

Thursday, December 25, 2008 (file cac180) revised

To: Dan Breedon

Fr: Ed Miller

Subj: Energy conservation, Growth, system engineering, sprawl, errata and remote sensing

Ref A: U.C. Davis conference on the roots of energy efficiency, Broadcast recently on UCTV Dec 21, 08, Conference on Oct 7-14, 08

Ref B: Regional growth lags behind state average, ER Dec 20, 08, A1

Ref C: W. Wade (editor), System Engineering, IEEE professional group on Engineering Management Review, Vol 36 #4, 4<sup>th</sup> quarter 2008

Ref D: Systems dynamics and systems thinking mega link list, <http://www.wu.uni-klu.ac.at/gossimit/linklist.php> (derived from Ref C pp96-97 entitled "surfs up" by L Langford)

Ref E: T. Gill, About system thinking, <http://www.phrontis.com/sthink>

Ref F: International council on system engineering, <http://www.incose.org/>

Ref G: K. Evatt, Learning to live without sprawl, Sac Bee Dec 21, E6

Ref H: L. Tsang editor, Satellite remote sensing missions for monitoring water, carbon and global climate change, Proc IEEE Fall 2009

Background: Ref A covers a broad range of California political and industrial initiatives that have reduced per capita consumption of energy currently to 6500 kwh/yr. Ref B shows that Butte County as of July 07 has grown at a rate of .87% for a total of 220,769 with an increase of 1895 residents. Ref C provides an overview of system engineering. Ref DC lists low level (K-12) and above fundamentals. Ref E lists references for individuals who want to pursue a career in system engineering. Ref G directly addresses the need for system thinking about complex systems where uncertainty abounds. Ref H is the key to remote sensing of water, greenhouse gas and global climate change. The two key players are Leung Tsang at U. of Washington ([tsang@u.washington.edu](mailto:tsang@u.washington.edu)) and Thomas Jackson of the hydrology and remote sensing lab of USDA ([tjackson@hydrolab.arsusda.gov](mailto:tjackson@hydrolab.arsusda.gov)). The following comments relate to the Butte County General Plan Update:

1. Merely flattening the per capita utilization of energy is not sufficient for attacking global warming. As one of the leaders in the energy conservation field, California needs to reduce per capita consumption of energy in the next few decades while we get our act together on renewable energy developments. A cartoon with a monkey pulling down the per capita energy curve goal of Butte County relative to the U.S. and current California based on a reasonable set of goals could enliven the General plan update document. Minimizing well depth recognizing

increased ground water demand, higher efficiency pumping/lighting/computing/TV/reduction of parasitic loads are example of county encouragement/subsidy/requirement activity that need to be melded into the general plan. In the cost column we need to decouple the 1<sup>st</sup> and life costs.

2. The current slow growth rate in Butte County (.87%) gives us time to get a handle on smart growth driven by a better understanding of limiting resources such as ground water and energy on the supply side and irrigation efficiency/vegetation selection on the demand side.
3. Errata in cac187:

item 9 a,b & c. 9a should read : A ball and a bat cost \$1.10 total. The bat costs \$1.00 more than the ball. How much does the ball cost? The typical answer is \$.10 and the correct answer is \$.05. The analogous system problem faced by stakeholders in forested regions of Butte County is the need to determine optimal thinning that recognizes timber return on investment, conservation of water, control of wildland fire, creation of biomass for energy/engineered products, visual/acoustic isolation, aesthetics, access, emergency escape, minimal footprint support services and multiple use growth potential. In the simple example, the tradeoff between the ball and bat costs is designed to shake up young and old about the need to avoid linear thinking based on false assumptions.

$$\text{ball} + \text{bat} = 1.1$$

$$\text{bat} - \text{ball} = 1.0$$

Note that these are two independent equations that need to be solved simultaneously. If you subtract the two equations, the bat cost will drop out and the ball cost = .05. Confusion arises because the bat cost is not given and the word "more" could be interpreted as a set.

In the TV program "are you smarter than a 5<sup>th</sup> grader" it is likely that he/she would immediately write down the answer by cut and try, or algebraic rules. Cognitive scientists, system engineers and educators could shed a tear over the wrong headed "automatic" approach, the need for reflection and failure to recognize that the bat cost was a variable that needed to be traded off against the ball cost. I suspect that the average wrong answer comes from a test speed driven education system that says this is a subtraction problem, grab two numbers and go to the next problem without testing. The time driven garden variety engineer might come up with an elaborate definition of given and find, drive out the cost of the bat and eventually determine the right answer. The time/responsibility driven system engineer might try to fit this problem into a more general model and eventually find the correct solution. The goal of this exercise was to sensitize individuals in a loosely focused group to a common thinking problem and not to run to an "expert". The second example 9b has a similar goal: If 5 machines take 5 minutes to make 5 widgets how long does it take 100 machines to make 100 widgets? My hypothetical 5<sup>th</sup> grader should cut to the chase and observe that the answer is 5 minutes since the scaling for the two sets is identical. The automatic or elaborate standard procedure folks/children can tend to make inappropriate calculations or get bogged down in blunders. The 3<sup>rd</sup> example: In a lake, there is a patch of lily pads. Every day, the patch doubles in size. It takes 48 days to cover the lake. How long does it take to cover half of the lake? Hopefully 5<sup>th</sup> grader would note that the best choice of reference would be the last doubling

of the lilies and generate the answer=47 days. The naive product of a dysfunctional education system might come up with the answer 24 days and the engineer might try to find the generating function in order to solve the problem starting at the first doubling. The goal for the failing 5<sup>th</sup> grader and associated teachers, parents and fellow students is to make this a fun challenging exercise rather than a thinning tool to separate the gifted from the plodders. Hopefully in a collaborative environment , by 2030 they will have the tools to solve important complex problems and develop a sense of worth that can drive the educational experience and help them find a productive niche in Butte County society.

Note that Thaler and Sunstein on p20 of their Nudge book lists two cognitive systems:

(Automatic)	(Reflective)
Uncontrolled	Controlled
Effortless	Effortful
Associative	Deductive
Fast	Slow
Unconscious	Self-aware
Skilled	Rule-following

4. Preparing for an expanded bio-mass industry in Butte County: If we are to believe much expert opinion, by 2030 we should consider the strong possibility that bio-mass will be a strong contender for energy/product production in myriad applications. At a minimum we need to place bounds and limits on this activity. In a creative scenario, government may want to become involved in initiative taking, funding, supervision and development of a skilled engineering/stewards/labor force that will take advantage of local cellulosic resources. Efficient/low energy support of stakeholders who would support this class of industry will need to be examined to make sure that we encourage investment.
5. Urban sprawl remains an undefined concern as illustrated by Ref G. The viability of multi-use forested areas, small niche organic farms and integrated industrial activities need to be studied.
6. Ref H looks forward to a major thrust by remote sensing satellites that we need to examine, and potentially shape, fund and evaluate to determine their utility.