Future Living
Blending Human Aspirations with Environmental Realities

Questions and Answers

Future Living. ***Blending Human Aspirations with Environmental Realities***
Systems and Systematic Design
Questions and Answers: **The Earth Awards 2010**

April, 2010

Extended Questions and Answers for:

The Earth Awards
An International Competition

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The Earth Awards Mission
Human imagination and ingenuity are the impetus of every good design all across the world. People from every walk of life are generating good design ideas that offer groundbreaking solutions to the ecological and social challenges of the 21st century. The Earth Awards provides a platform for these visionary ideas, presenting a unique opportunity for individuals and organizations worldwide to expose their design innovations to a global audience. The Earth Awards is committed to the idea of popularizing the most viable of these innovations, and transforming them into market-ready solutions.

Keywords: planning, design, future, housing

One-line Description

A plan for an adaptive housing system designed to improve quality of life in a wide range of cultural and climatic settings while helping to meet mid-century challenges of population growth, resource depletion and climate change.

Pitch

In the developed world, housing has become an object of consumption. As middle-class standards of living have risen, excess earnings have bought larger, more luxurious homes outfitted with space-filling objects of conspicuous display. Wasteful living now consumes a sizeable portion of our resources, a condition that has been tolerated, but no longer is tolerable. The forces of population growth, climate change and resource depletion will force all—in developed and developing nations alike—to reduce their impact on the Earth's resources. The alternative is not pleasant to contemplate.

In this project, Future Living sets forth a way of thinking about home and housing that allows individuals and families to become part of the solution instead of the problem. A collection of individuals amid a population of 6.8 billion seems woefully inadequate to any task of environmental reconciliation, but individuals live in households, and households provide basic services placing demands on resources and means of distribution. Reducing household demand on public and private sector systems for water, food and energy will have major impact on these primary resources. Changing a culture of consumption to one of conservation will extend that positive impact to a wide range of other resources used for the artifacts of daily living.

Advanced technologies, too, will play an important role. Information technology, as an example, has the ability today to convert printed information in the home to digital, multi-media data. For a household with even moderate amounts of paper-based information, the space-saving possible is remarkable. Robotics, as another example, promises to provide complex forms of assistance formerly only available from human providers and specialized machines. Biotechnology can alter crops to forms ideal for growing in the home, extending growth cycles to year-round activity and multiplying yields for space-saving, high-density production. Nanotechnology offers a wider yet range of potential technological benefits: materials that can change their properties, self-healing and self-cleaning surfaces, see-through solids, shape-changing forms, selectively permeable filters and much more made possible by design and construction at the molecular level.

Explicitly planning for the use of emerging technologies in the home allows us to conceptualize beyond the limits of today's technology. The best of what exists today can be integrated in seamless evolution with what we expect and choose from tomorrow. The result is a liberating, formulating vision of what living can be at mid-century. Critics may object to the speculative use of technologies only beginning to explore their potential, but this project intentionally puts that objection aside. The 2050 time frame is purposely far-enough distant to expect capabilities as yet unrealized. The planning process, by anticipating evolution, will afford housing the ability to adapt in timely manner to emerging change with the same flexibility that allows it to adapt to variations in cultural needs and climatic conditions.

For the best performance from our design, engineering and architecture communities, we need a challenging mix of present-day goals and distant targets. A system integrating state-of-the-art capabilities with features tantalizingly almost within reach presents just the right vision to stimulate the development needed to reach it!

Project Description

What is "Future Living"?

Future Living is a project to develop housing well-fitted to the Earth the next generation of humankind will inherit. In this, its conceptual phase, it describes "what" that housing should be. Although much of its projected capability can be produced today, it integrates material and functional concepts expected to be developed in the years between now and its target date, 2050. It is a system of housing that integrates the best of what we know today with reasonable projections for what we can make tomorrow. It is a system evolving to meet an evolving target.

What does it do?

Future Living establishes benchmarks for what housing should be at mid-century. It provides

living environments adaptable in scale from the smallest of households to large extended families, and it does so using a system of structural elements that may be added or taken away to adapt the home to changes in family size and changes in the functional support emerging technologies can provide. Beyond shelter, the Future Living dwelling helps its inhabitants to approach self-sufficiency in growing food, collecting and recycling water, and producing energy. Most importantly, it is an active support system for its inhabitants: for their personal development mentally, physically and emotionally; for their social development as participating members of local and extended communities.

What problems does Future Living address?
Population growth with the climate change and resource depletion it induces is the primary force setting the problems that Future Living addresses. The world population by 2050 is projected to be approximately 9.2 billion, adding the equivalent of nearly two present-day China's to our planet (based on UN 2004 projections and U.S. Census Bureau historical estimates, http://www.en.wikipedia.org/wiki/File:World-Population-1800-2100.png). Room exists for the additional people; far less certainty exists for their impact.

The impact of all these people on the Earth's systems is the concern of Future Living. At the primary level, this includes shortages of food, water, energy and raw materials. Given an average household stabilized conservatively at five individuals (with some families caring for three or more generations), there will be about 1.8 billion households by 2050. The resources consumed domestically by these households will not be trivial. Easing the load they place on our systems for living will make a significant contribution to reducing environmental impact. Removing their dependence on centralized distribution networks will enhance resistance to catastrophic system failure.

Climate change is already creating serious economic and social problems as we are forced to contend with climate-level creeping permanent changes and weather-level intense transient events. Future housing must be able to withstand both the destructive forces of high-energy weather and the relentless aggression of desertification, sea level rise and flooding.

World population is moving to the cities, increasing the potential for aggravated social problems derived from inadequacies of health care, training and education, work opportunities, constructive recreation and community interaction. As the focal point of family life, the home provides a center of opportunity for addressing social problems before they reach the community level. A home is far more than shelter. Designed thoughtfully, it is a support system—Le Corbusier's "machine for living"—at last within reach with support systems adequate to the challenge. Future Living housing must provide that support to empower its inhabitants to reach their potential.

Finally, there are the problems of design and construction: what kinds of housing should be attempted and how should housing be designed for fabrication, installation, modification and adaptation? If housing size has exceeded rational need, how should spatial needs be met, and how can smaller homes actually improve quality of life? The problems to be faced in the coming years will become more wicked as the impact of population growth increases, but the power of technological support will also increase. For maximum effect, Future Living must put a plan in place that seeks out, encourages and internalizes advanced technological developments. Future Living must evolve with the evolving technologies.

How will this design address the problems described?
Resource depletion. Material shortages can be treated as problems of supply or demand—or both.

For food, water and energy, Future Living works on the supply side, incrementally adding to the overall supply inventory by making it possible for households to grow much of their own food, collect and recycle water, and produce energy. The following general guidelines considering conditions from different geographic locations were used in establishing relevant spatial and functional requirements for housing intended to approach self-sufficiency.

A number of sources were consulted to establish target norms. Because the system is designed for mid-century conditions, technological developments were also projected as they would affect requirements. Specifically, for food production, current opinions suggest 500 - 700 square meters per person would be required for

garden/orchard space. The Future Living system assumes hydroponics and aeroponics with high-yield, year-round harvesting as well as biogenetically modified plants and artificially produced meat substitutes resulting in a ten-fold reduction in space requirement. For water, an international average of 50 liters per person per day is used, expecting major developments in water recovery through recycling, nanotechnology filtration, and new collection and storage capabilities to take advantage of high-intensity storm events. In the case of energy, the American model was extrapolated conservatively, assuming housing globally would make greater use of advanced technology, but that there will be a generally more measured pursuit of technological applications. The typical American household today consumes about 11,000 kWh per year. Assuming a current estimate of 2.59 persons per household in the U.S., an individual American uses about 11.6 kWh per day. Again, projections show considerable savings possible as smart systems waste less and machines require less energy. Combining efficiency estimates with a cooling of consumption, Future Living estimates 1 kWh per person per day. Some sample references are cited below.

- Food: 50 m^2 of growing space per person
http://urbanevolution.org/thinktank/viewtopic.php?f=6&t=11
- Water: 50 liters per person per day
http://www.data360.org/dsg.aspx?Data_Set_Group_Id=757&transpose=row
- Energy: 1 kWh per person per day
http://www1.eere.energy.gov/consumer/tips/appliances/html

For other material resources, Future Living works on the demand side, reducing the need for things by reducing the size of housing and making spaces, tools and materials serve multiple purposes. The primary module for Future Living construction is 4 meters on a side covering 16 square meters. A home for a household of 2 in Chicago, USA is projected to require three modules, or 48 square meters. For an extended family of 10 in Johannesburg, South Africa, it is 6 modules or 96 square meters. All calculations include space for food, water and energy production. Allocation and arrangement of space takes climate and cultural differences into account.

Climate and cultural variation. Future Living housing is modularly designed to be capable of spatial variation and change to match changing needs of its inhabitants. Modular exterior surfaces are capable of incorporating materials used locally as well as advanced weather protection materials, making adaptation to colder, hotter, drier or wetter climates a matter of choice and making new housing built with the system more readily compatible culturally.

Weather disasters. Patterns of climate change can be expected to introduce intense weather events on a scale matching the increased energy available. Future Living housing employs, among a number of structural features, a strong internal structural system to resist storm-water and winds, an optional piling foundation for flood-prone environments and an interior "safe" room for extreme conditions. Modular, bolt-together construction contributes to both fast installation and fast repair in the wake of storm damage.

Personal and social growth. Much of Future Living's focus is toward unobtrusive support to help individuals to stay healthy, grow intellectually and mature emotionally in potentially difficult environments. The investment extends to a commitment to community and the social side of growth; Future Living includes support for outgoing community communication, interaction and resource sharing designed to bring individuals and families together.

At what state of development is your design currently?

Future Living is at the conceptual stage in the research and development process. Using a planning process designed especially for first-stage conceptual planning, a 25-person planning team gathered extensive information. formulated it for insightful use, organized it in an Information Structure optimized for creative synthesis, and created the plan for the Future Living housing system. The plan is explained in a 187-page illustrated report supplemented with 300 pages of appendices. As a product of the Structured Planning process, it is a highly-detailed conceptual plan—in effect, the problem statement for a second stage design phase.

In the second stage of development, component "system elements" of the conceptual plan will be the subjects of tightly focused design research and development. Developers are able in the second stage to concentrate on "how to do it" because "what to do" has been thoughtfully addressed in the conceptual stage.

Are there any drawbacks or negative consequences associated with the design?

To our knowledge, there are no drawbacks or negative consequences associated with the Future Living design.

The Structured Planning process is particularly strong in exploring a wide range of information relevant to a design project. Over the course of research, a list of hundreds of functions thought necessary to a future living environment was assembled from the viewpoints of all who might be expected to be "users" of the housing system. Each of these functions was scrutinized intensely for insights about what might go wrong (or insightfully right) in fulfilling them. Along with the insights, ideas for how to use the insights were collected as partial solutions for fulfilling the functions. Then, using computer support, potential reinforcements and conflicts were sought out to identify situations in which good solutions might work for more than one function—and also, to identify seemingly good ideas for some functions that, used in the design, might make it difficult to fulfill other functions. All of this allowed the team to exercise extreme care in designing around potential drawbacks and avoiding negative consequences.

Why does this design matter? How does it positively affect our collective quality of life?

Future Living matters because the planet's future requires that we take action toward reducing our footprint. Sustainability is a word used often today, and sustainability is an appropriate model for Planet Earth. But for subsystems such as housing, sustainability is not enough. A better goal is self-sufficiency. While difficult to attain universally, self-sufficiency in food, water or energy—alone or in combination—will be achievable in many locales, and even coming close will make a valuable contribution. Future Living sets self-sufficiency as its goal for food, water and energy. At a higher level, it sets as its goal the achievement of more with expenditure of less—beginning with the commitment to using space more effectively.

Quality of life is a complex concept. That it may be achieved with reduced consumption of space, material and resource is an underlying assumption of the Future Living project. Space in Future Living housing is conserved by using design concepts and technological capabilities to make space multipurpose. We do not need a separate space for every activity. Treating housing as a support system for life and growth—the job of unimposing but empowering support tools—provides the means to engage inhabitants old and young in their own personal and social growth, necessities for quality of life. Collectively, communities with Future Living housing will be more independent and at the same time interdependent because of their homes' self-sufficient ability to save and share resources.

How does this design reflect who we are as its designers?

One of the things that a university can and should do is involve itself in research that has social value. Although such research may also have potential commercial value, it frequently is too risky or of too uncertain value for industry to undertake. Future Living is such a project. Like other projects we have undertaken, it confronts a real need not being fully addressed by others. We hope that this first step will motivate further research, continued development and, ultimately, introduction of housing that can contribute significantly to reducing environmental impact while improving quality of life.

A principle of good design thinking is that good design should not only meet and solve a targeted problem, it should do so with added benefits as practicable. A good solution, in addition to solving the problem it addresses, can have social, economic and environmental benefits. Future Living addresses the problem of societal impact on global life-support resources, but it supports an evolution of the housing industry, enhancement of quality-of-life, and environmental stability.

Category

Future. Future Living is a conceptual, first-stage model for what housing can and should be by mid-century. It is an achievable plan for advanced housing that has as its objective improved quality of life with self-sufficiency in the resources of daily living.

Matching the Criteria

Ecological

Future Living contributes positively toward reducing centralized system needs for food production, water distribution and energy supply. Housing constructed to follow its plan will pursue self-sufficiency in all three categories, increasing supply and contributing to a decentralized, robust system model better able to respond to the demands of mid-century and beyond.

Achievable

Many of the features of Future Living's housing plan can be achieved today. The power of the concept lies in its change in approach to what housing should be and do. Planning beyond today, the Future Living model anticipates change and incorporates adaptive thinking throughout a continuing existence in both space and time. It is designed to adapt to different climates, different cultures, changing household sizes, changing household needs—and new developments in material and functional technologies.

Measurable

Future Living housing is designed to do more with less. Goals for food, water and energy to be drawn from community distribution grids are 0 or negative values (net production rather than consumption). These are directly measurable. Less directly reachable, but indirectly accessible through their effects will be contributions to better health, learning, work, recreation and community interaction.

Scalable

Future Living housing is designed from the outset to be scaled. To meet this challenge, structural and functional elements are designed to be used modularly—different versions of components for different household types in different cultural and climatological contexts. Example plans have been created for households of two to ten people, in dwellings from single- to multi-family, settings from rural to urban, and climates from hot to cold and wet to dry.

Useful

What valid needs does Future Living address? Households today are consumers in the complex web of resource supply and demand, notably of food, water and energy. Housing today has little impact on the demand for these resources. But it could have. Future Living proposes housing with active and passive systems able to approach self-sufficiency for their households by growing food, collecting and conserving water, and producing energy. Beyond resource conservation, Future Living refocuses housing on the support an environment can provide for personal and social growth.

How should the ideas of Future Living be applied? Concepts for Future Living housing have now been defined in the conceptual stage report. Next steps involve targeted research and design of specific elements of the system described in the concept report. Applying technologies available today and emerging from research, a full-scale laboratory system should be constructed for ongoing test and development in cooperation with organizations (private and public) interested in furthering the work. As systems are certified, pilot projects implemented under license can follow at selected locations nationally and internationally.

What are some examples of where and by whom the design could be used? Sample installations projected in the Future Living report are for a two-person stand-alone house in Chicago, USA—cold winters, hot summers; a four-person apartment or condo in Shanghai, China—humid, subtropical floodplain; a six-person stand-alone house in Yadz, Iran—hot and dry desert; and a ten-person stand-alone house in Johannesburg, South Africa—mild, subtropical highland. Initial installations would test the effectiveness of modular approaches to meeting specific cultural and climatic needs as well as political and economic problems unique to each location.

Original

How is Future Living original? Future Living was created using a unique planning process: Structured Planning. The process constructs system solutions integrating the best concepts currently available with other existing concepts modified to fit the emerging system, and wholly new concepts developed to provide additional needed or desired functionality. Future Living, then, is a system solution putting together many ideas in a new pattern.

What differentiates this idea from others?
Many features differentiate Future Living housing from others. Key among them is its commitment to adaptivity—adaptive at the time of specification and manufacture to the needs of people and place; adaptive in service to change in inhabitant needs and change in technology's ability to serve them. A commitment to resource conservation and self-sufficiency above sustainability is another differentiating feature. Improving quality of life while reducing the space necessary to achieve it is distinguishing. Finally, a plan for continuous response to change with near as well as distant targets underlies its approach.