

Sustainable Reclamation: An Urban Model for Coal Country (Entry #055)

Synergizing Appalachia--Potentiating Solutions through Sustainable Urbanization:

Appalachia is littered with vast expanses of a landscape ravaged by the mining of coal. As the coal and the wealth it generates leaves Appalachia it also leaves behind impoverished communities who nevertheless love their land and are intent in maintaining a livelihood as well as the social networks that constitute their way of life. This entry presents an urban model, a civil process, and a technically assisted design method by which a community of local stakeholders together with a team of architects and technicians can develop a sustainable urbanism that heals these strip mining wounds and reclaims the Appalachian landscape.

Sustainable Town-as-a-Hill: Appalachia is a region of mountains and narrow river-bottom valleys with little level land for either town-building or farming. But it is also a stunning landscape comprising the most diverse hardwood forests in the country. Similar landscapes in Europe and elsewhere have spawned beautiful life-affirming hilltowns, but in Appalachia, poverty, absentee landholding and exploitation of resources have conspired to prevent the development of these sorts of proto-sustainable towns. Such hilltowns are notable for their rich, flexible, and responsive urban fabric and the ways in which their citizens have historically maintained, enduring, balance-seeking relationships with the surrounding agricultural and natural environment.

Inspired by the study of these towns around the world, we have developed not a town on a hill, but a Town-as-a-Hill concept—a compact pedestrian town that places those functions that in the modern town can be a blight on the visual and social landscape below the new ground surface of a constructed hill. All large scale commercial, institutional and industrial facilities, most service functions, parking, and other activities and infrastructure that create often unsafe dead zones in a conventional town are located within the hill. The “upper town” is supported by the **Coupled Pan Space Frame (CPSF)** an innovative, economical, cast-in-place concrete structural system capable of large two-way spans, that create the space of the inner hill. Within the systems space of the CPSF all the service systems needed for the upper town are housed.

The Sustainable Town-as-a-Hill is composed of a network of level streets, crossed by sloped streets that wind their way to the top of the hill. In addition there is a switchback swath of sloped paths cutting through a network of stairs that climbs the hill more directly, but always at a gently walkable slope. Like its historic predecessors, the town generates a rich diversity of public spaces; from narrow lanes to grand piazzas and from commercial streets to these monumental stairs to public amphitheatres – all supportive of a rich civic life. There is also a sloped elevator on the eastern side of the town that accesses each level and several elevators as well, that connect the inner hill with the levels above. This pattern assures an unprecedented level of handicap accessibility as each building entrance and every level is accessed without having to negotiate any stairs. This makes for a denser and smaller town than would otherwise be possible: large enough to provide a range of urban services and opportunities, yet small enough to be manageable as an intelligent system. Such a walkable town would typically be too small to contain the necessary variety and diversity of services, while maintaining the human scale essential for convivial living, but the vertical layering of different functions in the Town-as-a-Hill combines the complexity and dynamism of a small city with the intimacy of a human-scaled town. This Sustainable Urban Implantation also makes more land available for agriculture and recreation while facilitating the reclamation of land back to wild nature, which is also valued for its unique ability to balance greenhouse emissions.

The Sustainable Area Budget™ (SAB) Design Method: This method specifies the amount of land-based resources to which the sustainable town is entitled based on its population. Through the entire design process, design choices are constrained by the reality of land and

resource limits. The SAB concept is relatively simple. Each person is entitled to be sustained by his or her fair share of the Earth's bounty on a renewable basis and each town may claim the aggregated SAB of its citizens. This means that the SAB for a town is in the same proportion to the country's land area as the town's population is in proportion to the country's total population. The SAB may be calculated on a country basis or a state basis and ultimately to insure global equity it will need to be determined on a global basis. Although simple in concept, in actual usage the overall SAB is subdivided into more detailed categories including crop, pasture and forest land SAB's.

The calculations used in this project are based on Kentucky's SAB values. The total per capita SAB for Kentucky is 5.25 acres. For this Sustainable Urban Implantation (SUI) of 2442 people, the total SAB is 12,825 acres. The crop and pasture land SAB per capita for Kentucky is 2.39 acres. For this SUI the total crop and pasture land SAB is 5,844 acres. The forest land SAB per capita for Kentucky is 2.86 acres. For this SUI the total forest land SAB is 6,982 acres

In efforts to reduce their load on the environment, towns and cities all over the world have relied on two principal quantitative methods: the sustainability indicator approach and the ecological footprint approach. These analytical methods in their various forms are useful to inform both policy makers and the general public about the extent of the unsustainability problem. They have often been responsible for building the momentum to institute actions that lessen the load of these problems on the environment. But because they are analytical methods applied to existing towns and cities, their function is primarily to reduce the severity of existing problems, not to define sustainability. Because of this these methods are fundamentally incapable of being used to create sustainable towns or cities. Indicator and footprint methods can only show us quantitatively, our current degree of unsustainability. These methods can be effective in a patchwork manner—at slowing the rate at which a town's metabolism moves in the wrong direction. However, they cannot be used to develop the network of relationships and feedback loops that are part of any design process and that are essential for any sustainable urban system from a qualitative perspective. Thus the overall political strategy fostered by these methods of promoting resource efficiency and conservation is insufficient to realize the goal of long-term sustainability.

What is needed—and what this project provides—is a **design method** that will lead to the construction of a genuinely sustainable town. The beauty of the Sustainable Area Budget™ (SAB) Design Method is that it can both define the limits of the problem and, from a design perspective, explore the universe of possibilities within those limits. Both aspects are necessary to implement a viable sustainable town. The SAB is a comprehensive way of addressing the problem by assembling design scenarios of already available **sustainability-oriented means**. It is used in a process that creates alternative designs in which the unsustainability problems never even appear. With a fixed area budget, the decision makers and stakeholders of a town-region will have a clear understanding of the available resources within which to negotiate their sustainable balances. As long as they do not export any harmful imbalances beyond their SAB defined territory they are free to negotiate the design of their town and its way of life within those resource limitations. The SAB thus provides the land budget within which townspeople can collectively restructure their places, their processes, and their lifestyles so that they will be able to live at a given, realistic level indefinitely—a sustainable condition that may be understood as “equity extended into the future.” Thus the town, on a net basis, derives all its food, energy, recreation, material, and carbon balancing needs within its Sustainable Area Budgeted land. Reclaiming these devastated strip mining sites by creating new sustainable towns, permanently partners the land through the Sustainable Area Budget principle thus protecting it into the future.

Sustainability-Oriented Means: In this proposal, food production would occur in greenhouses, green roofs, reclaimed strip mine benches, mountaintop removal areas and terracing down the mountain. Moving down the mountain, croplands would transition into permaculture and then to reclaimed forests and wilderness. Crops will be grown for both food and energy.

During the world wars Kentucky was the major hemp producing state and this history will be built upon to reintroduce hemp production along with a range of other organically produced alternative crops and cultivation methods. In addition to hiking and cycling through the wooded areas, healthy lifestyles will be emphasized, by using the greenhouses that follow the contour of the strip mine benches for multiple functions. In addition to agricultural production and aquaculture they will house swimming and other sports facilities and the north walls of the greenhouses will house office and other commercial facilities as well. As the pioneer sustainable town site in the region, the project will also be a demonstration site of many different alternative, sustainability-oriented production methods. Whitesburg, the nearby town in the valley below, is the home of Appalshop, the pioneering organization that has produced numerous award winning documentary films and fostered all the arts and crafts of the region. This new sustainable town can be seen in part as building upon this local tradition of good work to create the first town that is ecologically, socially and economically sustainable.

Wind energy will be demonstrated and sewage will be transported through an oil-based system to power a biogas digestion system, which will also use agricultural and animal wastes. Electricity will be provided principally by large arrays of PV collectors that will cover, stabilize and encapsulate the sloping, potentially toxic valleyfills that had resulted from the bulldozed overburden from the contour mining operations. There will also be “eyebrow” PV panels installed as sunshades over south facing glazing as well as PV panels integrated into all south parapet walls on the ubiquitous green roofs that top the town’s buildings. The total area of the PV collectors will be 567,500 sq. ft. or 5675 kW, providing 7378 mWh of electricity on an annual basis to match the calculated electrical load of the town.

Heating will be provided through a unique out-of-season hot air collection and storage system. Large, inexpensive hot air collectors as low-to-the-ground tension structures will be installed below the town stabilizing and encapsulating the mining valley fills. In the summer, hot air will rise from these collectors and be directed to auger holes in the “highwalls” left over from mining operations. This year-round heat collection will form a large heat bubble within the mountain and will be distributed, also as a hot air thermosiphon, to heat the entire town during the winter as well as to provide for its hot water needs. The region has large local timber and masonry resources and as Sustainability Oriented Materials will be heavily favored in the construction of the town. Strong Sustainability precludes the use of any materials or processes that cannot be rebalanced within the SAB process.

Strong Sustainability: The SAB Design Method, developed by the current architects, derive from a **strong sustainability** definition, most of which was incorporated into the European Charter of Cities and Towns Towards Sustainability (the Aalborg Charter of 1994). This is the definition:

Sustainability is a local, informed, participatory, balance-seeking process, operating within its Sustainable Area Budget, exporting no harmful imbalances beyond its territory or into the future, and in so doing opening spaces of opportunity and possibility.

The above definition describes the principle of Strong Sustainability. Following this principle the town will generate all its food, energy and materials on a net basis from within its Sustainable Area Budget™ (SAB). The clarity of this definition permits the development of the towns form and structure to proceed as a design problem, a stakeholder negotiation process and a system dynamics modeling exercise. The SAB Design Method is facilitated by both citizen participation processes as well as by technical means, which consist of the:

Sustainability Game™, which structures a dynamic decision-making stakeholder process to create multiple alternative scenarios for achieving a sustainable town-system within its

SAB determined resource base. The Game is played through a number of iterations until scenarios emerge where all stakeholder needs are met within the allocated Sustainable Area Budget™.

Sustainability Engine™, which is a software tool under development, for use in the Sustainability Game™, within which the emerging town models from the Game are assembled. In the Engine the state of balance of the different model scenarios is simulated providing balancing feedback to the various “what if” questions posed by the stakeholders. The Sustainability Engine™ is developing as an advanced object oriented, BIM program that models the competing town design scenarios developed in the Sustainability Game. As a system dynamics based program it also stores libraries of Sustainability Oriented Methods and technologies that may be called up in balancing trials, so that stakeholders and their architects may assess the consequences of their various “what if” trials in their attempts to assemble town scenarios that satisfy their needs, interests and ideas.

No modern sustainable town currently exists on planet earth. Modern towns and cities reflect an unsustainable way of life. Current models of urban development are thus poor frameworks within which to try to establish balances between the way of life they are designed to support and the sustainable use of the earth’s resources that serve them. It is for this reason that this proposal presents a new urban model whose design and governance processes are in harmony with nature and its carrying capacities.

Competition Questions

A. *What led the entrants to take an interest in the competition?* Our team has been working on urban sustainability projects for more than twenty years in Europe, Asia, and the Middle East. As we have been focusing more recently on our home region, this competition presents the opportunity to present a model whose recognition could foster profound changes in this exploited landscape and effect a transition to a sustainable urbanism based upon renewables and regenerative processes to create a sustainable landscape and an eventual abandonment of the mining of coal.

B. *How does the submitted proposal sustainably respond to the challenge of Global Warming?* In the SAB we have developed a quantitative method that through a citizen participation process using the Sustainability Engine™ is able to develop multiple alternative design scenarios that through successive iterations are brought toward balance within the allotted land based budget. A town or city operating within its SAB is effectively removed from the global unsustainability equation. As this process proliferates the Global Warming problem is eliminated one town at a time.

C. *How would the entrants go about realizing their concept?* Giving a Kentucky project national recognition will spur the adoption of this design based program as a realized town whose success as a demonstration of a sustainable urbanism and way of life, will proliferate throughout the region and beyond.

D. *Discuss the largest obstacles to achieving the concept.* The largest obstacles to the project’s realization are the inertia against change that exists in the region and the assumption that progress and innovation in a depressed area will occur only after it has been developed in and imported from more prosperous regions. Yet the very conditions that typify the problem can well become the means of raising the level of regional development to the quantitatively validated level of sustainability.

E. *Discuss how the concept could respond to different climatic and geographic circumstances.* Because the SAB/Sustainable Town-as-a-Hill concept is not prescriptive form, but rather is a design process and a set of tools, each town that follows this program will be unique, as it responds directly to local landscape, customs, traditions, language, topography, soils, hydrology, materials, and creativity.