Minutes CESE Annual Meeting June 16, 2007

CESE's 11th annual meeting convened at the University of New Mexico's Anthropology lecture hall at 1 P.M. Estimated attendance was 80. Kim Johnson, out-going president, called the meeting to order and then read CESE's mission statement:

http://www.cesame-nm.org/about/mission.html

"The Coalition for Excellence in Science and Math Education (CESE) is composed of interested citizens throughout New Mexico and the nation, including scientists, engineers, educators, university faculty, members of the clergy, and parents. CESE is non-partisan and non-sectarian, and welcomes members of all religions and political philosophies. This coalition works to improve science education and science literacy for all citizens."

A summary of last year's accomplishments followed. Walt Murfin, CESE's statistician, did data reduction for the state's Public Education Department (PED) and for the Rio Rancho school district, emphasizing the mid-school level. CESE's Science Fair winner and a high school student at Rio Rancho, Suzannah Wood, did similar work. She and Walt came to the same conclusion.

During the last legislative session, New Mexico Senator Steve Komadina and House member William "Dub" Williams sponsored Senate Bill 371/Senate Joint Memorial 9 and House Bill 506/House Joint Memorial 14, respectively. If enacted, these bills would have required the state department of education to adopt rules allowing teachers to

"…objectively inform students of scientific information relevant to the 'strengths and weaknesses' of any 'theory of biological origins' taught, and allowing students to " 'reach their own conclusions about biological origins.'" If enacted, HJM 14 and SJM 9 would have asked the state department of education to comply with the requirements of HB 506 and SB 371, claiming that 'many credentialed scientists challenge certain aspects of evolutionary theory.'"

Kim, Dave Thomas, and Marshall Berman testified against these bills. The time spent fighting this legislation was at the expense of other projects.

The House memorial and the House bill were eventually defeated in committee. Dub Williams surprisingly reversed himself and tabled his own bill. The similar legislation in the Senate was never heard.

Most of the creationist candidates were defeated in the last Rio Rancho school board elections.

Jesse Johnson updated CESE's website. He said there have been three to five thousand unique visitors per month. Articles by Walt Murfin and Dave Beck titled, "The Bible: Is it a True and Accurate Account of Creation?" (Parts 1-3) have been getting many of these hits. (See link below.)

http://www.cesame-nm.org/index.php?
name=Sections&req=viewarticle&artid=42&page=1

The McCune Charitable Foundation gave grant money to CESE member Eva Thaddeus for 5th grade curriculum and training development in the subject areas of energy use and climate change. It will later be expanded to mid-school. CESE, a 501 (3) (c) organization, is holding these funds as fiscal agent. The title of her grant is "Our Energy Future, an Interdisciplinary Curriculum unit about Energy use and the Global Climate for New Mexican fifth grade students."

Marvin Mueller, a Los Alamos scientist, donated a large amount of money for the radio show NMSR's *Science Watch*. This donation was split, 2/3 of the funds for NMSR (New Mexicans for Science and Reason), and 1/3 for CESE.

Possible plans for the future include a poll and a study of the schools with poor demographics that are high performers.

Kim then asked all those attending to briefly introduce themselves. Afterwards, he presented our keynote speaker David Goodstein, Ph.D., Vice Provost and professor of physics at the California Institute of Technology. He was also the director and host of the educational TV show, *The Mechanical Universe.*

Dr. Goodstein's slides are online at:

http://www.arb.ca.gov/research/seminars/goodstein2/goodstein2.pdf

More on this presentation can be found also at:

http://pr.caltech.edu/periodicals/caltechnews/articles/v38/oil.html

http://web.mit.edu/newsoffice/2006/oil.html

"Out of Gas: The End of the Age of Oil"

There are myths regarding energy, Dr. Goodstein began. They are that $3.00 is too much to pay for a gallon of gas; oil companies produce oil; if we don't conserve energy, we will have an energy crisis; when the oil supply is gone, the marketplace will replace it with something else; there's enough fossil fuel in the ground to last another 100 years; nuclear energy is dangerous; the greenhouse effect and global warming are bad.

A brief history of energy: although the caloric theory explained some of heat transfer, experimental evidence by Benjamin Thompson in 1798 suggested that heat, like work, is a form of energy in transit. Later, physicist James Prescott Joule (1818-1889), provided the experimental evidence that heat is a form of energy in transit and that it can cause the same changes in a body as work. Heat is measured in terms of the calorie, defined as the

amount of energy required to raise the temperature of 1 gram of water 1 degree centigrade.

Energy can be divided into two major categories: 1) kinetic, which includes organized and random (such as temperature); and 2) potential, which includes gravitational, chemical, and nuclear.

Dr. Goodstein showed a graph of thermal radiation that plotted the intensity of energy versus the frequency. The line on the graph with the highest intensity is the sun, peaking between the infrared and the ultraviolet; followed by fire, its peak at the infrared, and the lowest line on the graph is "human," that peak being between the radio and infrared. Of the sunlight reaching the Earth, 70% is absorbed, and 30% is reflected.

Earth's climate is affected by 1) its tilted axis; 2) the El Nino system; 3) the greenhouse effect; and 4) the thermohaline flow, which is the directional movement of Earth's ocean currents. If this flow were reversed, the result would be global cooling instead of warming. The directions of the Earth's trade winds were also represented in an additional drawing.

During the pre-industrial age, the greenhouse effect was 88% due to water vapor, methane, and carbon dioxide. The feedback effects were limited.

Dr. Goodstein showed a slide with a graph of the 4 glacial cycles recorded in the Vostok ice core. The overall inferred temperature increased with higher amounts of CO_2 found in this core. In the last 200 years, carbon dioxide and methane levels have increased. The results could be catastrophic at the current rate, according to Goodstein.

Before 1800, useful sources of energy were sunlight, coal, oil seeps, and swamp gas.

In the 19^{th} century, important sources of energy were coal and whale oil. There was a demand for fuel that could reliably and cheaply illuminate and lubricate. Thus, in 1859 the first oil well was drilled in PA by E.L. Drake. By this time, we could no longer rely primarily on sunlight.

Dr. Goodstein then showed bar and pie graphs of the proven oil reserves in 2001. 65% of them can be found in the Middle East, followed by South and Central America, Africa, the former Soviet Union, North America, Asia Pacific, and the least amount in Europe.

Geophysicist M. King Hubbert correctly predicted that the fossil fuel era would be very short and that that U.S. oil production would peak in about 1970. It would decline afterwards.

Hubbert also predicted that there would be a second bell-shaped curve that would represent production, consumption, and extraction. The oil industry calls it "production," but the industry doesn't really produce any oil at all. What it reflects the rate that the oil is consumed.

Another graph shows that the world's known crude oil reserves are about a trillion barrels. The oil industry might say that oil is just waiting to be pumped out of the ground. Since we're using it up at a rate of about 25 billion barrels a year, we have 40 more years to go, so there's no immediate cause for concern. But Hubbert has shown that it's incorrect.

Dr. Goodstein indicated that a sudden jump of 300–400 billion barrels of oil in OPEC (the Organization of the Petroleum Exporting Countries) reserves occurred in the late 1980's. But there were no significant discoveries of oil in OPEC countries in that time period. What happened instead is that OPEC changed its quota for how much each country could pump on the basis of what it claimed in reserves, and politicians "discovered" 400 billion barrels of oil without ever drilling a hole in the ground. This shows how undependable these numbers are for worldwide proven oil reserves.

For the last quarter century, oil has been consumed faster than it has been discovered. World reserves should have decreased during that time by about 200 billion barrels. Instead, they've increased by 400 billion barrels. In any case, it should be possible then, to make a prediction similar to the one that Hubbert made for the continental United States for worldwide oil production.

Another graph, published in 1998 in *Scientific American*, predicts that we will have a worldwide maximum in oil production just about now—around the middle of the decade 2000–2010. What will happen when we reach that peak is not known. But we had a preview in 1973 and 1979 when the OPEC countries took advantage of the supply shortage in the United States and decreased production. What occurred were mile-long lines at gas stations.

However, Dr. Goodstein advised caution in evaluating these predictions. One crucial quantity that goes into making such an estimate is how much oil was in the ground before we ever started pumping it. The *Scientific American* estimate used 1.8 trillion barrels of oil as the baseline number. Today, it looks like 2.1–2.2 trillion barrels might be more accurate. That number—the total amount of oil that ever existed—tends to increase with time for a variety of reasons.

First, Dr. Goodstein continues, new technology and new discoveries both make more oil available. Secondly, as the oil becomes scarcer and the price increases, more oil becomes available at the higher price, because you can invest more capital into retrieving it. And finally, these estimates depend to some extent on those proven reserve numbers, and those numbers are not very reliable. Nevertheless, the main idea of the Hubbert Curve is correct: the supply of any natural resource rises from zero to a maximum point, and then it falls forever. Oil will behave in the same way.

In 1997, Kenneth Deffeyes, a former Shell Oil geologist, now professor emeritus of geosciences, published a book called *Hubbert's Peak—The Impending World Oil Shortage*. In it, Deffeyes writes that Hubbert was correct, and that the peak for domestic

production had been reached when he saw this sentence in 1971 in the San Francisco Chronicle: “The Texas Railroad Commission announced a 100% allowable for next month.”

The quote meant that the Texas Railroad Commission was the cartel that controlled the U.S. oil industry, by making strategic use of the excess capacity for pumping in Texas. When the commission said, “100% allowable for next month,” it meant that there was no longer any excess capacity. They were pumping “flat-out,” and Hubbert’s Peak had been reached. This quote required knowing that the Texas Railroad Commission, many years earlier, had been assigned the task of matching oil production to demand. It was essentially a government-sanctioned cartel.

In a *New York Times* article, 2-24-04, writer Jeff Gerth said that the oil production in Saudi Arabia was in decline. Officials are concerned that they won’t be able to meet the world’s future demand. Some economists, however, are optimistic that if oil prices rise high enough, advanced recovery techniques will be cost effective, avoiding problems of short supply. But some Saudis are not so sure.

It is uncertain whether we will look back years from now and say that this was the beginning of the end of the age of oil. Our figures are much too uncertain; however, to those who are aware of the Hubbert’s Peak predictions, as the writer of this article apparently was not, according to Dr. Goodstein, this was a chilling report.

According to another *NY Times* article, 3-5-07, Jad Mouawad writes, “Many oil executives say that peak oil theorists fail to take into account the way that sophisticated technology combined with higher prices make the searching for new oil more affordable. Typically oil companies can only produce one barrel for every three they find. (This) represents a tremendous opportunity.”

Goodstein explained that economists say there can never be a gap between supply and demand because the process is regulated by price. That’s never been true in the case of oil, because it has always been controlled by cartels, first in Texas and later by OPEC. However, once the peak occurs, OPEC will lose control of the situation, and the price mechanism will kick in with a vengeance. But the supply can keep up with the price only if there is something to supply.

The main oil users are petrochemicals; stationary power plants; home heating; and transportation, that includes cars, trucks, planes, ships, and trains.

Another graph compared the amounts of global energy consumption in 1998. Oil, gas, and coal were the highest -- much lower were hydro, biomass, renewable, and nuclear.

Fossil fuels besides oil, listed on Goodstein’s slide, include natural gas, shale oil, methane hydrate, and coal.

Natural gas could be a very good substitute for oil. Similar cars that we have today can run on compressed natural gas, and it's a clean-burning fuel. But natural gas will only be a temporary solution. The Hubbert Peak for it is only a decade or so beyond Hubbert's Peak for oil.

Oil was created when rock and organic material sank deep within the earth. The inside of the earth is heated by radioactivity, getting hotter with increased depth. This source rock sank just deep enough into the heated interior for the organic matter to get cooked into oil. Source rock that sank deeper got overcooked and became natural gas. Source rock that sank to a more shallow level became shale oil, which is essentially unborn oil that can be made into a fuel by strip-mining, crushing, and heating the rocks until you generate a usable liquid. Investors who have pumped millions into exploiting this resource have concluded that it will probably always be energy-negative, that is, more energy goes into acquiring and processing it than what comes out of it.

Methane hydrate is a solid that looks like ice, but it burns if ignited. It consists of methane trapped in a group of water molecules. It is formed when methane comes into contact with water under very high pressure at very low temperatures, close to the freezing point of water. It is not known how much exists, where it is, whether it can be mined, or how it would be used, just that it exists.

There is enough coal to last perhaps thousands of years, and the largest deposits are in the U.S. Coal can be liquefied and made into a substitute for oil, but oil is dirty, containing mercury, arsenic, and sulfur, some of which would be released in coal-fired power plants in the United States. Twice as much energy is used from oil as compared to coal. To mine enough coal to replace the missing oil, it would have to be mined at a much higher rate, not only to replace the oil, but also because the conversion process to oil is very inefficient. It would have to be mined at least five times beyond what is done now.

Switching to coal doesn't take into account the greenhouse effect, the difficulty in mining it over time, the increasing world population, and the desire for higher standard of living in third world countries. Finally, there's the Hubbert's Peak effect, which would apply for coal as well as oil, and that would be this century. That is, the supply would not be hundreds or thousands of years, but mostly likely one-tenth of that.

Conservation methods recommended by Amory Lovins of the Rocky Mountain Institute include ultra light strong materials; hybrids; efficient buildings and factories; fuel from switchgrass, poplar, and sugar cane; more efficient use of electricity; and feebates (fees for gas-guzzling cars). Goodstein said a combination of these would only provide short-term solutions.

Other suggested technological fixes of the greenhouse effect include a "space parasol" at the L1 point of the Earth-Sun system which would reflect some of the solar energy and ways to sequester CO2.

Another slide was titled “Solar.” Under this topic was hydro, wind, biomass, and photovoltaic cells (PV). Solar energy has potential, but a landmass half the size of California would have to be covered with photovoltaic cells to generate the same amount of energy produced by fossil fuels. Solar and nuclear options both face significant social and political hurdles. Biomass -- a throwback to 200 years ago when people burned what they grew -- will also be critical.

Under the topic of nuclear was geothermal, fission, and fusion. Under the heading of transportation are advanced batteries, hydrogen, and other fuels. The basic principles of these are understood.

There are only two commercially viable ways of making hydrogen. One is to make it out of methane, a fossil fuel. The other is to use fossil fuel to generate the electricity needed to electrolyze water to obtain hydrogen. However, the equivalent of six gallons of gasoline is needed to make enough hydrogen to replace one gallon of gasoline.

If the problem of harnessing thermonuclear fusion can be solved and we have more power than we know what to do with, that form of energy could be used to make hydrogen for mobile fuel.

According to Goodstein, nuclear power is also limited. Proponents maintain that acceptable ways to deal with the waste and security hazards can be found. But assuming that is possible, the potential is limited. To produce enough nuclear power to equal the power we currently get from fossil fuels, 10,000 of the largest possible nuclear power plants would have to be built. That’s an enormous, probably nonviable initiative, and at that burn rate, known uranium reserves would be depleted in 10 or 20 years.

The next slide was a nighttime satellite view of the U.S. in August 2003 showing a blackout of the area around the East Coast and parts of the mid-west.

The United Nations Intergovernmental Panel on Climate Change (2-2-07) said, “Global warming due to human activity is real. It’s time to stop the debate and do something about it.”

President Bush said in the 2006 State of the Union address that that we are addicted to oil. In the 2007 address, he said, “It's in our vital interest to diversify America's energy supply -- the way forward is through technology. We must continue changing the way America generates electric power, by even greater use of clean coal technology, solar and wind energy, and clean, safe nuclear power. We need to press on with battery research for plug-in and hybrid vehicles, and expand the use of clean diesel vehicles and biodiesel fuel. We must continue investing in new methods of producing ethanol -- using everything from wood chips to grasses, to agricultural wastes.”

The future holds that fossil fuels will run out, and we will soon face an oil crisis. The consequences for the planet are unknown. There would have to be more solar and nuclear energy, and there will be social, political, and technical dilemmas.

According to Goodstein, there will be an oil crisis very soon. Either it has already begun or won't happen until later in this decade or in the next decade. The numbers are not dependable enough to know for sure. While the difference between those estimates may be very important to us, it's of no importance on the time scale of human history. Either our children, our grandchildren, or we are in for some very bad times. If we burn all of the remaining fossil fuels, they will all probably start to run out by the end of the 21st century. Assuming that our planet remains habitable after such a vast consumption binge, we will have to invent a way to live without fossil fuels.

Dr. Goodstein predicts that civilization as we know it will come to an end sometime in this century, when the fuel runs out.

Following a question and answer session was Dave Thomas' demonstration of an easy method to find the cube root of a very large number.

Business Meeting

CESE has a checking account in the amount of $1800.90 and three savings accounts. The first savings account, from a donation by Marvin Mueller, belongs solely to CESE in the amount of $7396.00, the remainder of the original donation having already been dispersed to NMSR, per the original agreement. The second savings account, an additional donation from Marvin Mueller, is $24,264 ($16,641 designated for NMSR's Science Watch radio show and $7623 for CESE). The third savings account is Eva Thaddeus' grant money, in the amount of $5041.56.

Kim recommended that Cindy Chapman be elected to the CESE board. Lisa Durkin nominated her, and Attila Csanyi seconded the nomination.

The rest of the slate was as follows:

Dave Thomas, president;
Lisa Durkin, vice president/president-elect;
Marilyn Savitt-Kring, secretary;
Jerry Shelton, treasurer;
Kim Johnson, past president;
Marshall Berman, Steve Brugge, Jack Jekowski, Jesse Johnson, Rebecca Reiss, and Jim Stuart; board members-at-large

Jesse Johnson moved to accept the slate, and David Brugge seconded the nomination. Motion carried.

Student Suzannah Wood was made honorary CESE member till she graduates high school.

Kim passed the presidential gavel to Dave Thomas.

Dave thanked all the board members, then discussed future plans. We will continue to provide statistics for the PED and cultivate contacts there, as well as the legislature, and the LESC (Legislative Education Study Committee of the state legislature). We will monitor creationist legislation and any other attempts to challenge science literacy. We will support Eva Thaddeus'curriculum on climate change. Dave also wants to work with New Mexico Institute of Mining and Technology's (NM Tech) biology professor Rebecca Reiss on the forensic DNA mini-course taught at NM Tech to determine how successful the class is at encouraging students to study science.

Dave's political cartoons on Rio Rancho mayor and director of the New Mexico Family Council, Kevin Jackson, have been published in the newspaper *Rio Rancho Observer.* The organization Jackson founded, the NM Family Council sent Behe's pro Intelligent Design (ID) book *Darwin's Black Box* to many science teachers in the state.

The data show if students are taught abstinence only, they are more likely to have unprotected sex. Laurel Edenburn, president of the board of directors of the New Mexico Abstinence Coalition, works closely with Mark Burton, a young Earth creationist (YEC) who is head of the New Mexico Science Foundation, a front group for creationism/ID.

Rio Rancho's pro-ID policy 401 is now toothless, perhaps gone permanently.

There are new threats that require a proactive approach. Two new books have been released since the Dover trial that don't mention ID, just the "arguments against evolution." The first one is the Discovery Institute's (DI) *Exploring Evolution* by creationists Stephen C. Meyer & others, written as a textbook. The second is another one by Michael Behe titled *Edge of Evolution.* Dave predicted that these books and possibly also a video about "academic freedom" would be sent to science teachers.

Creationists always claim victory, often resulting in the perpetuation of misinformation, such as the *New York Times* article that included New Mexico as one of the states that permits the teaching of ID/creationism.

New Mexico's state textbook adoption process has been weakened, increasing the risks that these books could be used in the classroom. Communication with teachers and administrators will be required.

NMSR's Science Watch radio show at 1350 A.M., 2 P.M. on Saturday afternoons is always looking for guests.

Audience comments were next. Terry Dunbar, faculty member of the UNM Education department, said he would submit an article to the *Spectrum*, the newsletter of the NM Science Teachers Association on creationists' efforts to get their publications in the hands of science teachers.

Meeting was adjourned, and refreshments were served.

Respectfully submitted,

Marilyn Savitt-Kring

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