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To: Dan Breedon

Fr: Ed Miller

Subj: Physics factoids that may drive Butte County planning, global warming model tweaking and some brighter aspects of global warming

Ref A: Richard Muller, Physics for Future Presidents, The Science behind the Headline, W.Norton 2008(Butte County Library 530M)

Ref B: Richard Sommerville, The forgiving Air, Understanding Environmental Change, book reviewed on UCTV 2/22/09 as part of a general discussion on climate change, history of the IPCC and leading players.

Ref C: Dennis McCaffferty, The Good Side of Disasters, USA Weekend Feb 20-22, 2009, pp6-7

Background: In Ref A Muller, a U.C. Berkeley physicist, provides a comprehensive overview of issues that are likely to drive presidential decision makers. I will try to glean out factoids and option rankings that appear applicable to Butte County. I can recommend the book for thoughtful citizens on a wide range of issues. Ref B written by a meteorologist from Scripps who has been active in IPCC , looks objectively at the evidence for global warming/climate change, mitigation and concern over particulate clean up that may aggravate the problem. Ref C looks at disaster such as wildfires, volcanoes, landslides, Hurricanes and earthquakes that can have beneficial aspects.

Per Ref A:

Energy ranking relative to a unit weight of gasoline:

Superior: Steak X4, chocolate chip cookie X2, Methanol X2, Ethanol X1.5, Butanol 1.1

Inferior: Hydrogen X2.6, Nuclear fission X1E6, Nuclear fusion X6E6, Anti-matter X2E9

Efficiency of electrolysis in the generation of hydrogen: 30-40% in terms of motive power

Approximate average petro-chemical power in ascending order (Average Household demand=1 kw)

Intermediate size power plant	30-50 Mw
Large size power plant	1000 Mw/1 Gw
California total power plants	40 Gw
U.S. total Power plants	450 Gw

Adult average energy requirements=2000 cal/day=1.3. lbs of rice=70cents in small quantities=10 cents in large quantities=2 kw-hrs or 20 cents at 10 cents/kw-hr

Example of a solar electric power plant: 624 one thousand square foot mirrors directed to a central 377 foot high tower in Seville Spain produced 11 Mw of electric power at an efficiency of 15%. An expansion to 300 Mw is planned. The 28 cents/kw-hr electrical energy is justified on the basis of the Spanish agreement to the Kyoto protocol limiting CO2 emissions.

Availability of oil:

The Hubbert peak of worldwide oil production =2008 based on an increase of recoverable resources in 1990 of 1 billion barrels to a current 5 billion barrels using idealized recovery methods (surfactants, CO2 , polymers & bacterial biofilms).

The Fischer-Tropsch method of combining hydrogen from water and carbon from coal can furnish enormous quantities of oil at > $50/barrel. The U.S. has about 2 trillion tons of coal reserves. The investment costs and competitive sources risks are substantial and would likely require government guarantees. Mitigating environmental impact would be a major part of the mix. This system kept the Nazi war machine and South African Apartheid governments afloat.

Concerns about nuclear waste products/meltdown and terrorist nuclear threats:

High probability of creating cancer on a long term basis	2500 rem
Approximate short term half death ionizing radiation level	300 rem
Approximate Short term debilitating threshold level	100 rem
Typical cumulative radiation from radioactive particulates from uranium/plutonium bomb or power reactor meltdown	20 rem

To reduce the 77,000 tons of nuclear waste at Yucca Mountain to a level comparable to naturally occurring uranium would require < .1% leakage over 300 years

Reprocessing of nuclear waste to provide plutonium for energy production in pebble bed reactors can minimize weapon processing/diversion, minimize storage/operating costs.

Short half-life radioactive isotopes of iodine (8 days) can result in thyroid cancer that can be countered with short term iodine loading of people subject to inhalation or ingestion of this material.

A very likely cause of global warming:

Per the IPCC, the observed warming from 1957 to now is extremely unlikely (5% chance) to result from ordinary climate variations. Something must have forced it to change (such as natural solar variability or human CO2) It is very likely (90% chance) that humans are responsible for at least some of

the warming. The uncertainty arises from the negative feedback from cloud cover. The computer models are based on empirical data rather than physics.

Per Ref B in the eyes of Scripps, the more familiar position on global warming is emphasized as a great unplanned experiment that we need to bring to a grinding halt based on the tacit assumption that man-made CO2 inputs are the prime drivers and the side benefits of control are worthy in their own right. Pioneers like Revelle, Roland, Baleen and Keeling have established a reliable measurement basis. Whether we need to hold the CO2 to 450 PPM or a lesser amount can be debated but the rate data suggests that time is of the essence. Education is the key in an environment in which about 50% of the U.S. population is not aware that the earth moves around the sun and another fraction are not tuned into the effect of the spin axis tilt on the seasons.

Ref C looks at the beneficial effects of environmental change in terms of renewal and reflects on the energy pulse view from ecologists.

Potential actions or positions on the general plan based on Ref A-C.

1. The initial, life and indirect costs/benefits of cellulosic generation of butanol and related oil products needs to compared with alternate sources of energy.
2. High performance air filters as part of heating exchange or straight filtration need to be viewed as protection against remote nuclear disaster/terrorism inhalation, vegetation fire and general particulate generation.
3. Commercially viable thermonuclear fusion (CTF) has been predicted to be available in 20 years for the past 50 years. Betting the Butte County family farm on this outcome is a risky approach if you believe Muller.
4. Sequestration of coal or biomass plant effluent is estimated to add a cost of 30-60%.
5. Integrated gasification combined cycle (IPCC) offer hope of improved efficiency. We need to keep on top of this development.
6. Conservation of energy for fixed and mobile facilities, reduction in travel and improved CAFÉ standards need to be given the highest priority.