Creating Sustainable Solutions for a Complex and Consuming World

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With a current population of 6.5 billion, Earth is becoming a place in which human populations are:

- More consuming
- More crowded
- More connected
- Less diverse

..and in which living systems and cultures are in increasing jeopardy.
1.2 billion lack clean water
2.4 billion lack adequate sanitation
2.4 billion are at risk with malaria
29,000 children die from hunger daily
1.1 billion overfed vs. 1.1 billion underfed

Planet Earth Circa 2007

1.2 billion lack adequate housing
1.6 billion have no access to electricity
4.2 billion are unable to read
1.8 billion live in conflict zones, in transition, or in situations of permanent instability
IN THE NEXT TWO DECADES, ALMOST **2 BILLION** ADDITIONAL PEOPLE WILL POPULATE THE EARTH. THIS GROWTH WILL CREATE DEMANDS ON AN UNPRECEDENTED SCALE FOR:

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Infrastructure

Infrastructure is that part of the anthrosphere composed of the utilities, facilities, and systems used in common by members of a society and upon which the society depends for its normal function.

What we don’t want…

- Technologies that substantially or totally deplete natural resources
- Technologies that eliminate options for the future for natural and human systems
- Technologies that escalate costs to prohibitive levels and that ALL cannot afford
- Technologies that increase the probability of catastrophic future disaster either natural or technological
Questions..

What represent appropriate and sustainable technologies?
Can these technologies provide solutions to current problems and avoid (or minimize) irreversible long-term negative environmental, economic, and social consequences?
Who should such technologies serve?
NON-NATURAL SYSTEMS (Built Environment - Anthrosphere) vs. NATURAL SYSTEMS (Biosphere- Hydrosphere-Geosphere – Atmosphere)

- Cartesian
- Somewhat predictable
- Designed as closed systems
- Built to last
- Non-Cartesian
- Non-linear
- Coupled
- Chaotic
- Diverse
- Open
- Dissipative
- Changing
The word “sustainability” comes from “sustain” which comes from a Latin word that means to hold up and prolong, to keep in existence, to endure and withstand.
What do we want/need to sustain, hold up or prolong?

- The natural environment (air, water, land, biota)
- The human race and its basic organizations (family, individuals, communities). Critical issues are body, mind, soul
- The built environment (facilities, infrastructure systems)
- Production systems (goods, products, services)
- Resource base (different types of capital)
With two additional levels of complexity

- Spatial scale of sustainability
  (site, local, state, regional, national, global footprint, etc.)

- Temporal scale of sustainability
  (today, 1 yr., 1-5 yr., 5-10 yr., etc.)
Sustainability – What kind?

- Economic sustainability
- Social sustainability
- Financial sustainability
- Ecological sustainability
Sustainability and Sustainable Development Definition

“Sustainable development is the challenge of meeting human needs for natural resources, industrial products, food, transportation, shelter, and waste management while conserving and protecting environmental quality and the natural resource base essential for future development.”

(Policy Statement, ASCE TAC Subcommittee on Sustainability, 2001)
The three E’s (or 3 P’s) of Sustainability

- Environmental (Planet)
- Economic (Profit)
- Equity (People)

Sustainability
“Sustainable development implies a new and healthier balance in how we conduct our human affairs, one that celebrates depth along with surfaces, community along with individuality, spirituality along with materialism, art along with linear technique” ….. a new humanism”

(K. Frankel)
Emerging Trends

- Rapid global economic growth
- Expansion of resource consumption
- Growing awareness of the consequences of rapid growth
- Emergence of new powerful stakeholders and a new worldview
- Emergence of credible alternatives to business as usual (NC, TNS, ZERI)
Questions

- Is it possible to satisfy the needs of an exponentially growing population while preserving the carrying capacity of our ecosystems and the diversity of our cultural systems?  No

- Can we keep on living on our capital but not on the interest of that capital?  No

- Do today’s engineering graduates and engineers have the skills and tools to address the global problems that our planet and humans are facing today, or will be facing within the next 20 years?  No
“The significant problems we face cannot be solved by the same level of thinking that created them”

Albert Einstein