

## WHAT'S THE WORLD COMING TO: A Vision of a Sustainable Human Setting

By Bruce Coldham AIA, Amherst, MA<sup>1</sup>

If a sustainable society is a lower energy society contained by renewable resources, what would a sustainable version of present western industrial society look like? What would our choices be? What new opportunities would open up, and what present options would close? How would we spend our day?

I think that it is obvious that the containment of our collective undertakings by the available regional solar flux will have considerable social impacts - from the largest to the smallest scales of human organization.

The large hierarchical pyramids of social organization that characterize contemporary society, and that require large energy inputs to support themselves, will progressively deteriorate. They will break up into more numerous, smaller jurisdictions, re-asserting what Schumacher describes as their "subsidiary function" - (a more humane and efficient organizational state in which the freedom and responsibility of lower formations is carefully preserved).

Correspondingly, at the other end of the scale, localities will become more productive as their subsidiary functions are restored. This new found productivity will be geared to satisfying basic living needs from local resources. This is the essence of a sustainable society.

To better illustrate the differences between contemporary and sustainable lifestyles, consider a typical contemporary suburban setting as it is now, and how it

might adapt. Echo Hill outside Amherst, MA is, by today's standards, a well laid out, attractive residential development. However, the site serves only as a place for houses - houses that are usually well separated, randomly oriented, and located on the flattest, most arable land. The spaces between are paved to accommodate the vehicular lifeline. The surrounding landscape consumes energy to arrest or redirect its natural succession. Expansive lawns, which require water (potable water) and chemical nutrients to grow lush, and gasoline to cut down the lushness, produce nothing except visual amenity.

The waste nutrients are channeled away - a pollutant to be wary of.

Here, the sun bakes the pavement and the rain runs off fast to aggravate the local storm drainage system. Here, on-site production is a negative number.

How much more could such a suburban setting contribute to the sustenance of its inhabitants?

In a renewable energy based society Echo Hill would need to set some goals for local production of its citizens' needs. The guiding aspiration should be to harness the resources of the setting and would include at least the following goals of communal self-reliance:

- i) water supply
- ii) energy production for day-to-day requirements
- iii) basic food production (that required to provide an adequate, healthy diet)
- iv) cycling organic wastes as a nutrient resource.

Additional goals could be set which would progressively increase self-sufficiency. Such goals could include local production of medicines, fibers,

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building materials, indeed all durable materials and appliances. At some point, however, a regime of self-sufficiency is reached that would severely limit the range of goods, place unacceptable constraints upon the lifestyles of most people, and possibly place unacceptable demands upon the resources of the setting. Therefore, establishing reasonable production goals entails the consideration of questions like: how rich is the natural resource base of the locale? what population is it expected to serve? how big is "local"? what is the difference between self-sufficiency and self-reliance?

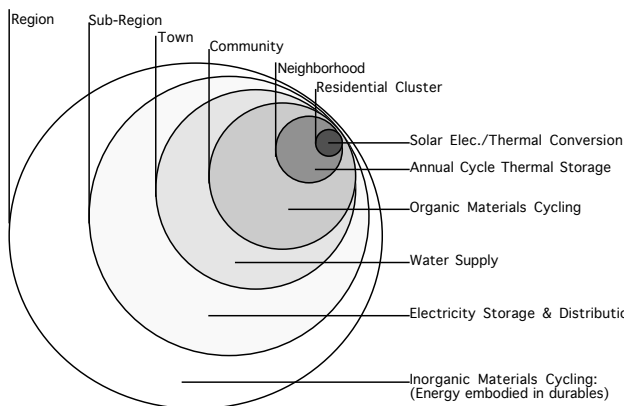


Fig 1 : Appropriate Scales for Productive Components in a Sustainable Society.

We are a society that historically has committed resources to trading goods and ideas from beyond our sphere of influence and it is safe to assume that this will continue.

Self-sufficiency implies isolation and is therefore inconsistent with this aspiration. Self-reliance, on the other hand, implies interaction from a position of strength and relative independence. It is a matter of degree, a balance, which in turn depends

upon the size of the locality. The larger the social and geographic unit, the greater its internal variety, and the greater its potential for producing a diverse range of goods; (see Fig. 1). There are production thresholds to be reached, economies of scale to be considered, just as there are subsidiary functions to be respected. But self-sufficiency, at any scale (large or small) ought not to be the end sought. The most humane and efficient organizational framework is what we are after. Both David Morris and Christopher Alexander have addressed the issue of scale. Each focuses on local control as the essence of a healthy community and define locality accordingly. Alexander, among others, considers communities of between 5,000 - 10,000 to be ideal noting that "people can only have a genuine effect on local government when the units of local government are autonomous...". Therefore, with this understanding of scale and self-reliance, we can proceed to an observation of the physical and social impacts of sustainability.

Let us re-examine our average community as if it were a part of a productive community setting in a sustainable society. Firstly, the site planning would reflect the need to release more productive land for agriculture. As a general rule, any expanse of prime agricultural land would remain open. Buildings would be clustered on sloping land in relative proximity to open, productive land allowing gravity to convey organic wastes/nutrients. The topography of the setting, its hydrology, surface geology, among other factors, would determine the appropriate scale of these clusters and of the productive land parcels to which they would be coupled.

## FOOD PRODUCTION AND ORGANIC WASTE CYCLING

Waste management would be developed as part of a continuing resource chain (a nutrient cycle), wastes becoming raw materials in a production process rather than an expensive problem, a source of environmental degradation, and a dispersal of natural wealth. Where once there were expansive lawns and pavement perhaps a variety of vegetables and herbs might grow using advanced, intensive techniques. It would provide fresh, healthy produce for the immediate community, and employment for those who need and want it. The variety and diversity promises a landscape rewarding to the eye, the ear, and the nose. Picture a walk flanked by espaliered apple trees or over-arching vines leading to a delightful place, offering shade and enclosure beneath a huge mulberry tree, overlooking acres of vegetable garden, an orchard bounded by a hedgerow of berry briars, or a field of mulch. The smell of organic nutrients from various quarters scenting the air may have a less universal appeal, and a rooster crowing at dawn can be a charming symbol of rural life or a cursed thing to be put to the axe. It would all be cause for careful planning.

A sustainable community will rely heavily and continuously upon biological processes. To maintain these processes year round in cool climates, temperate enclosures are required. In a renewable energy based society these would be designed to be tempered by the sun. Such enclosures - bioshelters - would be quite large, employing translucent tensile skins or shells to enclose a few acres. The technology that presently roofs football fields would be placed in service

to enclose a space that would be a focus of community life as well as a functional element in the local service infrastructure. It would be the town common, main street, the market place, and a winter garden as well as a market garden, a sewage treatment plant, and a fish hatchery. It would be the place to sit and be a part of local life, a place to be among people as well as a link in the life-support chain of the community.

In summary, we would see a new landscape that would:

- 1: preserve existing "prime" agricultural land, and maximize the yield of a given (small) acreage.
- 2: produce a variety of crops consistent with nutritional/dietary needs of an attendant population.
- 3: accept (and return) the nutrient flows from wastewater and organic solids.
- 4: reduce risks to public health.
- 5: provide a positive landscape amenity associated with a residential setting.
- 6: practice an agriculture based upon stewardship: to neither eutrophy or atrophy the productive medium.

## WATER AND ENERGY

Conservation techniques would reduce water use dramatically without sacrificing amenity. Indoor household functions can be accomplished with from half to one third of present average consumption of 80 gpd/person - without boosting deodorant sales. Organizing the open landscape into productive agriculture and cascading domestic greywater for its irrigation would virtually eliminate the use of potable water outdoors. With demand for potable water reduced six-fold, water supply options multiply. Roof top collection for example, especially from large,

smooth expanses such as that overlaying a bioshelter, becomes feasible. Each dwelling would produce sufficient energy for its own day to day operations from solar conversions. Again, with efficient appliances and practices, and appropriate end-uses, average domestic electric use would be reduced three to four fold such that the photovoltaic conversion from 500 s.f. of roof area would satisfy the need for electricity. Furthermore, the auxiliary heating requirement of a sensibly designed well constructed house would be met by the simultaneous collection of the heat accompanying the photovoltaic conversion.

Production, however, is only half the battle. Rooftop cogeneration involves harnessing an energy flow rather than converting a stock from which withdrawals can be at rates large or small corresponding to the need or desire. The energy flow from the sun is inexhaustible, but it is limited in its rate of delivery. It varies with the season, with the time of day, and with climatic condition from day to day, and the pattern of demand cycles incompatibly.

Therefore, for photovoltaic conversion of solar radiation to be a viable source of high grade power it must be accumulated in some form of storage to maintain supply over periods of scarcity or drought and also to perform a "load leveling" function. This is most effectively done at a community scale. Leading contending technologies include storage as compressed air in large, underground caverns, water pumped to elevated em-poundments ("pump storage"), and storage (through electrolysis) as hydrogen with reconversion through a fuel cell, are all possibilities. However, if a primary function of energy storage is load leveling,

then there is advantage in servicing a very large heterogeneous group whose member's demands are dis-synchronous. An additional method of storage is then to consider the existing municipal or regional network but the principal role of the Utility would become energy management rather than energy generation. They maintain the distribution network with strategic storage, and operate as brokers or bankers - by accepting deposits, allowing withdrawals, and making loans. The Public Utility Regulatory Policy Act of 1978 (PURPA) is a legislative instrument already in place that provides a basis for such transactions.

For heating purposes, wood has been a substitute for fossil fuel. It stores well from one season to the next, but as a mainstay for a sustainable society, it would be impossible in all but thinly populated areas. Even with tight, efficient houses, an acre of woodland would be required to sustain each dwelling. Better to collect the incident solar energy directly - in conjunction with photovoltaic conversion - and to collect it over the whole year, storing the summer excess for use in the wintertime. From day to day the solar resource is erratic, but over the longer term it is thoroughly reliable. Annual cycle storage is an appropriate district heating option given moderate residential densities, and its large thermal storage coffer would make an excellent bedfellow for the type of community bioshelter described earlier.

District heating technologies of this kind would be an additional incentive to the close grouping of buildings.

In addition to the constant flow of energy needed to maintain those of life's needs so far addressed, everything we acquire

has energy bound into it. It is the energy required to manufacture it, and to mine and process the resources embodied in it. The amount of this embodied energy depends upon the quantity and properties of a given material, and the complexity of components combining many materials. Local materials, simply processed and close at hand, generally have low amounts of embodied energy and in consequence would find increased use. Wood products, which never lost their popularity, would be joined, for example, by rammed earth techniques. Non-native species such as bamboo might be developed to withstand cooler conditions and cultivated for their peculiar building construction properties. In the process, building would retrace some steps toward a regional vernacular.

The Echo Hill community would be distant from many of the manufacturing processes of a renewable energy society. The modular components of a sustainable society, such as appliances, vehicles, PV panels and the like, would reap economies of scale that large centralized mass production has to offer. However, Echo Hill would make a productive contribution to its own durable material needs but it would be as an orchestrated part of a regional effort. It would be a part of the chain of inorganic material recycling that would feed these establishments, for a renewable energy society would spend less time mining the earth and more time mining its kitchens and workshops.

As we become more committed to a form of organization, so we become more adept at it. Sorting and separation would become more refined with more materials, in more specific groups, being reclaimed. Where today we struggle to col-

lect paper separate from all else, a renewable energy society would separate metals from metals, and plastics from plastics. Within this societal effort, each community would support a recycling center as the first organizational tier above "source" (ie domestic) separation. It, like the local laundromat, gas station, or library, would be one of those institutions in town where people exchanged gossip while they made their transactions. Conscious source separation and recycling activity are inevitably linked to views of consumption and production. If people are seriously involved in the management of their waste stream, their purchasing practices come under critical review. People are likely to ask of each purchase - "How will I dispose of this .... and when? - in addition to the standard question of its price. In a renewable energy society the market would favor more durable, longer-lived goods.

From a technical viewpoint such goods would be produced by designing components for maximum durability, and by designing the whole assemblage for easy repair and "remanufacturing"

The technical feat of producing long-lived products would be matched by their users inclination to retain and use them, or finding others who can. This, in turn, would be achieved by reducing service costs relative to new appliance costs, increasing the presence of the used appliance market, and by making replacement parts more readily available, especially for older appliances. In a small community like Echo Hill these life-prolonging factors would spawn local businesses remanufacturing goods in workshops and factories, and reopening repair shops on street corners.

### LIVING AND WORKING

The reduced scale and local productivity would result in the growth of local wealth and employment opportunity. Expansion in local employment would accompany domestic recycling efforts, the operation and maintenance of domestic services, and food production. Moreover, it would be work that could engage younger people full-time, and others (perhaps the elderly and the very young) in seasonal and part-time employment. With more activity at their doorsteps, the elderly might find opportunities to occupy those hours of the day or week that suit them. The very young would find the diversity of their environment an enrichment of their education as they tended plants or participated in the routines of animal husbandry.

Home/ working arrangements would thrive because the same pressures that act to decentralize production would act to reduce long-distance commuting. In addition, increased adoption of micro-processors would allow more, useful contributions to the market place to be made from remote workstations at home, or from small studios or offices. Cottage industries would undertake commercial projects in research, market analysis, mail ordering, data processing, etc. while others served the local and regional repair and remanufacturing market.

With more people working on local projects, more people circulating locally and dependent upon local resources and institutions, more people on foot or cycling, there would be increased ties, increased occasions for interactions, increased interconnectedness among residents, - which would result in a heightening of community cohesiveness. Family extensions would consolidate

where bonds of trust and reciprocity have arisen and where family groups decide that they can operate more effectively by pooling resources such as by car pooling, or by organizing as larger units so as for example to cope with household work or day care for toddlers, to process and store the summer time food harvest, as well as simply to enjoy oneself.

Studies of the collapse of cohesiveness in traditional Lapp and Eskimo societies that expanded their contact with their higher energy neighbors found correlations between social disintegration and increased dependence upon remotely supplied goods and services. The arrest and reversal of this "delocalization" would be expected to accompany the progressive reinstatement the former status quo, whether in the Arctic or the suburbs.

For a sustainable community to realize its goals, owner occupation must be the norm. Without personal responsibility for the production and use of vital goods and services, energy will be wasted and life will be shortened. For home ownership to be made available as an attainable option to the whole of the population, some fundamental changes in the housing market must obviously occur. Two in particular would help to achieve this goal. They are moving toward smaller houses supported by more shared (community) services, and increasing owner-building (or self- building). There was a time when most people made a significant contribution toward the construction of their own shelter. With the specialization and division of labor, those times have passed. Recently, however, the do-it-yourself market has surged along with the sales of publications advocating owner-building. Again, and for all sorts of rea-

sons, people are turning to building for themselves. A sustainable society would institutionalize this practice.

In a sustainable version of Echo Hill, self directed individuals and self managed groups of people would design and build their own shelter, even though it be a medium density cluster of attached units.

What sort of organization and support would be needed to provide the conditions necessary to foster owner-building? Sweat equity programs would help those with little or no initial capital. Here the perspirant's effort in building is converted to create an ownership stake. These and other owner-building initiatives would be co-ordinated and supported in each community by what Alexander has described as a "builder's yard". It would be "... a base of [community building] operations that combines the functions of a workshop and material storage, that is a demonstration of the local building system, and can be used to make experiments and refine it." The builder's yard has its antecedents today in the lumber yards, equipment rental agencies, local libraries and book stores, and the owner/builder schools and co-operative extension services.

Owner-building would be further facilitated by organizing the building process sympathetically. For example, construction of attached or clustered housing could be broken into a collection of primary components such as those of structural support, fire separation, building services, etc. which would be the work of building (sub-) contractors, and a collection of secondary or infill tasks which would be undertaken by the owner/builder. Such separation into "support" and "infill" categories has been practised in Holland and the U.K. where

an elaborate strategy involving a major commitment to modular coordination, and the rigors of public accountability has been developed<sup>2</sup>. A further example of support and infill can be seen in the conversion of warehouse structures. Developers find that their open interior and simple, repetitive structures offer little resisted - indeed provide creative constraints - for this change of use. In each case, the support structure acts as the longer lived framework within which "homesteading" (at one level of user participation or another), and subsequent expansions and contractions of family territories, can take place. Furthermore, the limits of the space that the aspirant homeowners are contemplating are immediately apparent. They can see the space; mark out the locations of intended domestic features such as walls, furniture etc.; they can appreciate the views and the sun penetration. All this reduces the enormity of a commitment to self-building.

Cooperation and mutual assistance would need to accompany a commitment to owner-building. Such cooperation is exemplified by the barn raisings of yesteryear. This need not be an onerous obligation as anyone who has been a part of a well organized community building project will testify. Indeed, over a three day period during September of 1985, the residents of Echo Hill, along with over 1,000 other citizens of Amherst, Ma. turned out with almost insatiable enthusiasm to construct a school playground. "Its really cemented the town together. Look around, everyone's here. Some-

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<sup>2</sup> The system has thus far been used mostly to encourage resident participation in the design process rather than in the building construction process

body put of their trip to the Bahamas to do this..." and so the comments ranged. The community bonding from these enterprises, together with the lower turnover rate of a citizenry who own their own houses and places of business would contribute to the fulfillment of other corporate objectives, particularly those of governance. Furthermore, the dollar cost saving (or job creation) aspects of self-building, and the increased pride of the successful owner/builder, would be accompanied by a learned capacity and incentive to maintain that property. It would be a demonstrable increase in local self-reliance.

Smaller housing units, supported by more shared (community) services is the second means of producing cheaper, more affordable housing. Sharing is a word that has soft headed and warm hearted connotations. In an expanded social network where heads have become harder and hearts have cooled in proportion to increased scale, sharing is thought to be either impractical or irrelevant or both. Sharing, however, is the common experience of community. For a community to exist, some degree of sharing must be in evidence. With physical services (for example those of power and water supply, roadways, libraries, etc.) this sharing has been acceptably institutionalized on a municipal scale. In a less mobile, sustainable community, a more connected locality with more people spending more time exchanging more things with each other, certain adjustments to this code would be made. A variety of local exchange mechanisms, (additional commonly accepted sharing practices) beyond those of national currency and taxes, would evolve

to facilitate more intense local interactions. Gift and barter exchanges like those involved in building or repair work are common among close-knit communities. The "Berkshare" network of the E.F. Schumacher Society, and circulating in western Massachusetts, is an example of a more formal local currency. It uses cordwood as its "reserve".

In Denmark, the settlements of Tynggarden and Overdrevett are examples of communities in which adjustments have already been made toward smaller house supported by shared community facilities. The latter is described by Madsen & Goss as follows: "The common house contains a large dining room, which accommodates about 100 people, a smaller meeting room, and a large kitchen where daily common meals are prepared; [each house has its own kitchen and dining facilities also]. There are also children's playrooms, laundry facilities, the central heating plant, storage space, a hobby room, a small store, and a guest room and a mail room."

The Danish example describes a formal living unit which is larger than a family but smaller than a village or town. It is similar in structure to a condominium, but one committed to sharing more than the a garden and a swimming pool. The extent of commitment is negotiable. It would be decided consistent with the aspirations of its members. However, in a lower energy society the balance between communality and privacy would shift. In the process, issues of cost and amenity would be balanced with those of individual and family privacy, support in child rearing, corporate decision making and conflict resolution, etc.

Changes in sharing practices, taken in the interest of increasing affordability and choice, however, would not easily undermine private life. Most adults in the U.S. are not interested in moving toward communal groups, nor are they interested in having new bureaucracies run family life. As Dolores Hayden explains, "they desire community services to support the private household rather than an end to private life altogether."

#### ATTITUDES, VALUES, AND CHOICES

Would we be better or worse off in a renewable energy based, sustainable society? Does less available energy mean a lower quality of life? Opinions vary. There is a view which sees the constraints of renewable energy as a retreat to the bad old days of a peasant existence. Opposing that is the view that economic progress over the last 200 years has only made life more complex, frantic, and wearing, and that we have lost some of the higher spiritual values associated with traditional societies. The pressures of modern life do frustrate such things as extended family support, stable local communities, time at home, time with friends. These are all things which may be more readily achieved in a lower energy setting.

Studies have shown no significant link between magnitude of energy use and quality of life. The relationship appears complex because it depends upon what of life's qualities we value. However, a link can be argued between energy flow and social values. A human being needs about 2,000kcal/day to survive. Beyond this lower limit of need, energy produced can be seen as surplus and as such available to support a system of values because decisions made as to the de-

ployment of the surplus are no longer governed by a matter of absolute need. Fred Cottrell is quite specific in stating that "...the preservation of a system of values requires a continuous supply of energy equal to the demands imposed by that system of values."

What are appropriate values for a solar based society? Essentially these may be seen as values which distinguish between maximizing all possible returns in favour of those geared to the fulfillment of human needs. In particular, these would value human effort, natural processes, individual development and personal choice, creative work as an end in itself - and would devalue (though not entirely) material affluence. Dwayne Elgin, and Paul Hawken are representative of many who have sought to describe its "voluntarily simple" lifestyle and "conserving" practices.

Many have argued the profundity of this shift. Kenneth Boulding in his seminal article entitled "The Economics of the Coming Spaceship Earth" declared that a fundamental shift in economic valuation was required for the "spaceship economy". Herman Daly and others have extended this in developing the notion of the "steady state" economy. William Ophuls observing from the viewpoint of political organization concludes "...that our political institutions appear to be no match for the gathering forces of ecological scarcity".(p 197). However, too much can be made of the need for radical change. True, a shift in social values is a necessary foundation upon which to build a sustainable society. But the value objectives are not new. They are traditional values of earlier lower energy societies. It is not so much a new ethic as the

resurrection of some old ones that is required.

A changing value system can be the product of a reduction in energy flow as the non-renewable subsidy of our higher energy society is stretched beyond its limit, or social values could be the change agent of a society which, for ethical or other reasons, chooses to limit its energy demands in advance of this day. Either way, as Pierre Dansereau said in one of his CBC broadcast lectures, "the richness of our inscapes is a preliminary to the good management of our landscapes".

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