process. Many utility executives handoff to middle management and then turn to the next task at hand.

The second major breakdown in the strategy execution process tends to occur with this handoff of strategy implementation to various project teams. Executive oversight and consultant involvement tends to phase out soon after the implementation project teams are formed.

Executives tend to watch the first few links in the chain carefully, However, executive oversight tends to fall off as time goes by (as other matters need attention) and the level of detail grows, as shown in Figure 6.

Some best practices for executive oversight include, but are not limited to, the following:

- Formation of Steering Committees
- Creating key communication and internal marketing messages
- Supporting the implementation effort in a high profile manner
- Managing the creation of boundaries, borders and handoffs between processes and other business units
- Creation of appropriate transfer pricing schemes
- Establishing proper goals, measures and incentives for the execution process
- Careful review of bimonthly reports on project status, problems and solutions, organizational barriers and roadblocks, etc.
- Establishing effective project management techniques
- Appointment of a full-time project leader(s)
- Quarterly Board of Directors reports

The level of executive effort should not fall steadily throughout the execution process. Instead, the level of involvement and oversight (at a macro level) should remain steady. This requires discipline and a great deal of time management and prioritization of activities by the executives involved – which is no easy task.

Internal Resistance

When the implementation projects get rolling, and project managers start to communicate and interact with other middle managers, internal resistance can become a problem. Those with the biggest stake in the old way of doing things, whose personal success is tied to their knowledge and experience with the status quo, are now asked to create – or cooperate with - a new direction, a new organization to tackle a new market opportunity. This is strange and uncomfortable to them.

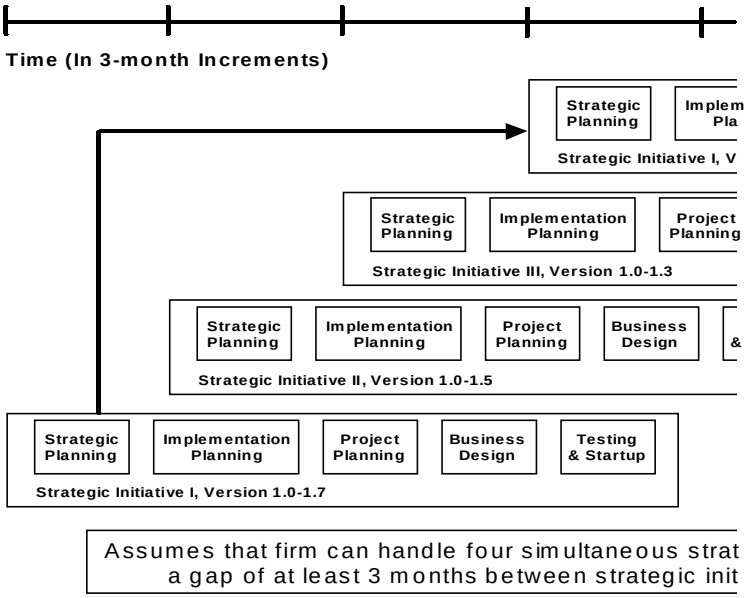
A colorful analogy to this problem of internal resistance is "T-N-T." Of course, T-N-T is the abbreviation of the chemical formula for a very explosive mixture. It also stands for "Turf 'N Toes." When a project manager inevitably steps across an invisible boundary line into another middle manager's department or area of influence, a not-so-subtle turf war can erupt. Many times, these political mini-battles are kept out of the prying eyes and ears of executives. Other times, they are seen but ignored.

Another three-letter acronym is "N-I-H." The "Not In-

(continued on page 22)

Figure 6

"Version Control" To Addres



Making Strategy Happen *(continued from page 21)*

vented Here" syndrome can also create trouble. Middle managers (and other uninvolved executives) that perceive that their input and advice was either not sought out or not heeded, if given, can also create significant internal barriers and roadblocks to implementation.

It is the cumulative effect of these wins and losses that can spell success or sink the strategic ship. Some best practice actions to enhance the chances for success are as follows:

- Appoint a project leader with good political and communication skills that can be a change manager as well as a project manager.
- Create an effective and skilled project team with an attitude – to aggressively create the maximum value from the strategic initiative, breaking down barriers where appropriate.
- Avoid "rotating bald tires" – avoid putting managers or team members that have been known to resist change in the past to the team in the hope that, by moving them from the frying pan into the fire, they will somehow change and grow into a stronger leader / employee.
- Create an internal communications and marketing plan to be executed throughout the implementation process.
- Have all executives and managers in the affected areas of the company frequently speak to the benefits of the strategic initiative and the success that will come to the company from its effective implementation.
- Squash T-N-T and N-I-H behaviors quickly. Don't ignore this problem. Often, a T-N-T or N-I-H problem isn't apparent, so you may need to seek it out.

Implementing strategy is a full-time job for the best and the brightest. Assigning or putting up with second best performers will achieve second best results. Can you afford that?

Compromised design and tactics

The design of the new business processes, or creation of the new business unit or line of business, must fit in and be supported by the whole organization. In the business design step of the strategy execution process, many compromises are sometimes made which tend to limit the potential opportunity in the best case, or turn it into another element of the old way of doing things in the worst case.

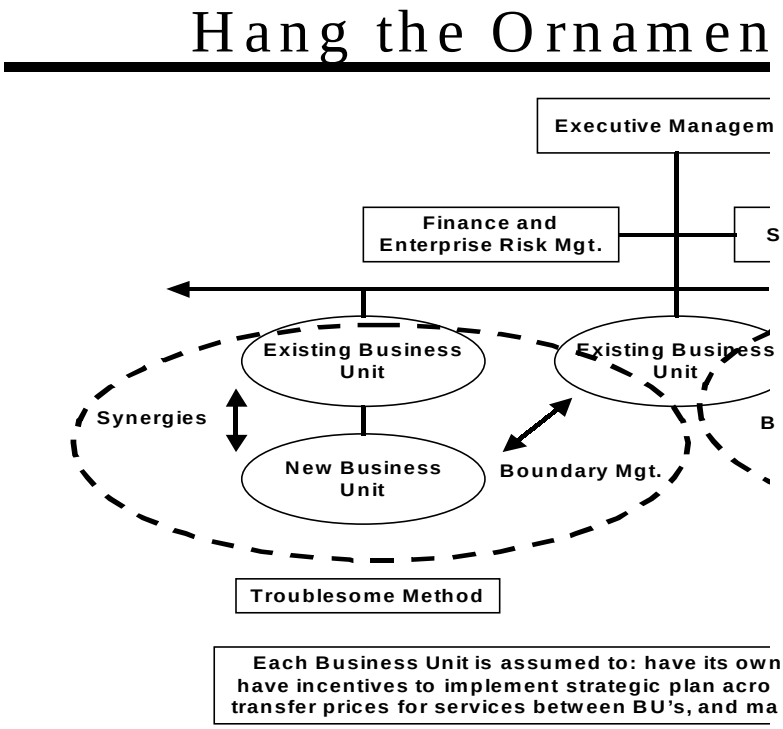
A typical strategic initiative involves the creation of, purchase of or merger with a new business or line of business (i.e., product or service). Therefore, the overall organizational and governance structure must be modified to integrate the new or changed pieces and parts of the company. A major problem area tends to be how the ornament is hung on the corporate Christmas tree. Options for "attachment" are shown in Figure 7.

When a new business is created or an existing business is significantly modified, the need for management oversight, governance, and corporate visibility suggests that the new organization report, at least initially, directly to upper management. This provides a means for management to manage synergies, monitor performance, and measure return on investment and achievement of original expectations (i.e., market share, customer count, geographic penetration).

Alternate approaches of combining new and existing businesses together to extract synergies can be problematic. Different cultures, skills, products and services, etc. can all lead to internal "fit" problems. These problems are difficult to see and manage if they are buried down in the bowels of the organization.

Managing the boundaries and borders between business

Figure 7



units is an old problem that tends to raise its ugly head when organizational or strategic changes are mandated. Most business units must work together or supply each other to some extent. Communication, transfer pricing, cross incentives (e.g., marketing commissions, quality and timeliness rewards), and group goal achievement rewards can all support effective integration of new or modified business units.

Extraction of "synergies" is another problem area. The reason for creating or modifying a business or line of business is to achieve competitive advantage and build long-term value. This is a continuous exercise in strategic optimization - optimizing the whole rather than each piece. Reengineering and merger integration techniques have done a great job in optimizing each individual business process, line of business and business unit. However, great value can be extracted from optimization across businesses (e.g., a loss leader in services may provide higher margins for commodity sales). Optimization of the whole necessarily suggests that some pieces may have to be sub-optimized.

Fitting a new idea or business into an existing organization is difficult. Compromising the new idea, strategy or business to fit it into the whole can be disastrous. The business design step must look beyond the micro world of the new business line or business unit and instead look globally at the value creation opportunities across the corporation (and joint venture partners).

The key to success is to redesign the old to fit the new, not compromise the new to fit the old.

Lack of Testing and Premature Startup

Testing of strategies, tactics and plans is a time tested success factor for military organizations around the world. Business "wargaming" (or "strategic simulations") has evolved as a strategic planning and competitive intelligence tool for the third millennium. Training and culture change programs for utility deregulation have recently incorporated many of the core attributes by simulating the probable activities of competing entities in a free marketplace.

While testing of strategic plans is growing in popularity, it is hardly widespread. Worse, testing throughout the rest of the strategy execution process is almost non-existent. Where it is used, testing of implementation plans, business designs, etc. can be a powerful tool to eliminate rework and lost time. An investment of time and money in testing seems like a waste until one considers the value that improvements in strategy, tactics, design and rollout can bring.

A strategic plan for one utility's state deregulation activity was tested in a wargame one year ago. The original strategic plan was found lacking in several key components and repaired. Over the last 12 months, the results of that wargame can now be compared to real life. The timeline of deregulation, activities and tactics of the other stakeholders in the deregulation process, and end results were forecast with amazing accuracy.

Routine use of a "business laboratory" where a strategic simulation can be built out to tactics and then business design and startup can be a powerful way to improve effectiveness, timeliness, and return on investment. All major telecommunications and technology (i.e., hardware, software, e-commerce, etc.) companies now use such simulations throughout the strategy execution process.

Direct access "pilots" were used routinely in the utility business in the recent past as a way to prepare for deregulation. Systems, customer service processes, customer education messages and marketing programs were all tested completely. While some of these programs were criticized as delaying tactics, performing a "shakedown" cruise has merit.

(continued on page 24)

Making Strategy Happen *(continued from page 23)*

Most products and services in competitive industries get this treatment. Beta versions of software, test marketing of consumer goods, and new methods of cooking and food assembly at McDonalds are examples of testing strategy, tactics, business design and rollout before committing to large startup costs and marketing programs.

Large investments in wargaming, market research, and consumer testing seem small in comparison to business failures that can run in the tens and hundreds of million of dollars.

Bottom Line

In the end, failure of the execution of the strategic initiative is not obvious until some time goes by, business results are disappointing, and competitive advantage and marketplace momentum are lost. The best measures of success are action and results.

Your new phraseology needs to be filled with more with specifics and results-oriented action steps rather than open promises, such as:

"Our implementation plan will be completed in October."

"We rolled out our new business venture last month and it is expected to be profitable by year-end."

"Our merger integration projects are ahead of schedule by over 2 months."

"Our new commodity and service menu is up and running on our website. Over one hundred customers signed up the first day!"

If internal expectations are continually managed downwards throughout the strategy execution process, with excuses and explanations for more time and money, then the loss can be huge. This loss is not only in the direct sense (e.g., loss of investment), but also in the lost market opportunity. In highly competitive industries, such missteps can be fatal as the swift and stronger hands of the competition guide their ships on course.

Work the strategy execution process well or the execution process can be the death of your strategic initiative. Stand and deliver – make your strategy happen.

Global Warming *(continued from page 8)*

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24. Wigley, T. M. L., *The Kyoto Protocol: CO_2, CH_4, and climate implications*, Geophysical Research Letters, 25, 2285-2288, July 1 1998. Tom Wigley, of the National Center for Atmospheric Research, is a noted proponent in his own right.

Your Annual Conference–IAEE International or USAEE North American: Dates, Rates, Space and Location

It's the middle of winter and we're going to Sydney! It's August and we're going to Orlando! Planning the Association's meetings, whether it be International or North American is a time consuming and intense process of blending a variety of aspects that determine such things as when and where we meet, what price the hotel will charge and the quality of service we can expect from the hotel that is chosen to host our meeting. As Energy Economics is a profession in its own right, so is meeting planning. There are many associations that support the industry of planning conferences and trade shows. Let's take a look at some of the many factors that make up where we go and what we pay.

Dates

Suffice it to say that we can expect a hotel to charge lower room rates when demand is low. August in Orlando is HOT…we can expect lower rates. January in Orlando is warm and at peak tourist season…we can expect to pay a lot more for a room. Judging when a destination is "in season" and "out of season" is necessary when trying to obtain a favorable sleeping room rate at a convention hotel.

The flow of dates at a hotel can also effect what we will pay in sleeping room rates. Those of us who travel to Las Vegas know this well. It's far more expensive to stay over the weekend than it is to stay during the week. However, Las Vegas is a destination in and of itself. First tier cities such as Chicago, Sydney, Houston, Rome, Philadelphia, etc., are well aware that guests dwindle on the weekend and increase during the work week. This is one reason why the USAEE North American meeting typically starts on the weekend (Sunday night) so as to take advantage of averaging the room rate over a weekend and into the workweek.

Rates

The date of a meeting, location, room block size, and season are some of the many factors that affect a room rate. Typically, if we want the best sleeping room rate, we go to a hotel during their off-season period. Remember the Washington, DC, meeting in 1995 held right after July 4th? Room rates were $100 a night! The flip side of this is going to Miami during cruise ship season. The city is bustling and you can expect to pay more than $200 per night for a convention hotel room!

Other factors, though, affect the room rate. Such factors as how much meeting room space the group will use, the amount of food and beverage revenue the hotel can expect to make during the convention, and whether or not the meeting is held over a weekend or weekday are all important.

A major factor affecting any hotel rate is the number of rooms the group blocks and guarantees to pick-up. If a conference blocks a large number of rooms, it can expect to pay less than a group that blocks a small number of rooms.

Space

A convention hotel primarily has three commodities it sells. These are rooms, function space (meeting rooms), and food and beverage. Suffice it to say that any IAEE or USAEE meeting takes up a lot of meeting room space. When a hotel looks at the large number of meeting rooms our group takes in proportion to the relatively small number of sleeping rooms we use, this typically affects the sleeping room rate. As a general rule, the convention industry allocates function space in proportion to the sleeping rooms the group blocks for its use. If a convention hotel has 400 rooms to sell on any given night and the group contracts for 100 of these rooms it (the group) will typically be given the right to 25% of the hotel's meeting rooms. The equation is quite different though, when a group asks for 100% of the meeting rooms and only guarantees 25% of the sleeping rooms. In this case, meeting room rental charges may be assessed or the sleeping room rate will be increased during the period when the group is in house.

Location

There's a big difference between holding a meeting in a 1st tier or 2nd tier city. We can expect to pay more for a meeting held in New York, Chicago or San Francisco than we will for a convention in Albuquerque, Charlotte or Indianapolis. Hoteliers and their stockholders are quite with the times. Markets like San Francisco, Chicago and New Orleans will only get more expensive, and far faster than 2nd tier cities. People want to visit these places and will pay dearly to travel and stay in these locations. Second tier city meetings are a different animal. Since some are out of the way and difficult to travel to, hoteliers price their properties attractively to pull business.

Resort hotels (Anyone like to golf, fish, or just sit by the pool?) are in a league of their own. Resort properties generally thrive from tourist business and their rates fluctuate with the season. When it's hot, you'll pay more; when it's cold, you'll pay less.

Attrition

A key factor in any group contract with a hotel is the word attrition. In general terms, the group guarantees that it will pick-up (actual room bookings at the hotel) a specific percentage of its overall room block with the hotel. If the group falls short of this guarantee, the hotel charges the group for the rooms unused. This is why it is so important for any group staying at a convention hotel to ensure the success of the meeting on behalf of the association. Paying attrition fees only hurts the association and causes rates to increase in future years of the meeting as the hotelier considering a prospective piece of hotel business always checks on the history of a group to see if it performed to its past hotel contracts. **Please** remember this when booking accommodations to attend any conference. We help the organization meet its contractual terms when we stay at the host hotel for the conference.

What's to Come?

Well, one thing is for sure, hotel rates are not coming down! The industry has enjoyed double digit inflation growth for the past 5 years and is adding inventory to accommodate the boom in convention business. Seven to eight years ago everyone was pleased with 4-5 star accommodations at the rate of $100-$125 a night. Those rates are now $150-$175 a night. To give a brief look at things, San Francisco is banking on an average nightly hotel rate of $250 by the year 2005! And, it's hard to find a decent room in Europe or Asia for under $200 per night. U.S. hoteliers see this and are acting accordingly.

Summary

The next time you attend a meeting, you may want to keep these four things in mind: dates, rates, space, and location. It

(continued on page 27)

New Members of USAEE

The following individuals recently joined the USAEE in the period March 1, 2000 to June 30, 2000. Welcome!!

Godwin M. Agbara
US General Accounting Office

John A. Anderson
Mobil Oil Corp.

Shimon Awerbuch

J. Derek Bandera

John R. Bitler
Levitan & Associates, Inc.

Marshall Brown
Robert Walters Associates

Chris Carr
Institute for Int'l Research

Margaret M. Carson
Enron Corp.

Kwang Choe
Missouri Public Service Commission

Michael D. Cochran
Anadarko Petroleum Corporation

Roger Coupal
University of Wyoming

Brynhildur Davidsdottir
Boston University

Thomas G. Davis
Energy Security Analysis, Inc.

Annette C. Dupont-Ewing
US Department of Energy

Sandra R. Ellis
University of California-Berkeley

Yasuyuki Endo
Massachusetts Institute of Technology

Robert Ethier
ISO New England

Stphen Fernands
Customized Energy Solutions, Ltd.

John Fraser
SRI Consulting

Villamor Gamponia
Pudget Sound Energy

Joe Green
Alaska House of Representatives

Stanton Hadley
Oak Ridge National Laboratory

Stacia Harper-Croyle
University of Alaska-Fairbanks

Scott M. Harvey

Stephen Harvey

Victoria Hawkins
Reliant Energy HL&P

Rick Heimann
PWI Energy

Gerald Hendrickson
Sandia National Laboratories

Jeffrey A. Holligan
BP Amoco

Takahide Hori
Electric Power Development Co.

Christopher J. Jablonowski
Penn State

Kamala R. Jayaraman
ICF Consulting, Inc.

John L. Jurewitz
Southern California Edison

Andrej Juris
National Economic Research Assoc.

Sami Kamel
Colorado School of Mines

John Kingston
Platt's

Raymond R. Knowles
United Nations

John E. Langdon
PGI/WES

Vicky Langston
Austin Peay State University

Pierre Lepetit
French Consultant Trade Office

Shu-Yi Liao
Pennsylvania State University

Carl B. Linvill
Public Utility Commission of NV

Robert B. Lydecker
Mobil Oil Indonesia

Michael McNair
FriedWire

David S. Milne, Jr.
D. Milne Associates, Inc.

Lucio Monari
The World Bank

Cheryl Morgan
Morgan Energy

Vance C. Mullis
Southern Energy, Inc.

Nori Nei
JETRO

David Nissen
Poten & Partners, Inc.

Boyko Nitzov
Sarkeys Energy Center-OU

Terry Ramsey

William J. Rapp
Texaco, Inc.

Dennis Ray
MSB Energy Associates, Inc.

Alan E. Rosenberg
Brubaker & Associates

Zeta R. Rosenberg
ICF Consulting

Lori S. Schell
Trigen Energy Corporation

Tom Schubbe
Sebesta Blomberg & Associates, Inc.

Brent P. Sherfey
Bechtel Corporation

Daljit Singh

Kenneth Skinner
PHB Hagler Bailly, Inc.

Andrew Slaugher
Shell Exploration & Production Co.

Brian C. Smith
Hawthorn Group, LC

Paul M. Sotkiewicz
Federal Energy Regulatory Comm.

Bradford L. Stults
Muse Stancil & Co.

Wilson O. Suarez
NY Institute of Technology

Ausma Tomsevics
Edison Electric Institute

Bradford H. Tuck
University of Alaksa-Anchorage

Russell J. Tucker

Marc L. Ulrich
Georgia Power Company

William Van Herwarde
Trust Company of the West

Stephen Walton
Braintree Electric Light Dept.

Gene Whitney
US Geological Survey

United States Association for Energy Economics

USAEE

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:
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Golden, CO 80401 USA
P)303-273-3921;F)303-273-3416;E)cadahl@mines.edu

Your Annual Conference *(continued from page 25)*

takes a lot of negotiation to get a fair "package" from a hotel. The dates may be off, yet the rates and location as well as the meeting space a hotel offers may be ideal. Conversely, the rate may be high, in a great location and during an ideal time. Finding the balance between these four factors is the real challenge in planning any conference.

David L. Williams, Jr.

Calendar

27-28 July 2000, Driving Successful Mergers and Acquisitions in the Utilities. London, UK. Contact: Samantha Jays, dmg World Media, Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, United Kingdom. Phone: 44-1737-855-380. Fax: 44-1737-855-283. Email: sjays@dmg.co.uk

7-8 August 2000, IIR's Negotiating the Transmission Revolution. Chicago, IL, USA. Contact: Mark Thabet. Phone: 212-661-3500. Fax: 212-599-2192. Email: mthabet@iirny.com

23-24 August, Latin Upstream 2000. Rio de Janeiro, Brazil. Contact: Babette Van Gessel, Managing Director, Global Pacific & Partners. Phone: 27-11-782-3189. Fax: 27-11-782-3188. Email: babette@global.co.za

31 August – 1 September 2000, Towards an Integrated European Energy Market. Bergen, Norway. Contact: Kellis Akselsen, SNF-NHH, Breiviksvn. 40, 5045 Bergen, Norway. Phone: 47-55-959500. Fax: 55-959439. Email: Kellis.Akselsen@snf.no

10-11 September 2000, Oil Prices and Investment Retreat. Le Meridien Picadilly, London, England. Contact: Jonathan Neale. Phone: 44-2-7704-6241. Fax: 44-2-7704-8440. Email: jneale@thecwcgroup.com URL: www.thecwcgroup.com

11-13 September 2000, 2nd Annual Africa Infrastructure 2000. Crowne Plaza Hotel, 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

11-15 September 2000, Hyforum 2000: The International Hydrogen Energy Forum 2000. Munich, Germany. Contact: Mrs. Sandra Hoderlein or Mr. Wolf Rasch, EFO Energie Forum GmbH, Godesberger Allee 90, D-53175 Bonn, Germany. Phone: 49-228-95-95-6-0. Fax: 49-228-95-95-6-50. Email: hyforum2000@zukunftsenergien.de URL: www.hyforum2000.de

14-15 September 2000, World LNG Conference. Meridien Waldorf Hotel, London, England. Contact: Jonathan Neale. Phone: 44-2-7704-6241. Fax: 44-2-7704-8440. Email: jneale@thecwcgroup.com URL: www.thecwcgroup.com

17-22 September 2000, Natural Gas: The Commercial and Political Challenges (Training Course). The Four Pillars, Oxford, England. Contact: Margaret Coen, The Alphatania Partnership, Rodwell House, 100 Middlesex Street, London E1 7HD, United Kingdom. Phone: 44-20-7650-1405. Fax: 44-20-7650-1401. Email: training@alphatania.com, URL: www.alphatania.com

17-23 September 2000, African Petroleum Management Institute/Upstream Leadership Program 2000. Johannesburg,

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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 non members 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 (non member rate).
Total enclosed $_____ Check must be in U.S. dollars and drawn on a U.S. bank, payable to IAEE.

Calandar *(continued from page 27)*

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

19-20 September 2000, European Electricity Transmission Pricing. Frankfurt, Germany. Contact: (p)44-20-7490-3774. Fax: 44-7505-0079 Email: louise@asi-conferences.com

20-21 September 2000, Internet Trading for the Energy Sector. Frankfurt, Germany. Contact: (p)44-20-7490-3774. Fax: 44-7505-0079 Email: louise@asi-conferences.com

23-24 September 2000, Pacific Petroleum Insiders. Raffles Hotel, Singapore. Contact: Vimla Mulchand, Managing Director, The Conference Connection, Raffles City Post Office Box 1736, Singapore 911758. Phone: 65-226-5280. Fax: 65-226-4117. E-mail: mpgc@cconnection.org URL: www.cconnection.org

24-27 September 2000, 21st USAEE/IAEE N.A. Conference – "Transforming Energy." Philadelphia, Pennsylvania, USA. Contact: IAEE Headquarters, 28790 Chagrin Blvd., Ste. 350, Cleveland, OH 44122. Phone: 216-464-5365. Fax: 216-464-2737. E-Mail: usaee@usaee.org URL: www.usaee.org

27-29 September 2000, 2nd International Conference on Energy Efficiency in Household Appliances and Lighting. Naples, Italy. Contact: Edgardo Curcio, AIEE, Via Giorgia Vasari 4, 00196 Roma RM, Italy. Phone: 39-06-322-7367. Fax: 39-06-323-4921. URL: www.aiee.org

27-29 September 2000, 7th Annual Africa Upstream 2000. Cape Town, 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

31 August–1 September, Annual European Energy Conference 2000: Towards an Integrated European Energy Market. Bergen, Norway. Contact: NAEE Conference Secretariat, Foundation for Research in Economics and Business Administration–SNF, Breiviksvn. 40, NO-5045 Bergen, Norway. Phone: 47-55-959500. Fax: 47-55-959439. URL: www.snf.no

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9-11 October, 2000, The Commercial Opportunities in the Generation of Power from Renewables. London, UK. Contact: The CWC Group, The Business Design Centre, 52 Upper Street, London N1 0QH, UK. Phone: 44-20-7704-6161. Fax: 44-20-7704-8440. Email: booknigs@thecwcgroup.com

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4-5 November 2000, The Impact of the Middle East/Caspian Oil on Global Energy Marks. Tehran, IRAN. Contact: S.A. Alavi, Institute for International Energy Studies, PO Box 19395-4757, Tehran, Iran. Phone: 9821-225-8098/9 Fax: 9821-225-8089. Email: conference@iies.org URL: www.iies.org

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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. E-mail: confs@economatters.com. URL: www.gas-matters.com

15-26 January, 2001, Ninth International Training Program: Utility Regulation and Strategy. Gainesville, Florida, USA. Contact: Michael Ford, Public Utility Research Center, Warrington College of Business Administration, PO Box 117142, 205 Matherly Hall, University of Florida. Phone: 352-392-6148. Fax: 352-392-7796. Email: purcecon@dale.cba.ufl.edu. URL: www.purc.org

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