

Deep Energy Reductions Keynote

SLIDE 1: First I want to thank my partners in this summit, PG&E and ACI for giving me the honor of addressing this important gathering. Special thanks also to Linda Wigington whose ability to synthesize ideas is one of our group's greatest assets. I have one grandchild and another on the way so I know where she gets her newborn future focus. The older I get, the more I realize that time is a scarce commodity and therefore I have a sense of urgency about this summit. It was 30 years ago in April that Jimmy Carter urgently asked Americans to reduce their energy use in order to achieve energy security, mitigate environmental destruction, conserve natural resources, and avoid future conflicts over energy. Carter was frustrated by the lack of interest in conservation. He said I quote "... our energy problem is worse tonight than it was a few weeks ago.... It is worse because more waste has occurred, and more time has passed by without our planning for the future. And it will get worse every day until we act." unquote

SLIDE 2: We have little choice but to eventually reduce our energy consumption. A combination of technical improvements and behavioral changes supported by a shift in policy could save us from the embarrassing realization that we can no longer afford our energy costs.

We face skepticism over our focus on deep reductions of 70 to 90 percent. However, to illustrate that deep reductions are possible, here you see the typical annual energy consumption of some different housing types shown in kWh per square foot and kBtu per square foot. On the bottom, the German Passive House consumes only ten or twenty percent of the energy of a typical German or American home. The colors on the bars denote the types of energy use. American homes vary by a

factor of at least 10 to 1 in the amount of energy they use per square foot and the amount of heating and cooling power they require per square foot.

SLIDE 3: Decades ago, Amory and Hunter Lovins introduced the idea of Factor 10 engineering, an approach that goes beyond conventional cost benefit. The Lovins have proved that there is a tipping point where the extra effort and investment in conservation suddenly becomes convincingly superior to a conventional approach. The Passive House or zero-energy-home approach demonstrates this economic tipping point through the goal of a 90 percent reduction in energy use. Some additional benefits, affecting economics and customer satisfaction, are listed on this slide.

How many days recently have I sat in my office surrounded by piles of complex standards and specifications, trying to reconcile them with each other, and pondering how to explain them to people entering our industry. Our current incremental-savings approach generates unexpected complexities, stumbles into problems, attempts halfway solutions, and produces unsatisfactory results. Our current energy-program goals and standards are too complex, too vague, and too low to produce the deep energy reductions that we're going to need to extend our prosperity to our children and grandchildren.

SLIDE 4: My first American experience with the deep-reduction approach was working at the National Center for Appropriate Technology in Butte starting in 1979. NCAT architect Bob Corbett partnered with local entrepreneur Brian Curran to design factory-built superinsulated houses at a business called Buffalo Homes. NCAT produced this popular booklet back in 1980, and we all thought we were on the cusp of a new movement in energy-efficient housing. We learned the hard way that social acceptance doesn't necessarily follow

technical innovation when Buffalo Homes failed in 1983. Nevertheless, over the years, superinsulated homes and superinsulated retrofits have continued in North America, although not many and not within an organized framework. Superinsulated homes are currently being built in North America under the banner of zero-energy homes and there is also a small American passive-house movement emerging whose representatives are here with us today.

SLIDE 5 & 6: My first European passive house connection was in 2005 when I met Andreas Hermelink, at a meeting of the European Council for an Energy Efficient Economy in France. Andreas delivered a paper on a Hungarian apartment building where he had supervised a passive house renovation. He related an interesting story of some dissatisfied customers there who complained about insufficient comfort during cold weather. When Andreas went to investigate, he found that the heat had been turned off to their section of the building for the entire winter. A Russian passive house customer living in Germany asked Andreas why you would need any heater at all if the temperature would drop only to 55 or 60 degrees during the coldest weather. This comfort standard would meet **her** expectations and it would certainly meet Linda Wigington's expectations.

SLIDE 7: Expectations are important to **us** here at this summit because if somehow we can reduce expectations, it makes our deep reductions much easier to achieve. I learned how to reduce expectations while living in the Czech Republic between 2003 and 2006. My wife and I discovered that our clothes didn't need washing as often as we had previously thought. This resulted from less clothes-washing convenience compared to at home. Washing machines are small and

everyone dries their clothes on clotheslines and drying racks in the Czech Republic.

One of my first Czech friends Jaroslav Shultz, a mechanical engineer and graduate of Michigan State University asked me why American use electric lights during the day in buildings with windows. Czechs evidently believe that offices with windows need no artificial light during the day. I see this ethic at work in many German and Austrian buildings too.

York Ostermeyer, a German passive house specialist, was told while visiting Japan that Japanese homes are hot in the summer and cold in the winter, but he had a difficult time getting an opinion about whether or not comfort was acceptable. The Japanese are rather reserved in their opinions. After a lot of polite questioning someone finally explained that indoor temperature variation was the natural order of things and necessary for people to adapt to the changing outdoor environment. Later he learned about a government standard that said that indoor temperatures between 60 and 90 degrees F were normal.

SLIDE 8: These anecdotes are important to understanding how people's expectations determine what constitutes an acceptable indoor environment. Do you see how widely these expectations vary and how they might dramatically affect energy consumption? We North Americans currently have some unsustainable expectations, which we will eventually have to revise. I hope we can do so voluntarily.

I attended the passive house conference in 2006 held in Hannover Germany. Passive house principles are applied only to new buildings and major renovations when the systems approach can be followed. The passive house standards are simple: Install no more than 1 watt of heating capacity per square foot of floor space, use no more than 1.5 kWh per

square foot for heating annually, and limit total on-site annual energy consumption to 4 kWh per square foot.

SLIDE 9: The heating load is so low that 30 cfm of ventilation air per person can distribute heat to the building. I must say that these metrics simply bowled me over and seemed to have a terrifically energizing effect on the other participants.

Particularly profound is their recognition that limiting installed heating capacity is vital to achieving real savings because it forces builders to use superinsulation and airtight construction. I suggest that we adopt this idea as a general principle of deep reductions. Limit installed capacity of space heating, cooling, water heating, and lighting.

Passive houses have created a burgeoning new industry niche in Austria and Germany. There are numerous manufacturers of passive house components including: low-capacity compact HVAC units, passive house windows and doors, and various types of innovative building systems.

In case I haven't already convinced you I'm a crackpot, let me share some of the non-technical challenges we must confront on the way to deep reductions. These are the 800-pound gorillas that we'd all like to ignore. SLIDE 10:

1. We need to tell people that the way to be green is to monitor their energy consumption and to make deep reductions. We need to say that as a society, we must sharply reduce our use of energy and natural resources from current levels. We need to shout this from the rooftops.
2. We must promote the building trades as the vital, vibrant and admired professions of the future. Few young people are joining their ranks because of a perceived lack of status, achievement, and fulfillment available in the building trades. We absolutely must reverse this trend

because currently we don't have the people we need to achieve deep reductions.

3. We must champion the waste-reduction efforts of our corporations. Capitalism will survive and thrive under widespread waste-reduction and conservation programs. If corporations want to really be green they should overcome their fear of shrinking markets, allow the conservation message to be heard, and figure out how to profit from the new reality.
4. We must implement time-of-use rates, inverted rates, and taxes on carbon or energy as soon as possible.
5. We should consider limiting the installed capacity of heating and cooling systems as a prime metric of energy-efficiency programs.
6. We should admit that the trend toward universal refrigerated air conditioning for all buildings is a costly mistake, an unsustainable expectation, and an environmental catastrophe in the making because the summer peak is driving the construction of more coal-fired power plants. We should reverse this trend starting in the North. We Northerners can substitute shading, insulation, air-leakage reduction, and other low-cost cooling measures for our air conditioners.

SLIDE 11: _____ had good intuition in mentioning the aesthetic considerations because effective insulation details, complete air barriers, and roof reflectivity among other energy-saving features are at sometimes odds with what the majority considers stylish good taste. I've been told many times in this very building by architects and builders that reflective roofs will never be adopted because they are ugly. We gotta find a way to make them beautiful. I can only hope that the simplicity movement will have a defining effect on our architecture. The

typical American MacMansion squanders money on blind adherence to a fashion that makes new homes look like they have already been badly remodeled. Let no one tell us that insulation, shading, air sealing, and other conservation measures are too expensive. Too expensive compared to what? Compared to what we spend on fireplaces, spas, and unnecessary light fixtures for our homes? Compared to the cost of securing our supplies of middle-east oil? C'mon we already spend \$40 billion on building renovation every year. Adding another 20 percent to our major renovation budget is probably all we need to start securing deep reductions.

We have an excellent opportunity in the next two days to make a difference by effectively synthesizing our ideas into a coherent course of action. We do face skepticism over this goal of deep reductions. The social, political, technical, bureaucratic, and behavioral challenges loom large indeed. For just two days however, let's put aside our doubts about whether these deep savings are achievable any time soon. Instead, let's assume that we absolutely must make deep reductions in the next 20 years. I think that this is a fair enough assumption **if** we want planned voluntary conservation to triumph over continued waste and excess devouring our prosperity. Thank you again for this opportunity.