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Subj: Likely electric grid configurations for Butte County, Impact of electric vehicles, Fusion factory, Train stopping technology, Biodiesel Production, Advances in solar technology, No-Till farming and food production constraints.

Ref A: Power and Energy Magazine, Making the Connections, Next-Generation grid, Vol 7 #2, Mar/Apr 09

Ref B: IEEE Spectrum, How Green is my Plug-In, Fusion Factory Start up and Stop that Train, Vol 46, #3, Mar 09

Ref C: G. Purcella, Do It Yourself guide to Biodiesel Ulysses Press 2008 (Butte Lib 662.669)

Ref D: d. Arvizu, Let the Solar Revolution Begin, Solar Today Vol 23 #2, Mar 2009

Ref E: Business Week, Solar, The Sun Will Come Out Tomorrow, Jan 12, 09 p51

Ref F: R. Higgins & J. Reganold, No-Till Farming, Scientific American July 2008 pp71-77

Ref G: E. Millstone & T. Land, the Atlas of Food, U.C. Press 2008

Advanced Metering Infrastructure (AMI): The prime responsibility for negotiating changes in the electric grid in Butte County rests in the arms of PG&E and the state utilities commission (CPUC) but Butte County can have an influence on the adaption scheduling and education of our stakeholders. Per Ref A p22, the ball is starting to roll on "Smart Metering". As of Sept 18, 2008 the CPUC approved installation of 5 million Smart Meters over 4 years by Southern California Edison (SCE). SCE will report to CPUC on energy savings, financial benefits, demand response, load control and conservation associated with AMI. The details of implementation need to be worked out. Boulder Colorado, the nation's first Smart Grid City is a good example. Further guidance can be obtained at www.naruc.org/Ferc/default.cfm?c =3. The meters themselves cost about \$200. Laying the groundwork for this potential change within the general plan could help avoid a ratepayer revolt, hold down our carbon footprint and enhance reliability of the network. The SCE implementation cost is \$1.63B and the direct benefits range from \$9-307M/yr. For the U.S. using the same principles, the equivalent CO2 would be reduced 106 million tons/year.

Improved Distribution Transformers: Per Ref A p26, If the U.S. and Mexico were to utilize 1 million high efficiency amorphous cores (not silicon steel) for distribution transformers, the annual energy savings would be 750 million kWh or the equivalent of 465,000 tons of CO2/yr or removing 90,000 cars from the road.

Demand Response Programs: It is estimated that the U.S. could save 47 GW by demand side management resulting in lower ratepayer costs and a CO2 reduction of 106 million tons/yr.

Increased Complexity: Reinvestment in the grid will be required to accommodate renewable, distributed generation, demand response, and plug-in vehicles.

Phasor Measurement Units: Establishing real time network stability using sampling rates of phase at 50-60 samples/second and associated communication will allow transmission lines to operate nearer to their ultimate limit and minimize the cascading effect of network faults resulting in improved reliability. The County needs to keep on top of the Power System Research Council, a consortium of 13 universities and 50 industry representatives and to encourage PG&E and load users in keeping up to the state of the art.

Plug-in vehicle support: Per Ref A p 56, most plug-in vehicles will require .2 to .3 kWh/mile of charging power. 30-40 mile trips would require 7-10 kWh of energy. It is estimated by the Pacific Northeast National Laboratory that plug-in vehicles could replace up to 73% of the nations vehicles. Providing 220 Volt 30 ampere GFI outlets at home and malls could have a profound impact on new construction and distribution system requirements. Ref B documents the benefits to be derived from the use of electric vehicles recognizing the carbon footprint of the generating sources.

Train stopping enhancements: All electric braking controls and higher performance requirements need to be recognized as a complex problem that has yet not been fully resolved. The county will need to keep on top of rail system operators to be sure that safety is maximized at a reasonable cost. Ref B documents the current status of advanced braking systems.

Fusion Factory Start Up: Per Ref B, the growing pains of the Lawrence Livermore pulse fusion facility overruns and scheduling are documented. In addition to industrial power, this facility uses this system to evaluate nuclear weapons and provides inputs to cosmology studies. The idea of 182 neodymium lasers creating a 500 terawatt bolt of energy that can release 20 times the input energy from pellets of deuterium is mind boggling. At Fusor.net, amateurs document small scale demonstrations of fusion on a non-economic scale that is intriguing and comparable to DNA experiments. As noted previously, Muller who is on the Livermore staff, cautions that we should not bet

too heavily on fusion up to the 2030 era but billions are being spent in a major effort that could change the landscape forever.

Do it yourself biodiesel: Ref C describes the detailed process of combining oil from e.g. a Chinese restaurant, adding methanol and a KAH/NaOH in a controlled fashion that could have implications for Butte County at various levels from individuals to larger scales. Providing ASTM qualification and waste handling needs to be recognized at the county and/or state level. Low temperature performance in the higher elevations of Butte County with biodiesel (as opposed to petrodiesel) needs to be recognized. Oil feedstock plants such as corn, soybeans, canola and jatropha are candidates. Jatropha is of special interest to Butte County for growth in marginal land. Algae in conjunction with CO₂ from cogeneration/CHP plants offer the potential for low carbon footprint production. Straight vegetable oil in diesel engines requires a dual system that is not EPA approved and is subject to "coking up" unless petrodiesel is used to flush the system reliably, that concern vehicle manufacturers. A combination of petro and bio diesel may be an emergency or transition fuel that will need to be regulated. Companies

in Butte County are starting to get into the biodiesel production field. Biodiesel is available in the Sacramento area and may come into this area in the near future. The addition of at least 10% biodiesel to the petrodiesel is beneficial in providing lubrication and particulate minimization for ultra low sulfur diesel that is now a requirement in California.

Photovoltaic solar cells advances: Reference D & E document basic technology and production improvements that are keys to progress in this area. Amorphous silicon is projected to be at \$50/kg or \$3.10/peak watt by 2012. This is a big reduction from the 2008 cost of \$250-500 for material. HelioVolt Corp is developing a printing process for coating of buildings that is promising. The National Renewable Energy Laboratory has demonstrated efficiencies of up to 40.8% at 326 suns concentration that is promising. The cost target for thin film copper indium gallium diselenide (CIGS) using concentrated photovoltaic technology (CTS) is 12-30 cents /watt that may be integrated into windows as well as solar concentrators.

No-till farming revisited: Ref F & G discuss the pros and cons of no-till farming practices. Rice and Potato farmers have tended to avoid this technique. Increased use of herbicides is common using this technique. Reduction in greenhouse gases is a primary benefit of this technique.

General agricultural challenges: Ref G is an excellent world view reference. Current concerns include Biofuel production caused decline in global cereal crops, weather/climate effects; small scale farmer evictions for jatropha/sugar plantations are typical. Feeding the 820 million developing world undernourished people of the 854 million total undernourished people is posing a serious problem in the face of long term and emergency situations. Water security, salinity and contamination pose special problems especially for the poor who cannot import food during a crisis. Agricultural water withdrawals account for 70% of freshwater usage. 5000 liters of water is required to produce the daily food for one person. Under-nutrition, Vitamin A, iron and iodine lead the problem list worldwide and in some cases industrialized nations. Over-nutrition is the most common problem in industrialized nations. Pesticides (insecticides, herbicides, fungicides...) kill 70,000 Ag workers per year. No effective data collection system is in place and many farmers are trapped in a vicious "pesticides treadmill". Genetically modified crops that take advantage of pesticide immunity are expanding. The U.S. uses 400,000 tons of pesticides annually. Non-organic fertilizers (NPK) have quadrupled from 1960-1990. Nitrogen fertilizer is critical in the release of greenhouse gas.

Potential actions items to enliven/improve utility of the general plan

1. PG&E: Obtain recommended corridor spacing width vs. voltage. Report on plans for "smart metering". Report on load demand control plans. Report on current and projected "islanding" and reclose on fault policies. Estimate the load margins by area (e.g. quad81 or 450 acres) with and without phase stability monitoring now and in the period up to 2030. What corridors do you want to set aside by zoning for major electrical/gas transmission systems involving renewables or the national grid? What is your policy on improving efficiency and reliability of electrical transmission?

2. SPI/large Industrial forestry organizations: What are your current cutting cycles, thinning and reforestation policies? What policies have you adopted or planned to minimize catastrophic wildland fire loss of life/structures/resources using minimal expenditure of public funds? What encouragement/funding would you require to expand your current cogeneration/CHP facilities throughout Butte County? Would you explore the possibility of creating an algae based oil production or carbon sequestration capability in conjunction with new or old CHP facilities? Have you considered utilization of hardwoods in high value applications such as flooring or furniture? How can your private road system be utilized effectively for mandatory evacuation?
3. Large scale cereal producers and associated pesticide/fertilizer applicators: Do you know or plan to trend soil health and adverse inputs to the surface/ground water aquifers?
4. Large scale nut & fruit producers: To what extent are you dependent on insect pollinators? Have you observed colony collapse? Are you in a position to evaluate/correlate nearby pesticide use with colony collapse?
5. Small scale organic and niche farmers: What scale do you find effective in providing for the needs of nearby consumers? What are your irrigation requirements?