MASTERS REPORT

THE URBAN ECO-OPERATIVE SYSTEM:

AN URBAN ECOLOGICAL AND COOPERATIVE ECONOMIC DEVELOPMENT SYSTEM

FOR

LOCAL SELF-RELIANCE

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INTRODUCTION

In the context of the dynamic complexities of contemporary urban life, the following report is a comprehensive analysis of the potentialities of local ecological and economic development for self-reliance. The integral planning processes for developing ecological and economic life-support systems to sustain urban self-reliance are collectively referred to as the Urban Eco-operative System (UES). Outlined in Part I, the concept of the Urban Eco-operative System combines local ecological and cooperative economic development into a framework of twenty-first century neighborhood re-settlement planning through the coordination of energy, economic, and environmental planning processes.

As a community resource management system, capital, human, and material resources are locally managed to supply goods and services for diverse human needs through small-scale production in proximity to household consumption. The concept of local development (or re-development) for urban self-reliance through integral resource management is analyzed in Part II. Where applicable, the conceptual analysis concentrates on the relationships between ecology and economy specific to a localized context, the block development model (refer to Appendices A and B). National and regional data is included in the analysis of the concept to infer a hypothetical limit to local economic development for self-reliance and to generalize the applicability of the UES.

To further detail the potentialities of urban self-reliance, Part III is a hypothetical application of the integral planning processes of the UES. Conceptual and analytical information presented in Parts I and II is synthesized in the derivation of the self-reliance potential of the block development model. The local economic development plan for the block development model is based upon environmental planning (see Appendix A), energy planning (see Appendix B), and economic planning and research; the integral plan is

representative of ecological and economic development for self-reliance as specified by the UES.

Environmental planning processes of the UES are summarized in Appendix A; urban ecological and cooperative economic development processes are outlined for the block development model. Local development would occur in three sequential phases: phase I, urban ecological development; phase II, cooperative economic development; and phase III, urban eco-operative development. Procedural outlines for each phase specify capital and energy conservation measures, instructional workshops, biological and technological energy conversion components, household and cooperative production components, and developmental planning and resource management guidelines.

Appendix B summarizes the energy planning processes of the UES. The productivity of biological and technological components of the renewable resource supply and reclamation system is quantified; the flow of natural and material resources inputs and outputs of primary production subsystems are diagrammed and examined. The potential of each subsystem for sustaining self-reliance through self-provisioning production is determined.

The principles of cooperation and participation are as old as humanity. The Urban Eco-operative System applies those principles to the management of local capital, human, and material resources to sustain urban ecological and cooperative economic life-support systems. That local ecological and economic development for self-reliance become integral with the creative, constructive processes of sustaining urban life, is fundamental to the concept of the Urban Eco-operative System. Herein, a new synthesis is put forth re-affirming the principles of cooperation and participation in the integral planning and development of urban ecological cooperatives.

PART I

THE URBAN ECO-OPERATIVE SYSTEM

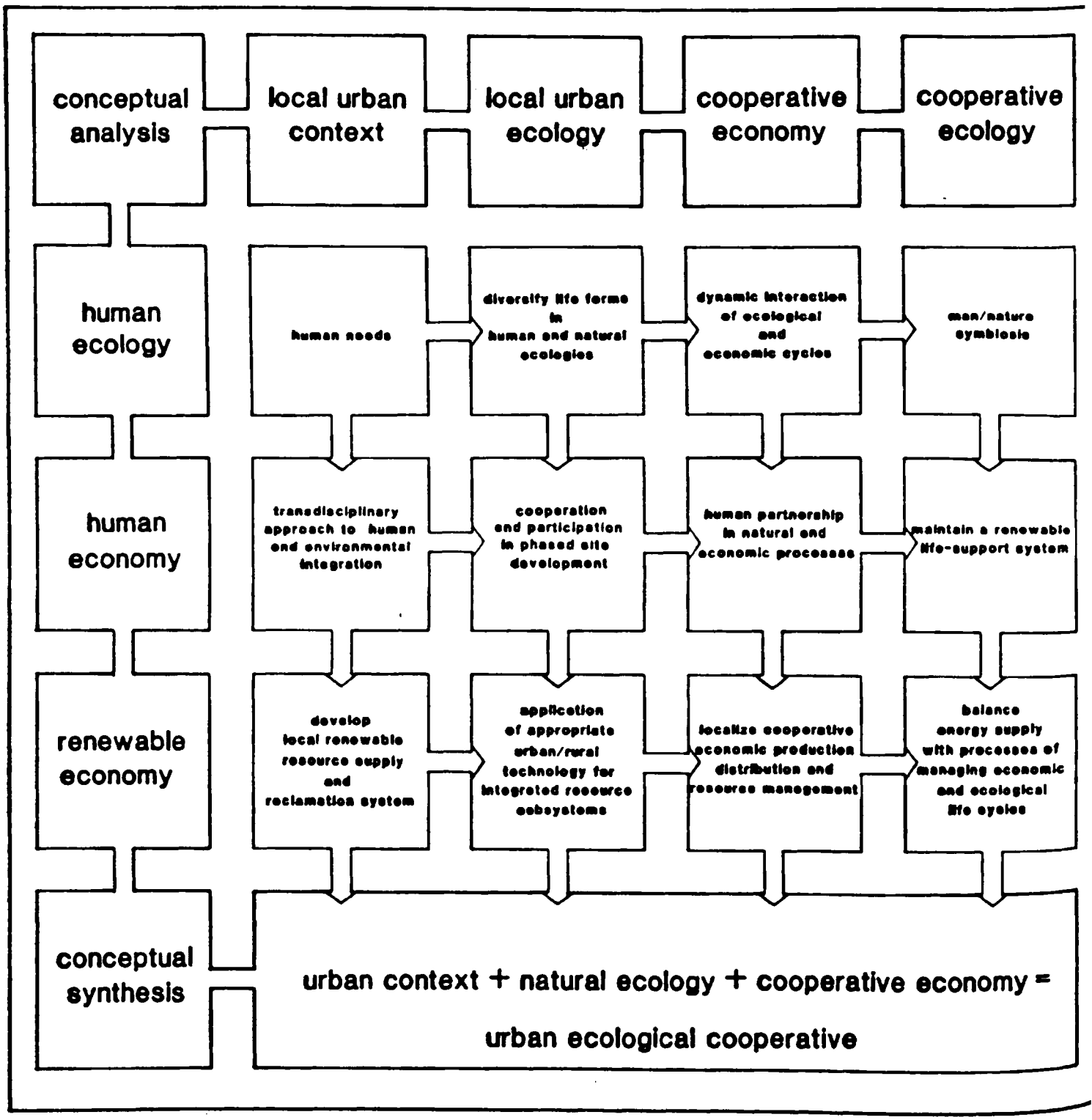

Figure 1: Conceptual Model of Urban Eco-operative. The matrix illustrates the interrelationships between urban context, ecology, and economy in the in the derivation of integral planning and development objectives essential to building sustainable, self-reliant, urban life-support systems, or urban ecological cooperatives.

THE URBAN ECO-OPERATIVE CONCEPT

The Urban Eco-operative concept is a systematic response to primary human needs through the development of integral urban ecological and cooperative economic support systems to sustain local self-reliance. The concept of an ecological cooperative emerged from an analysis of the interrelationship between urban ecological and economic life-support processes. Figure 1 illustrates the interrelationships between urban context, human, urban, and cooperative ecology, and human, cooperative, and renewable economy in a matrix of integral planning and development objectives essential to building sustainable, self-reliant, urban life-support systems. Conceptually, the Urban Eco-operative System (UES) can be defined as the synthesis of these relationships (refer to Fig. 1).

One of the most important relationships between ecology and economy lies in the common origin of the two words; both are derived from the Greek root, "oikos", meaning "house" or "home". Ecology: the relation between living organisms and their environment, their habitat, their "home". Economy: the art or science of managing a household. As a local ecological and economic development system, the household is appropriately considered the fundamental organizational unit of the Urban Eco-operative System. Ecologically, the home is a type of life-support unit (a synthetic, man-made environment) operating according to social, economic, legal, and physical principles governing the relationships between household members and the environment, interior and exterior, public and private, and so on. The management of resources of a unit organized to produce for its own use, householding, is fundamental to economic life and fundamental to the concept of the Urban Eco-operative System.

Human needs defined in relation to the household include: energy, food, housing, clothing, water, medical and personal care, transportation, leisure

and social activities among others. To self-provide these needs requires competent resource management (economy) and an appropriate life-support system (ecology) which can efficiently produce goods and services from indigenous capital, human and material resource supplies.

Americans have begun to confront the multiple impacts of limited resource supplies, and the problems could become further compounded by an insistence upon the convention of household autonomy. Even if we successfully curtail population growth, the trend toward one and two-member households will exacerbate the need to convert nonrenewable resources into home goods (i.e. building materials, appliances, equipment, etc.) that each small, non-integrated, life-support unit (home) can be fully equipped with the means of household production to supply the consumption needs of only one or two persons. In short, we are duplicating the means of household production unnecessarily. This trend is counterproductive to ecological and economic sustainability. The negative impacts of this trend will continue to erode attempts to bring about ecological and economic stability. Not only are we irrevocably committing more and more nonrenewable energy and material resources to duplicate household goods, we continue to endanger plant and animal species as their habitats are disturbed or destroyed; the totality of relationships between organisms and their environment in natural and urban eco-systems will continue to diminish.

To provide for the continuing diversification and preservation of natural life forms and the conservation of nonrenewable resources requires dynamic human involvement in ecological and economic life processes. Household collaboratives and cooperative partnerships could develop and implement comprehensive capital and energy conservation plans. Capital committed to develop the means of autonomous home production (i.e. expenditures for homes, autos, repairs, appliances, etc.) could be diverted to develop the means of

decentralized, cooperative production. Certain household functions could become partially or fully collectivized to eliminate unnecessary duplicity of capital goods for home production. Functions such as cooking, entertainment, transportation and others could become the responsibility of several cooperating households while capital goods (i.e. durable goods) could be collectively owned and used. The fundamental economy of the household could be re-defined, and the household's ability to sustain itself could be centered upon cooperative production and the collectivization of resources and work to conserve labor, capital, and materials.

With an adaptive-use strategy applied to existing structures, cottage and non-polluting industries can be introduced into neighborhood homes to supply a variety of local services and employment opportunities. The surrounding neighborhood could implement a cooperative network of services ranging from tool lending libraries and bicycle repair to worker collectives in which labor is exchanged for goods or a return service depending on individual or household need. By increasing local industry and employment opportunities, the neighborhood could simultaneously reduce the need for vehicular travel, curtail associated pollutants from automobile exhaust, and reduce family transportation expenditures. An economy of means (the means of managing a household) are used to achieve ecological ends.

Developing holistic systems of environmental biology and technology appropriate to small-scale urban production, the self-reliance potential of the Urban Eco-operative System is sustained by natural supply processes. Technological components augment the natural production of biological components of the local ecological system. Synthetic eco-systems, ecological cooperatives, would integrate biological components (urban livestock, vegetable and fruit gardens, etc.) with technological components of energy conversion (greenhouses, photovoltaics, solar hot water systems, etc.) to achieve maximum productivity

in a local economy built upon indigenous household and renewable resources. Local households could effectively self-provision food, energy, and housing needs through the coordination of energy, economic, and environmental planning. Furthermore, local households would be responsible for managing: waste-handling, transportation, finance, education, work, leisure and social interaction relative to local need and resource supplies.

Local ecological development and the ability to self-provision household needs from renewable resource supplies is integral with the need to develop a cooperative economic support system to manage household capital, labor, and material resources to sustain productivity. Self-reliance would be based upon an economy of renewable resources and sustained by a cooperatively managed ecological production system. The local resource management system becomes a framework for encouraging cooperation and participation in incremental neighborhood planning and development toward self-reliance. Local economic development would proceed according to local household consumption needs, time constraints, the scale of the development system, and the availability of capital, labor, and material resources.

The development processes of the UES focus upon three primary phases of local ecological and economic growth. In phase I, the ecological development phase, the emphasis of growth centers upon the formation of partnerships with nature beginning "in your own backyard". Instructional workshops prepare households for the management of gardens, composting and soil-building, home energy and water conservation, and material recycling. The objectives of urban ecological development are attained through the cooperative and participatory role of the urban dweller in managing the surrounding urban eco-system. To build a sustainable urban ecology, land-use policies, zoning laws, property taxation, and building code reforms will be required to re-direct municipal government action toward localized self-reliance. An

important role of government will be to stimulate the interest of private enterprise in providing technical support services in urban agriculture, urban forest management, waste-handling, recycling, and energy management among others.

To construct the framework for a sustainable local economy, phase II of the UES concentrates on cooperative economic development. Biological and technological components are introduced into the neighborhood to establish the means of cooperative production. Urban livestock and agricultural production, water and waste treatment, and technological energy conversion systems function as a self-provisioning supply system to minimize local household consumption expenditures. Savings derived from capital and energy conservation are invested in cooperative production means to further promote self-reliance.

An essential component of the Urban Eco-operative System is a renewable resource supply and reclamation system. The scale of the development (private home, neighborhood block or district, or urban/rural region) will determine the feasibility of specific urban and rural technologies utilized to supply renewable resources, recycle wastes, and reclaim materials. "Appropriateness" of technologies is evaluated according to the scale of the project, the degree of self-reliance desired, and economic feasibility. Though some technologies may satisfy these criteria, another important consideration is their adaptability to an integrated energy system where multiple technologies function as subsystems to each other.

With the establishment of local cooperative, cottage, and light industries and the enactment of mixed-used neighborhood zoning, the expanded means of production would significantly contribute to the sustainability of the local integrated life-support system. The objectives of cooperative economic development are achieved by the formation of cooperative partnerships and

corporations to share the financial and resource management responsibilities associated with operating a renewable resource supply and reclamation system and to equitably manage collective natural and material resources. The infra-structure of a cooperative economy could be further solidified through labor-managed cottage and light industries and the development of cooperative savings and lending institutions. Private ownership of property and other assets is not necessarily excluded from this scenario; it would be the responsibility of individual participants to determine the limitations of any partnership or corporation into which they desired to enter. Long-term ecologically balanced economic stability could be materially supported utilizing indigenous renewable natural and material resources in the self-provisioning of household needs. A regional cooperative marketing and commodity/labor exchange system could be devised for the distribution of locally produced goods and services. Capital and material gains accrued from the self-provisioning of goods and services would be equitably distributed according to household labor, capital, and material investments in the means of local production for self-reliance.

The Urban Eco-operative phase of development, phase III, is initiated by the implementation of a fully operative local resource management system to sustain the maximum levels of urban self-reliance. The objectives of Urban Eco-operative development are directed toward balancing input energy and capital with the processes of managing renewable economic and ecological life cycles. The theoretical limit of an Urban Eco-operative would be a steady-state eco-system and cooperative economy achieving a dynamic equilibrium between constant flows of capital and energy in local production, distribution, and consumption processes.

The final phase of growth is representative of a new, decentralized political economy of cooperation and participation in small-scale urban production for the self-provisioning of primary human needs. The decentralized political economy of self-reliance based upon small-scale, cooperative production, distribution, and consumption reduces household dependency on centralized production and distribution systems of the national market economy. Financial self-reliance, the ability to buy household needs, gives way to material self-reliance, the ability to supply household needs through local production.

The relationships between human communities and the environment are indeed numerous, perhaps innumerable. Currently, our relation to nature has many negative impacts upon the environment. Undoubtedly, the impact on human communites will become negative to the same degree as the cycles of our symbiotic relationship continue to move full-circle. The concept of the Urban Eco-operative System is based upon the re-conceptualization of our relation with nature and the re-introduction of natural processes into urban areas where human communities with their social, political, and economic institutions are concentrated. Balancing biological and technological energy conversions for small-scale production to supply human consumption needs, the symbiotic relationship between man and nature can once again be lived within an ecological context. Biological production in synthetic urban ecologies is assisted by appropriate technology to sustain a self-reliant standard of living while promoting positive interaction and partnerships between man and nature.

Furthermore, the concept of the Urban Eco-operative is based upon the systematic re-organization of local urban (i.e. household) resources. With capital and labor resources concentrated in urban areas, and with American

households commanding a larger portion of national wealth than ever before, it is possible to commit household capital, labor, and material resources to the development of small-scale, ecologically cooperative, production systems. Cooperative production, with local cottage and light industries, could not only self-provision basic consumption needs for housing, food, and energy, but supply new technologies and technical services supportive of a decentralized economy of self-reliance. The systematic response of the Urban Eco-operative System to primary human needs is likewise a response to the need to strengthen the economic and ecological life-support systems upon which we all depend.

The concept of the Urban Eco-operative System and the potential impact of local ecological and economic development for urban self-reliance are further detailed in Part II, the conceptual analysis. In Part III, economic, energy and environmental planning processes of the UES are applied to a hypothetical context, the block development model, to demonstrate the specific potential of integral planning and development for self-reliance. Though the conceptual synthesis is based upon the application of general planning and development objectives of the UES to a specific context, the concept of the Urban Eco-operative System has general applicability to any environmental context in which urban ecology and cooperative economics recieve serious consideration in providing for human needs.

PART II

AN URBAN ECOLOGICAL AND ECONOMIC DEVELOPMENT SYSTEM FOR LOCAL SELF-RELIANCE

INTRODUCTION

Economy, in relation to the Urban Eco-operative System (UES), is the willful activity of managing a sustainable urban ecology, the totality of relationships between human life, urban context, and technological components of productive energy conversion. The establishment of small-scale urban production systems to sustain local self-reliance through self-provisioning requires economic cooperation and participation in urban re-development processes. Public and private sectors must be willing to share the responsibility of managing local natural , material, human, and capital resources in developing a renewable economy of urban self-reliance. The provisioning role of the public and private sector doubtlessly will change as self-reliance on the local level alters the demand for goods and services provided by these sectors.

The application of appropriate urban and rural technologies for developing an integrated life-support system on the local level requires competent resource management. Local economic development must occur in cognition of the limits of indigenous resources particularly in securing capital development funds for local production means. The management system proposed by the UES for developing a local renewable economy (in support of a cooperative ecology) is based upon the recognition of economic pluralism. Economic life (on every scale) is not singularly organized as a market economy although conventional statistics may be biased to popularize such a notion. A fuller analysis of economic activity reveals several major economies simultaneously functioning to provide for human needs.

Scott Burns identifies three operative economies simultaneously supplying goods and services within the national economy (im toto); the market economy, the household economy, and the collective economy

form what Burns calls a national economic triad.[1] Each economy throughout American history has played a major role in the management and distribution of national wealth. The market economy dominated the national economy during the industrialization of America (1840-1900) before declining in the twentieth century as the collective economy increasingly expanded its role in provisioning for human needs.. Urban life has become dependent upon market and collective economies to sustain growing populations. Policies formulated during this period of rapid urban growth function to support centralized industrial production and government. If decentralized government and production is to be firmly established, a political economy based upon fuller human cooperation and participation in the means of production in the public and private sector will require policy reform on the local, state, and national levels. Local self-reliance as conceived by the UES advocates fuller human participation in the public and private sector of the economy, especially the local economy.

Since 1960, in what Burns terms the post-industrial period, the resurgence of the household economy has lead to a re-distribution of national wealth and power. Household income and investment returns (i.e. in household durable goods) have become competitive with (or exceeded) their counterparts in the market economy. In 1970, the imputed income of the household economy (based upon personal income and the value of household labor) was larger than the after-tax profits of all corporation in America.[2] Household capital formation exceeded that of private enterprise for equipment in 1950 and for structures by 1960. To Burns as well as many other economists, economic indicators reveal the dominance of the household economy (all households in America) in post-industrial America.

With heavy industries (i.e. steel, paper, utilities, transportation, and construction) unable to sustain competitive market returns on capital, increased participation of government (the collective economy) in the market is inevitable. Public spending, regulation of trade, wage and price controls are a few means by which government participates in the market. Other means are being considered to curtail the rate of inflation. Meanwhile, growth industries which directly supply household goods (i.e. tools and hardware) are sustaining high returns in the marketplace.

The market for home improvements has expanded its sales by 10% each year by producing easy-to-install products and supplying the do-it-yourselfer with a host of household goods. The Commerce Department estimated that 80% of all paint and 60% of all wallpaper is now purchased by do-it-yourselfers. By 1975, "home centers" were growing at a rate of 20% per year.[3] Retail sales of hardware and tools doubled between 1970 and 1975.

The role of industrial production in the market economy is changing from supplying goods and services to that of subcontracting goods and services to the household economy as individuals and families increasingly supply their own needs from household production. Household production is made possible through the purchase of capital goods (durables) from the market which are operable and serviceable by household members. "In addition to wider ownership of the means of production, they (consumers) generally own the physical capital which provides the services necessary to satisfy many of their own wants for living quarters, transportation, household services, and entertainment." So states the National Consumer Finance Association in 1970.[4]

Recognizing the growing strength of the household economy, the UES proposes an economic system of self-management of collective household resources on the local level. The means of establishing small-scale urban production systems for self-reliance through self-provisioning are achievable through corporate organization of households. Collectivizing household capital, material, and labor into self-managed production systems could firmly establish local self-reliance and sustain the new wealth and power of the household economy. The decentralization of production and economic policies relative to human provisioning, with local capital, material, and labor exchange can provide an economy on a human scale managed through local cooperation and participation.

Committing household capital, human, and material resources to the establishment of urban production systems which are ecologically balanced requires technological development. Currently available urban and rural technologies can be be adapted to new production roles, but there remains a need to develop technologies which are appropriate to small-scale production of food, energy, and other household needs. Sunrise industries supplying durable goods produced with and sustained by renewable sources of energy indigenous to local areas could sustain a self-reliant household economy and a re-directed market economy (as a subcontractor to the household economy). Assisted by centralized and decentralized collective economies (federal, state, and local governments) in research and development pertinent to indigenous conditions including environmental integrity, quality of life, urban conext, and technological demand, sunrise industries could become a critical supplier of diversified technologies which would sustain local productivity and make it more efficient. Goods supplied by failing heavy industries (i.e. paper, automotive, construction, energy, and fossil-fuel products) could be re-designed according to specifications for decentalized

self-provisioning by households. Energy and capital-intensive products (i.e. nylon, steel, plastics and synthetic materials) which remain the domain of heavy industries could be adapted to the changing technological demands of local production. Engineering new technologies appropriate to to small-scale household production would open new markets for declining industries while simultaneously supplying the means for self-provisioning in ecologically cooperative urban centers.

If small-scale urban production systems were engineered to simulate the low-entropy production occurring in natural ecologies, new hope for sustaining the quality of human life and the vitality of an ecologically balanced economy could emerge. Fuller involvement in all cycles of life, economic and ecological, is possible if productive activity for human sustenance occurs in proximity to human consumption. Decentralized, self-provisioning production processes are essential to the re-integration of individuals with the natural and technological components of the urban ecology within which they participate. The development of urban cooperative ecologies utilizing available technologies (as well as new technologies not yet on the market) to minimize capital, energy, and labor expenditures provides for a sustainable human economy of self-reliance. Energy and capital conservation become integral objectives in the management of economic and ecological life-cycles.

The local economic development system outlined below (illustrated by figure 1) suggests a re-organization of capital, material, and human resources to develop and sustain a local economy of urban self-reliance. Three major subsystems form the basis of the local economic development system: the market economy, the household economy, and the cooperative economy.

Burns[3] analysis demonstrated the growing wealth and power of the household economy as a national economic organization. In this report, the household economy represents a small group of cooperating households which eventually become incorporated. For the purposes of economic analysis, the household will be defined according to U. S. Bureau of Labor Statistics guidelines for computing annual family budget studies in comparing cost of living in major urban areas. Phillip T. Kolbe's "1980 Tucson Area Family of Four Budget Study" is used to analyze the economic development potential of the urban square block model illustrated in Appendix A.[5] His budget studies are compiled annually according to BLS specifications which include the pricing of over 400 items in local urban areas. The following report assumes one household occupies each of thirteen properties located on the urban square block based upon an actual block in the West University Historical District in Tucson, Arizona.

The household economy is the fundamental basis of the UES economic development system for achieving local self-reliance. The management of capital, material, and human resources of the household economy will be discussed in relation to the market and cooperative economies in local economic development. The household is viewed as an economic unit in which the individual's role is of paramount importance in managing household resources. Individual roles are diversified as households incorporate into cooperative partnerships to expand local productive capabilities and participate more directly in the local market economy. The development of cottage and light industries will provide an active means for household participation in the market to earn income through self-managed production. Households will play a consumptive and productive role in the market economy through a re-organization of household resources into cooperative corporate enterprises under UES

economic development.

The market economy will be discussed along the lines of Burns' assertion that industry will become the subcontractor of the household economy. How industries of the market economy might contribute to developing and sustaining a human economy of self-reliance will be examined. The potential gains to the household economy from resource conservation and self-provisioning production will be compared to the gains offered on capital invested in the market economy.

The collective economy, part of Burns' economic triad, is not included as a separate subsystem in UES economic development. As households voluntarily incorporate to form cooperative corporations competing with industry to supply a larger share of household needs, greater pressure will be exerted upon government (i.e. local government) for economic reform while households take advantage of federal and state corporate tax policies. This reform movement could be further supported by the recent attempts to decentralize government requiring state, county, and municipal governments to assume greater responsibility in providing for local needs. The UES economic organization is fully compliant with the ideals and practices of private enterprise as local corporate and household enterprises organize to supply local market demands.

With supplies of goods and services provisioned from the local private sector including household and cooperative production, with the public sector decentralized through organizational and policy reform, the relationship between public and private sectors will dramatically change. As local productivity and government assistance become decentralized, dependency upon centralized production and government assistance will subside. As decentralized economies develop the means for self-relaince, regional limits to growth will be established based upon the productive

capability of renewable natural, material, human, and capital resource supplies.

A new political economy is emerging; household capitalism is replacing market capitalism as the dominant economic organization of American society. As the market economy and household economy become a united private sector, the public sector's role in economic development will be limited (primarily to policy reform). The alternative of centralized government regulation and control of heavy industry threatens to weaken the economic fabric of a maturing capitalist society. Mobilizing collective capital to bolster failing industries has not been accompanied by similar supports and investment incentives to develop new technologies and sunrise industries. In the private sector, executive and middle-management bonuses for short-term profits exacerbate the problem of building a newly competitive market based upon long-term investment returns. National economic re-organization calls forth the development of a third sector as the decentralized counterpart of the national collective economy.

To date, one of the most relevant collection of essays on contemporary political economy addressing the development of a third sector is The Political Economy of Cooperation and Participation edited by Alasdair Clayre. Published by the Oxford University Press, the collection of essays was spawned by a small conference in Great Britian held in 1978 and sponsored by the Outer Circle Policy Unit directed by James Cornford. The third sector is primarily discussed in developing a cooperative economy, a cooperative sector in a mixed economy, and [illegible] profit-sharing in the market ecomony.

Local economic development for twenty-first century self-reliance under the UES plan is accomplished by developing a third sector

as a decentralized cooperative economy.

The cooperative economy would be organized as a network of locally incorporated households. Cooperative corporations formed by voluntary participation of individual households would collectivize capital, material, and human resources toward the development of local cooperative production supporting self-reliance through self-provisioning. Housing, food, energy, water, clothing, and capital are primary needs for which production means would be developed.

A system similar to the Mondragon Co-operative Federation in the Basque provinces of Spain could be established.[6] A cooperative bank would be supported by the collectivization of cooperative corporate assets. The federation would provide local management information, consulting services, financial and investment planning, and marketing information to member firms as well as provide investment capital to new enterprises including home-based industries.

In the following report, the development of a cooperative economy is an organizational response to the resurgence of the household economy. The resources for developing small-scale, self-reliant urban production systems is at hand. By collectivizing household resources (material, capital, and human), self-management of local cooperative production is achievable. The relationships between the household economy, cooperative economy, and the market economy are outlined below according to the UES local economic development plan for twenty-first century self-reliance through self-provisioning.

HOUSEHOLD ECONOMY

HOUSEHOLD CAPITAL RESOURCES

According to U. S. Bureau of Labor Statistics guidelines, Phillip T. Kolbe estimated that a Tucson area family for four required $23,462 to maintain a moderate standard of living in 1980. Of that amount, $17,693 were required to supply family consumption needs with the balance going for personal income taxes, social security payments, life insurance, occupational expenses, and family gifts and contributions.[1]

The following economic analysis will concentrate upon total family consumption expenditures. The consumption budget for an urban family of four as defined by BLS guidelines is divided into several major categories: food, housing, transportation, clothing, personal care, medical care, and other family consumption costs. Each budget category will be examined to identify key areas where capital savings would be achievable under the UES local economic development plan. Table 1 below outlines household consumption costs for 1980 according to BLS categories of expenditures as computed by Kolbe.

Household capital savings will be determined in constant 1980 dollars. Household and cooperative economic development each contribute to the conservation of capital resources; the study will specify which sector is responsible for the development of particular components of the UES development system contributing to household budgetary savings.

TABLE 1:
1980 TUCSON HOUSEHOLD CONSUMPTION EXPENDITURES (HYPOTHETICAL)

Consumption Category	Amount	% of Total Consumption Budget
Food	$5,322	30.1
Housing	$5,661	32.0
Transportation	$2,302	13.0
Clothing	$1,559	8.8
Personal Care	$ 547	3.1
Medical Care	$1,246	7.0
Other Consumption	$1,056	6.0
Total	$17,693	100.0

Source: Division of Economic and Business Research, The University of Arizona, 1981.

Food

In 1980, the hypothetical family of four in Tucson expended an estimated $5,322 for its food needs. This amount represents 22.7% of the total 1980 household budget estimated at $23,462; it is slightly over 30% of the total household consumption budget. Major subcategories of the household food budget are listed in Table 2 with 1980 estimated budget expenditures as computed by the Division of Economic and Business Research at the University of Arizona.

TABLE 2: 1980 HOUSEHOLD FOOD EXPENDITURES - TUCSON FAMILY OF FOUR[2]

Food Subcategory	Amount
Milk / Milk Products	$ 687
Meat, Poultry, & Fish	$1,685
Eggs	$ 104
Dried Peas, Beans, & Nuts	$ 45
Flour, Cereal, & Baked Goods	$ 489
Citrus Fruit & Tomatoes	$ 287
Potatoes	$ 151
Other Vegetables & Fruits	$ 587
Fats & Oils	$ 129
Sugar & Sweets	$ 235
Accessories (coffee, tea, etc.)	$ 215
Total Food at Home	$4,613
Total Food away from Home	$ 709
Total Household Food Expenditures	$5,322

Source: Division of Economic and Business Research, The University of Arizona, 1981.

At a cost of approximately twenty-five cents per square foot, vegetable gardening could save the family about 80% of its expenditure under the food subcategory of "Other Vegetables and Fruits" (see Table 2 above). Using biodynamic French intensive and Chinese raised-bed organic gardening techniques the vegetable needs for a family of four could be continually supplied on as little as 100 square feet of well conditioned soil.[3] About $587 of food expenditures could be conserved with minimum capital and labor investments.

The primary capital cost of vegetable production would occur in the first year of gardening which would coincide with the first year of UES economic development. Using organically produced seeds, some plants would be allowed to mature to produce the seeds for the next planting; hybrid commercial plants do not always yield seeds which will germinate to produce a consistent crop. Doubling the minimum land area required to produce the family of four vegetable needs for a year, the initial investment of fifty dollars is necessary. As the household growers become more proficient, they can diversify their crops adding variety to balance their diets.

Phase I of the UES development system is conceived as a low-cost training period where acquiring practical skills for achieving fuller self-reliance takes precedence over high capital savings and investment returns. Neverthless, the family can achieve a significant savings (nearly 9%) in total food expenditures with a minimum investment of capital and labor. Labor requirements for managing the vegetable garden probably will seldom exceed five hours per week after the garden has been established as a component of the surrounding ecological system. Local composting practices, greywater utilization, and other practical or technical components of the local ecology help to support home gardening through cooperative resource management including resource recycling.

The urban agricultural and livestock production subsystems of the UES integrated ecological system are capable of producing over 80% of household food needs (for 80 persons) relative to the development model illustrated in Appendix A. Small-scale, cooperative agricultural production includes: fruit and vegetable gardens, greenhouses, goats, rabbits, chickens, and orchards. Along with aquacultural production and beekeeping, a total

of $4,018 of the hypothetical 1980 household food budget could be conserved through self-provisioning production. Appendix B summarizes the productive capability of the self-provisioning food supply system of the UES (refer to Table 7, Appendix B).

If families were to eat 50% less food away from home (assuming they would eventually work at home in cottage and cooperative enterprises), an additional $355 would be saved. By the end of phase II of local economic development (roughly a fifteen year growth period), 82% of the 1980 household food budget could be conserved. Table 3 summarizes the capital conservation potential of UES food self-reliance according to BLS food expenditure subcategories for an urban family of four in Tucson. The phased economic development plan will be discussed in detail later in this report.

TABLE 3:
CAPITAL CONSERVATION POTENTIAL OF UES FOOD SELF-PROVISIONING

Food Subcategory	1980 Costs	UES Savings*	%	Balance
Milk/Milk Products	$ 687	$ 687	100	
Meat, Poultry, Fish	$1,685	$1,685	100	
Eggs	$ 104	$ 104	100	
Dried Peas, Beans, Nuts	$ 45	$ 45	100	
Flour, Cereal, Baked Goods**	$ 489	$ 0	0	$ 489
Citrus Fruits, Tomatoes	$ 287	$ 287	100	
Potatoes	$ 151	$ 151	100	
Other Vegetables & Fruits	$ 587	$ 587	100	
Fats & Oils**	$ 129	$ 129	100	
Sugar & Sweets**	$ 235	$ 235	100	
Accessories	$ 215	$ 108	50	$ 107
Subtotal of Food at Home	$4,613	$4,018	87	$ 596
Food Away From Home	$ 709	$ 355	50	$ 354
Totals	$5,322	$4,373	82	$ 950

*The Urban Eco-operative System may not provide the actual weight of all food items shown in relationship to cost, but equivalent calories will be provided to meet 80.7% of U.S. average per capita food consumption measured in calories.

**Grain and cereal crops can not be produced on the available land area to meet human consumption needs; the UES diet consists of 54% less fats and 93% less sugars and non-alcoholic beverages compared to national consumption averages; refer to Table 4, Appendix B.

Housing

BLS guidelines for computing family housing expenditures assume 75% of urban families own a home purchased seven years prior to the study year; the remaining 25% are classifies as renters. The 1980 Tucson area budget study is based upon a home having been purchased in 1973. Costs for several subcategories under housing expenditures are computed by weighting homeowner to renter costs according to the above percentages, 75% and 25%. The subcategories which are weighted include: mortgage/rent, utilities, and insurance. The household expenditures incurred by a hypothetical family of four in Tucson to cover housing needs in 1980 are listed in Table 4.

TABLE 4:
1980 HOUSEHOLD HOUSING EXPENDITURES - TUCSON FAMILY OF FOUR[4]

Housing Subcategory	Amount
Mortgage/Rent	$2,792
Property Taxes	$ 498
Utilities	$ 770
Insurance	$ 82
Repairs	$ 146
Kitchen Appliances	$ 45
Textiles	$ 48
Floor Coverings	$ 11
Furniture	$ 279
Appliances	$ 38
Housewares	$ 123
Other Furnishings	$ 60
Laundry	$ 122
Paper Supplies	$ 61
Services	$ 44
Communications	$ 60
Total Household Housing Expenditures	$5,661

Source: Division of Economic and Business Research, The University of Arizona, 1981.

The UES economic development plan suggests the collectivization of household functions; cooking, dining, and entertaining are functions which can be accommodated by common areas planned as a part of local construction. These and other functions would be architecturally planned in the design of integrated life-support units (see figure 6, Appendix A). Homes would retain spaces for privacy and sleeping while reclaiming kitchens, dining and living rooms for commercial functions. Cottage industries would be planned for the home to create a living/working environment bringing work into close proximity to and integral with the urban ecological system.

If one-half of the floor area of the home is utilized exclusively for a home-based business, one-half of the mortgage/rent costs, insurance costs, utilities, household furnishings (related to the business), paper supplies, and communications could be attributable to operating the small business. The portion of household expenditures which can be charged to operating the home-based enterprise is recoverable as business operating expenses.

Households would be responsible for capital formation related to cottage industries in phases I and II of the development. By phase III, the collective capital assets of incorporated households held in a cooperative bank or corporate bank account could provide low-interest loans or investment capital for home-based enterprises.

The energy conservation plan summarized in Appendix B is capable of establishing 100% local energy self-reliance. Capital savings derived from self-provisioning of food, energy conservation in household transportation, and other household and cooperative production would be used to equip the home with an energy plant supported by renewable energy supplies (i.e. solar

energy). Cooperative labor would contribute to capital savings in constructing attached solar greenhouses and installing domestic solar hot water systems. A photovoltaic system could be a component of a local energy plant (an energy center), or each home could be retrofitted with an appropriately-sized system. Since the cost of a photovoltaic power plant is relatively high in comparison to other energy technologies which will be applied to the household energy plant, it is important to achieve the highest level of energy conservation with less expensive equipment prior to installing the electrical power plant. In effect, capital savings of all installed energy conservation technologies will contribute to the cost-effectiveness of the photovoltaic system as the household energy plant becomes a long-term investment requiring additional equipment to improve the efficiency of energy consumption and production. Capital savings from previously installed energy-conserving equipment beyond their individual payback periods are applicable in the determination of the payback period for new equipment when considering all technological components as a part of an integrated energy system. This strategy will be discussed in detail later in the report.

With workshops, practical experience, and a library of self-help learning materials, householders will be providing their own repairs and services in home maintenance. Alternatively, a labor exchange program would provide a means to obtain specialized services in return for other services, matching local skills with local needs. Cooperative buying practices will reduce household expenditure for hardware, home building materials, and other household goods.

Expenditures for kitchen appliances, housewares, and other furnishings

are reducible by 90-95% through collectivization. Tool and appliance lending libraries stocked by household contributions of goods eliminate the need to duplicate household durables in every home. Vacuum cleaners, irons, sewing machines, lawn mowers, garden tools and so on are not continuously used equipment and could be easily collectivized for common use.

Ranges, refrigerators, automatic washers and dryers could likewise become common stock to equip community kitchens and laundry facilities. They could also be sold or used to barter for other market goods (assuming there would be a surplus).

Table 5 summarizes the capital savings potential for housing expenditures attainable under the UES development plan for self-reliance. By the final phases of growth, a 60% capital savings in household housing expenditures is possible. Primary budget savings for housing are planned as an integral part of cooperative economic development in phases II and III when the partnership of local households is solidified by formal agreement to incorporate capital, material, and human resources.

Urban ecological development also matures in phase II as technological components supplement natural production processes. The renewable resource supply and reclamation system provides a means to achieve full energy self-reliance contributing almost a quarter of the capital savings in housing expenditures. Appendix B summarizes the UES energy plan for urban self-reliance. The renewable resource supply and reclamation system, the energy basis of self-reliance, is illustrated in Figure 2, page 191. Production subsystems are diagrammed in more detail in Figures 3-9 in Appendix B.

TABLE 5:
CAPITAL CONSERVATION POTENTIAL OF THE UES FOR HOUSING EXPENDITURES

Housing Subcategory	1980 Costs	UES Savings	%	Balance
Mortgage/Rent*	$2,792	$1,396	50	$1,396
Property Taxes	$ 498	$ 0	0	$ 498
Utilities*	$ 770	$ 770	100	$ 0
Insurance*	$ 164	$ 82	50	$ 82
Repairs**	$ 194	$ 146	75	$ 48
Kitchen Appliances***	$ 47	$ 45	95	$ 2
Textiles****	$ 95	$ 48	50	$ 47
Floor Coverings****	$ 22	$ 11	50	$ 11
Furniture	$ 372	$ 279	75	$ 93
Appliances	$ 76	$ 38	50	$ 38
Housewares***	$ 129	$ 123	95	$ 6
Other Furnishings***	$ 63	$ 60	95	$ 3
Laundry	$ 153	$ 122	80	$ 31
Paper Supplies****	$ 122	$ 61	50	$ 61
Services**	$ 44	$ 44	100	$ 0
Communications****	$ 120	$ 60	50	$ 60
Totals	$5,661	$3,285	58	$2,376

*1980 Costs based upon the sum of 75% of homeowner costs (mortgage, $2,370; utilities, $822; insurance, $208) plus 25% of renter costs (rent, $4,059; utilities, $613; insurance, $32).
**Savings attributable to do-it-yourself skills acquired through local workshops and learning programs.
***Savings derived from the collectivization of material resources.
****Savings potential based upon the deduction of costs for goods assignable to a home-based business utilizing 50% of the floor area of the home.

Transportation

Family transportation costs rose nearly 11% between 1979 and 1980. Kolbe estimates that a hypothetical family of four in Tucson would have spent $2,241 to meet their moderate need for private transportation. Transportation expenditures include the annual replacement cost of the family automobile (a six year old Ford or Chevrolet traded for a two year old model), gasoline to travel 9669 miles, and operating expenses. Table 6 summarizes household transportation expenses for 1980 for a Tucson family of four with a moderate standard of living.

TABLE 6:
1980 HOUSEHOLD TRANSPORTATION EXPENDITURES - TUCSON FAMILY OF FOUR[5]

Transportation Subcategory	
Replacement of Automobile	$ 916
Gasoline	$ 732
Motor Oil	$ 40
Tires	$ 57
Battery	$ 15
Maintenance & Repairs	$ 152
Other Expenses	$ 50
Insurance	$ 187
Registration,License,Inspection	$ 40
Parking, Other Costs	$ 51
Private Transportation Subtotal	$2,241
Public Transportation	$ 62
Total Household Transportation Expenditures	$2,302

Source: Division of Economic and Business Research, The University of Arizona, 1981.

Nearly 30% of all vehicle miles traveled in urban areas in Arizona by private automobile are for home to work transport.[6] Of the annual estimated vehicle miles traveled (VMT) by the hypothetical family of four in Tucson, over 2,850 miles can be attributed to transporting the household income earner (the husband according to BLS specifications) from home to the place of work.

If the working member of the household were to carpool with one other person, a 50% savings in home to work transport is achieved. Theoretically, this savings would apply to gasoline, motor oil, tires, maintenance and repair, and parking expenses associated with work transport. Table 7 lists the theoretical savings of carpooling to work which requires no additional capital investment in the means of transport. Carpooling is an appropriate energy and capital conservation practice for phase I of the development as it qualifies as a low-cost or no-cost conservation measure. Over $150 of annual family transportation expenditures could be conserved by carpooling

to work with one other worker based upon estimated family expenditures in 1980.

TABLE 7: CONSERVATION OF HOUSEHOLD TRANSPORTATION EXPENDITURES FROM CARPOOLING TO WORK FOR A HYPOTHETICAL FAMILY OF FOUR IN TUCSON

Transportation Expenditure Category	1980 Expenditure*	1980 Dollars Conserved*
Gasoline	$ 732	$ 110
Motor Oil	$ 40	$ 6
Tires	$ 57	$ 9
Battery	$ 15	$ 2
Maintenance & Repairs	$ 152	$ 23
Parking, Other Costs	$ 51	$ 8
Totals	$1047	$ 157

*Source: Division of Economic and Business Research, The University of Arizona, 1981.

**Source: Adapted from an article appearing in Arizona Business by Hari Khanna, "Transportation Energy Consumption in Urban Arizona: 1976-1978 by Purpose", January, 1979.

Current urban transportation in Arizona by private automobile in relation to the purpose of travel and the vehicle miles traveled is shown in Table 8 below. Private transporation in general is a cost-effective means of obtaining market goods and services according to Burns. In fact, household transportation by private automobile costs one-fifth as much as it would cost to purchase similar service in the marketplace.[7] The market simply cannot compete with the convenient service provided by the private automobile. This convenience need not remain 13% of the household's consumption budget.

TABLE 8: HOUSEHOLD TRANSPORTATION BY PERCENT OF URBAN VMT*

Purpose of Travel	% Urban VMT
Home to Work	29.5
Home to Market	9.9
Non-Home Based	24.6
Home to Other	36.0

*Vehicle Miles Traveled

Source: Adapted from 1976 figures appearing in Arizona Business, January, 1979; article by Hari Khanna.

As cooperative economic development proceeds in phase II of the UES, cottage industries, self-provisioned goods, and self-help services will reduce the need for urban travel from home to work, to the market and points inbetween. Private transportation could become almost exclusively a recreational activity of the household. With cooperative buying and bulk delivery of goods on-site, maintaining exclusive, private ownership of an automobile for primarily recreational services would be unnecessary.

Theoretically, an upper limit of 64% of gasoline expenses could be conserved (excluding Home to Other travel as shown in Table 8); a similar savings applies to parking costs. With a four-family ownership policy based upon the collectivization of automobiles, a 75% savings in transportation costs would apply to replacement cost, gasoline, motor oil, tires, batteries, maintenance and repair, insurance, and registration, licensing, and inspection fees. A collective car fleet would supply the conservative needs of families while reducing houehold transportation expenses and land area required to store the cars. Household capital savings, land reclamation, energy conservation and reduced local pollution all beneficially contribute to local economic (and ecological) development for self-reliance.

Table 9 summarizes the potential conservation of capital resources for household transportation. Over 70% of the 1980 family expenditures for private transport are conserved by the end of phase II of the UES development plan.

TABLE 9: CAPITAL CONSERVATION POTENTIAL OF THE UES FOR TRANSPORTATION EXPENDITURES

Transportation Subcategory	1980 Costs	UES Savings*	%	Balance
Replacement of Automobile	$ 916	$ 687	75	$ 229
Gasoline	$ 732	$ 469	64	$ 263
Motor Oil	$ 40	$ 30	75	$ 10
Tires	$ 57	$ 43	75	$ 14
Battery	$ 15	$ 11	75	$ 4
Maintenance & Repairs	$ 152	$ 114	75	$ 38
Other Expenses	$ 50	$ 37	75	$ 13
Insurance	$ 187	$ 140	75	$ 47
Registration, License, & Inspection Fees	$ 40	$ 30	75	$ 10
Parking, Other Costs	$ 51	$ 33	64	$ 18
Subtotal of Private Transport	$2,240	$1,594	71	$ 646
Public Transport	$ 62	$ 0	0	$ 62
Totals	$2,302	$1,594	69	$ 708

*Savings of 75% reflect the collectivization of automobiles as four-family autos; savings of 64% represent a reduction in total vehicle miles traveled in the urban area.

Clothing

Kolbe's 1980 family budget study shows the Tucson family of four expended 6.6% of its total annual budget for clothing; 8.8% of its consumption budget. The clothing budget is based upon the purchase of selected items in the marketplace with costs based upon direct pricing in area stores (at least three stores per item).

The household budget for clothing could be reduced by purchasing recycled clothing. If 25% of annual family clothing expenditures were made for recycled clothing costing one-third the market price (based upon local estimates), a 16.7% capital savings is possible. By purchasing 50% of family clothing from recycled clothing stores, one-third of the household clothing budget would be conserved without a dramatic compromise in physical appearance. $520 of the estimated $1,559 household clothing budget for 1980 would be conserved. Clothing need not be a purchased

good. A community clothing exchange network provides a means of directly trading clothes without exchanging capital. Other goods or services might be bartered among participants to obtain coustom made apparel or recycled clothing.

Personal Care

Goods and services which the BLS specifies as items of personal care expenditures include: haircuts, hair coloring, soap, toothpaste, shampoo, and other personal hygiene items. By establishing a service exchange network, haircuts, dermatological and beauty services, and other personal care services could be obtained without monetary exchange, or self-provided with technical training and skill development in personal care workshops.

Natural soaps (i.e. from lecithin, bee pollen, aloe vera, oatmeal, etc.) and shampoos (derived from chamomile, rosemary, aloe, jojoba, etc.) are suitable goods for local cottage industrial production and distribution. Currently, the Food Conspiracy (a food cooperative) locally manufactures and distributes such items in Tucson. Natural ingredients for local manufacturing can be locally grown, produced, or collected to support small-business enterprises. A fifty percent savings in the purchase of personal care goods and services is achievable with an efficiently managed cooperative production and service exchange system along with a buyers cooperative.

Medical Care

The hypothetical family of four in Tucson spent an estimated $1,246 on medical care in 1980 according to Kolbe's budget study. Their expenditures included: health insurance, hospital care, dental care, opthamological care, prescription and non-prescription drugs, vitamins, and other medical supplies.

Integral with the intent of achieving greater self-reliance is the intent of maintaining good mental and physical health. In the development of an ecological system for the self-provisioning of food, workshops on nutrition, personal health care, preventative and natural medicine are important in sustaining human health at a minimum of cost. Seldom is the issue of self-help medicine fully analyzed in the popular movement toward local self-reliance. Dietary and nutritional consultants are important in planning a balanced food production system.

Plant, animal, and soil specialists can provide valuable information pertinent to ecological balance. Maintaining air, water and soil quality is a dynamic process requiring continual monitoring especially in urban areas where the self-reliant dweller is subject to surrounding environmental influences. Even the healthiest self-reliant urban dweller requires proper medical care. The cost of this care could be reduced by controlling environmental factors (biological, technological, and psychological) which influence the need for medical care. It is important to note that degenerative and respiratory diseases are leading causes of poor health and death in the United States. In 1970, 50% of U. S. deaths were attributable to degenerative diseases such as cancer and heart disease; an estimated 90% of those deaths were from environmentally related causes.[8]

Urban ecological development as proposed by the UES is an attempt to reduce illnesses associated with environmental stress and pollution. Lead and carbon monoxide from automobile exhaust, synthetic, chemical pesticides for lawns and gardens, and water pollutants would be significantly reduced by the UES process of urban re-development for self-reliance. Fewer or no automobiles would be allowed on the development site; plants would be grown in organic cultures; and, water would be naturally filtered and

distilled using solar energy distillation processes.

Family health insurance expenditures rose 16.2% between 1979 and 1980. A cooperative (group) health insurance plan could supplement or replace individual family plans self-provided or provided by employers. The U. S. Bureau of Labor Statistics urban family of four budgets are based upon the assumption that only 44% of employers cover full health insurance costs for workers; 26% pay half of the cost; 30% pay none of the cost. Group insurance policies which partially or fully cover pharmaceutical costs could provide major household savings as the cost to the Tucson family of four to obtain pharmaceutical goods rose nearly 24% in one year, 1979-1980.

Health care products derived from natural sources (i.e. herbs, algae, and brewer's yeast) can be locally produced to supply vitamins, minerals, and protein to human diets. They can also be used to treat ailments associated with improper dietary practices and stress. For example, brewer's yeast is rich in vitamin B and can be important in curtailing stress. Kelp is a natural source of iodine which is important to the functions of the thyroid glands which regulate metabolism.

A mass movement toward full medical self-reliance would alarm the American Medical Association and the health risks could be substantial. With the rising cost of medical care (exceeded only by the rise of taxes for the family of four in Tucson in 1980), the choices of the family are narrowing as income dollars are prioritized to support household expenditures. BLS family medical care expenditures are based upon the assumption of good health and with a cooperative (group) health insurance plan, preventative medicinal practices, nutritional diets, and natural dietary supplements, a budget savings of 50% would appear possible.

Other Family Consumption

In all likelihood, expenditures for newspapers, magazines, books, recreation, telecommunication, sports, and other leisure pursuits will rise during the development period. The urban dweller will demand the diversification of leisure services as capital and material self-reliance offers a means to support those services. The demands of a high-leisure society could be met with innovative responses from an expanding market of recreational and leisure goods and services. Educational and cultural activities may experience a dynamic resurgence as households become more capable of directly supporting (with time and money) the amenities of leisure in urban areas instead of depending upon collective (i.e. federal) funds to anonymously direct human and cultural development.

Non-consumptive Expenditures

Life insurance coverage could be supplied as a cooperative service with the benefit of a group rate discount. The guidelines established by the BLS fix the expenditure for life insurance at $160 in 1980 for the hypothetical urban family of four. Occupational expenses are also determined by a fixed sum, $80 in 1980. As households develop cottage and cooperative industries, this expenditure would most likely become an indirect cost of operating a business instead of a family expense. Professional and membership fees, certifications, licenses, and publications are costs which could be assigned to operating a small business.

Gifts and contributions are computed as 3½% of total family consumption costs minus miscellaneous expenses. The Tucson family of four was estimated to have allocated $612 for gifts and contribution

in 1980. As self-reliance becomes firmly established, capital contributions can be replaced by material, labor, and social service contributions. For instance, surplus food from local production could be contributed to a community food bank. Technical self-help assistance, labor, and discounts on local workshops on self-reliance would be social services to the less advantaged in the community (i.e. low-income families). Capital assistance in the form of low interest loans to initiate or assist economic development for self-reliance within the neighborhood is a service which the cooperative corporation could provide. Capital assistance is not always the most generous contribution to be made to the economically disadvantaged especially when consumer purchasing power is declining. Capital goods for local production and household durables are vital to sustaining a self-provisioning supply system. Technical and labor assistance in the re-development of low-income areas will be equally if not more important than capital contributions. If government cuts funding for social and human services, local resources will need to be mobilized in support of social programs.

Taxes rose at a higher annual rate than any other household expenditure category in 1980. Nationally, personal income taxes increased 29.6%, 24.7%, and 24.6% for low, intermediate, and high-income urban families respectively.[9] Reflecting the national trend in 1980, the hypothetical family of four in Tucson experienced a 14.2% increase in taxes as they paid an estimated $4917 on an income of $23,462. Taxes accounted for 21% of the total family budget that year; a portion of the total budget just below that of housing (24.1%) and food (22.7%).

Capital savings and interest on personal savings achieved in household

income as a result of local economic development would be subject to income taxes unless sheltered through effective investment planning. As proposed by the UES, household capital savings would be partially invested to increase energy and capital returns in household operations and production (including cottage industries), and partially invested in a cooperative corporation which manages local ecological and economic development. Deferred annual dividends or personal income could be re-invested into cooperative production to purchase capital goods for achieving greater self-provisioning capacity. In turn, household capital savings would increase over time.

In general, the goods and services provided by household production made posible by equipping the home with durable goods can be considered non-capital household income, an imputed income based upon the displacement of market expenditures for similar items. This imputed income derived through self-provisioning is a tax-free return on the capital investment in durable goods necessary for production. The goal of self-reliance is to fully equip incorporated households with the productive means for tax-free income in the form of self-provisioned goods and services which would otherwise require consumption expenditures in the marketplace. The need to earn capital income through market employment is reduced or at least re-directed from financial self-reliance (buying your needs) to material self-reliance (supplying your needs). A penny saved through household or cooperative production is one less penny to be earned through market employment. If the penny is earned, it buys additional means of local production; it does not supply the additional means (profits) of market production.

HOUSEHOLD MATERIAL RESOURCES

Based upon annual financial information compiled by the National Consumer Finance Association, the net worth of the American household economy increased by an average of about 18% per year between 1960 and 1980. NCFA estimated that by 1980, the household economy was worth nearly 6 trillion dollars with 4.189 trillion dollars of financial assets, 3.1796 trillion dollars of tangible (fixed) assets, and liabilities totalling 1.3968 trillion dollars.[1]

In the following discussion, household fixed assets as defined by the NCFA will be considered household material assets. In general, fixed assets include owner-occupied housing including the value of land and consumer durable goods.

Based upon actual county tax assessment information for 1981, the combined value of secondary land ($76,362) and secondary improvements ($495,436) for the urban square block development model (see Appendix A) is equal to $571,798. The value of personal property limited was set at $496,350. The estimated market value of housing and land of the block development model is between 1.5 and 2.0 million dollars.[2]

In 1980, the fixed assets of housing and land valued at an estimated 2.2714 trillion dollars accounted for 1.3146 trillion dollars of net household worth after deducting home mortgage liabilities; this amounts to 22.5% of total household net worth on a national level. Clearly, homes and land (real property) are primary assets of the household economy. On the local level, the material assets of housing and land are likely to provide a greater percentage of household net worth unless households reflect national figures indicating financial assets were about 70% of household net worth in 1980.

Personal consumption expenditures for durable goods (including housing) declined in current dollars in 1980 after increasing slightly in 1979 following a comparatively high growth period in 1977 and 1978. Consumers spent 211.9 billion dollars for durable goods in 1980 equal to just below 13% of total personal consumption expenditures.[3] On the local level (for Tucson), expenditures for durable goods accounted for nearly 30% of total family consumption costs for the hypothetical family of four. Expenditures for rent/mortgage and property taxes were equal to 55% of durable goods expenditures and almost 16% of total family consumption expenditures in 1980.

Using Kolbe's[4] computed annual mortgage payment of $2,370 for a home purchased in 1973 by a Tucson family of four, the family would pay $71,100 for their home (assuming a thirty-year mortgage with constant annual payments). If the home was financed at 8% interest with a thirty-year mortgage and a 10% down-payment, the original cost of the home would have been $29,350. By applying these figures to the block development model (see Appendix A) where the estimated market value of the home in 1981 (based upon property tax and real estate information in 1981)[5] averaged $152,700, the household would be earning an average 14.3% return on their investment; the net worth to the household would be $100,560. This investment return compares well with returns offered by corporate investments in the market.

Since capital formation for housing declined by 13.5% between 1979 and 1980, the household economy could be in danger of loosing its ability to sustain one of its most valuable assets, the privately-owned home. The UES development plan is aimed at reducing consumption expenditures of the household to sustain the power to afford the liabilities associated with home ownership (i.e. financial liabilities).

The value of other primary material assets of the household economy is determined by the worth of consumer-owned durable goods. Over the past two decades (1960-1980), the worth of household (consumer) durable assets has risen an average of 22.5% annually.[6] Over 79 million households in the United States owned 874.4 billion dollars worth of durable goods in 1979.[7] On the average, each household in America would have had over $11,000 worth of material assets that year. In 1980, 211.9 billion dollars of household durables were purchased requiring 178.1 billion dollars of household liabilities be assumed (as consumer credit). As a result, the net worth of the household economy rose 33.8 billion dollars; a 4% growth over the previous year.

As Burns suggested, the growth in household capital formation for durable goods over the last two decades indicates a willingness of households to self-provide goods and services which would otherwise be purchased in the market. Home improvement goods and services, food services, clothing, and entertainment are increasingly provided by the household itself. Self-provisioning is made possible by equipping the home with durable goods purchased in the market for household production. As stated earlier, the market for industries directly supplying home durables (in general) has boomed in recent years (excluding automobiles).

As consumers learn the value of collectivizing household tools and appliances which are used only occasionally for household operations, unnecessary duplicity of common capital goods for home production can be avoided with the cost-benefit passed on to the household budget (reduced household expenditures). Local lending libraries for small home appliances and tools are becoming popular in urban neighborhoods.[8] The West University Neighborhood Association in Tucson, Arizona is considering a tool lending library as a component of neighborhood

development. The block development model (Appendix A) was based upon an actual block in the West University Historical District. An estimated 4.5% of the total family consumption expenditures for the hypothetical family of four was allocated for household capital goods (excluding the family home and automobile) in 1980.[9] Expenditures totalling $804 would have included: ranges, refrigerators, lawn mowers, tools, and so on. Close to 75% of those expenditures ($604) could be eliminated from the family budget through the UES development plan.

The family automobile offers a return on investment which is competitive with industrial investments in the market economy; the return is measurable in service rendered compared to the cost of obtaining similar service from the market.[10] With the cost of financing the family auto rising, the liability of private automobile ownership is exceeding the means of many. The family of four in Tucson required an estimated $916 in 1980 to cover the cost of replacing the six-year old family car with a two-year model financed over a four-year period. Seven and one-half percent of the family consumption budget was allocated to operational expenses associated with the family auto. With an estimated $2,240, the family was able to supply its own transportation service; this sum is equal to 12.7% of the family's total consumption budget. As the cost of private ownership of an automobile rises, the consumer will respond with fewer purchases in the market. National purchases of automobiles and parts were down by 6% during 1980 as measured by dollars. The number of domestic passenger cars sold in 1980 was down by over 21% from 1979 sales while the number of imports sold was up by only 3%.

The estimated 1980 family budget for supplying the family with private transportation services could be cut by 75% with cooperative ownership (four-family cars), reduced vehicle miles traveled to work and the market (from carpooling, home-based work, and self-provided goods and services), and self-servicing. Semi-private transportation would become more affordable, public transportation more attractive, and the conservation of energy (i.e. gasoline) and capital become integral means of balancing human consumption with urban ecological production in support of human life.

HOUSEHOLD HUMAN RESOURCES

To sustain the 1980 U. S. population of about 225 million people required 1.672 trillion dollars of personal consumption expenditures.[1] For every dollar of personal consumption expended, 13¢ was for durable goods, 40¢ was for nondurable goods, and 47¢ was for services. Total personal income in 1980 exceeded two trillion dollars. The distribution of 1980 personal income is shown in Table 10 below along with the hypothetical distribution of income for the Tucson family of four.[2]

TABLE 10: U. S. PERSONAL INCOME DISTRIBUTION COMPARED TO THE HYPOTHETICAL DISTRIBUTION OF EXPENDITURES FOR A TUCSON FAMILY OF FOUR IN 1980

Outlay	% U.S. Total Personal Income*	% Expenditures Tucson Family of Four**
Personal Savings	4.7	-
Durable Goods	9.8	21.7
Nondurable Goods	31.3	38.3
Services	36.3	16.4
Other Consumer Outlays	2.2	2.6
Personal Taxes	15.7	21.0

Sources: * "1981 Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 29.
** Adapted from Phillip T. Kolbe's "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March 1981.

With an annual income of over two trillion dollars in 1980, it behooves participants of the household economy to develop a collaborative management system to sustain the growing wealth of American households. The UES could become an organizational prototype to establish a national household collaborative in the re-direction of household resources toward local economic development to sustain self-reliance. A national household management collaborative could be organized as a network of locally incorporated households cooperating to reduce household operating expenses, to conserve household capital income, and to develop new means of household

production. Depending upon a market provisioning system, continuing to loose - purchasing power, and the inability to afford the cost of capital, has left the American household no choice; it must be re-organized as a dynamic economic force. It must participate more fully in the means of production; it must at least produce more for its own use.

Financial planning to sustain the (individual) household's economic position is now a necessity; in a sense, it has always been a necessity. With households depending upon an international supply system, their economic stability is based upon a high level of uncertainty. Daily, international events beyond the control of individual households have a dramatic impact upon the system of supplies which help to sustain the human resources of households. A household financial plan could be devised to conserve local capital to be allocated toward establishing local production means to self-provision basic household needs in an effort to reduce our dependencdy upon uncertain markets which exceed the direct participation of local households. Americans for the most part consume in their homes. They could produce more there as well.

The list of goods and services procured daily in the marketplace is astounding; it is culturally shocking according to Alvin Toffler.[3] Food, paper supplies, gasoline, clothing, personal care products, auto insurance, utilities, medical care , and housing are but a few of the many generic categories of household consumption. The choice of specific items under these generic categories is innumerable. The U. S. Bureau of Labor Statistics outlines over 400 items which are indexed or directly priced in many urban areas to compare the cost of living in major American cities.

In Tucson, a hypothetical family of four would have spent $8,994 to obtain the nondurable needs to support a moderate standard of living

in 1980. The family would have spent $3,617 for the services outlined by BLS in its urban family budget studies. Over 50% of the total family consumption budget went for nondurable goods, with another 20.4% allocated for services. Nondurables and services directly support the needs of the household's primary resource, its human resource. The market is not the only supplier of these human needs. The householders themselves could supply nondurables (i.e. food) and services (i.e. home repairs) for their consumption needs. Under the UES development plan, a savings of over 65% in nondurable spending and 56.5% in service spending could be actualized through human resource development along with the development of home production means. Table 11 summarizes the savings potential of the UES for nondurable and service expenditures. Conservation has already been discussed in relation to the development of self-provisioning production means; the role of human resources in household and local production for self-reliance is discussed below.

TABLE 11: UES CAPITAL CONSERVATION POTENTIAL FOR FAMILY EXPENDITURES FOR NONDURABLE GOODS AND SERVICES OF A HYPOTHETICAL CONSUMPTION BUDGET*

	1980 Expenditure	UES Savings	%Savings
Nondurable Goods			
Food	$5,322	$4,373	82.2
Non-food	$3,672	$1,513	41.2
Subtotal	$8,994	$5,886	65.4
Services			
Insurance	$ 351	$ 222	63.2
Home Services	$ 238	$ 190	80.0
Auto Services	$ 192	$ 144	75.0
Transportation Services	$ 113	$ 33	29.2
Medical Care	$1,246	$ 623	50.0
Leisure, Recreation	$ 587	$ 0	0.0
Communcations	$ 120	$ 60	50.0
Utilities	$ 770	$ 770	100.0
Subtotal	$3,617	$2,042	56.5
Totals	$12,611	$7,928	62.9

*Based upon U.S. Bureau of Labor Statistic Guidelines for computing a family of four budget; adapted from Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981.

Diversification of individual roles in the means of production is critical to the development of a comprehendable cooperative ecology. Participation is vital to the success of local development toward urban self-reliance; public, private and cooperative sectors must be willing to participate in newly defined partnerships in the urban eco-system. Human resources development would primarily consist of workshops and local training programs. Re-defining the roles of consumers and producers, instructing consumers on means to conserve energy and capital, and developing diverse practical and technical skills are required to achieve dynamic local growth and efficient productive work. With the concerted effort of all sectors, energy supplies can be balanced with the processes of managing economic and ecological life cycles.

The energy required to sustain the integrated ecological production system will be supplied by two primary resources indigenous to the local development area: solar energy and human energy. The labor energy input required to manage the ecological system is estimated to be 3.55 million Calories. The self-provisioning of food and energy will annually demand nearly 21,000 labor hours, approximately 400 hours per week. An equal distribution of labor between eighty residents would necessitate a five-hour commitment per week per capita.[4] Maintenance of the local renewable resource supply and reclamation system is labor-intensive; that is to say, the energy input to the system beyond solar energy is in the form of human labor, not capital. This labor-intensity does not mean that residents will be enslaved by the processes of self-provisioning their food and energy needs. Close to 70 million Calories will be supplied by the food production processes, with a 3.55 million Calories labor energy input. A 5% labor energy subsidy is necessary to manage

the biological and technological life cycles of food producing subsystems of the local urban ecology.

A newly emerging humanism brought about by the re-establishment of local self-reliance is surrounded by the realities of our contemporary means of sustaining life in America. In our society, the market economy is a given fact of economic organization. This fact does not preclude the fuller participation of households in production processes of the market beyond wage and salaried labor. Another fact, in the last decade, personal income from wages and salaries accounted for only two-thirds of personal income; the other third came from proprietors income, rent, interest, dividends, and transfer payments . Household financial assets outnumbered fixed assets in relation the net worth of the household economy by two to one in 1980 after deducting liabilities.[5] Household assets applied to the development and management of production can have a dramatic, dynamic impact on the market economy. They could also have a positive impact on local collective economies by generating tax revenues and conserving public spending (as self-reliance becomes supportive of social services in the community).

A new "economy of scale", a scale appropriate to management by local resources (i.e. human and capital resources), could emerge. The full participation of individuals, households, and collectives in sustaining a renewable life-support system provides an ecologically based human economy. With the value of human labor and household material resources newly defined by their productive capabilities in sustaining local self-reliance, a re-valuation of capital might suggest a more appropriate standard of determining economic balances; the determination of net energy balance is one example of a new standard of measurement based upon an economy of calories, not dollars.

The development of local food production systems could reduce household consumption expenditure for food by over 80%. Nondurable consumption spending could decline further by purchasing recycled clothing, conserving gasoline and paper supplies, and manufacturing household products locally (i.e. personal products such as soap, shampoo, etc.). Traditional rural and indigenous cultural technologies could be re-applied in local production systems to supply human needs in urban areas. By developing indigenous and rural cultural arts, urban dwellers could learn how to manufacture hand-made, labor-intensive products in local cottage and light commercial industries.

Auto and home services are target areas for providing self-help skill development workshops. A local resource library and learning center could contain self-help manuals, and technical assistance could be arranged through a service and labor exchange network. Technical training for self-servicing the home and auto could yield savings exceeding 75% of household expenditures for similar market services.

Local health care services can be provided for many medical needs which do not require the direct consultation or visitation of a medical doctor. Some out-patient services, health insurance consulting, self-help and preventative care services, natural medicinal treatments, and dietary programs are among the services which a local clinic could provide. Local clinics might be satellites of local county health clinics providing supplemental care to area residents and transportation service to professionally staffed clinics and hospitals. By the twenty-first century, self-diagnostics and self-treatment may become a part of the growing potential of services provided by home computer systems. Biofeedback, indexed medical information, personal medical histories and so on could be supplied by a central data bank and available to the individual patient

and physician simultaneously. Technologies which would allow the individual to provide more of their own health care needs and participate in their choices of treatment with professional consultation are within the means of computer engineering. Necessity, the need to conserve household capital resources, may well be the mother of such inventions. Medical care need not require the transport of individuals to central facilities; centrallized information exchange could transport medical data at a fraction of the cost of transporting human beings. Home care could replace hospital care, and the duplicity of energy-intensive construction of new hospials could be minimized.

Human resource development is required to achieve local energy self-reliance. Energy consumers can become energy (power) producers as well. Capital for energy self-reliance would come from several sources: capital conservation from food production, capital savings from energy conservation, other household self-provisioning to conserve capital, and tax-credits. According to the UES development plan (to be outlined later) energy self-reliance is a dynamic process; it could require fifteen to twenty years to achieve 100% energy self-reliance which would actually be energy self-sufficiency. A major emphasis of energy development is the development of practical and technical skills of local participants to minimize labor costs in the assembly, installation, and maintenance of components of the integrated home energy system. Components and parts for energy systems can be obtained through a buyer cooperative and assemble on-site at a significant savings to the household. To provide appropriate local training to manage the integrated components of home energy systems, workshops could be conducted prior to or concurrent with the implementation of the self-reliant energy plan. The following list is suggestive

of the type of workshops which might be conducted locally to equip household human resources with technological and practical know-how for developing and sustaining local energy systems.

LOCAL WORKSHOPS FOR ENERGY DEVELOPMENT TOWARD SELF-RELIANCE

Construction Tools & Equipment: Operation and Safety
Residential Water Conservation
Residential Energy Conservation
Home Energy Audits
Weatherization and Insulation Applications
Improving Fireplace Efficiency
Wood Burning Stoves: Selection and Operation
Passive Solar Heating and Cooling Technology
Photovoltaic Power Systems
Energy Storage Systems
Wind Energy Conversion Systems
Biomass Energy Systems

As local development matures, apprenticeship, research, and internship programs relative to home-based light industrial production and cooperative systems operation and management could be implemented. Diversified skills training is an important component of cooperative development insuring a variety of work roles from which the individual may choose to participate in local production processes. A neighborhood learning and resource center could provide individualized training, self-help technical assistance, and home-based educational programs with the aid of a growing line of home electronic products (i.e. home computers). The UES is conceived to be a dynamic living/learning system of ecologically cooperative economic development toward local self-reliance. Living is integral with learning, and vice versa.

Local labor-management demands competant, knowledgeable participation of workers. Organizing worker collectives for self-management of production offers the benefit of earning labor shares in the cooperative corporation according to the productive capability of participants while supplying common needs to all cooperative members. A labor, capital, and material

exchange policy provides a means of exchanging personal assets and human labor for necessary household provisions (i.e. food, energy, and housing). Households will obtain shares in the cooperative corporation based upon their investments of capital, labor, and materials according to cooperative policies establishing and monitoring equivalent worth of household inputs. A labor and exchange collective would provide an individualized program of skill development, worker placement, adjust earnings from corporate shares according to the worth of contributed resources (labor, capital, or material), and continuously update household net worth information for financial planning.

In phase III, the Urban Eco-operative Development Phase, the local management system will mature. Food, housing, health care, financial, labor, transportation, education, leisure, and technological management teams will cooperatively sustain the integrated ecological and economic system. Appendix A outlines the general responsibilities of each management team in the third phase of development (refer to pages 179-182).

SUMMARY

Sustaining a moderate standard of living (as defined by BLS) is dependent upon household financial planning. Conservation of capital and energy (purchased with capital) is imperative. Rising prices in an inflationary economy will have the effect of radically re-directing household spending priorities. A study commissioned by the National Housewares Manufacturers Association in 1979 showed "price" was the number one criterion upon which consumers selected small electric appliances. Nearly 28% more consumers chose "price" as the most important factor of selection in 1979 than in a similar survey in 1974. In 1974, the most important factor was "brand name". Forty-two percent of those surveyed expected small electric appliances to last five years; nearly fifty percent expected a life-cycle of ten years or more.[1]

Consumers are expecting (perhaps demanding) that household products become durable once again out of economic necessity. The throw-away society is a no-way society. Household budgets dominated by food, housing, and taxes are straining to afford escalating transportation and medical expenses. It is imperative that in an inflationary economy goods be selected with high durability to insure the household will be able to self-provision goods and services through household production to reduce market expenditures. Capital conservation in all budget areas is a key to sustaining formation capital to equip the home with its own means of production; making it less vulnerable to the uncertain supplies of the market economy.

The global scale of the market economy prohibits direct participation of individuals in decision-making roles. Participation is represented by cash receipts in the marketplace, not human interaction. Dollars, not people, direct the market economy. Decentralized production supplying

local markets with necessary goods and services to supplement self-provided goods and services of the household economy offers more direct participation and cooperation of individuals and households in economic activities. The means to sustain a local market economy are in the hands of local households.

By 1980, housing and automobile purchases were waning. Unprecendented, high interest rates deterred prospective buyers from assuming the liabilities of home mortgages and car loans. To the astute household investor, the comparatively low returns offered by private home and automobile ownership were refused for good reasons. Other household durables (i.e. televisions, dishwashers, storm windows,etc.) offer much higher investment returns. A renter unable to finance a house offering a 10-20% return could have chosen to purchase a television with the possibility of a 40% or more return (for entertainment value) on the invested dollars. The entertainment dollars saved from purchasing market entertainment could have defrayed the cost of rising rent payments. Similarly, the homeowner might have chosen the 30% return offered by installing storm windows over the comparatively low (8-10%) return offered by financing a new car at a high interest rate. Savings from high investment returns might be used to extend the life of the used car which could be driven less.

Household capital used to purchase durable goods to sustain autonomous home production for single-family needs can lead to unnecessary duplicity of the means of production. It is becoming impossible with run-away inflation to equip households with the capital goods necessary to achieve the same level of self-reliance offered by the UES. The conservation of household capital resources (used in part to purchase capital goods for household production) provides a means of re-directing the household economy toward a higher level of self-reliance. The means of conservation of capital and energy are multiplied through household collaboration and

sustainable through household cooperation.

The development of home-based enterprises through adaptive-use of existing space within the home with the parallel development of common facilities to supply household needs cooperatively offers a means of sustaining a local pluralistic economy. The local system of supply is triadic; the market economy, the household economy, and the cooperative economy (a collaborative of households) function as producers to supply household (human) needs. The capital means of local production become available through household capital and energy conservation. A high level of local self-reliance is made possible by the development of an integrated household financial and investment plan.

The re-conceptualization of household goals and objectives is of paramount importance in local economic development to attain higher levels of self-reliance. With personal bankruptcies on the rise, the household economy is in danger of loosing its stronghold on the American economy. Rising unemployment is exasperating the problem along with inflation. The worth of household capital in terms of consumer purchasing power is diminishing as households remain dependent upon market supplies for most of their basic human consumption needs. The position of the household relative to the market economy is unstable. Relative to a local economy sustained by human and renewable energy resources, the household's position is one of dynamic equilibrium.

Local economic growth and development need not be biologically, ecologically, or psychologically disruptive to human life. Economic development can be a part of the creative, constructive basis of life when human beings are allowed to participate and cooperate with one another in sustaining economic and ecological life processes to their fullest potential. After all, the fundamental root of economics lies

within the processes of "householding". The Greek word "oikonomia" means "householding"; the organization of a unit to produce for its own use. It comes from the Greek words "oikos" meaning house and "nemein" meaning to manage.

Our popular conception of economics has been obscured by exclusionary conventions of the mass-media, government, and corporate organization of production. Human civilization is and always has been based upon an economy inclusive of the household; the household being the fundamental organizational unit of economies. Above all else, the goal of the UES is to re-assert the fundamental economics of the household and its ability to sustain itself through self-provisioning production, and to demonstrate how its means of production can be economically re-developed utilizing traditional, conventional, and new, state-of-the-art, technologies.

COOPERATIVE ECONOMY

COOPERATIVE MATERIAL RESOURCES

For a third sector to develop in the local economy, capital goods are required to build its means of production, and equip workers with appropriate technology to complete work efficiently. Initially, capital goods for cooperative production will be supplied by participating households according to joint-venture, contractual agreements.

Land, gardening and home repair tools, light construction equipment, and recyclable materials (fencing, lumber, glass, etc.) common to many American households are the foundation of material assets necessary to manage initial ecological development. Cooperative production for self-provisioning begins by nuturing a local ecology, establishing organic gardens, composting, small orchards, recycled material storage, and plant nurseries. Production in phase I is designed to familiarize the households with natural production processes and to clarify the symbiotic relationship between man and nature.

Collectivized material assets provided by households can be centrally housed in an adapted accessory structure (i.e. a garage or carport) or in a home storage area providing accessibility to local residents. A tool lending policy may be necessary to manage a collective tool library. Operation, handling, safety, and maintenance of tools can be the topic of workshops in phase I of the development plan (refer to Appendix A). The tool library could be located adjacent to or contiguous with a workshop area where practical and technical instructions would be provided. The goal of phase I is to minimize capital formation needs (i.e. for structures) taking advantage of indigenous material resources and recycling them where appropriate for adaptive-uses.

Other household material assets supplied to cooperative development would include: self-help manuals, learning resource materials, calculators, typewriters, desks, shelving, and so on. A neighborhood resources center would be an asset to cooperating households offering a central network to exchange knowledge and services. A directory listing skills, interests, resources, and needs of area residents could be compiled and locally distributed. A small management office could be located in an adapted rental unit, a room in a home, or a converted garage or storage shed.

Cooperative buying practices would enable homeowners to purchase household materials at reduced costs. Solar hot water systems, insulation, garden seeds, and food items are a few examples where group purchases would conserve capital expenditures for durable and nondurable material goods.

During phase II, collectivization of automobiles, appliances, and land (in whole or in part) increases the cooperative's ability to borrow against collective assets to finance certain (capital-intensive) components of the development. Contractual agreements preceding household incorporation would specify the relationship between collaborating households. Private land ownership could be maintained during this period unless specific agreements are established to form collective property rights.

During phase III, households would incorporate. Material assets previously contributed to the collective would become material investments in the cooperative corporation. Determination of household shares in the cooperative is dependent upon establishing an equitable value system for material assets invested which form the capital goods necessary for local production. Household capital investments in the cooperative

corporation (providing its formation capital) would go toward the purchase of structures and equipment to diversify production means. Shares in agricultural and aquacultural production, high-density housing with an integrated life-support system, tools, and other cooperative material assets would be determined by continually assessing household percentages of capital, labor, and material investments. Shareholding in the cooperative corporation is a dynamic process requiring the implementation of a value-system to compute (or impute) equivalent worth of capital, labor, and material contributions or investments.

An accounting system is a vital component of the resource management system. Resource utilization and distribution, shareholder information, and cooperative finances must be organized into an accessible information retrieval system. A small-scale computerized information system is appropriate for managing the diversified resources of incorporated households. A household wanting to borrow against its shares of assets in the corporation to begin a home-based business would need to know its corporate status. A small-scale home computer network is one way to supply the expanding information services required of self-reliant households that have collectivized their assets. The interdependent relationship between families necessitates an efficient data processing system to insure equitable distribution of collective wealth. Home electronics have and will continue to clear the way for efficient, expedient, small-scale business management.

With the responsibility of procuring material resources from the market economy for development, the cooperative economy must be linked by telecommunication networks to suppliers. With current market information at hand, comparative buying to economize capital resources is made possible. As cooperative production begins to establish local

markets, marketing information for locally produced goods and services will become a management responsibility of the cooperative corporation. Selecting a management information system appropriate to small-scale diversified production is critical to the development of a sustainable local market supply system. The development of a sustainable local economy (i.e. a market-based economy) is a grassroots endeavor; it literally begins in your own backyard (and home).

COOPERATIVE HUMAN RESOURCES

The need for local labor organization in the UES differs from the need for labor unions. Nationally, labor unions secure and protect the rights of workers, and wage-earnings are equitably distributed to laborers regardless of productive individual work. Labor unions do not secure the need for highly productive workers to be compensated with higher earnings than the minimally productive worker; they operate under a quasi-socialistic labor policy. Workers are generic beings in this respect; each worker is assumed to produce equally and is compensated thusly. Higher earnings in industries employing unionized labor often necessitate upper mobility into middle or upper management roles at the risk of losing labor union benefits. This is especially the case with large corporations with hierarchical management.

As a member of a worker collective in the UES, management is synonomous with labor. Workers directly own, operate, and manage production. Their ability to earn is based upon their ability to produce individually and collectively. Collective earnings are based upon the equitable distribution of cash receipts for fixed wages. Individual earnings are based upon the distribution of profits (cash receipts minus operating expenses including fixed wages) according to worker participation in the production process. Many studies support the higher productivity potential of labor-managed enterprises compared to hierarchical corporate management typical in the market economy.[1] The worker in direct control of the means of production is capable of making decisions which directly bear upon his/her work. With livelihoods at stake, the laborer has a vested interest in his/her productive work. The more one produces, the more one benefits through earnings.

The basis of cooperative work in the UES begins during phase I of

development. Household members learn the benefit potential of participation in collective ventures as they earn higher savings from the self-provisioning of food, energy, and housing needs. The groundwork for self-reliant urban living is just that, ground work. Economic self-reliance is founded in the development of production means to support material self-reliance through the provisioning of goods and services from which capital savings in personal income expenditures are derived. Gardening and home repair tools are collectively shared as is the labor required to establish gardens, composting, material recycling, and home energy efficiency in phase I.

In joint-ventures, compressors for painting, backhoes and roto-tillers for earth moving and mixing, and home insulation are purchased at a group buying discount or collectively rented to accomplish work efficiently at a minimum of cost to all. With homeowners encountering similar problems and having similar home repair needs, equipment rented or purchased and used collectively conserves human energy and household capital expenditures; capital otherwise used to obtain equivalent market services.

Cooperative economic development begins by establishing near-term objectives and long-range goals according to the needs, interests, and expectations of participating households. Collectively, households can analyze the cooperative development potential of their properties identifying optimal land areas for agriculture, livestock (i.e. rabbits, chickens, and goats), energy, and architectural development. Reclamable and infill land areas can be targeted for expansion of the development system and perimeter land can be analyzed according to public access areas, site entrances, parking, and commercial development potential.

As preliminary land-use plans, environmental studies, and neighborhood context maps are completed, household participants begin to define their

work roles in the development process. Collective work groups will manage gardens, tilling the soil, planting, watering, harvesting and so on; composting, collecting materials, forming piles (windrows), distributing finished products (humus); orchards and plant nurseries; tool libraries and repair shops; a learning resource center; a recycling center; and workshops. As households organize energy conservation programs, insulation, solar hot water systems, and other components will be purchased and installed collectively.

As local production means are diversified, work roles will diversify as well. With training an integral component of managing growth, the worker has the option of changing his/her role in local production over time. Eventually, the development of cottage and light industries will offer the householder the means of supplying personal income at home. Capital income will be supplemented by the non-capital (imputed) income of goods and services provisioned cooperatively. Household expenditure savings resulting from self-provisioning of goods and services provide capital for home industries. Personal income savings made possible with increased self-reliance will be apportioned to personal savings and capital formation of cooperative development.

By phase III, the cooperative management system will be fully operative. Labor-management of cottage enterprises, privately-owned worker collectives, will provide work for cooperative members while they continue to participate in collectively-owned production processes with labor, capital, and material investments. High-density housing units will provide living quarters for new members; new members who will participate in the management of cooperative production. As the labor force expands, cooperative and cottage industries will provide work roles for new members along with technical and practical training.

Production subsystems of the block development model were designed to supply the basic needs (food, energy, housing, water, and clothing) of double the indigenous population of 1980. Eighty residents can be supported at over 60% self-reliance. The high-density housing units will be constructed along with the integrated life-support units providing private living quarters for the growth in population. Figures 4 and 5 of Appendix A illustrate the development of a high-density housing cluster consisting of private spaces of the integrated life-support units and surrounding private homes adapted for private living/sleeping units.

New residents will earn membership in the cooperative by investing labor in local production as specified in formal agreements. Work roles of the founding members having moved toward earning capital income in cottage and light industries will provide vacancies in the management of cooperative production. New residents will assume responsibility for local self-provisioning production in architectural, agricultural, aquacultural, livestock and recycling subsystems. New members may also participate in worker collectives depending upon local needs for private and household labor.

Non-member residents will work under fixed-income contracts; income will be in the form of goods and services and/or capital according to specific agreements. This does not preclude the possibility of maintaining employment in the market. Fixed-income for cooperative participation could be a supplement to personal income earned in the market or vice versa.

Human resource development advocated by the UES includes the diversification of worker roles. Members of the cooperative are not restricted by specialized roles; specialization is a matter of personal

choice. Relative to the market economy, the services offered by self-reliant urban producers may appear to be specialized. In ecological production and management, cooperative members will have general and specific knowledge of all subsystem functions and interactions.

The ecological production system will be a part of everyday life. All components of the integrated system will become a familiar part of daily ecological awareness and knowledge, and the symbiotic relationship between man and nature will be a lived experience.

Members and worker collectives can offer many services to the community. Workshops and self-help training programs on energy conservation, home repairs, water conservation, food production and preparation, recycling and so on will supply local revenue to cooperative development. Technical, labor, and capital assistance will become available to the community as the development matures.

COOPERATIVE CAPITAL RESOURCES

In contrast to labor investments earning cooperative membership, new residents may opt to invest capital or materials for membership. Membership in the cooperative through capital and material investments does not exclude non-residents. In fact, outside investments in the development could expedite the processes of growth so long as this investment strategy is satisfactory to local members. Capital needs in general are intended to be supplied through the contributions (or investments) made by households from savings. Household capital investments are supplied by a percentage contribution from annual or cumulative savings made possible through cooperative self-provisioning.

Cash receipts of the worker collectives are managed by the mother corporation, the cooperative corporation, through a cooperative banking system. A portion of worker collective receipts are withheld for the services provided by corporate management including: financing, marketing and management information, investment counseling, and group insurance policies.

Members and non-members of worker collectives earn personal, capital income on a fixed-sum basis according to labor-management policies and contractual agreements. Deferred income (capital) is pro rated in accordance to work contributed by individual members of worker collectives. Deferred annual earnings may be applied toward the purchase of additional corporate shares. Corporate profits are distributed to residents and non-residents in relation to capital, labor, and material shares owned. Goods and services provided by the cooperative may substitute for capital dividends depending of specific policy development covering the equitable distribution of resources among members; goods and services would be considered imputed income

andawould be relatively tax-free as no capital is exchanged. Non-members working under contractual agreements would not be eligible for corporate or worker collective profit-sharing.

Financial and investment planning services offered by the cooperative corporation would encourage households to diversify their investment portfolios. Local production offers many opportunities to invest in collective enterprises supported by corporate resources and assets. Household investments in worker collectives and the cooperative corporation could be supplemented by outside market investments (or vice versa). The corporation could invest capital, labor, and materials in the local market to stimulate cooperation and participation in the local economy.

SUMMARY

Corporate investment capital along with human and material resources will assist other cooperative developments in the local community. The time required to reach maturity of production in new developments could be reduced significantly with capital inputs by existing cooperatives. An expanding network of collaborating, cooperative industries will supply goods and services through a diversified exchange system (capital, labor, and material exchange) to support higher levels of community self-reliance.

A network of cooperatives could collectively fund research and development of new technologies appropriate to small-scale production and manufacturing for self-reliance. Engineering research could identify new applications and adaptations of existing technologies suitable for local manufacturing as well. Small-scale labor, capital, and materials management needs could be supplied more efficiently and expediently through research and development of integrated technological systems (i.e. integrated energy systems).

In collaboration with local government, cooperative development could open new markets for the manufacturing of new technologies which could be produced in proximity to or contiguous with living areas. Cottage and light industries producing goods and services in support of local economic development (i.e. solar panels, energy planning, etc.) would offer many local employment opportunities with labor-intensive manufacturing. Decentralized, labor-intensive production utilizing renewable energy resources indigenous to local areas could support the conservative needs of self-reliant households and contribute simultaneously to ecological balance. Local economic development is coordinated with ecological development assisted by appropriate technological components to supply goods and services through

cooperation. Collectivized capital, labor, and material resources from collaborating households become the means to establish ecologically cooperative, small-scale urban production for self-reliance. As local production becomes capable of sustaining higher household savings for personal consumption expenditures, collaborating households will incorporate to more directly participate in production for the market economy. Worker collectives will become the active components of local economic organization to produce capital income along with goods and services cooperatively produced (as imputed income). A network of cooperative producers will help to supply local human needs which can not be adequately self-provided such as grain and cereals. Local production increases simultaneously with declining consumption (i.e. energy) toward a dynamic equilibrium of energy supplies (renewable energy) and the management of economic and ecological life-cycles.

MARKET ECONOMY

MARKET CAPITAL RESOURCES

In real terms, GNP dropped .1% (1972 dollars) from 1979 to 1980. The 8.8% rise in current 1980 dollars was countered by a 9% rise in prices that year. Compared to 1972, the proportion of GNP attributable to personal consumption and exports is increasing while government purchases and domestic investments for goods and services is declining as of 1980. During this eight year period (1972-1980), the personal consumption expenditure proportion of GNP increased by an average of .3% per annum (using current dollars); exports averaged a .1% increase. The proportion of GNP attributable to government purchases dropped an average of .1% per year while domestic investments fell an average of .175% per year during the same eight year period.[1] Personal consumption expendutures (in current dollars of GNP) were three times greater than government purchases and four times greater than domestic investments throughout the period from 1972 to 1980. Obviously, the consumer continues to play a vital role in the national economy. Sustaining the consumer's ability to purchase goods and services in the market is a national economic priority. An economic priority of the UES is to conserve consumer expenditures for goods and services and re-direct household capital savings toward industrial investments, especially investments in local cooperative and cottage industries.

The UES economic development plan to establish local self-reliance would effectively reduce personal consumption expenditures yielding high capital savings to the household. These savings could be beneficial to the private sector of the national economy, and without a doubt could be beneficial to the development of a third sector (the cooperative economy) if savings were invested in private industries. Cash receipts for some durable goods would rise with incorporated households cooperatively

developing the production means to supply more and more of their own nondurable goods (i.e. food) and service (i.e. transportation) needs. Durable goods for construction (building materials and equipment) and local energy development would be in greater demand while the demand for other durables (i.e. housewares) would stablilize or decline. Labor services associated with household operations would decline as homeowners increasingly discover the benefit of developing practical self-help skills. Demand for technical services is likely to rise as households move into areas of relative unfamiliarity, areas for which continued research and development could significantly increase the potential impact of new technologies on the market (i.e. photovoltaics). The development of new technologies, especially renewable energy technologies, could have a dramatic impact on re-developing urban areas with a sustainable, decentralized production system to support local self-reliance. New technologies require capital investments for research, development, production, and marketing. So far, American industry has not been able to mobilize private or public capital in sufficient amounts to have more than a token impact upon the market at home or abroad. When there has been a major development (i.e. computer chips, transistors, etc.) American production lags behind that of other countries (i.e. Japan and Germany).

The primary objective of the UES local economic development plan is that household savings become investment dollars for industrial growth. Dollars saved are partially intended for capital formation in the household economy to secure higher savings by equipping the home with greater means of self-production. Other dollars saved are intended to expand local private industry whether it be in the cooperative or market economy,

or both. Purchases of durable goods (capital goods of production) will continue to contribute dollars to the market economy and the GNP. The role of the third sector is to conserve household expenditures and to direct household savings toward corporate investments, especially investments in the cooperative corporation. Such corporations function as privately-owned and operated corporations of the market economy; managing collective household and cooperative production in and out of the market economy to sustain higher self-provisioning of human needs. Offering capital returns to shareholders, the goal of private enterprise in the market economy is to increase production for profit by supplying goods and services at a price above cost. The goal of cooperative (third sector) enterprise in the UES is to supply goods and services at cost to members while building industries to compete in the market economy from capital savings derived from the reduction of personal consumption expenditures.

The third sector, organized as the cooperative corporation in the UES, would strengthen household purchasing power in obtaining the means of self-production. It would likewise sustain consumer purchasing power for durables, nondurables, and services obtained in the market economy by managing buyer cooperatives. The third sector is an extension of the household economy. Households participate in cooperative production similar to family members participating in private household production. The cooperative corporation is simply a complexified replica of the prototypical American household collectively organized to participate effectively in the national (and especially in the local) economy. Increasing household productivity makes self-provisioning a more efficient and inclusive process of securing human needs within local ecological limits.

Just as personal income becomes household income to sustain the family, household income becomes collective income (invested capital) to sustain the cooperative corporation.

Building a sustainable third sector from incorporated households, families will participate as consumers and producers in the market economy. The cooperative corporation is a liaison between the market and the household economies. Local production and consumption costs for goods and services which cannot be self-provisioned are cooperatively purchased from the marketplace and distributed to participating households. Goods and services which are locally produced are marketed by the corporation, and outside capital is borrowed when necessary against the assets of the corporation.

The third sector is also an extension of the market economy. The cooperative corporation assists in the management of worker collectives particularly in marketing and promoting goods and services supplied by local industries. The corporation procures capital, labor, and material resources from the market to supply production processes of worker-collective industries. It provides financial and investment planning for the worker collectives to secure their positions in the local market economy and beyond. Private capital from the market-at-large can be invested in the local cooperative enterprise, but returns on capital investments may not be pro rated dividends from corporate profits to capital shareholders. The management of the corporation determines the means by which gains will be equitably distributed to labor, material, and capital shareholders.

Services such as medical care, education, and recreation will continue to be primarily supplied by the market. In the case of education, the collective economy (government) would continue to supply a major portion

of the service supported by public and private dollars of research nationally, and cooperative dollars of research locally. Local incorporated households could supply practical experience and technical training programs through contracts with public and private institutions. Personal care products, clothing, and nondurable goods will continue to be supplied by the market economy. Buying practices may change, but the market supply system will continue to be supported by the household economy.

Capital goods for cottage and light industrial production and cooperative production for self-provisioning will be supplied by the market economy. Dollars of household expenditures conserved will become market cash receipts for home and cooperative capital formation in the development of a local production system. Operation and maintenance costs will add to the cash flow to the market. The volume of sales of some market goods would decline as a result of conservation requiring industries to adapt production to new markets emerging from the re-directed needs of households. Current expenditures for gasoline and oil might decline, while expenditures for synthetic products derived from fossil-fuel resources might increase (i.e. plastics, nylon, etc.). New low-technology applications of synthetic products could expand fossil-fuel industries' markets into new areas of supply. For instance, polyethylene and PVC pipe are inexpensive materials for constructing greenhouses (i.e. quonset-style greenhouses). Nylon and synthetic fabrics are appropriate materials for constructing lightweight structures (i.e. tensile structures) offering a flexible volume of shelter with an economy of materials and energy required for assembly or re-assembly. Whether or not we have an affinity with the fossil-fuel industries, in the near-term transitional period toward fuller economic self-reliance,

their role in the national economy will prevail. Selective-use of products derived from nonrenewable resources can offer local industries a relatively inexpensive means of supporting growth toward a higher level of self-reliance. Concurrentlwith the utilization of such products, biological and energy research could study the potential of deriving synthetic fuels, chemicals , and materials from other sources which have shorter, sustainable renewability periods. The biological conversion of solar energy is one such area of research which has already shown the tremendous potential of producing fuels from plants (i.e. methane digestion of water hyacinths and gasification of dried plant materials). Russell Anderson discusses many other areas of biological solar energy conversion in his book, Biological Paths to Self-Reliance: A Guide to Biological Solar Energy Conversion.[2]

A great deal of our goods purchased in the market are packaged in synthetic materials (i.e. plastic and styrofoam) in order to preserve their freshness in transport and on the shelves of the marketplace. Locally produced, fresh foods consumed as they are produced will conserve energy for transport and packaging. Nevertheless, packaging materials will continue to be produced, and goods will be sold in local markets which were grown or manufactured elsewhere in the world. The goal of the UES conservation plan is not to eliminate these and other practices of the market, but to supply alternatives which make such practices less competitive means of supplying local needs; less competitive in price and less competitive in quality. The goal of the UES conservation plan is to present a sustainable local supply system and offer alternatives to conventional consumer practices which will directly benefit households attempting to conserve their capital, labor and material means.

Capital costs of local economic development could be supplied by loans, corporate, and private investments from the market economy. Capital costs can also be supplied by the market economy through the conservation of expenditures made against personal income earnings from market employment or self-employment. The market economy as stated earlier is a vital component of the American economy. Advocating changes in the structure of the economic system, especially the establishment of a third sector, is congruent with the ideals of a capitalistic society. The means of production remain privately-owned. The UES simply advocates that private ownership should be more widely distributed among American households. Decentralizing economics, increasing local productivity to establish. .. a sustainable self-provisioning system, and local self-reliance are economic objectives fully supportive of a humanized capitalism. Household capitalism opens the door to fuller participation and cooperation in sustaining an ecologically balanced economy relevant to the scale at which we carry on our daily processes of sustaining life.

Economic systems are as strong as their weakest sector: public, private, or cooperative. The household, market, collective, and eventually the cooperative economy are and will remain interdependent components of a mixed, pluralistic economy. The UES advocates a more balanced and fully participatory economic organization which is responsive to diverse, decentralized human needs. It advocates broader-based private ownership of the means of production to insure that decision-making remains relevant to local conditions and needs in the development of a more self-reliant urban way of life.

The household economy has been shown to be commanding a growing percentage of national wealth[3]; While personal income continues to grow in current dollars, purchasing power is declining; the gain in one area becomes a loss in another. Growth in real personal income is retarded by inflation. When consumer purchasing power declines, and consumption expenditures fail to support profits of the private sector to sustain market competitiveness, areas of the market become depressed. In recent years, the collective economy has increasingly supplied failing sunset industries (i.e. Chrysler) with collective income dollars (tax dollars) to sustain their existence in the market while simultaneously reducing research and development dollars to support sunrise industries attempting to open new markets to bolster American competitiveness in the global economy. Public assistance to the private sector comes in several forms: government contracts, corporate tax loop-holes (accelerated depreciation), federally-backed loans, and so on. Private dollars from the household economy (personal income taxes) are collectivized and used to support private industry directly or indirectly. If private industries' portion of collective (tax) revenue declines, personal income taxes rise to sustain collective income and the burden of public spending is carried by American households. In 1980, federal income taxes rose by 17.9%, state income taxes rose by 6.5%, and social security payroll deductions were up by 9.9% for the hypothetical family of four in Tucson with a moderate standard of living.[4] Taxes accounted for 21% of the total family budget for the same family of four in Tucson.[5]

Nationally, taxes were responsible for over one-third of the rise in the cost of living between 1972 and 1979 based upon U. S. Bureau of Labor Statistics budget estimates for urban families.[6] Taxes on personal income

including social security payroll deductions rose 148% between 1972 and 1979; followed by transportation (89.8%), food (88.7%), and medical care (86.2%).[7] Capital conservation on the local level (in the household economy) must be met with capital conservation in the public sector. Private industries of the market economy should not be more heavily supported by government spending or tax laws than the private industry of household production. The UES economic plan is a means of mobilizing and collectivizing household resources in an attempt to re-position the American household within the collective generosity offered to private industries of the market economy through corporate re-organization of households.

MARKET HUMAN RESOURCES

Labor in the market economy is supplied by American households. Workers from the household economy invest their labor in the market in exchange for capital earnings, wages, salaries, and related income. Labor investments by workers in the market is measurable in time (hours) for the most part. Between 1948 and 1965, hours worked in the market grew by about .4% annually. The growth rate of hours worked rose to 1.1% per year between 1965 and 1972, and up to 2.1% from 1972 to 1978. Thirty-five percent of the total hours of work added to the market economy in the third period of economic growth since World War II, 1972-1978, were for the provision of services; 5.7 billion work hours were added in this period.[1] Of the service hours of work added, 42% were for health care and 27% were for business services (lawyers, accountants, consultants).[2] Five percent of productivity decline in the market economy in the third period was attributable to the growth in services according to Thurow.[3] Services are a low-productivity occupation often adding nothing to production for dollars of cost.[4]

As the growth rate of the private labor force increased five times between the first period (1948-1965) and the third period (1972-1978), the growth rate in capital stock increased by only .1% annually. Investments in private plants and equipment were 9.5% of the GNP in the first period compared to 10.3% in the second and third periods. The growth rate in capital stock was not keeping pace with the growth rate in hours worked. The result: productivity declined and the ratio of capital to labor followed suit. On the average, the worker in 1978 was not as well equipped with current technology as the worker in previous years. With a 3.4% increase in capital stock and a 4.8% increase in work hours; the capital-labor ratio dropped 1.3% in 1978.[5] In the third

period, capital costs (including finance charges, energy costs of equipment operation, and purchase price of equipment) rose 4.2% per year in relation to the growth in cost of labor. In the first period, labor costs were rising at a higher rate than capital costs; total capital costs were actually declining 1.1% relative to total labor costs. The market economy operates under many dynamic forces; the interaction of capital and labor, the changing demands of the consumer, and the relationship between resource availability and the production of goods and services are a few of the dynamism of the market.

Growth of investments in American industries has not risen at a higher rate (averaging 10.3% of the GNP in the third period) due to tight monetary and fiscal policies aimed at slowing growth to curb inflation.[6] These policies have contributed to higher interest rates, and the cost of capital for investments has risen, reducing industries' incentive to increase capital investments. Industry is left with falling production, idle capital capacity, and a further declining capital-labor ratio. In general, it would have been more profitable to add workers to increase production in the third period than to increase capital investments in the private sector. Capital formation by business (gross domestic investment) generally increased during the third period; it declined in 1974 and 1975 . The rate of growth in gross capital formation by business declined by an average of 8.9% between 1976 and 1980; dollars of capital formation dropped by 2.4% in 1980 from the previous year.[7]

The labor force (i.e. union workers) must compromise wage and salary increases and employee benefits in new contracts in order to reduce the cost of labor in industrial production. Labor carries a significant portion of the burden to sustain and increase production in the market economy. Meanwhile, the reduction in capital to labor intensifies

the difficulty of sustaining productivity . Sustaining competition in national and international markets requires capital investments in new equipment and skilled personnel. The incentive to produce more with less inevitably leads to labor and management conflict especially if wages do not reflect the workers' increased participation in production.

Income to non-producers (non-workers) was rising at a higher rate than income to market producers (workers) as of 1980. Social security and government pension benefits were rising with the Consumer Price Index (CPI), wages and salaries to producers were not. The rate of increase in transfer payments (income to non-producers in general) was double the increase in wages, salaries, and related income in 1980. Transfer payments increased 17.9% compared to 9.3% for wages, salaries, and other income according to the National Consumer Finance Association.[8] This hardly provides an incentive for market labor to increase output. In that same year, personal interest income rose 22.2%, and income from rent, interest and dividends accounted for 15.2% of the total 1980 personal income for all sources. The proportion of personal income from wages, salaries, and related income sources has declined since 1972 when it accounted for 68.8% of total personal income; it contributed only 65.9% in 1980. Personal outlays of capital were up 10.6% in 1980 while personal savings amounting to 101.8 billion dollars were up by over 18%. Personal income rose 11.1% in 1980 while disposable income was up 11.0% in current dollars. Adjusted by deflators used by the Department of Commerce, real income grew by only .7% in 1980 with a 10.2% overall rise in prices.[9] As illustrated by changes in personal income sources, the household economy is turning to sources other than wages and salaries to procure income. If this trend were to become

widespread among the population, if low and middle-income households were to participate in the economy as capital investors and not merely labor investors in industry, a new dynamism would emerge in the market economy. The national wealth would become less centralized, less in the hands of the few, and more in the hands of the many. Household capitalism is supported by the economic development proposals of the Urban Eco-operative System. It advocates means by which low and middle-income households could collectivize capital savings earned through capital and energy conservation for investments in the market economy via the development of a third sector, the cooperative economy. Participation of households in the market economy as producers is made possible through the incorporation of households and the collectivization of family capital, labor, and material assets and resources.

Personal income earned in the market becomes the operating capital upon which most American households depend after taxes are deducted. The portion of total personal income coming from sources other than wages and salaries is growing. In 1980, 15.9% of personal income came from rent, interest and dividends (up 18.6%), 13.6% from transfer payments (up 18%), and 6.0% from proprietors income (up 6.5%).[10] Households are turning to other income sources (other than wages and salaries) to secure operating capital and formation capital to sustain the home economy.

A flight from the labor market particularly of highly skilled, technical, and well-educated workers could have dire consequences for industry. Even when output falls, skilled workers (i.e. managers) are retained in hopes of maintaining experienced labor for a forthcoming growth period. With the development of small-scale local industry

(i.e. cottage and light industry), many skilled laborers would be able to sustain personal income at or above their market incomes while becoming their own managers and investors. Their labor investment in the market economy is not as profitable as their capital and labor investment in their own economy, the household economy. Their return on labor investments is not growing as fast as their return on capital savings and investments in the market economy.

Private investments in home-based or local industries accompanied by a life-support system capable of provisioning many basic needs reduces the risks inherent in withdrawing from the labor market in favor of developing labor-managed small enterprises. Cooperative savings and business investments provided by the development of a cooperative banking system and a mother corporation (the cooperative corporation) further reduces the risk. Local capital, labor, and material investments could channel household resources into the development of a sustainable local economy. Production and consumption could occur side by side within the home or in closer proximity to the home.

As local production supplies most of the household's basic needs for food, housing, and energy, the risk of leaving the market labor force declines. Labor in the market could become a contractual service offered by households. When the market can support increased labor inputs and offers a fair capital return compared to local income earnings, local labor would more fully participate in market production. When the labor needs of the market economy contract, participation in local production would resume at or near its previous level. So long as this process is supported by the development of a local self-provisioning system which functions equally well when indigenous labor returns to the market, the process has little inherent risk to households

dependent upon personal income earnings. The local provisioning system would therefore need to be built as a sustainable, labor-intensive system without demanding an inordinant amount of time to manage its economic and ecological processes. The time necessary to manage the processes of the block development model (see Appendix A) averages about five hours per week per capita.

With household capital expenditures reduced to a minimum (by over 60%), earnings in the market from contractual work need not be as high as the hypothetical family budgets completed annually by the U. S. Bureau of Labor Statistics might indicate. Those budget studies do not take into account goods and services which the family provides for itself in determining the cost of living on a moderate standard. The primary benefit to the market from contractual work is reduced labor costs. When the industries of the market experience a boom period, they could employ labor under direct contract for a fixed sum to fulfill their labor needs (including management personnel). The process is similar to labor working under union contracts which are negotiated for longer periods of time. Here, the time period of the contract would vary according to the ability of industry to sustain productivity, and when it fails to, the worker has a self-support system to fall back upon which is capable of supplying many of his/her basic family needs.

Contractual labor could be mutually beneficial to industry and to labor if the appropriate means of auxillary support were developed locally. By reducing the direct cost of labor in a period of declining productivity without fearing the permanent flight of skilled labor and management personnel, industry could conserve cash receipts, sustain profits, and continue to justify investments in capital equipment for current markets and for new markets. The benefit to the productive

worker would be the assurance of participation in the market labor force as a contractual worker in a period of industrial growth requiring capital-intensive production means. The industrial growth could be in response to the changing needs of the consumer turned producer; the workers' participation in capital-intensive production might yield new technological products which could be advantageous to local production for self-reliance. When the market for capital-intensive production contracts, the worker can more fully participate in the labor-intensive, capital-conserving local production processes to insure household sustenance. Labor-intensive local production could be supported by the development of new technologies produced by capital-intensive industries in which the worker participates. In this manner, the processes of growth and decline in the market economy would not be as disruptive to human lives as it now is. The potential for re-defining the partnership between industry and labor is supported by the development of local self-reliance. Self-reliance can be established in many ways. The re-industrialization of America is a complex process and the options for industrial development become fewer with time as we irrevocably commit capital and nonrenewable resources to floundering sunset industries (steel and automobile industries) and industries which do not yield net energy, that is to say there is no payback for the energy consumed (i.e. nuclear industry); energy and capital are lost in the imbalances of economic choices.

A progressive step toward a humanized labor policy to meet the productive needs of the market economy while simultaneously meeting the needs of the household and cooperative economies would be the development of a labor exchange program. Household and cooperative labor-forces could supply skilled labor (locally trained) to the market under

direct contract. Local training could also be accomplished under direct contract between industries and local educational institutions including the workshop and training programs suggested by the UES as a part of local skill development for self-provisioning production. The return to labor negotiated by the contract may be in the form of personal income capital or in the form of goods and services directly supplied by industry to the household or cooperative. Durable goods attained in this manner would increase the local stock of capital goods for self-reliant production. Capital exchange would be usurped by labor exchange for the provision of certain market goods and services which cannot be produced locally. Tax reforms could make the exchange even more beneficial by eliminating or reducing taxes on the transfers. Promoting and testing goods and services could not be more effective than contributing them to households in direct exchange for labor provided. This type of exchange program would conserve capital resources of all subsystems of the economy; household, cooperative, and market economies could have more capital available for investment.

In exchange for contractual labor to operate industrial equipment, industry might agree to research production means appropriate to small-scale local manufacturing and provide technical services to assist in the development of those means. The goal of the UES is to make the interdependent relationship between all subsystems of the economy mutually beneficial. Irregardless of means, the need of the market economy (i.e. market industry) will continue to be the conservation of capital to provide investments in plants and equipment to achieve higher productivity, to comply with environmental regulations and controls, and to develop energy-conserving production means.

Increasing capital investment potential through capital and energy conservation is a goal shared by the market economy, the household economy, and the development of a cooperative economy. TheHUES supports the development of means whereby low and middle-income households can more fully participate in market investments. Collectivized household savings and cooperative investments offer such a means; a means which is more humanized than raising personal income taxes which reduce household disposable income to compensate for revenue lost from the private sector (i.e. corporate tax revenues).

The household through personal income allocations (expenditures and investments) will support the re-industrialization of America. The support could be public through higher taxes, or it could be private through higher investments, or it could come from cash receipts paid by the consumer for industrially produced goods and services. All American households should have the option of participating in the processes of re-industrialization beyond taxation and consumerism. There is nothing in the fundamental organization of economic life which should exclude the household (all households) from being a primary beneficiary of national production including the distribution of industrial profits. The investments of capital and labor in industrial production deserve a fair return.

MARKET MATERIAL RESOURCES

Consumers added an average of 41 billion dollars of fixed assets annually to the net worth of the household economy between 1974 and 1980.[1] Even though personal consumption expenditures for durables were down in 1980, households spent nearly 212 billion dollars on durables that year.[2] Material resources added to the household economy as measured by capital formation exceeded that of business by an average of over 17% per year between 1974 and 1980.[3]

As of 1979, the combined value of housing, land, and durables, the fixed, material assets of the household economy, was estimated to be 3.2 trillion dollars. This amount is equal to the estimated GNP of the United States for 1982. The wealth of the household economy is substantial; in fact, it is competing for a higher percentage of national wealth and succeeding. Fixed assets of households (housing, land, and durables) are capital goods equipping the home with its own means of production; producing goods and services for its own use. Household consumption costs are required to sustain household needs which can not be self-provisioned through production in the home. In the case of the UES, self-provisioning is a cooperative production process occurring on collectively-used land adjacent to homes.

Many renewable energy technologies are appropriate to small-scale applications. Photovoltaics would provide a decentralized electrical power source to supply the conservative needs of local households. Methane digesters could supply fuel from human, plant and animal wastes. Figure 2 in Appendix B illustrates the potential integration of energy technologies in providing a system of local self-reliance based upon renewable resource supply and reclamation processes.

There will continue to be a need for developing new technologies potentially beneficial to local economic development. Home computers and electronics are prime examples of new technologies which can support local development. Home financial management and entertainment are a few of the services which such technologies can provide. The conservation of capital, labor, and material resources could be appropriately managed with a small-scale computer network linking incorporated households to one another and to the cooperative corporation. In turn, the corporation might be linked to other enterprises and information systems of the market to receive current management information and to collaborate with other self-reliant groups. Educational programming, self-help instructions, development policies, and other records could become a part of an expanding information retrieval system supporting self-reliant living. The technological components of the ecological system could be operated automatically and centrally controlled. Agricultural irrigation systems could operate according to a pre-determined time schedule, heating and cooling components could be automatically controlled, and so on. Selective capitalization of local production could minimize the labor-intensity of life-supporting systems and conserve capital, labor, and materials necessary for self-provisioning production.

Material resources for development will primarily come from two sources: the natural ecology (in some cases it would be a synthetic urban ecology), and the market supply system. To obtain material resources from the urban ecological system, households will cooperatively manage indigenous resources by developing a renewable resource supply and reclamation system. This supply system is based upon biological and technological solar energy conversion. Food, energy, and reclaimed

water are self-provisioned by the renewable ecological supply processes.

The capital costs of the local supply system will be supplied by collectivized household capital contributions under cooperative management. Material resources (tools, appliances, etc.) of the household will be contributed as capital goods for local production reducing capital expenditures for equipment. Labor will also be contributed as a cooperative investment returning basic material provisions to households, or non-capital income. Local labor and material exchanges for goods and services supplied through self-provisioning production reduce the need to accumulate cooperative development capital.

Making every autonomous household in America as self-reliant as the households in the UES would lead to extreme environmental stress of the natural ecology. Demands for material goods requiring the extraction of natural resources and huge amounts of energy for the conversion of raw materials into household products could bankrupt natural eco-systems. To conserve natural resources and fossil-fuel energy for conversion processes associated with centralized industrial production and transport costs, it is appropriate to develop the infrastructure for local self-reliance cooperatively. The conservation of energy (and capital) requires selective-use of natural resources to extend supplies of nonrenewables and to sustain the regenerative processes of renewables according to human time requirements. Renewable resources derived from natural and urban ecologies (agriculture, aquaculture, etc.) must be managed to sustain their productivity and renewability. An appropriately-scaled urban production system providing collective household needs would require less capifal formation than the duplicity inherent with maintaining autonomous household self-reliance at the same level.

. Currently, natural resource inputs (i.e. copper, iron) into industrial production to sustain the lifelong needs of a single human being in America are measurable in tons per capita. Our resource-intensive, centralized industrial production system is rapidly consuming our national dowry of natural resources. Costs of industrial production are generally reflected in the purchase price of market goods and services. So long as our supplies of natural resources are capable of meeting the demands for industrially produced goods and services, capital inputs of production may be recoverable in price, but price is not necessarily the most relevant measure of return on inputs to production. As nonrenewable resources become more scarce and the costs of extraction and processing escalate, we will need to re-examine markets controlled by price. Even though capital costs of production are recoverable from cash receipts, the value of nonrenewable resources will continue to fluctuate with uncertain supplies, and the result will be price instability.

Energy costs will continue to be a major factor in determining the total capital costs of production. If industrial production remains dependent upon nonrenewable energy supplies, the limit of industrial production is fixed. The constraint of diminishing resource supplies may supercede a capital limit to growth in industrial productivity. Our centralized, industrial production system is energy-intensive and highly entropic. Natural production of eco-systems is generally energy-conserving and sustained by low-entropy processes of energy conversion. Industrial production is highly centralized, natural production is highly decentralized. Local production can simulate the production occurring in natural eco-systems: decentralized, low-entropy energy conversion, and renewable resource utilization. Biological and technological solar energy conversion can sustain local economic development and

small-scale urban production within an ecological system of natural renewability. Reclamation of household material resources (tools, appliances, etc.) and cooperative use of capital goods in local production will minimize material resource needs for local economic development. Technological components of the ecological system will supplement the natural, biological energy conversion processes, and be sustained by renewable resources. New markets for appropriate technology for local economic development could contribute to re-industrialization based upon sustainability.

SUMMARY

Declining productivity must lead to a fall in our standard of living according to Lester C. Thurow.[1] Problems in agriculture, construction, mining, utilities, and services accounted for nearly 57% of the national declineein productivity from the first period (1948-1965) to the third period (1972-1978) of economic development since World War II. The construction industry had a declining rate of growth in the second and third periods, 1965-1978. In the third period, mining followed in its tracks. Wholesale trades was the only industry in the second period to achieve a faster rate of growth compared to the first period. Only one industry was able to improve its second period performance in the third period, communications.[2]

The remaining 43% of the national productivity decline since WWII is related to two factors according to Thurow: inflation policies and the baby boom.[3] The growth rate of the labor force in the third period was five times that in the first period; the growth rate in capital stock was a mere .1% annually in the second and third periods.[4] The ratio of capital to labor continues to decline as inflation brought about in part by tight monetary and fiscal policies increases the cost of capital. Rising energy, equipment, and environmental controls costs have contributed to the rise in total capital costs to industry, and capital for investments in new plants and equipment to increase productivity has not been available.

According to Thurow, declining national productivity attributable to agriculture, mining, utilities, and services for the most part is irreversible. The same may be true in the construction industry. Investments in research and development even if restored to previous levels would not increase productivity in the short-run. Pollution and safety controls, higher energy costs, and the cost to achieve energy conservation are new facts of U. S.

economic life. In an article published in the Arizona Review, Thurow points to investment as the key to achieving a higher rate of productive growth in the economy.[5] Americans must be willing to consume less, conserve personal consumption expenditures, and simultaneously be willing to invest more. Capital must be re-directed toward new areas of industrial growth. Sunrise industries developing new technologies to compete in international markets must emerge from our period of declining productivity, and failing sunset industries must become stable if we are to sustain the American economy and our standard of living.

The establishment of a third sector in the American economy, a local cooperative economy, is one means of re-directing capital to develop new technologies through a sustainable long-range investment plan. The development of new technologies could benefit local efforts to further conserve capital and energy resources through decentralized production for self-provioning of basic consumption needs (i.e. food, energy and housing). Capital savings made possible through self-provisioning of goods and services become the investment capital of incorporated households. Small amounts of household capital savings collectively become dollars of investment capital to support new technologies and sunrise industries in local and national economic development. The cooperative bank could become an important local component in the development of a comprehensive long-range investment plan by directing collectivized capital into local industrial development (cottage, light, and cooperative industry). Their is a positive relationship between the economic development of a third sector, especially the development of cooperative industries, and the resurgence of productivity in the American economy. Through the development of a third sector, the household economy would participate as a producer in the market economy and the means of production would become

decentralized to respond more directly to local human needs.

The household economy has little or no choice save to support the re-industrialization of America whether by paying higher taxes, making more capital investments, or acquiring skills which will be necessary to new and changing industries. Fuller participation in industrial investments could be made possible with a comprehensive, collectivized savings and investment plan allowing low and middle-income families the opportunity to earn capital dividends. Wages and salaries could be accompanied by profit-sharing based upon labor investments in industrial production valued according to the relationship between labor and capital in specific areas of productivity. Valuing labor essentially as an investment in production similar to capital is appropriate at the local and national level in the economy.

If re-industrialization is to occur, it would be advantageous to the household economy to participate through capital investments to receive capital dividends from industrial profits. As every household in America is responsible for their share of taxes to support the collective economy, all households should be given the opportunity to participate in the market economy through capital as well. If the re-industrialization processes are supported through collective tax dollars, households will not receive capital returns on their invested tax dollars. Industrial profits will become private income to some households at the exclusion of others, particularly low and middle-income households. Yet, it is these very same households that will be expected to contribute more to collective (i.e. tax) revenues to sustain public spending as corporate tax incentives reduce the tax burden of industry. Tax dollars which support industrial re-development will support private wealth. Capital investments from the household economy will support private wealth as well, but there is a greater chance that

wealth could be dispersed among a more fully participating household economy as low and middle-income households collectivize their investment dollars. The means of choice to the household economy is capital, and capital used for tax dollars (invested into the collective economy) does not return capital dividends. The return is in public goods and services. Capital used for investments in the market economy do return capital dividends as well as goods and services. Capital investments in the market economy are therefore more beneficial to the household economy.

The relationship between the primary subsystems of the national economy would doubtlessly change dramatically if the household economy were to participate more fully in the market economy, especially through capital investments. Full description of the new relationship, a new human capitalism, escapes possibility here, but an analogy based upon participation in the construction industry seems appropriate to the discussion.

Burns suggested that the role of the market economy in relation to the household economy would be likened to that of the subcontractor. The subcontractor works under the jurisdiction of the prime contractor, supplying a portion of work on a given project as determined by formal agreement. In the new economic relationship defined by the UES, the cooperative economy would act as the prime contractor directing the work of local economic development. Participating households (supplying cooperative capital, labor, and materials) collectively would be the private owners of the project, the local economic development occurring on their properties. Cooperating through a contractual agreement, households would invest collectivized capital, labor, and material resources in the local economic development project to construct a sustainable self-provisioning system

in support of local self-reliance. The owners become managers of the local production system sustained by indigenous resource supplies managed and reclaimed to insure renewability according to human time requirements. The owners will self-provision a major portion of their basic needs: housing, food, and energy.

The role of the developer, the one who secures, manages and coordinates investment resources for the project, is shared between the cooperative and the household economies. As required, resources supplied by the market economy (i.e. durable goods or capital for investments) would extend the role of the developer to include the market economy; a role which is secondary in comparison to the roles of the household and cooperative economies.

Industrial development on the local level as outline by the UES would consist of low-entropy, non-capital-intensive production processes. Nonrenewable resources (i.e. fossil-fuel and minerals) in the form of energy and material goods would be selectively-used in cooperative production to supply multi-household needs with a minimum of capital goods (i.e. durable goods). Renewable resources would play a major role in local production. Biological solar energy conversion would reduce nonrenewable resource requirements for urban agriculture, aquaculture, and livestock production. Nonrenewable resource utilization would be limited to the application of industrial products (i.e. durable goods) required for the most part to sustain technological energy conversions to supplement the natural, biological conversion of energy in accordance with human time requirements.

The potential for developing small-scale, decentralized industrial production should be fully exploited. If new technologies were developed to sustain local production processes with indigenous renewable resource

supplies (i.e. labor and energy), a whole new era of industrialization could emerge. In effect, the development of local, small-scale industies is also the development of sunrise industries. In most respects, local industrial production would utilize new technologies. Technologies which are currently available in the market would be adapted to new roles in production. The development of new technologies could be easily assimulated into local production if research begins to focus on their application in small-scale, decentralized urban production systems.

Our contemporary social and economic organization is bankrupting our natural economic foundation as acre by acre our eco-systems are irrevocably withdrawn from our collective reserves. Socially, we are organized into autonomous households with each requiring a diverse assortment of capital goods to equip the home with the means of supplying family services. Families, particularly with four or more members, are finding it necessary to have two incomes to supply enough capital to sustain their standard of living. One and two member households are now the norm of household organization as large families continue to field the stresses of economic limitations. By 1979, 53.8% of households in America had one or two members; 17.5% had three members, 15.8% had four, and only 12.9% had five or more.[6]

The trend toward smaller households will intensify the utilization of natural resources committed to the production of household capital goods. Even if the population stabilizes, the number of households requiring durable goods from the market will increase as one and two member households becomes the new standard of social organization. The need to collectivize durable goods, equipment necessary for household and cooperative production, will become even more apparent. Single parents and large families will find it more difficult to compete in an

economy directed toward markets for one and two-member households where both members are earning personal incomes. The market may well shift toward supplying the needs and conveniences of one and two-member households (i.e. disposable, nondurable goods and convenient services).

With both adult members of households working to make ends meet, their has been a shift toward increased purchases of nondurable goods and services at the loss of durable spending; spending which in effect supplies the home with its own means of production, The market for nondurable goods grew by 43% and the market for services grew by 66% between 1972 and 1979. The market for durable goods during that same period grew by only 14.5%.[7] Service expenditures in 1972 were roughly three times larger than personal consumption expenditures for durable goods. By 1979, the ratio of service to durable spending was close to four to one. Similarly, the ratio of nondurable to durable spending at 2.7 to 1 in 1972 had increased to 3.2 to 1 by 1979.[8]

Households with one and two members (especially when both members work in the market labor force) simply do not have the time for householding; that is to say, they do not have the time to work in the home as well as outside of it. As a result, these households opt to purchase nondurables (i.e. convenience foods) and household services (i.e. home repairs) from the market to reduce the need to sustain production of goods and services in the home. They require fewer means of household production, durable goods. According to the principles of supply and demand, this trend could move industry further away from supplying durable goods to homes and closer to the demand for more and more nondurable goods and services. The service sector of the market has expanded by leaps and bounds already. Services accounted for over 36% of personal outlays of capital in 1980, and were

up 12.8% from 1979. Personal income dollars used to purchase nondurable goods (31.3% of total personal income) were up by 12.2% in 1980, while expenditures for durable goods declined by .2% and represented less than 10% of total personal income.[9]

The consumer is demanding (or at least expending) more on non-productive goods and services from the market; non-productive in relation to household production for its own use. Some of consumer expenditure changes are attributable to rising prices paid for market goods (and services in some cases). This is particularly true in relation to nondurable goods as gasoline and oil rose 30.3%, and fuel oil and coal rose 22.5% in 1980. Other consumer expenditure changes such as the rise in personal income allocations for services indicate growing dependence upon the market to supply services which cannot or are not being supplied by the household itself. A shift away from the self-provisioning of services (and to a lesser extent nondurable needs) could have deleterious consequences in the household economy. Households could become further estranged from the processes of home production, and find it ever more difficult to once again produce for itself without the capital goods (i.e. durables) necessary for such production. This form of household economics would be based upon a false sense of investment. The returns on household investments will continue to be as high or higher than returns offered by the market. The higher the price for market goods and services, the higher the potential return offered through self-provisioning of goods and services made possible by investments in household capital goods. Purchases of nondurables and services from the market do not offer a means to conserve capital, and they do not offer a return on the capital expenditure. Only durable goods offer such means.

Investments in household durable goods provides the primary means of establishing a sustainable local economy of self-reliance. No household is intrinsically excluded from participation in the means of production. It is only through the conventions of social and economic organization that we feel relatively excluded. We are not forced to participate in economic life by labor alone. Capital is available to afford the means of participation in production beyond the role of laboring in all subsystems of the economy (market, household, collective, and cooperative). We have the freedom to choose what means of production we will support through labor and capital investments. We should also have the choice of deciding how to allocate our natural resources in the means of production. Indirectly, we have this choice on election days.

If we do not choose to equip our homes and neighborhoods with local means of production to self-provision our local needs, the market provisioning system will theoretically equip itself to supply our needs regardless of how they shift at a price. Price, for the most part, will not be a matter of choice, and there is no guarantee that the price will be within our means.

A growing dependence upon nondurable goods and services supplied by the market will not provide the incentive for the market to re-industrialize to supply new technologies; technologies which could be vital to the development of decentralized, small-scale production. Sunrise industries will not be able to justify investments in the development of new capital goods aimed at increasing local production for self-reliance if household expenditures for durables do not reflect an increasing demand. Local self-reliance as outlined by the UES is based upon durability, sustainability, and renewability in the self-provisioning of basic human needs. Self-reliance is made possible by equipping our homes and neighborhood with durable means of self-provisioning production.

REFERENCES

INTRODUCTION:

[1]Scott Burns, Home, Inc.: The Hidden Wealth and Power of the American Household (New York: Doubleday & Company, Inc., 1975).

[2]Ibid., p. 40.

[3]Ibid., p. 43.

[4]"Finance Facts Yearbook", National Consumer Finance Association, 1970, p. 29.

[5]Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981.

[6]Refer to, Alasdair Clayre, "Some Aspects of the Mondragon Co-operative Federation", The Political Economy of Cooperation and Participation (Oxford: Oxford University Press, 1980).

HOUSEHOLD CAPITAL RESOURCES:

[1]Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981.

[2]Ibid., p. 11.

[3]Jim leckie, Gil Masters, Harry Whitehouse and Lily Young, Other Homes and Garbage (San Francisco: Sierra Club Books, 1975), p. 275.

[4]Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981, p. 13.

[5]Ibid., p. 15.

[6]Hari N. Khanna, "Energy and Urban Transportation", Arizona Business, January, 1979.

[7]Scott Burns, Home, Inc.: The Hidden Wealth and Power of the American Household (New York: Doubleday & Company, Inc., 1975), p. 37.

[8]Helga Olkowski, Bill Olkowski, Tom Javits, The Integral Urban House (San Francisco: Sierra Club Books, 1979), pp. 149-150.

[9]"Family Budgets", Monthly Labor Review, August, 1981, p. 56.

REFERENCES

HOUSEHOLD MATERIAL RESOURCES:

[1]"Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 39.

[2]Figures based upon a comparison of the value of "Personal Property Limited" as recorded for 1981 by the Pima County Tax Assessor's Office and the value of real estate on the market in 1981 in relation to the actual square block from which the block development model was derived. The average ratio of "Personal Property Limited" to actual market price for 1981 was 1:4.

[3]"Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 28.

[4]For explanation of the method of computing family housing costs see, Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981, pp. 12-14.

[5]See footnote #2 above.

[6]Computed from Table 11, "Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 33.

[7]"Finance Facts Yearbook", National Consumer Finance Association, 1981, pp. 24, 39.

[8]Refer to, Richard Britz, The Edible City Resource Manual (Los Altos: William Kaufmann, Inc., 1981).

[9]Adapted from, Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981.

[10]For more detailed discussion of household investment potentials, see Scott Burns, Home, Inc.: The Hidden Wealth and Power of the American Household (New York: Doubleday & Company, Inc., 1975).

HOUSEHOLD HUMAN RESOURCES:

[1]"Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 28.

[2]Family of four expenditures are adapted from, Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981.

[3]Refer to, Alvin Toffler, Future Shock (New York: Random House, 1970).

REFERENCES

[4]The UES block development model was designed under the assumption that the estimate 1980 population of 40 persons would double by the third phase of development, or by the twenty-first century. The production systems are designed to supply the needs of 80 persons.

[5]"Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 39.

SUMMARY (HOUSEHOLD ECONOMY)

[1]"Major Appliances and Electric Housewares", Fairchild Fact File, 1981, p. 46.

COOPERATIVE HUMAN RESOURCES:

[1]Refer to Alasdair Clayre, The Political Economy of Cooperation and Participation (Oxford: Oxford University Press, 1980).

MARKET CAPITAL RESOURCES:

[1]"Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 28.

[2]Russell E. Anderson, Biological Paths to Self-Reliance: A Guide to Biological Solar Energy Conversion (New York: Van Nostrand Rienhold Company, 1979).

[3]Refer to, Scott Burns, Home, Inc.: The Hidden Wealth and Power of the American Household (New York: Doubleday & Company, 1975).

[4]Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981, p. 21.

[5]Ibid., p. 8.

[6]"Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 30.

[7]Ibid., p. 30.

MARKET HUMAN RESOURCES:

[1]Lester C. Thurow, "Leading America's Economic Slowdown: The Productivity Problem", Arizona Review, Second Quarter, 1981, p. 8. Reprinted from: Technology Review, November/December, 1980.

REFERENCES

[2]Ibid., p. 8.

[3]Ibid., p. 8.

[4]Ibid., p. 8. Thurow makes the point that when an extra 150,000 private security guards were added to the labor force after 1972, the hours of work added were not accompanied by an addition to productivity; the result was a decline in overall productivity.

[5]Ibid., p. 8.

[6]Ibid., pp. 8-9.

[7]Adapted from, "Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 33 (Table 11).

[8]Ibid., pp. 21-23.

[9]Ibid., p. 23.

[10]Ibid., pp. 22-23.

MARKET MATERIAL RESOURCES:

[1]Adapted from, "Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 33 (Table 11).

[2]Ibid., p. 28.

[3]Ibid., p. 33. Adapted from Table 11.

SUMMARY (MARKET ECONOMY):

[1]Lester C. Thurow, "Leading America's Economic Slowdown: The Productivity Problem", Arizona Review, Second Quarter, 1981, p. 3. Reprinted from: Technology Review, November/December, 1980.

[2]Ibid., pp. 4-5.

[3]Ibid., pp. 8-10.

[4]Ibid., p. 8.

[5]Ibid., p. 11. Thurow also points out that disinvestment in old industries is just as important as investment in new industries as a source of economic growth.

[6]Adapted from, "Finance Facts Yearbook", National Consumer Finance Association, 1981, p. 24 (Table 8).

[7]Ibid., p. 28, (Table 10).

REFERENCES

[8]Ibid., p. 28. Adapted from Table 10.

[9]Ibid., p. 29.

PART III

INTEGRAL PLANNING FOR URBAN SELF-RELIANCE

ECONOMIC PLANNING

INTRODUCTION

Local economic development planning for urban self-reliance begins by determining a hypothetical household budget specific to the development area (assuming actual budgets are not available). In the following analysis, Phillip T. Kolbe's "1980 Tucson Area Family of Four Budget Study"[1] will provide a hypothetical household budget. The economic development potential of the block development model outlined in Appendix A will be analyzed in accordance with previous discussions on the availability of resources in the household, market, and cooperative economies. As demonstrated in the discussion on household resources, the family budget is used to target specific areas of household consumption where conservation and/or self-provisioning could effectively reduce household expenditures and increase household savings.

There are three major phases of local economic development. The first phase is marked by the initiation of household energy, water, and capital conservation practices requiring little or no capital costs beyond the costs included in the hypothetical budget. Phase I is termed the ecological development phase as the principles of energy conservation and low-entropy energy conversion (i.e. biological) become locally practiced arts and sciences of urban life. The process of conserving energy and capital expenditures starts with low-cost or no-cost development. Annual savings from conservation are added to accumulative savings from previous years as dollars saved become dollars earning interest in personal savings accounts. With the capital savings derived from conservation, the capital cost of additional development is affordable to individual households and to the cooperative (group of incorporated households).

In the second phase, cooperative economic development is signaled by the collectivization of household resources to equip production processes for self-provisioning. Urban agricultural production, small urban livestock production, recycling of materials, water, and fibers, and cooperative buying are examples of activities occurring during phase II. A portion of the savings accrued from cooperative and household production to self-provide food, energy, and housing are re-invested into further economic development toward maximum self-reliance.

Local economic development proceeds according to an incremental growth plan contigent upon the continued availability of resources (capital, labor, and material). As a portion of the households' capital savings are transferred to the cooperative corporation (a contractual partnership between participating households), a cooperative budget is determined. Annual contributions to the cooperative budget sustain local development which might otherwise be beyond the means of autonomous households. Components of the local production system (biological and technological) are funded according to need, sequence, and economic feasibility on a year to year basis according to a long-range plan and in accordance to accumulated cooperative capital. The development plan outlines an appropriate chronology for adding production components to eventually establish a fully operative, integrated local supply system to provision a high level of household (human) needs.

Phase III, the ecological cooperative or eco-operative phase, is defined by the development of a fully-operative integrated ecological production system supplying local housing, food, and energy needs. Ecological production is supported by a renewable economy; an economy based upon the biological and technological conversion of solar energy

in partnership with human (labor) energy.

As phase III of the development unfolds, the original households, having constructed an integrated life-support system over a twenty-year growth period, can retire. Household savings which have accumulated over the years could be invested into the cooperative corporation as capital shares...The investment return on the capital shares would be expected to yield dividends competitive with industrial returns on investments in the market economy. These returns could be substantially higher than the return offered on personal savings accounts. With a healthy annual income from cooperative and industrial investments, accumulated savings, and with most basic needs provided locally, retirees could enjoy a long period of leisure while assisting in any number of productive roles within the cooperative ecology.

A new generation of self-reliant households can assume the roles of semi-retired households. A high-density housing cluster will allow a doubling of the urban block density as new households participate in the cooperative venture. Semi-retired members may choose the added convenience of living in the high-density cluster close to cooperative food preparation, entertainment, and dining areas. Residential structures, if sold or rented to new members, would provide additional income to retiring households; income which could be invested in the cooperative corporation or other industries. If the cooperative corporation functions as the real estate broker, finance and transfer costs could be minimized, and supported by cooperative lending institutions (i.e. a cooperative bank). New members will assume managerial roles in the UES while earning membership and decision-making responsibilities.

The household, cooperative, and market economic development plans specific to the model block development (Appendix A) are discussed below to demonstrate the potentiality of local economic development under the UES. Each of the three major subsystems of the local economy will be outlined in accordance to the phased development plan to establish local self-reliance. The following list of assumptions were used in calculating the economic development potential of the model block development illustrated and outlined in Appendix A:

1. The household will be defined to approximate U.S. Bureau of Labor Statistics specifications for the hypothetical urban family of four: a husband and wife each 38 years old, a son 13, and a daughter 8. The husband and wife are assumed to have been married for 15 years, and at least one adult is assumed to have worked for 15 years. Household budgets reflect the expenditures required for a typical family to sustain a moderate standard of living in Tucson, and does not necessarily reveal the family's actual spending. The budget is compiled from indexing or pricing over 400 items in the local market which are necessary and/or desirable to supply conventional social and physical needs of the household.

2. In the block development model, forty residents are assumed to live on the urban square block in phase I. One household is assumed to occupy each of thirteen properties on the block. By phase III, the block's density is expected to double, and all production components of the ecological system are designed to accommodate and support a population of 80 persons.

3. The local economic development plan outlined below is based upon a 20-25 year growth plan. Appendix A outlines the sequential growth.

4. 1980 dollars are used throughout the hypothetical development analysis. The inflation rate applicable to the hypothetical family budget

studies completed by Kolbe in the past several years has averaged nearly 10%.

5. Estimates of capital costs are based upon 1980 figures.

6. Capital costs of material and technological components of the UES are covered by cash payments primarily from cumulative household savings derived through self-provisioning of goods and servides. Cooperative capital costs for development are partially financed through bank loans and/or capital investments in the cooperative corporation from outside sources.

7. Annual savings are equal to the estimated dollar savings in the hypothetical urban family budget for a moderate standard of living in Tucson in 1980 as determined by Kolbe. Capital savings are assumed to accrue at an equal monthly rate. Twelve monthly deposits in personal savings accounts are assumed to earn interest at an annual rate of 6% for the first five years of development (phase I), and 10% thereafter.

8. Households are assumed to incorporate their financial assets in the twentieth year of cooperative development. Cooperative capital investments offer an estimated 12% return. Fixed assets may be incorporated before this time.

9. Prior to incorporating financial assets, households will contribute capital to the cooperative corporation annually based upon the larger of two amounts: 50% of current annual savings plus interest, or 50% of cumulative savings (excluding the current year) plus interest. In addition, households will contribute the computed fixed-sum of gifts and contribution as specified by BLS to the cooperative corporation. The sum is derived as 3.5% of total family consumption expenditures minus miscellaneous expenses.

Gifts and contributions are assumed to take the form of materials and services provided through cooperative production rather than capital.

10. Specifications and performance of components of the UES are summarized in Appendix B.

11. Local economic development phases are defined by:

Phase I = years 1 to 5; beginning in 1980.
Phase II = years 6 to 15
Phase III = years 16 and beyond

Local economic development periods are defined by:

Period 1 = years 1 through 5; beginning in 1980.
Period 2 = years 6 through 10
Period 3 = years 11 through 15
Period 4 = years 16 through 20
Perios 5 = years 21 through 25

LOCAL ECONOMIC DEVELOPMENT

The UES household capital and energy conservation plan is directed toward expenditure savings in transportation, food, and housing.[1] Table 12 outlines the sequence of household economic development, the cost of development system components, and the potential annual savings achievable through household conservation and production; all figures are expressed in 1980 dollars. The development plan would be implemented by all of thirteen households indigenous to the urban block development area as shown in Appendix A.

TABLE 12: UES HOUSEHOLD ECONOMIC DEVELOPMENT PLAN

Year	UES Component of Development System	1980 Cost	UES Savings (annual)
1	Carpooling	$ 0	$ 157
1	Vegetable Production	$ 50	$ 534
2	Weatherization/Insulation	$ 242	$ 132
6	Solar Domestic Hot Water System	$ 500	$ 87
6	Energy Equipment Maintenance	$ 0*	$ 14
6	Improved Fireplace Efficiency	$ 0*	$ 8
6	Shading Devices	$ 0*	$ 10
6	Home Ventilation (attic)	$ 0*	$ 9
9	Solar Heating & Cooling Retrofit	$5,000	$ 206
16	Home Photovoltaic System	$10,000	$ 209
	Totals	$16,097+	$1,397

*Cost is considered an expenditure of family budget for household furnishings and household operations requiring no additional capital outlay by the household.
+In addition to this total, an estimated $5,000 would be allocated for an adaptive-use project in the home to accommodate cottage business in the sixteenth year.

Annual savings minus the sequential costs of components added to the household economic development system would accumulate interest in personal savings accounts according to assumption #7 above. Cumulative household savings would be used to cover the cost of adding components to the home development system throughout the three-phase development. Components

are assumed to be purchased with cash to eliminate finance charges.

A portion of household annual savings or a portion of household cumulative savings would be contributed to cooperative economic development beginning in the third year of growth. The cost of cooperative economic development would be supported by annual capital contributions made by the thirteen indigenous households as outlined in assumption #9 above. Table 13 lists the components and estimated cost of the cooperative economic development plan as applied to the block development model outlined in Appendix A.

TABLE 13: UES COOPERATIVE ECONOMIC DEVELOPMENT PLAN

Year	UES Component of Development System	1980 Cost
4	Tool Library (adaptive-use project)	$ 1,500
4	Repair Shop (adaptive-use project)	$ 1,000
4	Management Office (adaptive-use project)	$ 650
4	Neighborhood Center (adaptive-use project)	$ 10,000
5	Plant Nursery	$ 1,500
5	Outdoor Workshop Area	$ 500
5	Shade Structure @ Waste Collection Area	$ 1,000
5	Fencing @ Composting Area	$ 1,000
5	Community Kitchen & Cafe (adaptive-use project)	$ 7,500
	SUBTOTAL @ PHASE I	$ 24,650
6	Chicken/Rabbit Shelter	$ 16,500
6	Fruit & Vegetable Gardens	$ 4,000
6	Additions to Plant Nursery	$ 6,442
6	Greywater Storage Tank	$ 5,000
6	Grass & Soil Filtration System	$ 1,000
8	Methane Digesters & Settling Tank	$ 10,000
8	Algae Pond Construction & Equipment	$ 250
10	Cooperative Greenhouse (with attached barn)	$ 50,000
10	Recycling Center	$ 10,000
12	Domestic Water Storage Tank	$ 25,000
12	Water Run-off Canal & Irrigation System	$ 2,000
12	Solar Water Distillation System	$ 9,000
12	Lab Equipment (water, plant, soil, animal testing)	$ 10,000
12	Goat Shelter	$ 3,750
14	2 Additional Cooperative Greenhouses	$ 80,000
14	2 Bio-aquaculture Units	$ 60,000
	SUBTOTAL @ PHASE II	$292,942
16	Completion of Integrated Life-Support System	$425,000
	SUBTOTAL @ PHASE III	$425,000
	TOTAL COOPERATIVE DEVELOPMENT COST	$742,592

Local production and resource management systems are cooperatively developed by capital, labor, and material contributions from participating households. The savings potential of cooperative economic development is intended to be beneficial to household economic development as well. As Table 14 illustrates, the savings derived from integrating household and cooperative economic development are nearly eight times the savings potential of household economic development alone (compare Tables 12 and 14). Table 12 demonstrates how the household could save nearly $1,400 of transportation, food, and housing expenditures annually after a sixteen-year development period. Table 14 demonstrates how that savings potential could grow to $10,669 by the sixteenth year of development if households participated in cooperative economic development concurrently with household economic development. Components of the UES are listed according the year in which they could be supplied based upon the cooperative and household development plans outlined in Tables 12 and 13. The annual savings potential from local self-provisioning of specified goods and services is also given in Table 14 below.

TABLE 14: UES INTEGRATED LOCAL ECONOMIC DEVELOPMENT PLAN (SAVINGS)

Year	UES Component of Development System	Annual Savings[2]
1	Carpooling to Work	$ 157
1	Vegetable Production	$ 534
2	Weatherization/ Insulation	$ 132
	FIRST PERIOD SAVINGS POTENTIAL	$ 823
6	Meat, Poultry	$ 725
6	Eggs	$ 104
6	Dried Peas, Beans, Nuts	$ 45
6	Tomatoes	$ 57
6	Potatoes	$ 151
6	Other Vegetables & Fruits	$ 587
6	Sugar & Sweets	$ 24
6	Previous Energy Conservation	$ 132
6	Solar Domestic Hot Water System	$ 87
6	Equipment Maintenance (home energy system)	$ 14
6	Improved Fireplace Efficiency	$ 8
6	Shading Devices (windows)	$ 10

TABLE 14: (CONTINUED FROM PREVIOUS PAGE)

Year	UES Component of Development System	Annual Savings
6	Attic Ventilation	$ 9
6	Appliances (collective lending library)	$ 57
6	Home Repairs (cooperative buyer discount)	$ 19
6	Carpooling to Work	$ 157
6	Recycled Clothing Purchases (25% of clothing)	$ 130
	SUBTOTAL @ SIXTH YEAR	$ 2,316
9	Solar Heating & Cooling Retrofit (per household)	$ 206
10	Milk/Milk Products	$ 687
10	Citrus Fruits	$ 230
10	Fats	$ 39
10	Recycled Clothing Purchases (50% of clothing)	$ 520
10	Personal Care Expenditures	274
10	Medical Care Expenditures	$ 623
	SECOND PERIOD SAVINGS POTENTIAL	$ 4,895
12	Collective Auto Ownership	$ 1,413
15	Fish Production	$ 824
15	Fats & Oils	$ 90
15	Sugars (honey and substitutes)	$ 209
	THIRD PERIOD SAVINGS POTENTIAL	$ 7,430
16	Adaptive-Use of Home for Cottage Business	
16	Photovoltaic Home Power System	$ 240
16	Food Savings	$ 4,373
16	Housing Savings	$ 3,045
16	Transportation Savings	$ 1,594
16	Clothing Savings	$ 520
16	Personal Care Savings	$ 274
16	Medical Care Savings	$ 623
	FOURTH PERIOD SAVINGS POTENTIAL	$ 10,669
23	Home Mortgage Ends (30-year period)	$ 1,396
	FIFTH PERIOD SAVINGS POTENTIAL	$ 12,065

An integrated local economic development plan combining household and cooperative development components over a twenty-five year growth period provides a means to establish a sustainable, self-reliant urban life-support system. Table 15 outlines the sequential savings potential to individual households which would result from integrating household and cooperative development systems. Column one (Table 15) gives the year of local

economic development. Column two represents the potential savings in annual household consumption expenditures based upon the 1980 budget analysis for a Tucson family of four completed by Kolbe.[3] The third column lists the cumulative savings available to the household for the current year of growth. These figures represent the operating capital of the household which is applied to household and cooperative development costs; interest on savings is included in the figures.

Components of the cooperative development system are funded by the collectivization of household savings in the amount shown in column four of Table 15. Each household would be expected to contribute capital toward local economic development in this amount. Household capital contributed at years-end would become the operating budget for cooperative development in the following year.

Column five of Table 15 outlines the cost of household development which is subtracted from column three. Each household would be responsible for covering the cost of adding components to the integrated home energy system to establish 100% energy self-reliance (self-sufficiency). In addition to energy components, $5,000 is budgeted for an adaptive-use project to convert a portion of the home for commercial use in the sixteenth year of development.

Column six specifies the annual balance of household savings. Annual balances are carried over to the next year of development along with interest earnings. In the twenty-first year of growth, the balance of household savings is converted into a capital investment in the cooperative corporation with the expectation of a 12% annual return. Annual savings in household expenditures derived from the mature development system (self-provisioning production and management) combined with the 12% return on capital investment in the cooperative corporation become annual (actual and imputed) income

sources forllocal households (see column six, Table 15). Figures shown for years 21 through 25 assume that annual savings and dividends are re-invested into the corporation. Column three of Table 15 for the years 21 through 25 is computed as the sum of current capital investments in the corporation plus the annual income listed in column six. Table 15 outlines the growth in household financial assets derived from capital savings and corporate dividends (after year 21) attributable solely to local economic development as suggested by the UES. Other financial assets which families might have during the development are excluded from the tabulated values.

TABLE 15: HOUSEHOLD CAPITAL CONSERVATION (SAVINGS) PLAN

Year	Annual Savings	Cumulative Savings	Cooperative Dev. Costs*	Household Dev. Cost	Annual Balance
1	$ 691	$ 710	-$ -	-$ 50	$ 660
2	$ 823	$ 1,546	-$ -	-$ 242	$ 1,304
3	$ 823	$ 2,228	-$ 691		$ 1,537
4	$ 823	$ 2,475	-$ 815		$ 1,660
5	$ 823	$ 2,606	-$ 880		$ 1,726
6	$ 2,316	$ 4,321	-$ 1,211	-$ 805	$ 2,305
7	$ 2,316	$ 4,958	-$ 1,268		$ 3,690
8	$ 2,316	$ 6,481	-$ 2,030		$ 4,451
9	$ 2,522	$ 7,534	-$ 2,448	-$ 5,000	$ 86
10	$ 4,895	$ 5,214	-$ 2,560		$ 2,654
11	$ 4,895	$ 8,038	-$ 2,560		$ 5,478
12	$ 6,308	$ 12,622	-$ 3,298		$ 9,324
13	$ 6,308	$ 16,896	-$ 5,128		$ 11,724
14	$ 6,308	$ 19,517	-$ 6,448		$ 13,044
15	$ 7,430	$ 22,122	-$ 7,174		$ 14,934
16	$10,669	$ 27,593	-$ 8,214	-$15,000	$ 4,371
17	$10,669	$ 15,971	-$ 5,579		$ 10,387
18	$10,669	$ 22,589	-$ 5,713		$ 16,871
19	$10,669	$ 29,718	-$ 9,279		$ 20,437
20	$10,669	$ 33,640	-$ 11,240		$ 22,399

Year	Annual Savings	Cumulative Savings	Corporate Investment	Annual Income
21	$10,669	$ 36,245	-$ 22,399	$ 13,846
22	$10,669	$ 51,752	-$ 36,245	$ 15,507
23	$12,065	$ 70,580	-$ 51,752	$ 18,828
24	$12,065	$ 91,668	-$ 70,580	$ 21,088
25	$12,065	$115,286	-$ 91,668	$ 23,618

*Household capital contribution toward cooperative development

As stated in assumption #9, participating households will contribute a portion of their savings each year toward cooperative economic development. Family expenditures for gifts and contributions listed in BLS family budget studies[4] will become capital contributions to cooperative development to supplement contributions from household savings. The annual amount of the supplemental contribution is based upon the fixed sum computed by BLS specifications as 3½% of family consumption expenditures minus miscellaneous expenses. In the family budget for Tucson in 1980, this fixed sum was equal to $612.[5]

Cooperative contributions begin in the third year of development as the family starts to accumulate savings from low-cost and no-cost conservation practices (i.e. carpooling and vegetable production). Third-year contributions deferred until the end of the year provide a cooperative budget for the following year, the fourth-year of development. Fiscal and calendar years are assumed to coincide. Household capital contributed at the end of the calendar year forms the cooperative budget in the following fiscal and calendar year throughout the development process. Phase II begins in the sixth year of growth, and as will be demonstrated below, the sharpest rise in economic growth occurs in the second period of development (years 6 through 10). For this reason, phase II is termed the cooperative economic development phase. The rate of economic growth diminishes after the second period as the ecological and economic processes move toward a steady-state by balancing energy and capital supplies with the management of ecological and economic life-cycles.

Table 16 summarizes fiscal data pertinent to cooperative economic development for a twenty-five year growth scenario. Column six of Table 16 specifies annual cooperative budgets necessary to sustain growth and manage

Development Year	Balance @ Previous Year	Interest @ Previous Year	Annual Household Contribution @ Savings	Supplemental Household Contribution	Annual Cooperative Budget (Subtotal)	Annual Cooperative Development Costs (cash)	O & M Costs*	Constant Annual Loan Payment	Ending Balance
1									
2									
3									
4			$ 8,047	$ 7,956	$ 16,003	$ 13,150	$		$ 2,853
5	$ 2,853	$ 171	$ 10,595	$ 7,956	$ 21,575	$ 11,500	$ 658		$ 9,417
6	$ 9,417	$ 942	$ 11,440	$ 7,956	$ 29,755	$ 32,942	$ 1,233		-$ 4,420
7	-$ 4,420**	-$ 663**	$ 15,743	$ 7,956	$ 18,616		$ 2,880		$ 15,736
8	$ 15,736	$ 1,574	$ 16,484	$ 7,956	$ 41,750	$ 10,250	$ 2,880		$ 28,620
9	$ 28,620	$ 2,862	$ 26,390	$ 7,956	$ 65,828		$ 3,392		$ 62,436
10	$ 62,436	$ 6,244	$ 31,824	$ 7,956	$108,460	$ 60,000	$ 3,392		$ 45,068
11	$ 45,068	$ 4,507	$ 33,280	$ 7,956	$ 90,811		$ 6,392		$ 84,419
12	$ 84,419	$ 8,442	$ 33,280	$ 7,956	$134,097	$ 49,750	$ 6,392		$ 77,955
13	$ 77,955	$ 7,796	$ 42,874	$ 7,956	$136,581		$ 8,880		$127,701
14	$127,701	$12,770	$ 66,664	$ 7,956	$215,091	$140,000	$ 8,880		$ 66,211
15	$ 66,211	$ 6,621	$ 83,824	$ 7,956	$164,612		$15,880		$148,732
16	$148,732	$14,873	$ 93,262	$ 7,956	$264,823	($425,000)***	$15,880		$248,943
17	$248,943	$24,894	$106,782	$ 7,956	$388,575		$37,130	$67,900	$283,545
18	$283,545	$28,354	$ 72,527	$ 7,956	$392,382		$37,130	$67,900	$287,352
19	$287,352	$28,735	$107,743	$11,628	$435,458		$37,130	$67,900	$330,428
20	$330,428	$33,043	$154,101	$11,628	$529,200		$37,130	$67,900	$424,170
21	$424,170	$42,417	$219,458	$15,300	$701,345		$37,130	$67,900	$596,315
22	$596,315	$59,631	$ 91,560	$ 7,344	$754,851		$37,130	$67,900	$649,821
23	$649,821	$64,982	$108,636	$ 7,344	$830,783		$37,130	$67,900	$725,753
24	$725,753	$72,575	$132,732	$ 7,344	$938,404		$37,130	$67,900	$833,374
25	$833,374	$83,337	$146,646	$ 7,344	$1,070,701		$37,130	$67,900	$965,671

*Operation and Maintenance Costs for Cooperative Development

**A short-term (one-year) loan at 15% annual interest is assumed to cover the negative balance carried over from the sixth year of cooperative development. Local participating households could also contribute capital toward this annual cooperative loss and earn additional capital shares in cooperative development.

***A twenty-year loan at 15% interest, compounded annually, would require a constant annual payment of $67,900 with a principal of $425,000. The amount shown ($425,000) would not be considered an annual cooperative development cost, rather a loan payment cost.

TABLE 16. PROJECTED TWENTY-FIVE YEAR FINANCIAL PLAN FOR COOPERATIVE ECONOMIC DEVELOPMENT

local production processes (biological and technological). Cooperative budgets consist of revenue from previous-year balances (column 2, Table 16), interest earned on previous balances (column 3), annual household capital contributions, and supplemental household contributions (see columns 4 and 5, Table 16 respectively).

Column 7 of Table 16 is the sum of annual costs for adding components to the cooperative development system taken from Table 14 above. Column 8 lists the estimated operation and maintenance costs to sustain the development system. Operation and maintenance costs are estimated at five percent of the total cost of development prior to the current year as listed in column 6. For instance, by the seventh year, total costs shown in column six are equal to $57,592. Five percent of this amount ($2,880) is estimated to be required for operation and maintenance costs in the eighth year.

Column nine in Table 16 represents the annual cost to finance components of the cooperative development system which exceed the available capital resources of the cooperative federation (the collaboration of all participating households). With the collectivization of household resources (labor, capital and material) comprising the cooperative corporation (a corporate household partnership), capital can be borrowed against collective assets as required (refer to Table 16, column 9). In the sixteenth year of the local development, an estimated $425,000 is necessary to complete construction of the integrated life-support system (i.e. high-density housing and common facilities such as a kitchen, laundry, and dining area; see Figure 5, Appendix A for architectural design). With an estimated $264,823 available in the sixteenth year, the corporation would be expected to borrow the capital needed to complete the final (and possibly the most important) component of the development system. For a twenty-year loan period with

an interest rate of 15%, a constant annual payment of $67,900 would be required to finance the project. Construction of the life-support units would allow the local population to double and provide housing for twelve new households to continue the local self-reliant system beyond the first generation of households. Local biological and technological production systems are designed to supply the basic needs of eighty persons; roughly, this is double the indigenous population of the square block in 1980.

By the eighteenth year of local economic development, an estimated six new households could be accommodated in the high-density housing cluster. The six new households would begin to contribute a portion of their capital (from savings) toward cooperative development in that same year. In the eighteenth year, the annual household savings potential would have climbed to $10,669. The new households would enter the development at this level of savings as they would benefit equally from the processes of self-provisioning along with the first generation of households. Capital contributions made by the incoming households in the eighteenth year appear in the cooperative budget in the following year. Similarly, six additional household are assumed to move into the high-density cluster in the twentieth year bringing the total of participating households to twenty-five.

Household development costs would not be incurred by incoming households as their housing would be constructed on a par with existing homes retrofitted with a self-reliant home energy system. Table 17 outlines the scenario of the households entering the development in the eighteenth year, and Table 18 outlines the captial participation of households entering in the twentieth year of development. Figures in column 4 of Tables 17 and 18

are added to the household contributions made by the first generation of families as outlined in Table 15. New households are expected to contribute the fixed sum of $612 annually as supplemental capital for cooperative development.

TABLE 17: HOUSEHOLD CAPITAL CONSERVATION (SAVINGS) PLAN FOR SIX NEW HOUSEHOLDS IN THE EIGHTEENTH YEAR

Year	Annual Savings	Cumulative Savings	Cooperative Dev. Costs*	Annual Balance
18	$10,669	$11,158	-$ 5,579	$ 5,579
19	$10,669	$17,295	-$ 5,579	$11,716
20	$10,669	$24,046	-$ 6,644	$17,602
21	$10,669	$30,520	-$ 9,681	$20,839
22	$10,669	$34,081	-$11,462	$22,619
23	$10,669	$36,039	-$12,441	$23,598
24	$10,669	$37,116	-$12,979	$24,137
25	$10,669	$37,709	-$13,276	$24,433

*Household capital contribution toward cooperative development

TABLE 18: HOUSEHOLD CAPITAL CONSERVATION (SAVINGS) PLAN FOR SIX NEW HOUSEHOLDS IN THE TWENTIETH YEAR

Year	Annual Savings	Cumulative Savings	Cooperative Dev. Costs*	Annual Balance
20	$10,669	$11,158	-$ 5,579	$ 5,579
21	$10,669	$17,295	-$ 5,579	$11,716
22	$10,669	$24,046	-$ 6,644	$17,602
23	$10,669	$30,520	-$ 9,681	$20,839
24	$10,669	$34,081	-$11,462	$22,619
25	$10,669	$36,039	-$12,441	$23,598

*Household capital contribution toward cooperative development

The capital resources of the first generation of households which are derived through the capital conservation plan are invested in the cooperative corporation at the end of the twentieth year of development. With an estimated value of $22,399, each of thirteen households would make a corporate investment; the total collective investment would be $291,200. The corporate investment is separate from the financial plan for the local development shown in Table 16. By the twenty-first year of

development, the corporation would begin an industrial investment plan to expand the potential of local production for self-reliance. First generation households would participate in the expansion of local industries (i.e. cottage and light industries) through capital investments in the cooperative corporation and/or through cooperative banking. After the twentieth year, cooperative development, operation and maintenance, and finance costs become the responsibility of new households. Table 16 (columns 4 and 5) shows a marked decline in cooperative revenue from annual household contributions indicating the reduction in the number of participating households beyond the twentieth year. The financial plan of the first generation of households would shift from local self-provisioning production toward industrial investment planning during the fifth period of economic growth (see Table 15 for years 21 through 25).

The role of the cooperative corporation diversifies in the twenty-first year of growth. With the development system completed, cooperative revenue would be used to sustain operation and maintenance costs and loan payments. Cooperative revenue from the twelve new households beyond development costs could be used for industrial investment in the third sector to increase cooperative participation in the local economy (i.e. in the marketplace). The cooperative corporation could support regional farmers who would produce grains, cereals, and fibers under a contractual agreement since land area in the local urban development can not support these crops. The cooperative corporation could also function as a real estate broker, and provide assistance in residential and commercial financing.

Sustained by large capital investments from the founding households and annual revenue from newly established households, a cooperative federation could assist in local industrial development; regional and national industries could also be supported by local investment capital.

The cooperative federation could establish cooperative banking services including: investment planning, financial planning, lending and savings services. Other areas of local investment might include: the development of local health care facilities (i.e. computerized home care services); alternative educational and occupational services (i.e. in cultural arts and technical sciences); alternate transportation services such as small trams and electrical vehicles for local travel; and, neighborhood recreational facilities.

HOUSEHOLD ECONOMIC DEVELOPMENT

During the twenty-five year UES development period extending into the twenty-first century, the founding households in the block development model (Appendix A) would conserve over 2 million dollars (1980 dollars) worth of expenditures for goods and services. Each household would benefit from capital and energy conservation in the amount of $160,462 with an averaging annual savings after deductions for development costs of $6,418. An estimated $76,536 would be contributed to cooperative development and another $21,097 to household development leaving a balance of $62,829 dollars in accumulated savings. With interest on annual savings at $7,282 over the twenty-five year growth period, interest on cumulative savings at $12,458, and corporate dividends (12% return) at $32,717, the household gains a total of $115,286 during the development. The average annual gain over twenty-five years is estimated to be $4,611. Table 19 summarizes the household financial and investment gains over the course of local economic development through the twenty-fifth year.

TABLE 19: HOUSEHOLD CAPITAL GAINS FROM TWENTY-FIVE YEARS OF LOCAL ECONOMIC DEVELOPMENT

Household Annual Savings	$160,462
Interest on Annual Savings	$ 7,282
Interest on Cumulative Savings	$ 12,458
Corporate Dividends	$ 32,717
Subtotal	$212,919
Cooperative Development Costs	-$ 76,536
Household Development Costs	-$ 21,097
Ending Balance @ 25th Year	$115,286

Tables 20, 21, and 22 outline household capital development for the three phases of development. By the end of the first phase, a five-year growth period, households would have a net savings balance of $1,726. That balance increases by nearly eight times by the end of the following ten-year growth period, phase II. The household has a net savings balance of $2,654

TABLE 20: HOUSEHOLD CAPITAL GAINS FROM PHASE I OF LOCAL ECONOMIC DEVELOPMENT

Household Annual Savings Plus Interest	$ 4,094
Interest on Cumulative Savings	$ 310
Subtotal	$ 4,404
Cooperative Development Costs	-$ 2,386
Household Development Costs	-$ 292
Ending Balance @ Phase I	$ 1,726

TABLE 21: HOUSEHOLD CAPITAL GAINS FROM PHASE II OF LOCAL ECONOMIC DEVELOPMENT

Household Annual Savings Plus Interest	$47,690
Interest on Cumulative Savings	$ 5,448
Subtotal	$53,138
Cooperative Development Costs	-$34,125
Household Development Costs	-$ 5,805
Current Savings Balance	$13,208
Previous Savings Balance	$ 1,726
Ending Balance @ Phase II	$14,934

TABLE 22: HOUSEHOLD CAPITAL GAINS FROM PHASE III OF LOCAL ECONOMIC DEVELOPMENT

Household Annual Savings Plus Interest	$115,960
Interest on Cumulative Savings and Corporate Dividends	$ 39,417
Subtotal	$155,377
Cooperative Development Costs	-$ 40,025
Household Development Costs	-$ 15,000
Current Savings Balance	$100,352
Previous Savings Balance	$ 14,934
Ending Balance @ Phase III	$115,286

at the end of the first five-year period in phase II with an average annual growth rate of nearly 11%. In the second period of growth in phase II, household savings grow by an average of 92.5% per year over the ending balance in the previous period. The net balance of household savings is estimated to be $14,934 by the end of phase II after fifteen years of development.

The rate of growth in household savings (resulting from participation in household and cooperative production to self-provision goods and services) slows to 10% per year in the fourth period of growth when compared to the ending balance in the previous period. In the second half of phase III (the fifth period), annual savings derived from self-provisioning level off to $12,065 as home mortgages end in the twenty-third year.[1] Interest on annual savings is equal to $553 assuming twelve monthly deposits in home savings account earning 10% annual interest.

During the fifth period of growth (years 21-25), the household is assumed to transfer its net savings to the cooperative corporation as a capital investment, with the expectation of earning a 12% annual return. As dividends and annual savings with interest are invested into the local corporation, the households net capital balance at the end of the fifth period is equal to $115,826 (1980 dollars). This figure represents household financial assets which are gained through participation in local economic development. Other financial assets of the household are not included, but could be substantial if the household's annual income exceeds that of the hypothetical family of four in Tucson for 1980 (estimated to be at least $23,462 for a family with a moderate standard of living and with expenditures as outlined by BLS[2]). The household capital savings plan was based upon the assumption that household income would remain constant over the development period.

Over the course of twenty years of growth, the founding thirteen households will have contributed an estimated $76,536 each to cooperative development from their capital savings. Supplementing their total annual cooperative contributions, the households are assumed to have contributed $12,240 toward cooperative development from expenditures for gifts and contributions (as outlined by BLS specifications for urban families[3]). This supplemental contribution would amount to $612 annually.

Total cooperative development costs (including operation and maintenance and finance costs) through the first twenty years of growth are estimated at $814,451. Thirty-three percent of this total ($271,600) is attributable to loan payments, twenty-eight percent pays for operation and maintenance costs, and thirty-nine percent of the total cost of cooperative development is attributable to direct purchases of capital goods for local production (i.e. equipment and materials for structures). With a total of $1,154,088 contributed by the founding households ($88,776 each) by the twenty-first year of development, a net capital balance of $339,637 remains as collective capital. Each household would have an estimated $26,126 of collective capital assets (and $62,650 of collective material assets) remaining in total cooperative funds after the twentieth year. To this amount, the household adds $22,399 at the end of the same year as a corporate investment. The household would therefore have a total of $48,525 worth of financial assets from participation in cooperative economic development (based upon actual estimated dollar values and not market values). The amount of $26,126 represents capital to be utilized at the discretion of corporate management to increase the productivity of the local development system. In this sense, household capital will be invested into material goods (durables) by the corporation and the return to the household will be in added goods and services supplied through self-provisioning processes. A capital return

will be forthcoming on the capital investment of $22,399 along with any additional investments made beyond the twentieth year.

In 1979, household financial assets from savings accounts averaged $14,841 nationally.[4] The U.S. average annual growth rate in household financial assets for savings accounts alone was about 15.5% between the years 1972 and 1978. Under the UES local economic development plan, households could achieve a 21% average annual growth rate in financial assets for household savings based upon a growth scenario relative to the 1979 U.S. average value of $14,841 for household savings. The UES growth rate in household financial assets from savings exceeds the national average from 1972 to 1979 by 35%. Growth in the household's financial assets relative to savings accounts using the 1979 U.S average as a base figure is outlined for the first four periods of growth in Table 23 below.

TABLE 23: GROWTH IN UES HOUSEHOLD SAVINGS ACCOUNTS OVER THE FIRST FOUR PERIODS OF LOCAL ECONOMIC DEVELOPMENT

	1979[5] Ave.	Period 1	Period 2	Period 3	Period 4
Total Savings	$14,841	$19,245	$35,495	$72,383	$134,873
Deductions					
Household		-$ 292	-$ 5,805	$ 0	-$ 15,000
Cooperative		-$ 2,386	-$ 9,517	-$24,608	-$ 40,025
Net Household Savings Balance	$14,841	$16,567	$20,173	$47,775	$ 79,848

Capital contributions which were applied toward cooperative costs are assumed to become fixed assets of the development system with ownership shared equally among participating households. The capital balance beyond cooperative development costs is assumed to be collective capital used at the discretion of corporate management for the development of local industries without yielding a capital return. The estimated balance of $339,637 of collective capital after development expenditures could be

used for industrial capital formation. The return to the household on industrial investments made by surplus collective capital would be in the form of additional goods and services provided by local cottage and light industries. Continued growth in self-provisioning production will further reduce the households dependency upon centrallized supplies imported to the local area and requiring the flow of local capital beyond the local economy.

The participation of households in cooperative capital formation for self-provisioning and local industrial production increases by 7.5 times between the first and fourth periods of growth. Each household would contribute $109,873 toward total capital formation in the development; $62,650 would go toward cooperative capital formation for self-provisioning production; $21,097 would go toward household development (i.e. for energy technology) and the remainder, $26,126, would be applied toward capital formation in local industries. Fifty-seven percent of the capital contributed by the household toward total development is expended for cooperative durables (structures and equipment), 19% is expended for household durables, and 23% would go toward other industrial durables to increase local productivity. Growth in total UES capital formation attributable to individual household participation is shown in Table 24 below for the first four periods of development.

TABLE 24: GROWTH IN HOUSEHOLD CAPITAL FORMATION FOR DURABLE GOODS

	Period 1	Period 2	Period 3	Period 4	Totals
Household Durables	$ 292	$5,805	$ 0	$15,000	$21,097
Cooperative Durables	$1,947	$8,998	$18,167	$33,538	$62,650
Local Industrial Durables	$3,499	$3,579	$ 9,501	$ 9,547	$26,126
TOTALS	$5,738	$18,382	$27,668	$58,085	$109,873

The growth rate in gross capital formation by participating households accelerates between the first and second periods indicating the beginning of the cooperative economic development phase, phase II. Capital formation grows by an average of 45% per year during the second period when compared to the ending balance of the first period. The growth rate in total household capital formation slows to 10% per year in the third period before rising to 25% in the fourth period. This rise is a result of high cooperative capital costs for the construction of the high-density housing cluster and retrofitting homes with solar power systems.

Table 25 outlines the growth in household material assets resulting from participation in the local economic development system. The growth scenario is based upon the U. S. average of household material assets for 1979 with an estimated value of $11,057.[6] Each household is assumed to begin the development period with this average value of material assets from 1979. Since the household is assumed to pay cash for durable goods for home production (i.e. energy technology), the household would not be responsible for any liabilities against its material assets. Liabilities against cooperative material assets shown in Table 25 are the responsibility of the cooperative corporation and not the household; liabilities are therefore excluded from the determination of the average net worth of household durable goods over the first four periods of economic growth.

TABLE 25: GROWTH IN HOUSEHOLD NET WORTH FROM GROWTH IN HOUSEHOLD MATERIAL ASSETS (excluding housing)

	1979 U.S. Ave.[7]	Period 1	Period 2	Period 3	Period 4
Household Durables	$11,057	$11,299*	$17,104	$17,104	$32,104
Cooperative Durables		$ 1,947	$10,945	$29,112	$62,650
Other Industrial Durables		$ 3,499	$ 7,078	$16,579	$26,126
TOTALS	$11,057	$16,745	$35,127	$62,795	$120,880

*Figure excludes the $50 expenditure for vegetable production from the first year of development

Based upon the national average of household net worth of durable goods in 1979, the household would increase its durable assets (excluding owner-occupied housing) by ten times in the first twenty years of local economic development. The average rate of growth in material assets is nearly 47% per year. The U. S. average rate of growth in durable assets was 14.5% between 1972 and 1978.[8] The rate of growth in household durable assets for the UES local economic development exceeds the national average from 1972 to 1978 by 325%.

COOPERATIVE ECONOMIC DEVELOPMENT

Revenue sources for cooperative development are diverse. Primarily, development capital is contributed by households from their annual savings or cumulative savings made possible through local production (i.e. household, cooperative, and light industrial production). Cooperative revenue from household savings is supplemented by a fixed-sum annual contribution. This contribution is based upon the annual expenditure a family of four would be expected to make for gifts and contributions according to BLS specifications ($612 for the Tucson family of four for 1980[1]).

In phase I, other cooperative revenue sources would include: commercial plant nursery sales, cash receipts for surplus food production, garden space rental and site tours. Other revenue sources for phase I are outlined in Appendix A. During phase II, cash receipts from the salvage of appliances, tools, and other recyclable materials would provide cooperative revenue. Similarly, grants, agricultural sales, office rentals, and industrial service payments would augment cooperative revenue from household savings. By phase III, the local development could earn income from selling electrical power (back to the public utility), from worker collective cash receipts, dividends from local investments, (historical) tourism, and so on.

In this economic analysis, all cooperative revenue sources are excluded from the development plan except those coming directly from household capital resources. In this respect, household participation in local development will demonstrate the upward limit of their collective financial responsibilities and show how the local development system is affordable by indigenous households. The analysis assumes that households will earn income over the twenty-five year growth period to at least meet (if not exceed) hypothetical 1980 expenditures for a family

of four with a moderate standard of living.[2] This being the case, household contributions made toward cooperative development are all derived from the conservation of capital made possible through the development of local means of self-provisioning production. No additional expenditures beyond those specified by Kolbe to be necessary to maintain a moderate standard of living in Tucson in 1980 would be required of the household.

The local capital conservation plan was outlined in Tables 15, 17 and 18, and household contributions to sustain cooperative economic development were shown in Tables 15 and 16. The cooperative economic development plan is outlined in Table 13, and the integrated local economic development plan is summarized in Table 14.

Cooperative economic development is analyzed in relation to five periods of sequential growth. Each period is five years in duration. The first period is defined as phase I, the ecological development phase, which includes several low-cost and no-cost capital conservation practices. The second and third periods represent a ten-year cooperative economic development period, phase II. The third phase of development, the eco-operative phase, begins with period four. Table 26 compares the balance sheets for the twenty-five year cooperative development plan summarized into five periods of economic growth. The table indicates the participation of local households in economic development. The figures are based upon the participation of thirteen households through the twenty-first year. The balance of their savings in the twenty-first year becomes a corporate investment. Six new households begin their participation in cooperative capital development in the eighteenth year and six additional household join the development in the twentieth year as was outlined in Tables 17 and 18 above.

TABLE 26: COOPERATIVE BALANCE SHEETS IN LOCAL ECONOMIC DEVELOPMENT

	Period 1	Period 2	Period 3	Period 4	Period 5
Cooperative Revenue					
Household Contributions	$18,642	$101,881	$259,922	$534,415	$ 699,032
Supplemental	$15,912	$ 39,780	$ 39,780	$ 47,124	$ 44,676
Interest Earnings	$ 171	$ 11,622	$ 40,136	$129,899	$ 322,943
Subtotal	$34,725	$153,283	$339,838	$711,438	$1,066,651
Cooperative Expenditures					
Development Costs	$24,650	$103,192	$189,750	$ 0	$ 0
Operation & Maintenance	$ 658	$ 13,777	$ 46,424	$164,400	$ 185,650
Finance Costs	$ 0	$ 663	$ 0	$271,600	$ 339,500
Subtotal	$25,308	$117,632	$236,174	$436,000	$ 525,150
Current Balance	$ 9,417	$ 35,651	$103,664	$275,438	$ 541,501
Previous Balance		$ 9,417	$ 45,068	$148,732	$ 424,170
Ending Balance	$ 9,417	$ 45,068	$148,732	$424,170	$ 965,671
Capital Investments*					$1,498,718
Corporate Dividends**					-$ 425,321
Cooperative Net Financial Worth	$ 9,417	$ 45,068	$148,732	$424,170	$2,039,068

*Figure represents household capital investments made in the cooperative corporation at the end of the twentieth year of growth.

**Corporate dividends could be deferred over several years to supply cooperative corporation investment capital or be re-invested into the corporation to bring the cooperative net financial worth at the end of the fifth period to $2,464,389.

Total cooperative revenue from household sources increases on the average $51,600 per year beyond the first period. The rate of growth in cooperative income from these sources declines from the 68% average annual growth rate between the first and second period to 24% between the second and third periods. It declines further in the fourth period with an average annual growth rate of 22%. The average annual growth rate in cooperative income falls to 10% in the fifth period relative to the ending balance of the fourth period.

During the twenty-five year development period outlined in Table 26 above, cooperative expenditures increased by an average of $25,000 per year

beyond the first period. The rate of growth in cooperative expenditures declines in each period from the 73% average annual growth rate between the first and second period. In the third period, expenditures increase by an average annual rate of only 20%. By the fourth period growth is slowed to 17% per year, and the fifth period rate of growth is down to an average of 4% per year. Thereafter, the rate of growth in cooperative expenditures for local development to sustain cooperative self-provisioning of goods and services would stabilize. Operation and maintenance costs would continue to be near 5% of the total cumulative capital development costs, and finance costs are based upon a constant annual payment.

Table 26 indicates the ending balances for the five periods of cooperative economic growth increase markedly over twenty-five years; the average increase is about $47,800 annually after the first period. After the twenty-first year of cooperative development, dividends at a fixed-percentage (12%) are also paid out of cooperative revenue beyond operating expenses and current capital formation requirements.

Following the trend of the rate of growth in revenue and expenditures, the average annual rate of growth in surplus capital slows beyond the second period. In the second period, the rate of growth in surplus capital (ending balance) averages 78% annually over the ending balance of the first period. In the third period, the average rate of growth is 46% per year, 37% in period four, and 25% in the fifth period.

The rate at which capital flows from the household to support the establishment of a third sector, a local cooperative economy, slows markedly over the twenty-five year development period; it declines by about 4% per year between the end of the second period and the end of the fifth period. Likewise, the growth rate in expenditures from the cooperative economy in support of household self-reliance and consequent capital savings declines

by 5% per year from the end of the second period to the end of the fifth period. Finally, the growth rate in surplus cooperative capital declines by 3.5% over the same periods.

Beyond the fourth period, the cooperative corporation would concentrate on capital investments in local industrial development. Corporate financial and investment planning would be directed toward capital formation for cottage and light industries locally, and for sunrise industries exploiting new technologies to improve local self-reliant production regionally and nationally. The corporation could invest capital in other local development projects to expand the potential for neighborhood and community self-reliance. A network of cooperative suppliers would also be supported regionally with investment capital and cash receipts or other means of exchange (bartering). Agricultural suppliers of grains, cereals, and fibers, suppliers of building materials, light and heavy equipment for construction, and worker collectives providing local goods and services could be supported.

As shown in Table 26 above, the founding thirteen households would invest $1,498,718 in the cooperative corporation over a five-year period, in period five. This total includes contributions from annual household savings, capital investments in the twenty-first year, and the re-investment of corporate dividends earned over that five-year period. With this total capital investment, the ending balance in the fifth period indicates the cooperative corporation has a financial net worth of 2.46 million dollars, or 2.04 million dollars if corporate dividends are deducted.

Table 27 summarizes the growth in cooperative net worth over five periods of local development. Cooperative financial assets are taken from Table 26. Material (fixed) assets are computed from the costs of development which for the most part are based upon the cost of materials and equipment

to construct the integrated life-support system. The cost estimates for cooperative development (see Table 13) do not account for the cost of labor to construct the integrated life-support components. Labor is assumed to be supplied from local human resources; labor is considered an investment in the cooperative development with a return in goods and services directly, and indirectly a capital return in dollars of expenditures saved. The actual worth of the material assets would be substantially higher than indicated in Table 27 if an imputed cost of labor were included; that imputed cost would approximate the dollars of cost conserved from contracting labor services from the market.

The value of the cooperative development system would probably be at least double the figures shown in Tables 13 and 27 if the (imputed) cost of labor were added to the value of material assets (especially the value of structures as outlined in Table 13). The values shown in Table 27 for worth of material assets reflect an estimated 12% annual investment return; the value of material assets grows at rate of 12% annually. This return is similar to the returns on household investments in durables as discussed earlier in this report in relation to Burns' analysis[3]; the return is imputed from the value of market services (or goods) displaced by self-provisioning made possible by the purchase of durable goods for production. Self-provisioning production is estimated to supply about three million dollars worth of goods and services over the twenty-five development period. Total estimated cost of development is 1.34 million dollars. The actual average return on this investment would be 9% per year, but development costs cover several components which are non-productive and not directly a part of the ecological production system (i.e. the neighborhood center). Also, goods and services not

included in BLS family budget studies would be provisioned locally such as distilled water (solar distillation), occupational training, and the cost of labor to construct or install components of home energy systems. With these considerations in mind, the 12% return is likely to be a conservative estimate.

TABLE 27: GROWTH IN COOPERATIVE NET WORTH

	Period 1	Period 2	Period 3	Period 4	Period 5
Financial Assets	$ 9,417	$ 45,068	$148,732	$ 424,170	$2,039,068
Material Assets	$27,995	$170,915	$527,906	$1,599,097	$2,818,155
Total Assets	$37,412	$215,983	$676,638	$2,023,267	$4,857,223
Total Liabilities*	-$ 0	-$ 0	-$ 0	-$1,086,400	-$ 746,900
COOPERATIVE NET WORTH	$37,412	$215,983	$676,638	$ 936,867	$4,110,323

*Cooperative liabilities are computed as the outstanding debt on cooperative loans financed at 15% annual interest, compounded annually, for 20 years. Table 16 above outlines constant annual payments made in the amount of $67,900 during the term of the loan.

Estimated dollars of net worth for cooperative material assets increase by an average of $139,500 annually in the twenty-year period beyond the first period. Compared to the net worth of cooperative material assets in the first period, the value of material assets increases five times per year over the next four periods on the average. The rate of growth in the net worth of cooperative material assets does not increase over time. In fact, each period beyond the second period marks an overall decline in the rate of growth in all cooperative assets. The average annual rate of growth in the second period for material assets is equal to 102% of the first period's balance. This growth rate declines by an average of 12% per year in the third period relative to the rate of growth in period two. The average rate of growth in the third period is 42% per

year. In the fourth period, the rate of growth in cooperative material assets is slightly below that of the previous period at 41% per year (compared to 42%). By the fifth period, cooperative material assets are growing at an average annual rate of only 15% as the local economic development system approaches a sustainable, low-growth state supported by low-entropy biological and technological (i.e. solar energy technology) energy conversion processes.

Until the fourth period, cooperative economic development does not require the assumption of liabilities against its total assets. In the first period, phase I of the development, cooperative net worth is valued at $37,412 (excluding the value of labor in constructing components of the integrated ecological system). During the second period, cooperative net worth climbs by an average of 95.5% per year over the first period to a value of $215,983. With the rate of growth slowing to 42.6% compared to the ending balance of the second period, cooperative net worth in the third period has grown to $676,638. Cooperative liabilities begin in the seventeenth year as the cooperative makes a constant annual payment in the amount of $67,900 on a twenty-year loan. Capital is borrowed for the completion of the integrated life-support system (i.e. the addition of common facilities and high-density housing). With a principle of $425,000 and interest totalling $933,000, the cooperative liability over twenty years is equal to $1,358,000.

With four annual loan payments made in the fourth period, cooperative liabilities are equal to $1,086,400 at the end of the period. Total fourth period cooperative assets are valued at $2,023,267. Deducting total liabilities, cooperative net worth equals $936,867 at the end of the fourth period. The rate of growth in net worth over the third period is down to 7.7% per year, and the asset to debt ratio for the

cooperative stands at about 2:1. Cooperative equity is 54% of total assets in the fourth period.

The average growth rate in cooperative net worth accelerates to 68% per year in the fifth period compared to the fourth period performance. The debt remaining on the borrowed capital is reduced to $746,900 with eleven annual payments outstanding. At the end of the fifth period, the asset to debt ratio is 6.5:1, and the cooperative net worth is valued at $4,110,323. Cooperative equity is now 85% of total cooperative assets valued at nearly 5 million dollars (1980 dollars).

MARKET ECONOMIC DEVELOPMENT

Over one-half of the capital conserved by the household economy (locally) went toward the development of a local third sector, the cooperative economy. Theoretically, the market economy would have lost nearly 3 million dollars worth of cash receipts for the total goods and services locally provisioned from household and cooperative production in twenty-five years of development. Cash receipts in the market for other goods would have risen dramatically; the capital goods of local household and cooperative production systems would have been purchased in the market. The emphasis of local market expenditures would change, but the flow of capital to the market would theoretically continue at or above the expected level without local development. The cooperative economy represents a broker collectivizing household capital and allocating it to the market for selective purchases and investments. The pattern and emphasis of market expenditures of the local households would be altered by the re-organization of household resources in the development of local corporate production means, and the flow of capital between the three primary subsystems of the local economy would be directed by a dynamic re-definition of local needs (i.e. the need to participate more fully in economic life as a local producer, supplier, investor, and not merely as a laboring consumer).

In the five periods of economic growth, an estimated 1.8 million dollars would flow from the household economy to the cooperative economy and earn nearly half a million dollars worth of interest. Of that amount (2.3 million dollars), 1.34 million dollars would flow back to the market economy to purchase equipment and materials to construct the components of the local production system for self-provisioning.

Table 28 summarizes the growth in market cash receipts from household and cooperative expenditures for local economic development.

TABLE 28: GROWTH IN MARKET CASH RECEIPTS FROM LOCAL ECONOMIC DEVELOPMENT OVER FIVE PERIODS

	Period 1	Period 2	Period 3	Period 4	Period 5
Household Development Expenditures	$ 3,796	$ 75,465	$ 0	$195,000	$ 0
Cooperative Development Expenditures*	$24,650	$103,192	$189,750	$ 0	$ 0
Operation & Maintenance Expenditures	$ 658	$ 13,777	$ 46,424	$164,400	$185,000
Finance Costs	$ 0	$ 663	$ 0	$271,600	$339,500
TOTAL EXPENDITURES	$29,104	$193,097	$236,174	$631,000	$525,150

*Represents cooperative development expenditures paid for with cash from cooperative revenue.

Cooperative development costs (paid in cash) account for 23.7% of total market cash receipts for cooperative economic development. Operation and maintenance costs add a total of $410,909 to market cash receipts and represent 39.7% of the total cooperative expenditure budget. The remainder of cooperative expenditures is attributable to the cost of financing the completion of construction for the integrated life-support units; loan payments require 45.6% of the cooperative expenditure budget. In terms of total cooperative dollars expended, period five represents the largest five-year period of growth in cooperative development.

While 1.8 million dollars of household capital flowed to the cooperative economy, .3 million dollars of household savings went to the market economy to finance the development of an integrated household energy system for self-reliance. Fourth period household development expenditures account

for over 70% of the total cost of household economic development.

Growth in market receipts follows the previously discussed trend of cooperative development. After rising sharply in the second period, the rate of growth in market receipts dramatically declines. The second period average annual growth rate is over 100% of the first period ending balance. In the third period, the average growth rate plunges to 4.5% per year when compared to the second period performance. Aided by a large capital outlay by the household economy to install home power systems (photovoltaics) and to adapt the home for commercial use, the annual growth rate in market cash receipts in the fourth period is 33%. By the fifth period, the rate of growth levels off with local economic development substantially completed (excluding continued local industrial development). When compared to the ending balance of the fourth period, market cash receipts were off by a total of 16.8% in the fifth period with an average drop of 3% per year.

After total household expenditures and cooperative contributions are deducted from total household savings (all 25 participating households), a balance of nearly 2 million dollars remains. Add to this amount the 1 million dollars from the cooperative corporation's ending balance in the twenty-fifth year, and the potential for industrial investments in the market (including the third sector) is extremely high. Of course, the balances of household savings and the cooperative corporation budget do not indicate that industrial investments could not have been made at any time during the twenty-five years of development. These figures merely show the potential for investment beyond the total cost of development. With a sound investment plan, households could substantially increase their annual incomes by earning industrial dividends from the

market economy (i.e. in heavy, capital-intensive industries), the cooperative economy (i.e. light, labor-intensive, energy-conserving local industries), and the household economy (i.e. cottage and light commercial industries).

SUMMARY

From local economic development on one urban square block (see Appendix A), a 2.9 million dollar investment potential is derived from capital and energy conservation over a twenty-five year development period. Table 29 summarizes the capital balances for each subsystem of the local economy during the total development period (through the twenty-fifth year). Industrial investments could support the development of new technologies in sunrise industries locally, regionally, and nationally. Investment capital could support the growth of cooperative industries in the third sector as well (i.e. the growth of the local cooperative corporation in new industrial production areas).

TABLE 29: CAPITAL BALANCE SHEETS FOR LOCAL ECONOMIC DEVELOPMENT OF THE THREE MAJOR SUBSYSTEMS OF THE LOCAL ECONOMY

HOUSEHOLD ECONOMY	
Total Household Capital Gains	$3,761,000
Contributions to Cooperative Development	-$1,614,000
Expenditures for Household Development	-$ 274,000
Net Capital Balance @ Household Economy	$1,940,000

COOPERATIVE ECONOMY	
Contributions from Household Capital Savings	$1,614,000
Supplemental Contributions from Household Economy	$ 187,000
Interest Earned on Cooperative Capital	$ 505,000
Total Cooperative Capital (Revenue)	$2,306,000
Expenditures for Cooperative Development	-$1,340,000
Net Capital Balance @ Cooperative Economy	$ 966,000

MARKET ECONOMY	
Cash Receipts from Household Development	$ 274,000
Cash Receipts from Cooperative Development	$1,340,000
Total Cash Receipts	$1,614,000*
Interest Payments on Savings Accounts	-$ 841,000
Net Capital Balance @ Market Economy	$ 773,000
Potential Investment Capital	$2,906,000
Potential Capital Balance @ Market Economy	$3,676,000

*Similarity with other figures is coincidential

Even with the theoretical 3 million dollar loss in market cash receipts for goods and services locally self-provisioned, the market economy would stand to gain substantially by local economic development. Over 1.6 million dollars would be expended over the twenty-five years of development; 1.34 million dollars from cooperative development and .27 million dollars from household development would flow to the market. Add to this a 2.9 million dollar investment potential, and the scenario for market economic development dramatically unfolds. Changes in the local market supply system relative to local economic development are called forth.

Local production supplies a major portion of food (over 80% in dollars), energy (100+%), and housing (nearly 60%) needs. The emphasis of the local market supply system would shift toward supplementing these needs (i.e. grain, cereal, and fiber production in agricultural industries), and toward the development and marketing of technological, durable components of local production systems (i.e. photovoltaics, solar hot water systems, and electronic equipment such as computers).

The significant increase in household capital savings could supply investment capital to support the development of new technologies and sunrise industries. The local economic development system outlined by the UES would therefore benefit all subsystems of the local economy (market, cooperative and household). The household economy could more fully participate in the market economy as a result of the re-organization of local resources (capital, material, and human) and the development of a local third sector, the cooperative economy (i.e. the development of a household partnership, the cooperative corporation).

Economic development for local self-reliance moves toward a steady-state economy; toward a balanced equilibrium of energy and capital flows to sustain local low-entropy, energy-conserving, labor-intensive, ecological production. Renewable energy resources supply local energy and power needs without requiring the flow of capital outside the local economy to purchase nonrenewable energy (i.e. fossil-fuels). Capital flowing beyond the local economy is limited to the purchase of supplemental supplies of goods and services and capital goods of mechanical production. Self-provisioned goods and services supplied through local, small-scale, urban production (i.e. biological and technological solar energy conversion processes) and a regional network of cooperative suppliers maintain an ecologically balanced standard of living while reducing the flow of capital beyond and the importation of nonrenewable energy resources to the local economy and the local ecology.

REFERENCES

INTRODUCTION:

[1]Refer to, Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981.

LOCAL ECONOMIC DEVELOPMENT:

[1]Expenditure savings for housing include savings from energy conservation as the U.S. Bureau of Labor Statistics includes energy as an expenditure (utilities) under the category of housing. For the most part, reference to housing in this report includes an inferred reference to energy as well.

[2]Computed from expenditures outlined in the "1980 Tucson Area Family of Four Budget Study" by Phillip T. Kolbe cited above.

[3]Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981.

[4]Ibid., p. 20.

[5]Ibid., p. 20.

HOUSEHOLD ECONOMIC DEVELOPMENT:

[1]U.S. Bureau of Labor Statistics family budget studies used in this report to provide a hypothetical household consumption budget specify that the home-owner is in his/her seventh year of home mortgage payments in the year (1980) that this economic analysis is assumed to start. Furthermore, the loan is assumed to require constant annual payments for a period of thirty years.

[2]BLS family budget studies are not intended to supply household income information, but they do assume that expenditures made by the hypothetical family of four are for necessary and/or desirable goods and services to sustain a moderate standard of living. See "1980 Tucson Area Family of Four Budget Study" cited above.

[3]Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981.

[4]Computed from, "Finance Facts Yearbook", National Consumer Finance Association, 1981, pp. 24 and 39. The value of household financial assets for savings in 1979 is $1,173,600,000,000 and the number of households is estimated at 79,080,000 in the same year. The average value of household savings in 1979 is computed as $14,841.

REFERENCES

[5]Ibid., pp. 24,39.

[6]Computed from, "Finance Facts Yearbook", National Consumer Finance Association,, 1981, pp. 24,39. The value of household durables in 1979 was estimated at 874.4 billion dollars and the number of household estimated at 79,080,000. The computed average is $11,057.

[7]Ibid., pp. 24,39.

[8]Taken from, "Finance Facts Yearbook", National Consumer Finance Association, 1973, 1978, and 1981.

COOPERATIVE ECONOMIC DEVELOPMENT:

[1]Phillip T. Kolbe, "1980 Tucson Area Family of Four Budget Study", Division of Economic and Business Research, University of Arizona, March, 1981, p. 20.

[2]Ibid.; The Tucson family budget study is completed according to BLS specification for urban family budget studies, and as such does not represent actual spending. It is used here as a hypothetical family budget for analytical purposes.

[3]Refer to, Scott Burns, Home, Inc.: The Hidden Wealth and Power of the American Household (New York: Doubleday & Company, Inc., 1975).

APPENDIX A

ENVIRONMENTAL PLANNING

INTRODUCTION

The concept of the Urban Eco-operative System was applied to an existing urban square block located in the West University Historical District in Tucson, Arizona to demonstrate the potential of local ecological and economic development for self-reliance. The project was undertaken as a studio design problem in the College of Architecture at the University of Arizona in the fall of 1981. The illustrations and text appearing below are reprinted from The Urban Eco-operative Concept: A Twenty-First Century Urban Re-Settlement Plan by R. E. Wheeler II.[1]

The Urban Eco-operative was discussed briefly in relation to a conceptual model in Part I above. The conceptual model (refer to Fig. 1, Part I) provided a theoretical framework wherein the objectives for local ecological and economic development were identified. The following environmental context profile outlines the urban context and summarizes environmental information for what will be termed the block development model. To the environmental context of the block development model, the integral planning and development objectives of the Urban Eco-operative System were applied as an urban re-settlement plan for self-reliance.

The three-phase development (re-settlement) plan, illustrated by Figures 2, 3, and 4, provides a hypothetical growth scenario for achieving maximum local self-reliance through ecological and economic development. The time-span of development is projected to extend into the twenty-first century making the UES a twenty-first century urban re-settlement plan. Urban ecological development, cooperative economic development, financial profiles, and land-use summaries are outlined for each of three phases of growth. The development summaries are chronologically organized; local resources for biological and technological energy conversion processes are logically added to eventually form an integrated ecological production system. Local production processes are intended to supply a major portion of basic human needs (i.e. energy, housing, food, and water) to area households. The text for phase III outlines the management components of the local supply system, the renewable resource supply and reclamation system. Figure 5 illustrates the schematic design of an integrated life-support system in which simultaneous production supplies diverse goods and services (i.e. food, natural heating and cooling, food preparation, living quarters, etc.).

Although the block development model represents a specific application of the integral planning processes of the UES, the approach to local ecological and economic development for self-reliance has a more general applicability. The concept, the integral planning and development objectives, and processes of phased ecological and economic development have general applicability to any environmental context in which urban ecology and cooperative economics receive serious consideration in providing for human needs.

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[1] Ronald E. Wheeler II, The Urban Eco-operative Concept: A Twenty-First Century Urban Re-Settlement Plan, unpublished manuscript, copyright Ronald E. Wheeler II, 1982.

Environmental Context Profile * (BLOCK DEVELOPMENT MODEL)

BUILDING #	BUILDING FUNCTION	ZONING	LAND AREA (sq.ft.)	OCCUPANCY
1	Private Residence	R-3	2425	2
2	Private Residence	R-3	1850	5
3	Rental Space	R-3	1750	3-4
4	Private Residence	R-3	2000	2
5	Commercial	B-2H	1900	
6	Commercial	B-2H	2100	
7	Private Residence	R-3	2100	2-3
8	Private Residence	R-3	2650	2
9	Rental Space	R-3	300	1
10	Rental Space	R-3	200	1
11	Private Residence	R-3	3000	4-5
12	Private Residence	R-3	3000	2-3
13	Rental Space	R-3	2250	6-8
14	Rental Space	R-3	1400	1
15	Private Residence	R-3	2475	2
16	Private Residence	R-3	2025	2
17	Private Residence	R-3	1400	2
18	Carport	R-3	600	
19	Carport	R-3	400	
20	Storage Space	R-3	900	
21	Rental Space	R-3	700	
22	Shed	R-3	200	
23	Rental Space	R-3	650	
24	Garage	R-3	550	
25	Storage Space	R-3	250	
26	Storage	R-3	700	
TOTALS			37,775	40 (approximate)

AVERAGE RESIDENTIAL LAND AREA PER PERSON	800 sq. ft.
AVERAGE GROSS LAND AREA PER PERSON (DENSITY)	3920 sq. ft.
PERCENT RESIDENTIAL LAND AREA	84.0 %
PERCENT COMMERCIAL LAND AREA	10.5 %
PERCENT ACCESSORY STRUCTURE LAND AREA	5.5 %

SELF-RELIANCE PROFILE:

Primarily financially based. One group of the Southeast quarter has extensive gardens and cottage artisan industry.

* Refer to Figure 1, page 157.

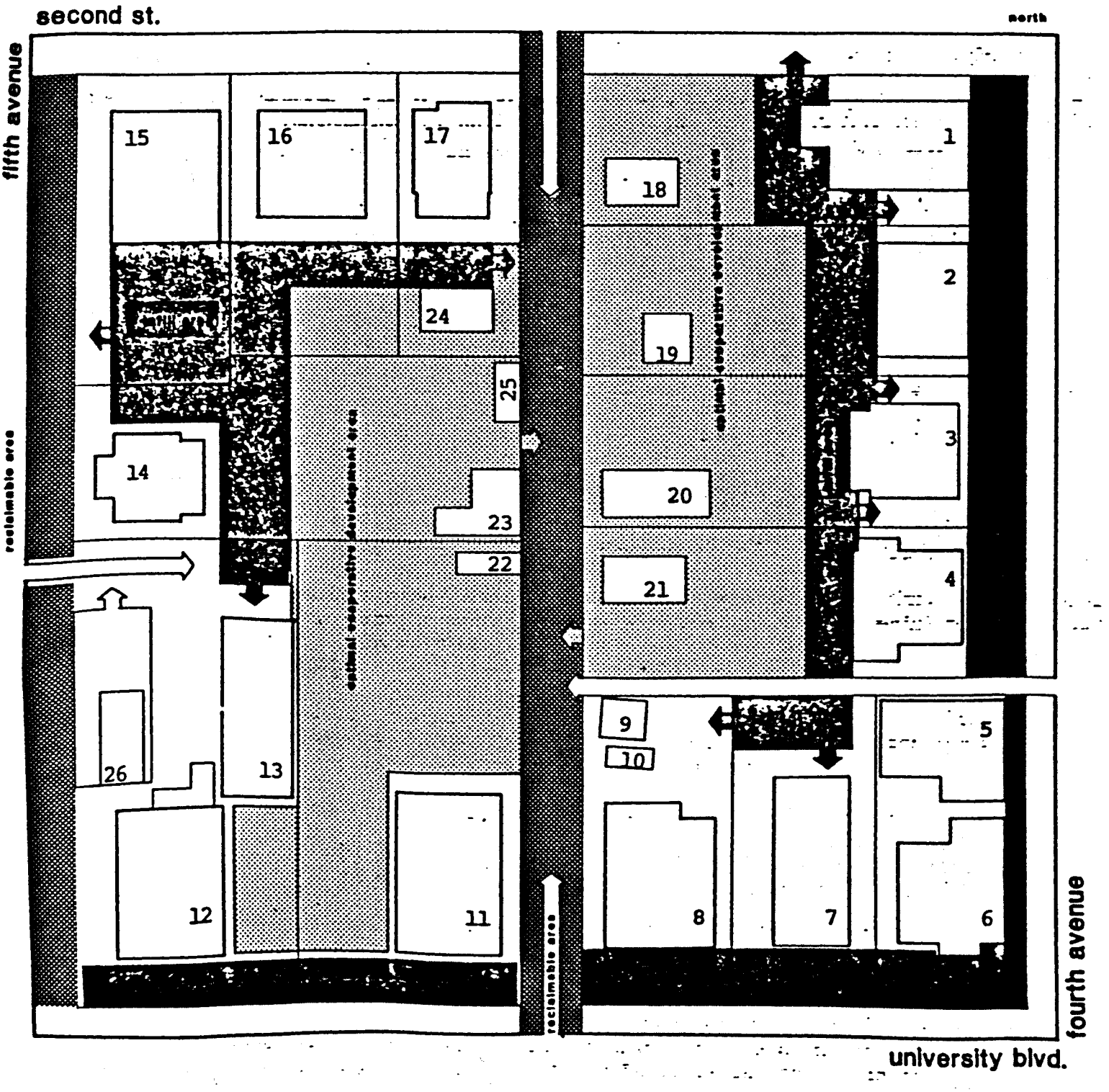


Figure 1:
environmental context

LAND-USE PROFILE	sq.ft.	acres	% of total
GROSS URBAN BLOCK AREA	156,816	3.6	100
NET BUILDING LAND AREA	37,775	.87	24.0
NET OPEN SPACE	119,041	2.73	76.0
OPTIMAL COOPERATIVE DEVELOPMENT AREA	41,649	.96	26.5
INFILL AREA	17,715	.40	11.3
PERIMETER AREA	15,400	.35	10.0
RECLAIMABLE AREA	10,454	.24	6.6
ADJACENT RECLAIMABLE AREA	7,128	.16	not included
NET VEHICULAR CIRCULATION	15,809	.6	10.1
NET UNDEVELOPED AREA	24,468	.56	15.6

SOLAR	
Average Direct Beam w/ Normal Incidence	2524 BTU/SQ.FT.-DAY
Average Total Horizontal Insolation	1872 BTU/SQ.FT.-DAY
Percent Possible Sunshine	86.0%
Mean Cloud Cover	3.6%
WIND	
Wind Direction (day)	SE
Wind Direction (night)	WSW
Wind Speed	8.2 MPH
AGRICULTURE	
Average Growing Season	250 Days
RAIN	
Annual Average Precipitation	11.0 Inches
Annual Evaporation Rate	72.0 Inches
% Rainfall July1 - September 15	50.0%
% Rainfall December - March	20.0%
LATITUDE	32° 07' N
ELEVATION	2584 Feet
SEMI-ARID REGION (SONORAN DESERT)	
SOIL	SANDY ALKALINE
VEGETATION	CACTI, MESQUITE, PALO VERDE CALIFORNIA & DATE PALMS

PHASE I

URBAN ECOLOGICAL DEVELOPMENT PHASE

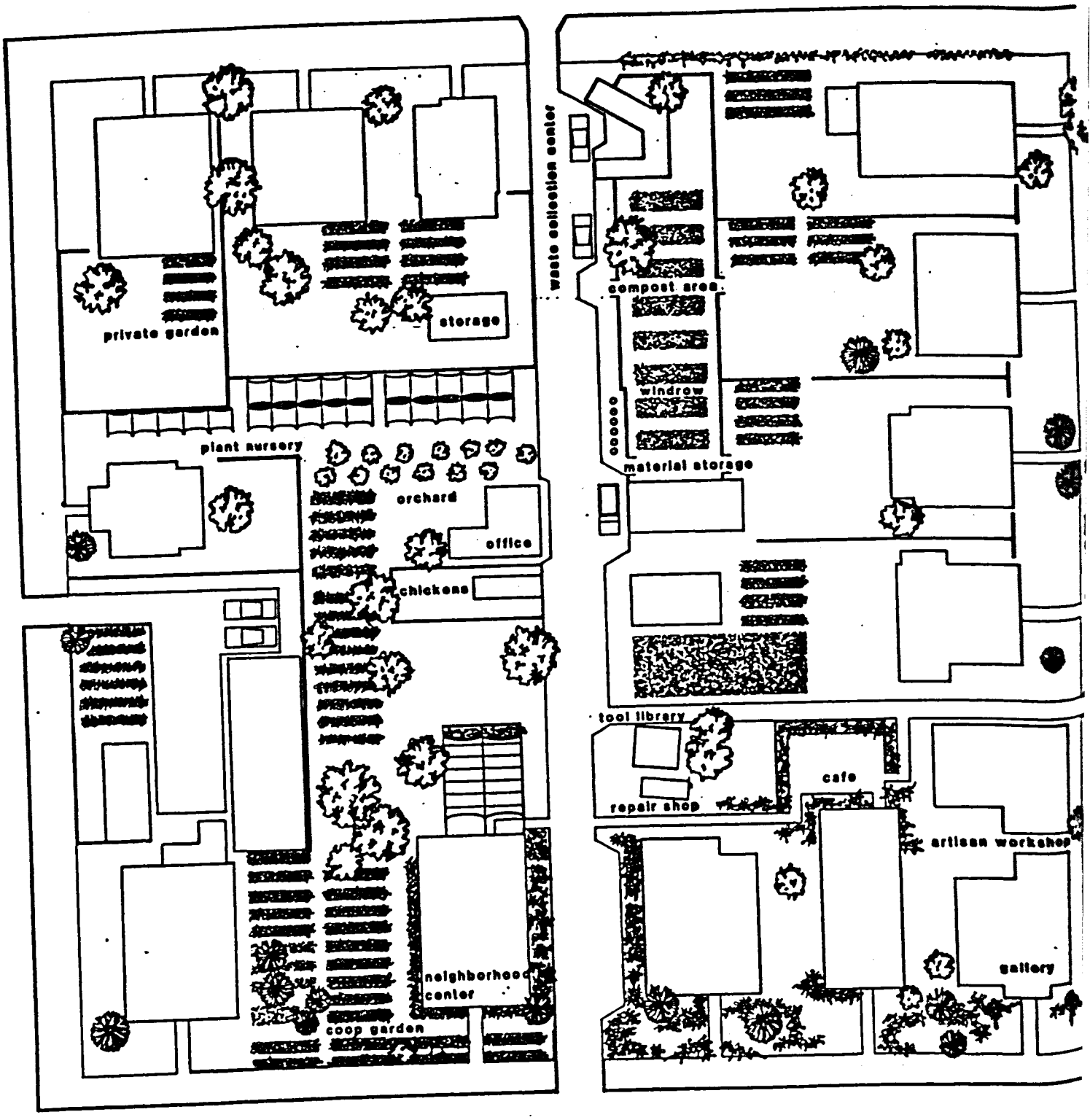


Figure 2:
urban ecological development

Urban Ecological Development

PHASE I (PROCEDURAL OUTLINE)

WORKSHOP: Composting Techniques - collection of materials; storage; labor requirements; resource requirements (water, wastes, land, etc.); composition of compost piles.
WORKSHOP: Gardening Tools - utilization and applications
WORKSHOP: Construction Tools - handling and safety

Adapt Building or Construct Storage Area for Tools and Equipment

Locate and Enclose Composting Area

WORKSHOP: Soil Building - planning; soil fertilization; application to gardens
WORKSHOP: Location of Gardens - proximity to building for possible adaptation of low-tech greenhouse for home heating and greywater utilization for irrigation
WORKSHOP: Seasonal Planting Guidelines - summer, fall, winter, and spring gardens; French and Chinese biodynamic gardening practices; companion planting and insect husbandry
WORKSHOP: Constructing Cold Frames

Begin Composting Piles During Fall to Take Advantage of Moderate Seasonal Rainfall and Defoliation of Deciduous Trees

Identify Accessory Structures in Disrepair for Recycling of Materials

Implement Local Drive to Collect Leaves, Refuse, and Household Wastes

WORKSHOP: Residential Water Conservation
WORKSHOP: Residential Energy Conservation
WORKSHOP: Recycling Material Resources

Implement Recycling Program - Collect Glass, Paper, Metals, Wood, Plastics, Appliances, Clothing, Oils, and Hardware

Begin Energy Audits for Buildings and Analyze Energy Use Patterns

Implement Building Weatherization and Insulation Program

WORKSHOP: Improving Efficiency of Fireplaces and Wood Burning Stoves
WORKSHOP: Planting Techniques - starting plants from seeds; intensive gardening practices; planting and harvesting strategies

Locate and Construct Cold Frames and Plant Nursery for Starting Vegetable Plants, Fruit Trees, Drought Tolerant Landscaping Plants, Ornamental Plants for Site Use and for Commercialization

Select and Adapt Building for Neighborhood Center - Model Energy Conservation; Provide Plant, Energy, and Waste Management; Process Food; Operate Cooperative Kitchen and Cafe; Counsel for Adjusting to Cooperative Living; House Tool and Book Libraries; Conduct Workshop Program; Organize Cooperative Buying; Distribute Information.

Begin Fruit Orchards for Twenty Year Life-Cycle; Use Dwarf Species Where Vertical and Horizontal Space is Limited

WORKSHOP: Small Urban Livestock - Chickens

Introduce Chickens into Adapted Shed as Experimental Learning Experience

Construct Outdoor Shaded Workshop Area

Construct Waste Collection Center for Receiving Regional Wastes, Managing Recycled Materials and Compost Area

Cooperative Economic Development

PHASE I (PROCEDURAL OUTLINE)

Consolidate Gardening Tools; Storage Area Required

Develop Tool Lending Policy

Provide Tool and Bike Repair Shop

Consolidate Home Maintenance and Repair Tools; Storage Area Required

Develop Directory of Participant's Skills, Experience, Interests, Schedule, Material Resources, Property Ownership and Location

Organize Cooperative Meeting to Identify Near-Term Objectives; Participation and Cooperation Potential; Committment to Settlement; Individual Needs and Expectations

Land-Use Planning:
- -Locate Gardens, Compost Area, Orchards, Plant Nursery, Tool and Bike Repair Shop, Lending Library, Neighborhood Center, Workshop Area
- -Identify Future Land-Use Potential: Reclaimable Areas; Perimeter Areas; Optimal Cooperative Development Area; and, Potential Infill Areas
- -Compile Local Environmental Profile
- -Develop Neighborhood Context Map Illustrating Recreational, Commercial, Industrial, Educational, and Professional Services in Proximity to Site

Purchase or Rent Tools and Equipment for Phase I Development - Paint; Plaster; Plumbing and Electrical Hardware; Mechanical Maintenance Equipment; Insulation; Weatherization Material, etc.

Develop Composting Labor Schedule and Distribution Policy

Install Recycling Collection Bins

Organize Cooperative Seed Buying

Initiate Commercial Production of Native Landscaping and Ornamental Plants in Nursery

Petition Municipal Government to Reduce Vehicular Traffic and Access on Central Access Street

Narrow Central Access Street to One-Way Traffic and Provide Resident Parking

Locate Public Functions Along Central Access Street (Waste Collection and Recycling Areas)

Enact Labor Management Policies to Efficiently Manage Waste and Recycling Operations, Plant Nursery, and Neighborhood Center

Elect Management Staff and Develop Resource Distribution Policy

Adapt Residential Structures for Neighborhood Center, Artisan Center, and Cottage Industry

Petition Municipal Government for Mixed-Use Zoning in Areas with Light Commercial Development Potential

Form Worker Collective to Install Weatherization and Insulation in Community and Seek Public Contracts for Low-Income Energy Conservation Projects

Market Surplus Vegetables, Landscape and Ornamental Plants

Distribute Annual Earnings to Participants or Re-Invest Earnings in Continued Development

Financial Profile

PHASE I

REVENUE / EXCHANGE RESOURCES

Plant Nursery Sales
Surplus Vegetables Sales (use to barter with regional farmers for grains, fruits, nuts, or fibers)
Duplicate Tool Sales
Garden Space Rentals
Tariff on Collected Neighborhood Refuse
Collected Recycled Materials Sales
Artisan Center Sales
Tool Lending Fees from Non-Residents
Worker Collective Earnings
Public Workshop Tuition from Non-Residents
Site Tours
Publications

EXPENSES

Purchases of Tools
Tools Storage Materials
Repair Shop Materials
Books, Materials and Equipment for Library
Workshop Instructional Materials
Garden and Nursery Seeds and Seedlings
Cold Frames and Nursery Construction Materials
Building Weatherization and Insulation Materials
Adaptive-Use Materials for Residential Projects

PROFITS

Distribute Earnings to Participants According to Invested Labor, Materials, and Capital

PHASE I - LAND-USE SUMMARY

LOCAL DEVELOPMENT COMPONENTS	LAND AREA (sq. ft.)	ACRES	% OF TOTAL LAND AREA
Net Development Area	74,150.	1.7	47%
Net Building (land) Area	36,325	.83	23%
Residential Use Only	15,200	.35	
Residential/Cottage (Mixed-Use)	8,025	.18	
Commercial Use	4,200	.096	
Management Use	5,100	.117	
Work Areas	2,400	.055	
Accessory Buildings	1,400	.032	
Biological Production Area	28,325	.65	18%
Organic Gardens	13,875	.32	
Composting/Recycling Area	7,200	.165	
Plant Nursery	2,500	.057	
Orchard	1,800	.04	
Grain Crops	1,750	.04	
Livestock	1,200	.028	
Vehicular Circulation	9,500	.218	6%
Net Undeveloped Area	82,666	1.90	53%
GROSS URBAN BLOCK AREA	156,816	3.6	100%

PHASE II

COOPERATIVE ECONOMIC DEVELOPMENT PHASE

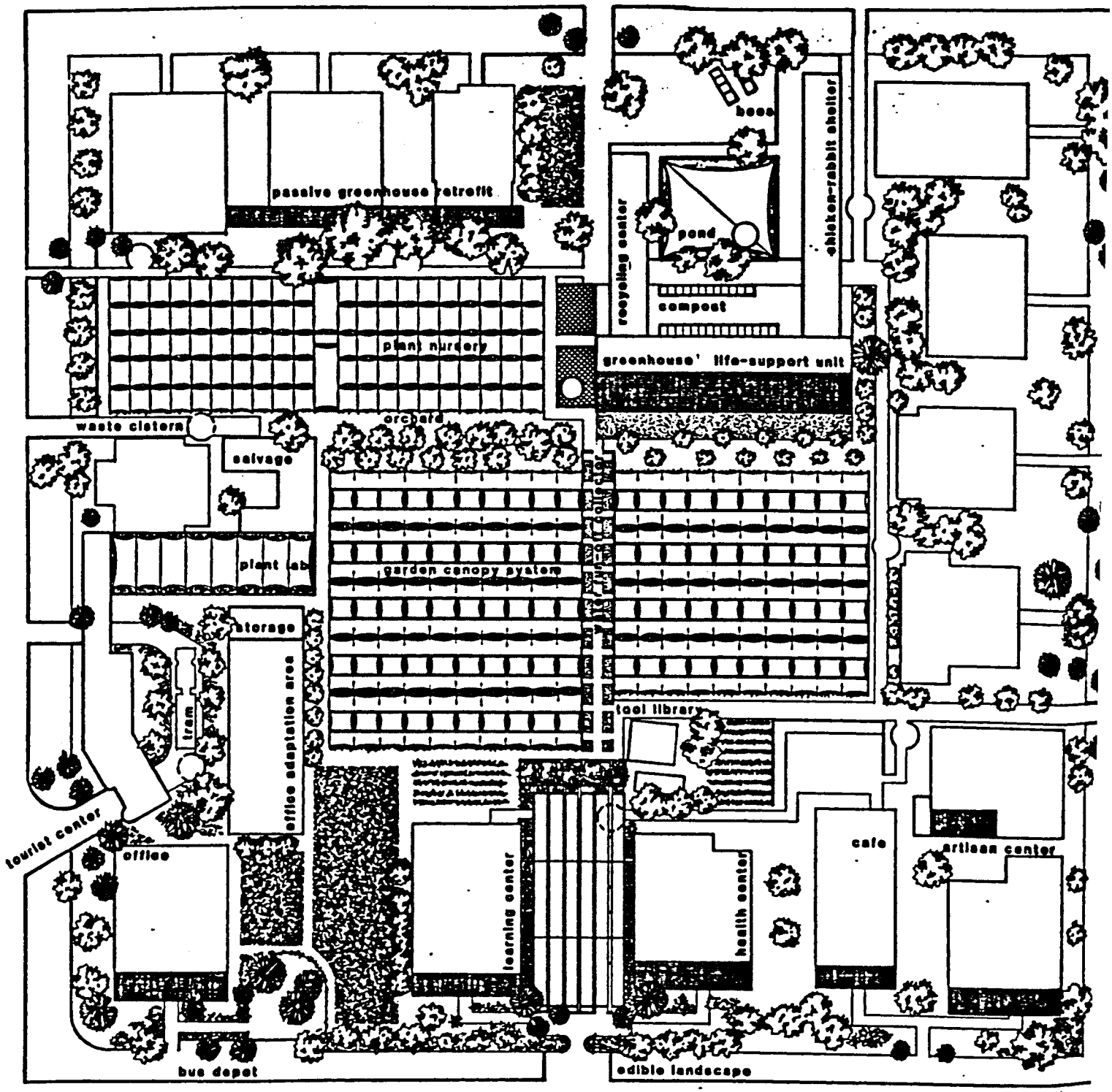


Figure 3:
cooperative economic development

Urban Ecological Development

PHASE II (PROCEDURAL OUTLINE)

Diversify and Expand Tool and Equipment Supply for Cooperative Lending Library

Expand Intensive Agricultural Production Area in Central Development Space
Diversify Crops (Grains, Herbs, Fruits, and Vegetables)
Develop Terraced Gardens Sloping to Central Water Collection Canal

Develop Garden Canopy System for Extended Seasonal Food Production

Expand Plant Nursery Area

Expand Fruit and Nut Orchard Toward Perimeter of Site and Use Orchard as Landscape Infill

Move from Ornamental to Edible Landscaping Practices

Construct Bee Hives for Plant Pollination

Construct Central Water Run-Off and Drainage Canal with Underground Storage in Reclaimed Street; Use Canal as an Axis for Planning Radiating Terraced Garden Beds

Install Waste Collection Cisterns to Store Solid and Liquid Wastes from Buildings

WORKSHOP: Passive Solar Retrofit Techniques
Passive Solar Greenhouse Systems and Management (construction techniques, alternative material utilization, benching, beds, heating and cooling systems, soil and soilless growing media, soil sterilization, irrigation systems, and attached greenhouse energy interactions, fertilization, plant nutrients, carbon dioxide requirements, light and temperature, insect husbandry, disease control, handling, harvesting and marketing practices
Food Handling and Processing
Solar Food Drying and Cooking
Preservation and Canning Techniques
Freezing Techniques
Nutritional and Dietary Planning

Begin Recipe and Food Preparation Collective

Implement Passive Solar Greenhouse Retrofit Program

WORKSHOP: Raising Small Livestock in Urban Ecology (chickens, rabbits, bees)
Composting with Worm Cultures

Locate Urban Livestock Area for Natural Ventilation; Plant Aromatic Landscape to Buffer Odors

Construct Phase I of Integrated Life-Support System - Construct Underground Water Storage Tank to Form Foundation of Future Integrated Life-Support Unit and Pour Grade Slab; Construct Greenhouse, Recycling Center, Animal Clinic, Methane Digesters, Chicken/ Rabbit Shelter, Oxidation/Algae Pond; Install Evaporative Cooling System, Solar Water Distillation Unit, Hot Water System, Photovoltaic Array, and Gas-Fired Generator for Electrical Back-Up

Develop Health Center Laboratory for Local Soil, Plant, and Animal Testing to Control Pests, Disease, and Food Quality; Monitor and Manage Ecological Balance of Water System, Methane Digester Tanks, Oxidation Pond, Biological Filters, and Greenhouse Systems.

Provide Permanent Outdoor Multi-Purpose Area with Shading Devices for Farmer's Market, Workshops, and Social Gatherings

Develop Site Entries as Directional and Placement Elements Using Landscape Planting and Enclosures

Plan Pedestrian Pathways on-site with Vehicular Path for Electrically Powered Cart for Evacuation of Waste Cisterns for Deposit in Methane Digester

Cooperative Economic Development

PHASE II (PROCEDURAL OUTLINE)

Petition Municipal Government to Ease Restrictions on Greywater Use, Mixed-Use Zoning, Urban Livestock, Vehicular Access, and Parking Requirements

Implement Solar Hot Water Retrofit Program

Expand Plant Nursery and Intensify Production of Native Landscape and Ornamental Plants (Trees, Shrubs, and Flowers)

Expand and Diversify Agricultural Production Systems

Construct Nursery and Garden Canopy Systems for Seasonal Climatic Tempering Conducive to Plant Growth

Develop Salvage Yard and Construct Storage Area for Sale of Duplicate Tools and Household Appliances

Collectivize Living Spaces in Upper Floors of Two-Story Homes. Provide Room Rentals with Common Facilities

Introduce Cottage Industries into Homes in Mixed-Use Zones on Perimeter of Site to Take advantage of Existing Neighborhood Commercial Patterns

Develop Cooperative Cafe to Supplement Artisan Center Earnings

Adapt Spaces for Studios, Workshops and Gallery in Artisan Center

Purchase Equipment and Supplies for Artisan Center

Begin Arts and Crafts Workshops to Supplement Artisan Earnings and Provide Instruction on Indigenous Cultural Arts and Historical Crafts

Reclaim Secondary Vehicular Access Street for Central Development

Construct Public Transport Depot

Promote Historical and Site Tourism and Adapt Historical Home for Tourist Center Office. Schedule Walking Tours of Site and Tram Tours of Historical Neighborhood

Construct Moveable Covering to Shade Outdoor Workshop Area

Implement Public Workshop Program for Local Self-Reliance, Self-Help Skills, Neighborhood Development.

Convert Apartment Units to Professional Office Spaces

Implement Passive Solar Greenhouse Retrofit Program to Reduce Fossil-Fuel Consumption and Reduce Dependency on Public Utilities

Convert Air Conditioning Systems to Evaporative Cooling Systems to Reduce Electrical Consumption

Promote Use Patterns to Take Advantage of Daylighting and Reduce Artificial Lighting Loads

Construct First Phase of Integrated Life-Support System: Greenhouse, Recycling Center, Methane Digesters, Composting Bins, Algae/Oxidation Pond, Bee Hives, Rabbit/Chicken Shelter, Water Collection System, Solar Water Distillation Unit, Solar Dehydration Units, Biological Water Filter, Animal Clinic, Photovoltaic Array, and Solar Hot Water System.

Install Greywater and Solid Waste Cisterns to Collect Building Wastes for Methane Digester

Obtain Health Department Approval of Water, Waste, and Food Management Systems; Obtain USDA Approval of Meat and Produce

Construct Experimental Laboratory to Test: Soil, Water, and Plant Quality; Growing Media, Nutritional Value of Foods, etc.

Raise and Sell Fryers (Chickens) at Four Months

Recycle Feathers and Rabbit Fur in Arts and Crafts Industry

Develop Farmer's Market to Sell Surplus Produce and Materials

Adapt Building for Natural Health Care Center to Practice Preventative Medicine, Supply Natural Medicinal Products, Plan Exercise and Nutritional Programs, Provide Couseling Service, Manage Group Insurance, and Manage Experimental Lab

Expand Functions of the Learning Center to Include Resource Management: Plant, Small Livestock, Energy, Water, and Waste Management; Develop Adaptive Technology for Life-Support System; Provide Skill Development to Diversify Roles of Collective Workers; Manage Labor Exchange Program; and Develop Cooperative Policy Through Democratic Processes.

Consolidate Individual Automobiles into Cooperative Fleet and Sell Unneeded Autos

Move Toward Cooperative Corporation Ownership of Land and Material Resources

Work Toward Local Financial and Lending Institution Policy Reform to Encourage Cooperative Investments

Purchase Group Auto, Life, and Health Insurance

Enact Policy to Allocate Earnings of Cooperative Corporation According to Capital, Material, and Labor Shares.

Promote Outside Capital Investments in Local Business and Industry as Required

Outline Labor and Capital Share Policies for the Development of Labor-Managed Collective Businesses and Industry

Promote Regional Trade and Exchange

Selectively Use Fossil-Fuel Products in Adaptive Technological Roles (PVC, Polyethylene, Nylon, Tools, Packaging, Synthetic Fabrics, etc.)

Develop Policy Outlining Relationship Between Cooperative Corporation and Worker Collectives

Financial Profile

PHASE II

REVENUE / EXCHANGE RESOURCES

Plant Nursery Sales
Collected Recycled Materials Sales
Artisan Center Sales (artwork, historical crafts, local products such as soap, dry food mixes, canned goods, honey, pollen, and meats)
Tool Lending Fees from Non-Residents
Worker Collective Earnings from Cottage and Light Industry
Public Workshop Tuition from Non-Residents
Site and Historical Neighborhood Tours
Publications
Research Grants
Internship Tuition
Agricultural Produce
Farmer's Market Sales (salvage goods; clothing, appliances, autos)
Professional Office Rentals
Room and Board Fees
Off-Site Individual Earnings
Corporate Investment Returns
Labor Exchange

EXPENSES

Fossil-Fuel Products (plastics, nylon, etc.)
Building Materials, Equipment Rental, Hardware for Greenhouses, Animal Shelter, Water and Waste Management Systems, Recycling Center, Artisan Center, Garden Canopy System, Tourist and Financial Center Adaptive-Use Projects, Health Care Center, Learning Center, Laboratory, and Terraced Gardens
Advertising
Marketing
Management Consultants
Livestock
Lab Equipment
Cooperative Auto Fleet
Solar Hot Water Retrofit Program
Workshop Materials

PROFITS

Corporate Profits Will be Distributed to Resident and Non-Resident Capital, Labor, and Material Investors.

Worker Collective Profits Will be Distributed to Resident and Non-Resident Members According to Labor-Management Policies. Deferred Annual Earnings May be Applied to the Purchase of Capital Shares in Cooperative Corporation Non-members Will Work Under Fixed-Income Contracts in Worker Collectives.

PHASE II - LAND-USE SUMMARY

LOCAL DEVELOPMENT COMPONENTS	LAND AREA (sq. ft.)	ACRES	% OF TOTAL LAND AREA
Net Development Area	125,850	2.89	76.8%
Net Building Area	42,375	.973	26%
Residential Use Only	8,450	.194	
Residential/Cottage (Mixed-Use)	8,025	.184	
Commercial Use	4,200	.096	
Management Use	3,000	.069	
Work Areas (Non-industrial)	3,800	.087	
Office/Business Area	6,450	.148	
Industrial Work Area	3,800	.087	
Service Area	4,650	.107	
Biological Production Area	68,925	1.58	42%
Organic Gardens	21,000	.482	
Composting Area	1,200	.028	
Plant Nursery	9,350	.215	
Orchard	23,900	.549	
Grain Crops	6,250	.143	
Livestock Barnyard & Housing	3,200	.073	
Greenhouse	2,000	.046	
Oxidation Pond	2,025	.046	
Technological Production Area	3,550	.081	2.2%
Water Collection, Filtration, & Storage	3,550	.081	
Transportation Area	11,000	.253	6.7%
Vehicular Circulation	5,000	.115	
Pedestrian Circulation	6,000	.138	
Net Undeveloped Area	38,094	.874	23.2%
GROSS URBAN BLOCK AREA	163,944*	3.76	100.0%

*Gross Urban Block Area increases from phase I due to the reclamation of some perimeter land area for local development

APPENDIX B

ENERGY PLANNING

INTRODUCTION

The Urban Eco-operative System (UES) was conceived as a means to establish local self-reliance through human participation in self-provisioning processes. An essential component of the Urban Eco-operative System is a renewable resource supply and reclamation system developed to sustain urban ecology at the local level. Urban, rural, and adaptive technologies are utilized to supply renewable resources, recycle wastes, and reclaim water and material resources. The "appropriateness"of specific technological components of the renewable resource supply and reclamation system is determined by the scale of the development project, the degree of self-reliance desired, and economic feasibility. Though some technologies may satisfy these criteria, another important consideration is their adaptability to an integrated energy system where multiple technologies function as subsystems to each other.

The following analysis was conducted as a hypothetical re-development plan for an existing urban square block in the West University Historical District in Tucson, Arizona. The re-development plan is intended to be incremental where economic and ecological development occurs in three main phases of growth. The first phase concentrates on the establishment of urban ecology, the second phase introduces cooperative economics, and the third phase integrates urban ecology and cooperative economics as the Urban Eco-operative System. illustrated by Figure 1 below (also refer to Figures 1-5, Appendix A).

The site chosen for the analysis is located in a semi-arid region where water consumption currently exceeds the recharge rate of the underground aquifer by twenty-five to fifty percent. Agricultural production in the area consumes nearly 70% of the annual water budget. Food expenditures accounted for 30% of the estimated annual family consumption budget for 1980. Home utility costs accounted for 4.4% of 1980 family consumption costs. With housing costs increasingly demanding more of the family's annual budget, 32% of consumption costs in 1980, the Urban Eco-operative System was designed to supply local food and energy self-reliance. By developing an integrated self-provisioning system utilizing renewable resources, appropriate reclamation technologies, intensive organic gardening techniques, urban livestock production, and indigenous human labor, local cooperative production can significantly reduce family expenditures for food and energy. Operating expenses for housing are reduced by applying energy technology to collect available solar energy to supply home thermal and power needs. Cooking fuel can be supplied by producing methane from recycled kitchen and human wastes.

The renewable resource supply and reclamation system is the material, energy, and technological support system of local urban ecology. It consists of six major production subsystems: Architecture, Urban Agriculture, Urban Livestock, Aquaculture, Water Supply, and Recycling. Each cooperatively managed subsystem supplies a portion of individual, family, and collective housing, food, energy, and water needs, contributing to local self-reliance. (see Figure 2)

The following energy analysis will demonstrate the productive capability of each subsystem of the renewable resource supply and reclamation system in the establishment of local self-reliance. Natural and material resource inputs and subsequent production outputs will be quantified for each subsystem.

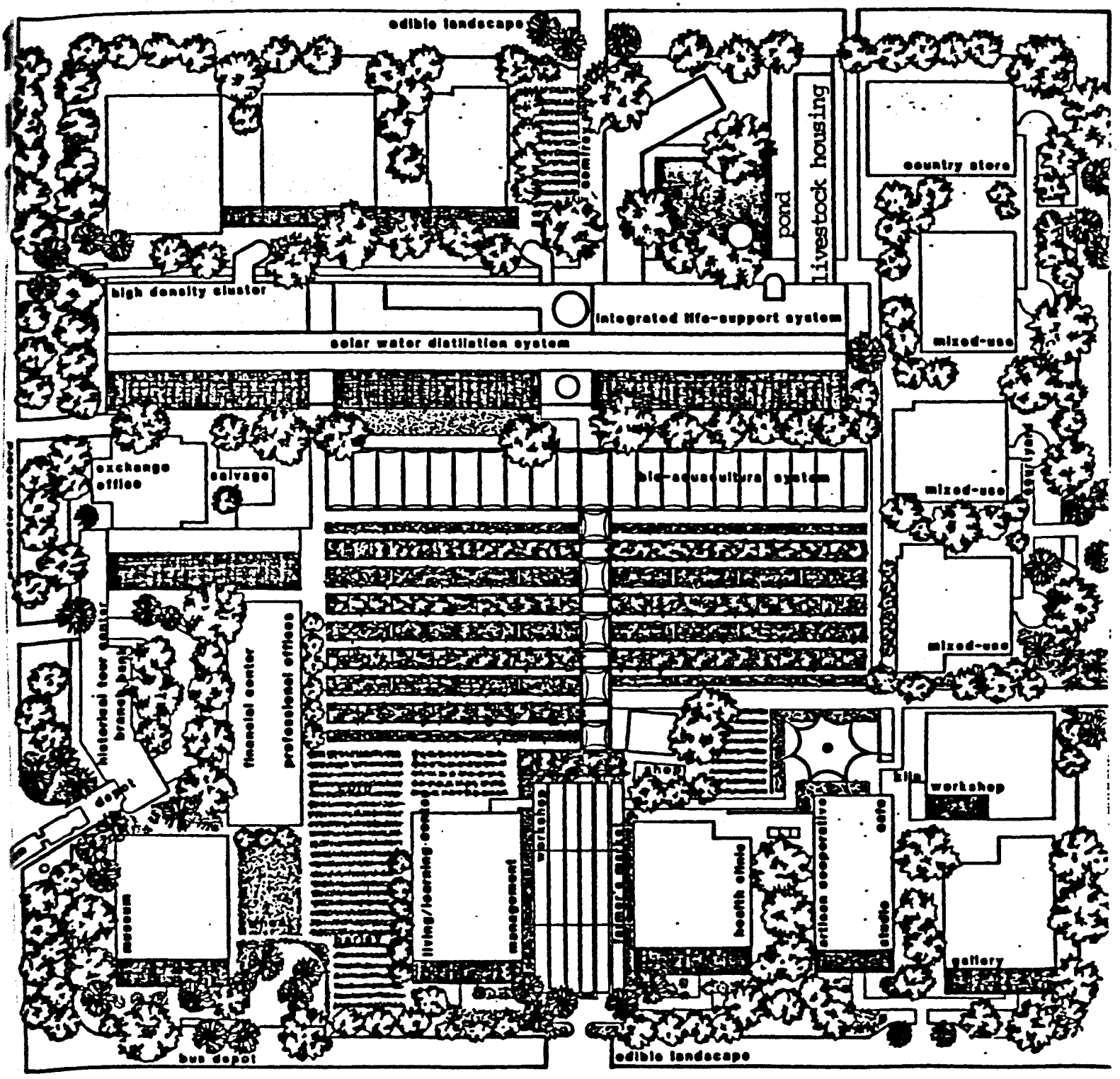
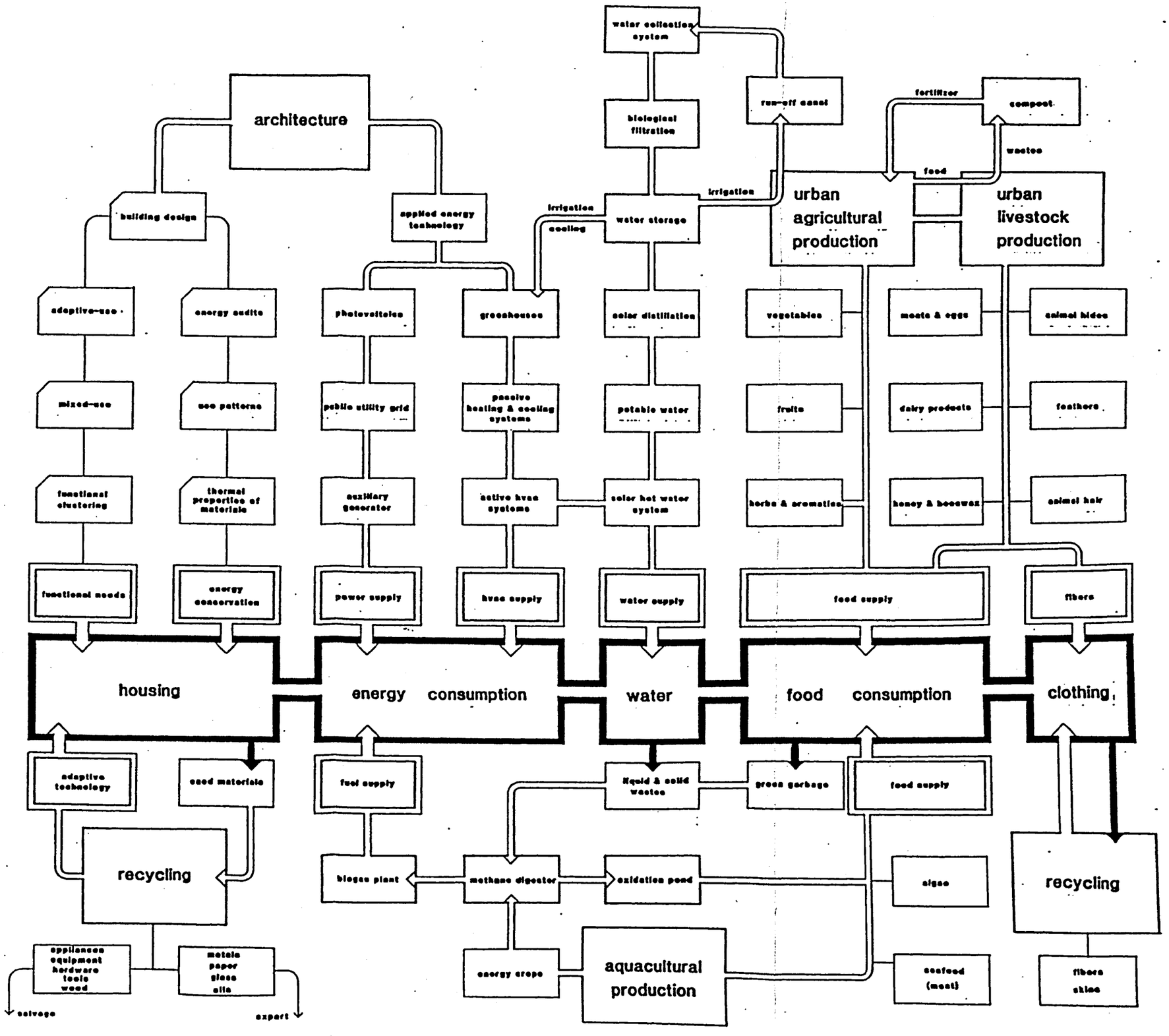


FIGURE 1: THE URBAN ECO-OPERATIVE SYSTEM — AN ILLUSTRATIVE DEVELOPMENT PLAN

The agricultural production subsystem as shown above radiates from the central garden area toward the perimeter of the site when it becomes an edible landscape of fruit orchards, vines, and shrubbery. The livestock production subsystem is located in the upper right corner of the plan surrounding the oxidation pond as a component of the integrated life-support system. The aquacultural production area is noted aboye, the salvage yard is a component of the recycling subsystem, and the circular forms indicate components of the water subsystem, storage tanks.

High density residential areas will be a twenty-first century reality for Tucson, Arizona if population growth continues to fulfill expectations. By the year 2000, the 1980 population of the area is expected to at least double. Realizing that urban sprawl is a remedial, energy-intensive response to urban growth, the illustrative example of the application of the Urban Eco-operative System used in the following analysis will be evaluated according to its ability to sustain twice the 1980 population of forty persons on the given land area of 3.6 acres.

The energy analysis will demonstrate how 80 persons (hypothetically, twenty families of four persons each) could be 100% energy self-reliant, 80.7% food self-reliant, and 50% self-reliant in supplying water for local consumption. Per capita figures assume a population of 80 persons. Family budget figures assume a family of four persons as defined by the U.S. Bureau of Labor Statistics in developing national family budget studies each year. Gross production figures assume economic feasibility which will be demonstrated by an economic analysis separate from the following study (see "economic planning", under Part III above).


architecture
building design
applied energy technology
adaptive-use
energy audits
mixed-use
use patterns
functional clustering
thermal properties of materials
functional needs
energy conservation
housing
adaptive technology
used materials
recycling
appliances
equipment
hardware
tools
wood
metals
paper
glass
oils
salvage
export
photovoltaics
greenhouses
public utility grid
passive heating & cooling systems
auxiliary generator
active hvac systems
power supply
hvac supply
energy consumption
fuel supply
biogas plant
water collection system
biological filtration
run-off canal
irrigation
cooling
water storage
solar distillation
potable water
solar hot water system
water supply
water
liquid & solid wastes
methane digester
oxidation pond
energy crops
aquacultural production
vegetables
fruits
herbs & aromatics
food supply
food consumption
green garbage
fertilizer
compost
wastes
food
urban agricultural production
urban livestock production
meats & eggs
dairy products
honey & beeswax
algae
seafood (meat)
animal hides
feathers
animal hair
fibers
clothing
fibers
skins
recycling

THE ARCHITECTURAL SUBSYSTEM

The Urban Eco-operative Concept views architecture as an analytical and productive process inclusive of energy planning in building design. The primary objectives of architectural production are to deliver energy conservation, accommodate functional needs, and to adapt architectural design to the local availability of natural and material resources.

By conducting energy audits, analyzing building and human use patterns, and specifying appropriate thermal materials, the utilization of energy to accommodate human functions and environmentally condition living spaces can be minimized. Energy planning may be an integral process within architectural planning and building design preceding construction, or occur as a post-construction process in planning retrofit projects to deliver energy-conserving buildings (i.e. housing). Residential energy conservation can significantly reduce or eliminate the need for consuming non-renewable resources to provide thermal comfort and electrical power in the home.

Figure 3 outlines a residential energy plan for achieving 100% household energy self-reliance. According to national averages, heating and cooling loads account for 60% of residential energy consumption followed by 15% for heating water, 15% for refrigeration, cooking, and clothes drying, and 10% for lighting and appliance operation. (Source: Integral Urban House, Olkowski, p.77) Adjusting the national averages to reflect the heating and cooling requirements of an arid region where cooling degree-days excede heating degree-days by 60%, heating loads account for 23% of the annual energy budget and cooling loads account for 37% of the energy budget for a family in Tucson. (Sources: U.S Weather Service information and "Tucson Tomorrow,"1978 & 1980)

In 1980, a prototypical family of four expended $770.00 for utilities. (Source: 1980 Tucson Area Family of Four Budget Study, Kolbe) At the rate of $.06/KWHR, this expenditure would be equivalent to 12,829 KWHR of energy consumed in 1980. Figure 3 illustrates the energy savings of various home conservation measures which will be discussed below. The percentages of energy savings shown in Figure 3 do not accrue linearly, but incrementally as the homeowner applies various conservation measures over time. An initial heating load of 100 KWHR to which a 25% energy savings for insulation and 75% energy savings for a passive solar retrofit is applied would yield a net energy savings of 81.25 KWHR (100KWHR X .25 X .75 = 81.25 KWHR). The heat load would then be (100 - 81.25) 18.75 KWHR.

Energy Conservation

Based upon energy audits conducted in the Tucson area, weatherstripping, caulking, and insulation reduce heating and cooling loads by at least 25%. In a poorly sealed house, infiltration losses alone can account for 10 to 20% of the heating and cooling loads. (Source: Energy Conservation for the Home, Reagan, 1975)

Passive Solar Retrofit Project

An appropriately designed passive solar greenhouse, sunspace, or other solar collection system could provide 75% of the home's heating load and at least 25% of the cooling load. (Source: Passive Solar Handbook, Mazria, 1978)

Equipment Maintenance

The proper maintenance of heating and cooling equipment can reduce home energy consumption by 10%. Operational efficiencies and life expectancy can be improved and extended through appropriate care for heating and cooling systems. Lubricating bearings of fan motors, tightening fan belts, replacing air filters, inspections and cleaning are all energy conserving measures which will help to reduce home energy consumption and decrease family energy expenditures. (Source: Energy Conservation for the Home, Reagan, 1975)

Improved Fireplace Efficiency

According to "Improving Fireplace Efficiency", a Western Regional Agricultural Engineering Publication, selecting and using appropriate heat reclamation fireplace accessories can materially increase the heating efficiency of a fireplace - conceivably bringing it up to 20-25% efficiency. Cleaning flues, well designed dampers, using outside air for combustion, glass enclosures and heat exchangers are among the many recommendations discussed for achieving a higher fireplace efficiency. In houses not equipped with an operable fireplace, a properly selected wood stove can achieve similar energy savings for home heating.

In arid regions, wood is not always an abundant indigenous resource. Experimentation with converting tumbleweeds into combustable fuel logs is currently being conducted at the Bio-energy Research Facility in Tucson. Woodlot management programs around the country are demonstrating the benefit of collectivized production of wood as a competitive home heating fuel. In arid regions where natural irrigation occurs along washes and riverbeds, urban forestry management could provide a low-cost wood fuel source while simultaneously providing natural shading from the hot desert sun.

Shading Devices and Ventilation

10% of seasonal cooling loads could be conserved by using adjustable shading devices such as venetian blinds to emit or reject solar energy and light as required. Selectively planted deciduous vegetation can achieve the same end by shading the home in the summer and allowing solar energy to penetrate windows of the home in the winter. By installing ventilation hardware in the home (i.e. in the attic) to exhaust warm air, an additional 10% of the home cooling load would be saved. This savings could also be achieved by natural passive means by providing apertures oriented to take advantage of natural cool breezes.

Solar Hot Water Systems

Installing active solar hot water systems on homes can easily conserve 75% of the natural gas or electricity used to heat domestic water. Workshops for constructing and installing solar domestic hot water systems to supply 75-100% of family hot water needs are being conducted by Pima Community College in Tucson. Implementing a neighborhood program to install solar hot water systems on a large scale would reduce initial capital costs and reduce the payback period to the families.

Lighting and Appliance Operation

By collectivizing household electric appliances which are normally duplicated in each home and retaining only personal-use applicances (such as clocks, hair dryers, shavers, home computers, radios and stereos), an estimated 36% of energy required to power home appliances could be conserved. (Source: "Tips for Energy Savers", DOE, 1978) Appliances such as blenders, coffee makers, trash compactors, irons, vacuum cleaners, and sewing machines could be collectivized into an appliance library and borrowed periodically by households.

Cooking, Refrigeration, & Clothes Drying

The processes of cooking, refrigeration, and clothes drying could become communal functions. Eliminating the need for household duplicity of ranges, refrigerators, freezers, clothes dryers, washing machines, and dishwashers, major electric appliances could be housed in common kitchens and laundry facilities. Family budgets would no longer require expenditures for operating major electric appliances in the home. This functional adaptation would save nearly 15% of the 1980 household energy budget.

Photovoltaics

By implementing the conservation measures listed above, the family would save the equivalent of 9211 KWHR, 72% of the 1980 family expenditure for utilities. 100% of the remaining 1980 home energy budget, less than 4000 KWHR, could be supplied by 500 square feet of flat-plate photovoltaic collectors producing 2 watts per square foot. (Source: Integral Urban House, Olkowski, p. 60) The cost of the photovoltaic system would be nearly $10,000 in 1980. If annual interest rates remain at or near 15% and electric utility costs increase at an annual rate of 20%, 80% of the cost for the photovoltaic system could be recovered in twenty years. Over the next twenty years, research and development of photovoltaic technology could significantly decrease market costs, improve efficiency (using concentrators), and produce integrated energy systems which simultaneously generate electricity, hot water, and usable heat for the home.

Summary

Functional adaptations, energy conservation, passive solar HVAC retrofit projects, active solar hot water systems, and photovoltaic power generation contribute to the development of total (100%) household energy self-reliance. If favorable technological and market developments occur in the next twenty years, the Urban Eco-operative System could conceivably become a net energy production system instead of a minimum energy consumption system.

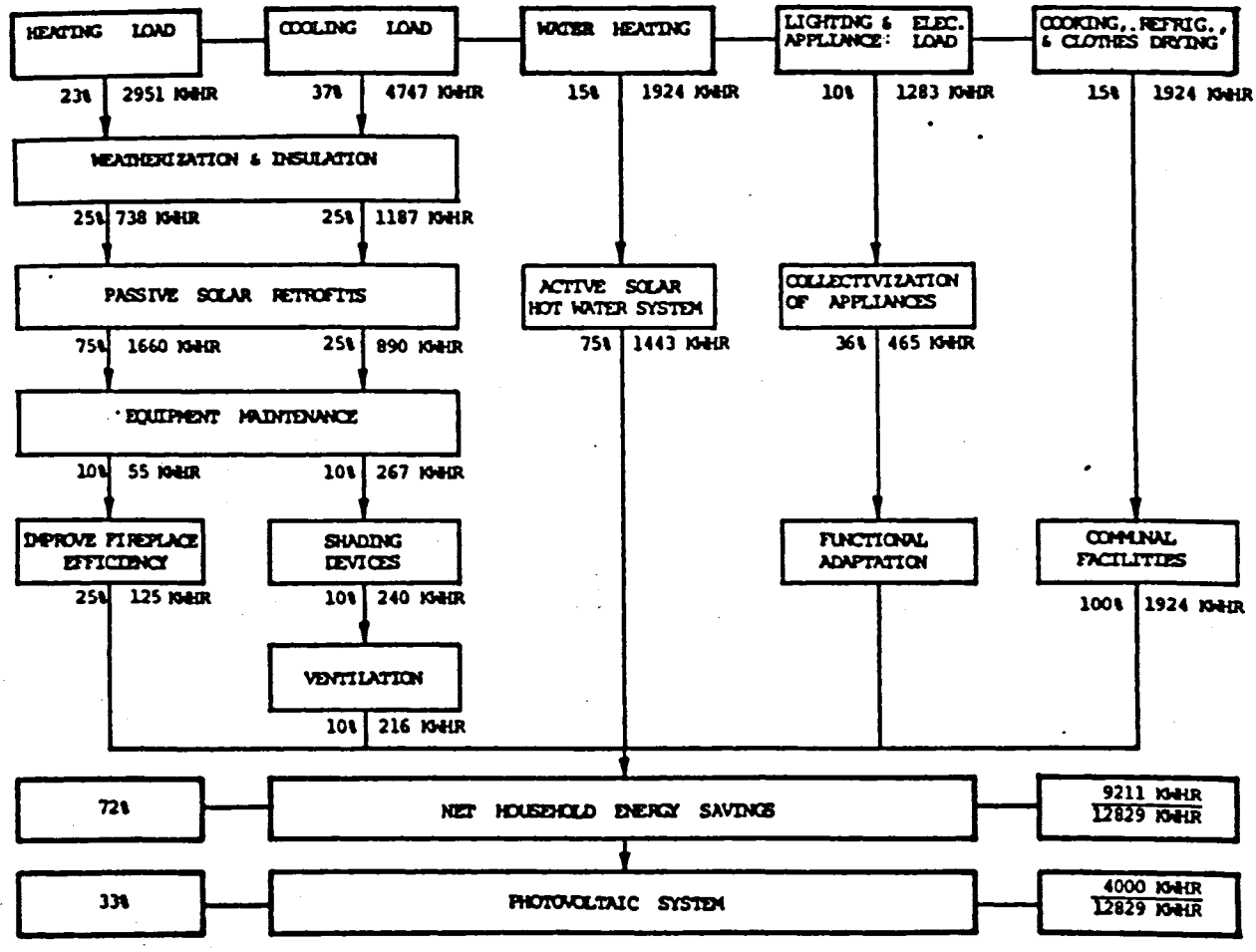


FIGURE 3 : Household Energy Planning for Self-Reliance Computed from 1980 Family Utility Costs. Values Shown are for Percent Savings and Equivalent Kilowatt-Hours of Total Annual Energy Consumption.

THE WATER SUBSYSTEM

The major components of the water subsystem (see Figure 4) are an underground compartmented reservoir, agricultural irrigation, a water run-off canal, and a biological filter. Through water conservation practices, the daily per capita consumption of water is estimated to be 50 gallons, less than half of the U.S. per capita daily consumption rate. Domestic water consumption would require 4000 gallons per day. 800 gallons of domestic water consumption would flow into the oxidation pond each day as wastewater. The remainder, 3200 gallons per day is reclaimed as greywater for crop irrigation.

Agricultural production requires 6960 gallons of water per day to provide 44,550 sq. ft. of crop area with ½" of water. Irrigation water is applied at a rate of 5-6 gpm or .0125"/hr. over a twenty-hour period. The soil has the capacity to store 80% of the water applied over the twenty-hour period, 10% would be lost by evaporation, and 10% could be reclaimed in the run-off canal. The run-off canal is designed to collect surface run-off from rainfall over a 33,000 sq. ft. area. Annual rainfall collection could be as high as 247,500 gallons which averages to 678 gallons per day of water supplied on-site. With a maximum capacity of 45,000 gallons, the canal could easily manage a one-inch rainfall producing 22,500 gallons of collectable water. Reclaimed water will be filtered at a maximum rate of 11,250 gpd through a grass and soil filter bed before recharging the underground water supply.

To produce 8% feed slurries to the methane digesters, 168 gallons of water is required per day. 208 gpd of supernatant from digester tanks combines with 800 gpd of domestic wastewater as feed for algae growth in the oxidation pond. Of the 1008 gpd of effluent released from the oxidation pond, 504 gpd is necessary for irrigating the 3200 sq. ft. of collective greenhouses at a rate of .84 gpm. The efficiency of the greenhouse irrigation system will be nearly 100% with an application rate of .025"/hr over a ten-hour period, or ½" of water per day. (Source: Sprinkler Irrigation in Arizona, Cooperative Extension, University of Arizona, 1968)

With 504 gpd of effluent flow from the oxidation pond, 3200 gpd of domestic greywater, 696 gpd reclaimable from irrigation run-off (10%), and an average of 678 gpd collected from the 11" of average annual rainfall, agricultural production requires 1882 gpd of water from underground storage (municipal water supply). 73% of the 6960 gpd required for crop irrigation is provided by reclaimed water sources on-site. 100% of greenhouse irrigation is provided by recycled water. Combined, all agricultural irrigation is 75% sustained by reclaimed water sources from local energy production processes. (see Tables 1 and 2 below)

Domestic Requirements	4000 gpd
Methane Digester Requirements	168 gpd
Field Crop Irrigation	6960 gpd
Greenhouse Irrigation	504 gpd
TOTAL DAILY WATER USAGE	11622 GALLONS PER DAY

TABLE 1: DAILY WATER CONSUMPTION FOR LOCAL PRODUCTION

Field Crop Irrigation	
Domestic Greywater	3200 gpd
Irrigation Return Flow (10%)	696 gpd
Oxidation Pond Effluent	504 gpd
Average Daily Rainfall Surface Run-off	678 gpd
Greenhouse Irrigation	
Oxidation Pond Effluent	504 gpd
TOTAL RECLAIMED WATER USAGE	5582 GALLONS PER DAY

TABLE 2: DAILY RECLAIMED WATER UTILIZATION FOR AGRICULTURAL PRODUCTION

The water subsystem of the Urban Eco-operative System reverses the current trend of 3-4 times more water consumed by agricultural production than by municipal consumption in the Tucson Area. Twice as much water must be supplied by municipal water for domestic use than for agricultural use, even though agriculture production supplies over 80% of local food needs. Small-scale agricultural development allows for the containment, re-collection, and recycling of the desert's most limited natural resource, water, reducing the need for exhausting the underground aquifer from large-scale cash cropping in open fields. Water conservation for domestic and agricultural consumption can be appropriately managed in decentralized, small-scale production.

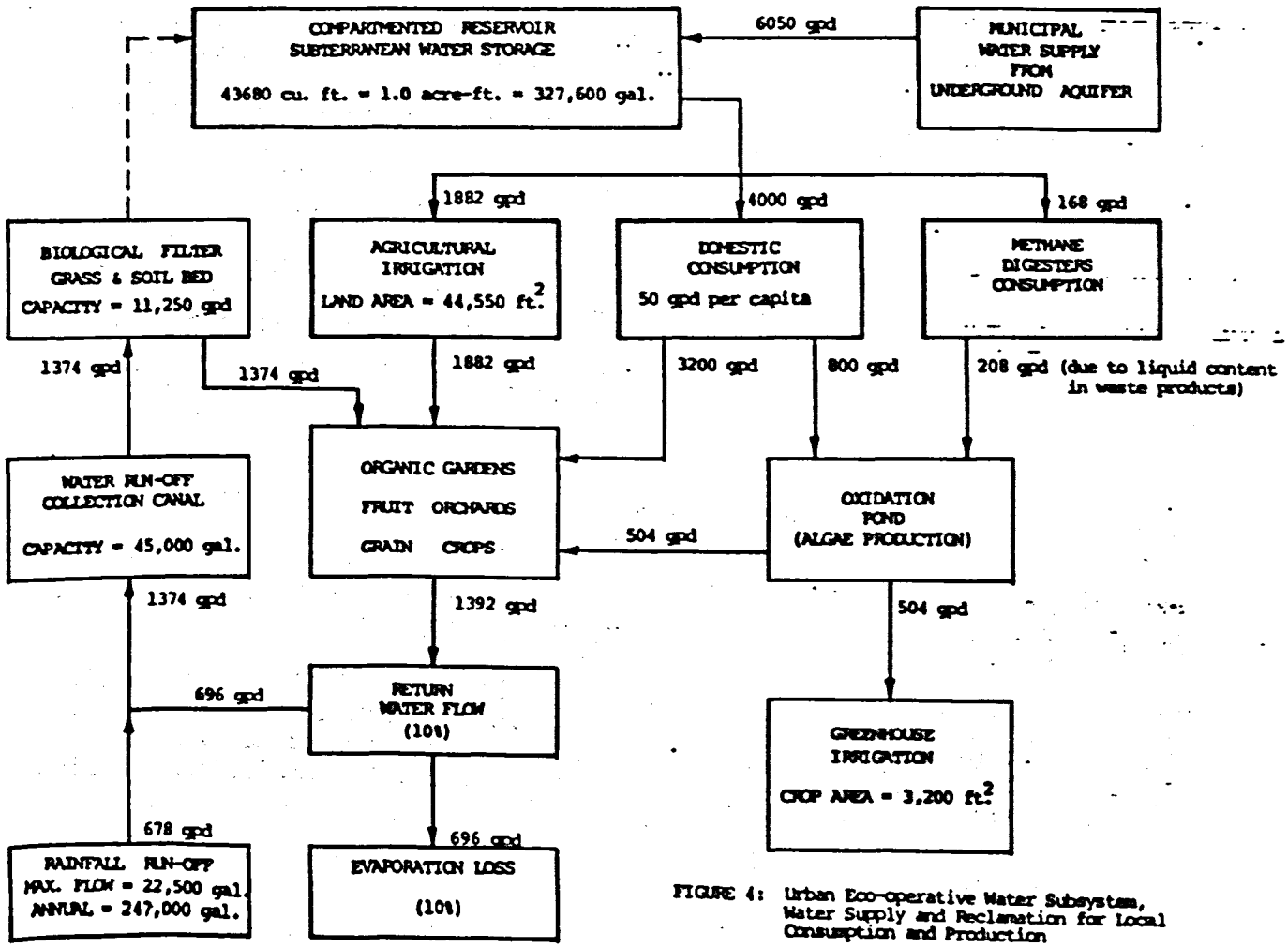


FIGURE 4: Urban Eco-operative Water Subsystem, Water Supply and Reclamation for Local Consumption and Production

AGRICULTURAL PRODUCTION SUBSYSTEM

Vegetable Production

Figure 5 on the following page quantifies the annual production of vegetable crops using Chinese and French intensive organic gardening techniques on 8000 sq. ft. of soil. With a growing season of 250 days and an average yield of 4 lbs. per day per 100 sq. ft. of production area, 40 tons of vegetables could be harvested annually. Per capita consumption of vegetables could increase 325% over the current average U. S. per capita consumption rate relative to pounds consumed annually. 150,000 calories would be available per capita per year from vegetable crops produced in the fields neglecting greenhouse production.

At an average market value of $.43/lb., an individual's vegetable supply is worth about $430 per year. The annual cash value of vegetable production would be over $34,000. Theoretically, if production occurs over the entire year, the cash value of the annual harvest exceeds $50,000. (Source: Adapted from Integral Urban House, Table 3.5, p. 59)

Fruit Production

With 6400 sq. ft. of intensive organic fruit cultivation and 23,900 sq. ft. of orchards used as landscaping infill, 7.6 tons of fruit is harvested annually. (see Figure 5) The consumption of 189 lbs. of fruit per capita exceeds the average U. S. consumption rate per capita by 25%. The fruit crop's cash value at an average of $.35/lb. is $5302.50.

Combined, fruit and vegetable production utilizes nearly 1 acre of land, 1386 ft^2 of organic fertilizers per year, 6960 gallons of water per day, and 2.08×10^{10} BTUs of solar energy per year. At a conversion ratio of about 1000:1, solar energy calories are converted into 15 million calories of fruits and vegetables per year.

Grain Production

If vegetable crop production occurs during only 68% of the year (250 growing days), winter grain crops such as barley, oats, and winter wheat could be cultivated. With approximately 6250 sq. ft. of continuous grain production area plus 21,000 sq. ft. of vegetable field winter cropping, nealy 1 ton of grains could be produced for livestock feed. If vegetable crops were grown in collective greenhouses, the annual grain crop yield would double to 2 tons of wheat, oats, barley, corn and alfalfa. (Source: Small-scale Grain Raising, Logsdon)

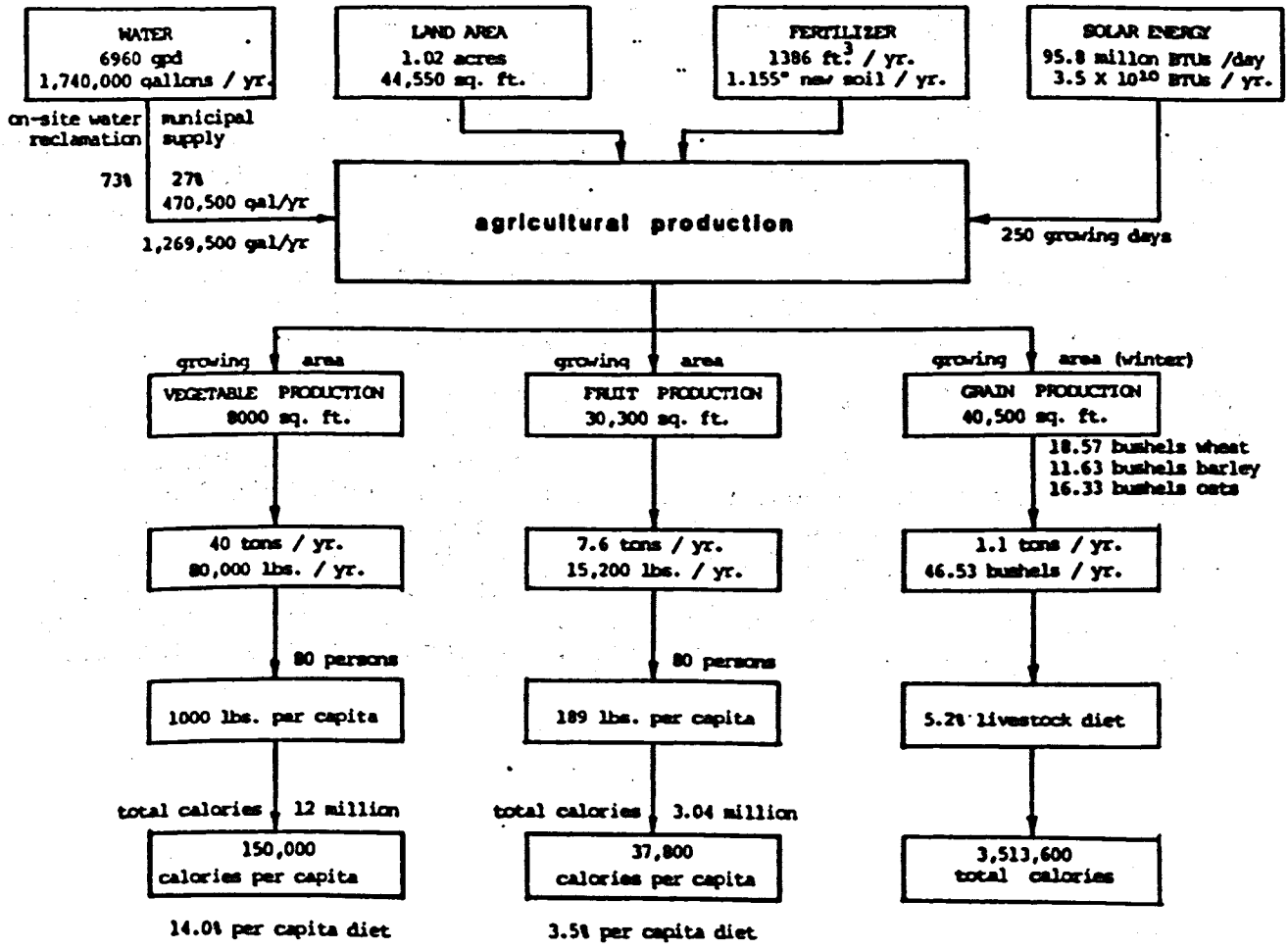


FIGURE 5: AGRICULTURAL PRODUCTION SUBSYSTEM

AQUACULTURAL PRODUCTION SUBSYSTEM

Nearly 1.5 tons of seafood including fish, prawns and clams could be produced annually by two self-contained, self-sustaining bio-aquacultural systems. (see Figure 6) Each production unit contains fish culture tanks with prawns and water hyacinths, biological filters with clam cultures, hydroponic vegetables, earthworm cultures for feed, and breeding tanks. (Adapted from Energy Primer, R. Merrill & T. Gage, 1978)

Nearly 12% of per capita daily protein requirements can be met by algae production from the oxidation pond (for location, see Figure 1). Algae is cultivated by releasing digested wastes (supernatant) into the pond each day from the methane digester tanks. Annual production is about 1000 lbs.: 15.5 grams of algae per day per capita is harvested from the pond and dried. 50 grams of spirulina contains about 30 grams of protein which is equivalent to 40% of daily protein requirements. The daily yield per capita is therefore equivalent to about 12% of daily protein requirements. (see Figure 6) (Source: Biological Paths to Self-Reliance, Anderson, 1979)

With an effective land area equivalent to 9600 sq. ft., using continuous cropping techniques, hydroponic or soil-based vegetable production could exceed 70 tons per year in collective greenhouses. All vegetable crops grown in organic plots on 8000 sq. ft. of land area during the 250 day growing season could be grown in greenhouses on only 3200 sq. ft. by cultivating plants year-around. All greenhouse irrigation, ½" per day, is supplied by 50% of daily oxidation pond effluent production or 504 gpd. The central agricultural production area could be reclaimed for small-scale grain production, communal activity space, a central orchard, or a small woodlot. (see Figure 6 for a diagram of greenhouse production)

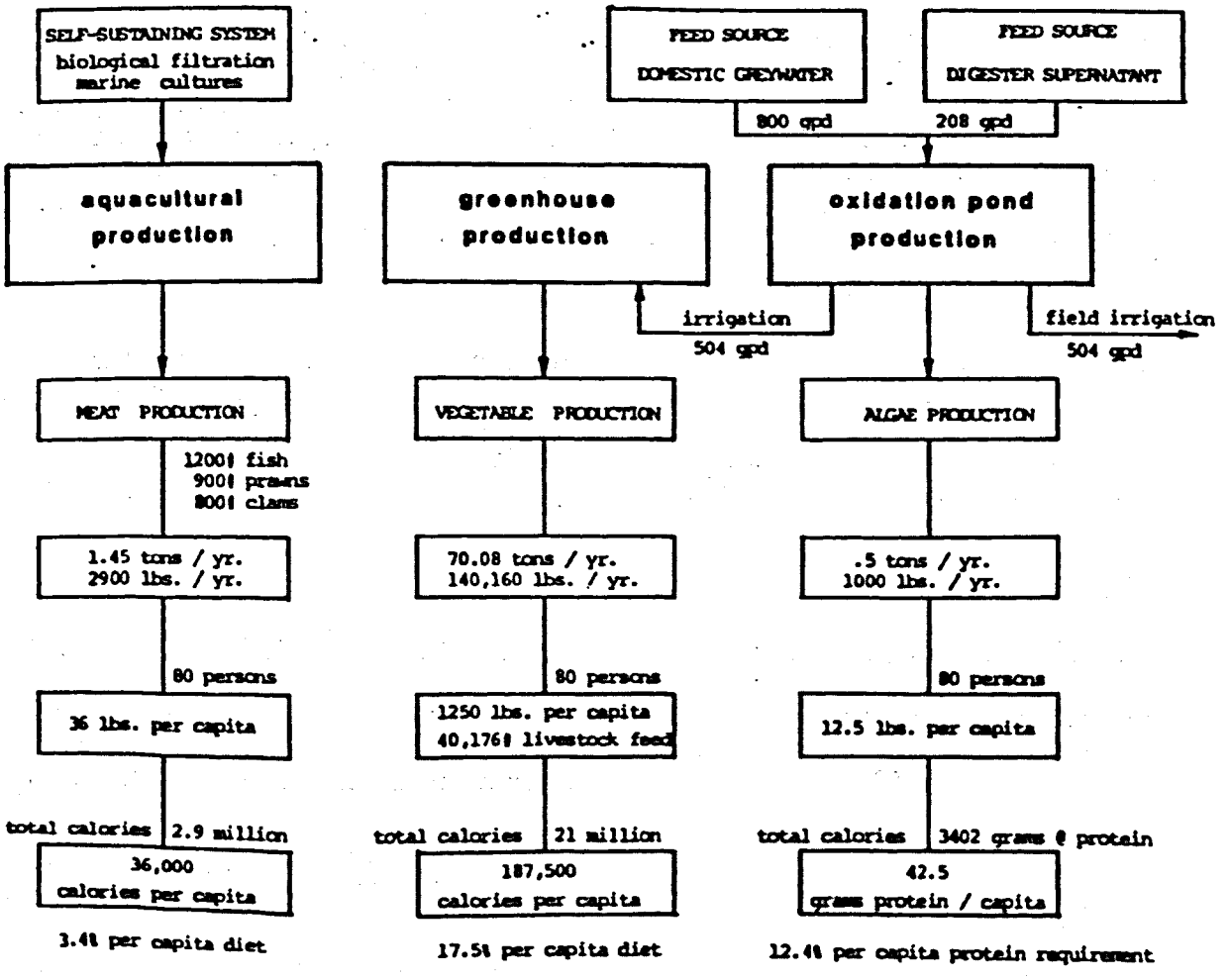


FIGURE 6: AQUACULTURAL PRODUCTION SUBSYSTEM WITH GREENHOUSE AND OXIDATION POND PRODUCTION

LIVESTOCK PRODUCTION SUBSYSTEM

Chickens / Meat Production

Americans annually consume 39 lbs. of chicken per capita. By selecting chickens bred specifically for brooding (i.e. Cornish and Cornish Crosses) local meat production approaches 1440 lbs. per year or 18 lbs. per capita. Fryers slaughtered after 3-4 months growth yield 3-4 lbs.of meat each. At this yield rate, the collective flock of fryers would number about 90 birds continuously with 30 birds being slaughtered each month. 1½ lbs. of home-grown organic chicken meat would be available for consumption per month per capita. Feathers and fat wastes from slaughtering can be used in local artisan industries. Manure production from the flock would be recycled into compost for garden fertilizer. Annual meat production from chickens would have a value of nearly $3000. (see Figure 7)

Chickens / Egg Production

Breeds such as Bantams and Leghorns have high egg production yields. With 80 quality layers, 16,000 eggs could be produced each year or 200 eggs per capita. To achieve high egg production, a hen will consume nearly 89 lbs. of feed per year. The annual market value of locally produced eggs exceeds $1250. (Source: The Homesteader's Handbook to Raising Small Livestock, Belanger, 1974)

Rabbits

Exceptionally high meat yields are obtainable from raising rabbits. Each doe produces 10 times her weight in meat each year. A doe is capable of producing 30 four pound fryers annually. With a collective stock of 50 does, 6000 lbs. (3 tons) of high-protein meat is annually harvested with a market value of nearly $12,000. Per capita consumption is 75 lbs. per year.

A ten pound doe requires 6 oz. of grain per day or 1.6 oz. of green feed or root crops. Surplus vegetable and grain crops (Jerusalem artichokes, comfrey, and alfalfa) will supply an adequate diet for the rabbit herd.

New Zealand White and Californian breeds are among the most popular meat producers. Their fur and pelts can be utilized in local artisan industries. (Source: The Homesteader's Handbook to Raising Small Livestock, Belanger, 1974)

Goats

A quality milking goat produces 1500 lbs (750 quarts) of milk per year. Milk is generally produced only ten months of the year. With a herd of ten does, nearly 2000 gallons (15,000 lbs.) are yielded annually. Per capita consumption is near 187.5 lbs. each year, providing 225,000 calories to each person's diet. The market value of goat's milk is over $10,000 per year or $125 per capita.

Each doe consumes about 2 lbs. of feed per day, 7300 lbs. per year for a herd of ten. An additional benefit of raising goats for the organic gardener (beyond the production of milk) is the production of manure. Six tons of manure are produced each year for every 1000 lbs of goats with an annual savings of over $1500 for fertilizer. (Source: Belanger, 1974)

Bees

Seventy-five to one hundred pounds of honey may be produced by a single hive in one year. Having eight hives, it is possible to yield 800 to 1000 pounds of honey per year with a per capita yield of about 10 lbs. annually. The yearly harvest has a market value exceeding $1000.

Bees are an essential component of urban ecological production, pollinating local orchards and crops for annual fruit and seed production. Beeswax is also a valuable by-product for candle-making and as sculpting material for local craft production. (Source: Belanger, 1974)

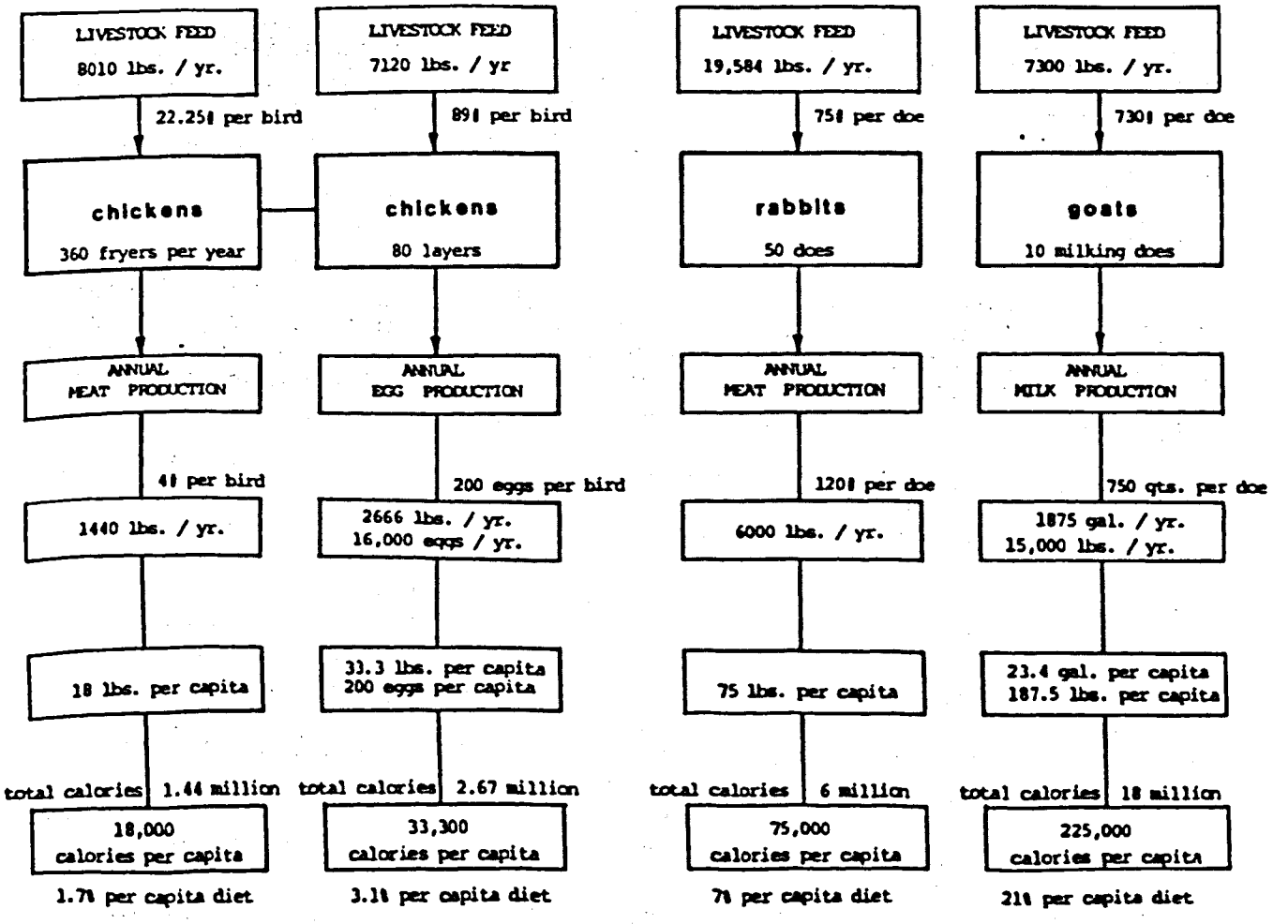


FIGURE 7: LIVESTOCK PRODUCTION SUBSYSTEM

RECYCLING SUBSYSTEM

Fibers

By-products of livestock production, rabbit fur and pelts, chicken feathers and goat hair can be harvested for local craft and artisan industries. Used clothing may be sold or exchanged locally for other articles of clothing. Fibers can be used for woven materials and artisan goods, re-constructed for new clothing, and adapted for other household or collective uses.

Used Materials

Building materials such as window casings, lumber, tile, hardware, equipment and tools can be salvaged from demolition, home improvement, or adapt-use projects. Salvaged materials can be re-applied in adaptive roles. Wood, metals, plastics, and paper are directly re-usable in new construction and adaptable to local production needs. Some materials may be collected and exported to recycling centers for cash. As the cooperative moves toward collective ownership of automobiles, common laundry facilities, and common kitchen facilities, surplus cars and appliances can be salvaged, sold, or technologically adapted to perform different electrical and mechanical functions.

Biomass Production

Kitchen, human, and household wastes are recycled to produce agricultural fertilizers, feed slurries for algae growth, carbon dioxide for greenhouse plant production, and methane for cooking fuel. Two methane digesters will be used in bio-mass production (see Figure 8). This allows for continuous biogas supplies when one tank is being cleaned or repaired.

One digester tank will operate with green garbage as a raw material input, the other will operate on human and paper wastes. Animal wastes will be recycled into anaerobic compost bins.

Figure 8 illustrates the process of converting raw material wastes into gases, sludge for fertilizers, and supernatant for algae production using anaerobic digestion. One tank operates at 95°F, retaining wastes for 50 days with a chemical oxygen demand (COD) of 51960 parts per million, and a carbon/nitrogen (C/N) ratio of 30:1 . The tank is supplied daily with 160 lbs. of green garbage produced on-site at a rate of 2 lbs per capita per day (half the national average waste production due to conservation consciouness). The raw waste is mixed with 12 lbs. of sawdust and 370.5 lbs. of water (44.6 gallons) to produce an 8% feed slurry. The daily yield from this digester tank will be 90.5 cu. ft. of methane for cooking fuel, 45.25 cu. ft. of carbon dioxide for greenhouse production, 41.9 lbs. of sludge for agricultural fertilizer, and 62.6 gallons of supernatant for algae growth in the oxidation pond.

The second digester tank will daily convert 1022 lbs. of water, 100 lbs. of human urine, 53 lbs. of human feces, 80 lbs. of newspaper, and 10 lbs. of sawdust into 242.4 cu. ft. of methane, 121.2 cu. ft. of carbon dioxide, 98.5 lbs. of sludge, and 146 gallons of supernatant. The digestion time will be 50 days at a temperature of 95°F. The sawdust and newspaper are used to balance the C/N ratio to 30:1 (both have high carbon to nitrogen ratios). The COD is 60,000 parts per million. (Source: Other Homes & Garbage)

The daily fuel supply from the two digester tanks is 333 cu. ft. of methane. The collective kitchen will require about 500 cu. ft. of cooking fuels per day. If water hyacinths were harvested and digested from aquacultural production, an additional 241 cu. ft. of fuel could be supplied daily raising fuel output to 574 cu. ft. of methane per day.

Compost Production

Household and garden refuse, and animal wastes are the raw material inputs for anaerobic composting. The annual production of wastes is shown in Table 3 below.

SOURCE	OUTPUT (tons/year)
Household and garden refuse	5.46
Rabbits (4.2 tons/1000#)	3.36
Chickens (4.5 tons/1000#)	5.76
Goats (6 tons/1000#)	4.8
Total	19.38

TABLE 3: ANNUAL WASTE PRODUCTION BY SOURCE

Finished compost and digested sludge can supply a total of 53.78 tons of organic fertilizers each year. 2.4 lbs of fertilizer will be available for each square foot of agricultural production area. About 1.2 inches of new organic material is supplied for the 1.2 acre crop area. Approximately 1/5 of the nutrients in livestock feed are returned in manures. Plants use only one half of the manure nutrients applied to soils each year. (see Figure 9 ; Source: The Homesteader's Handbook to Raising Small Livestock, Belanger, 1974)

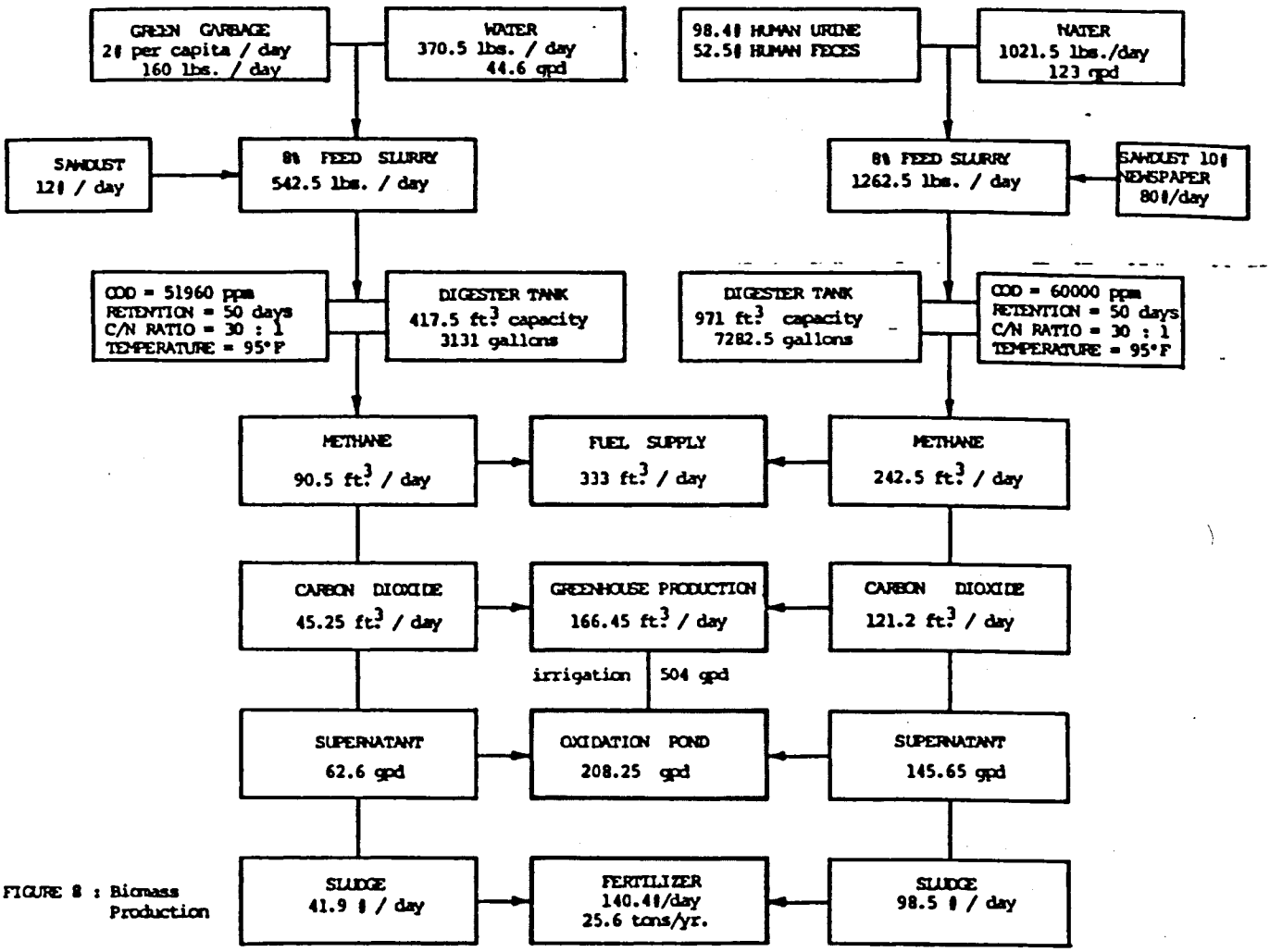


FIGURE 8 : Biomass Production

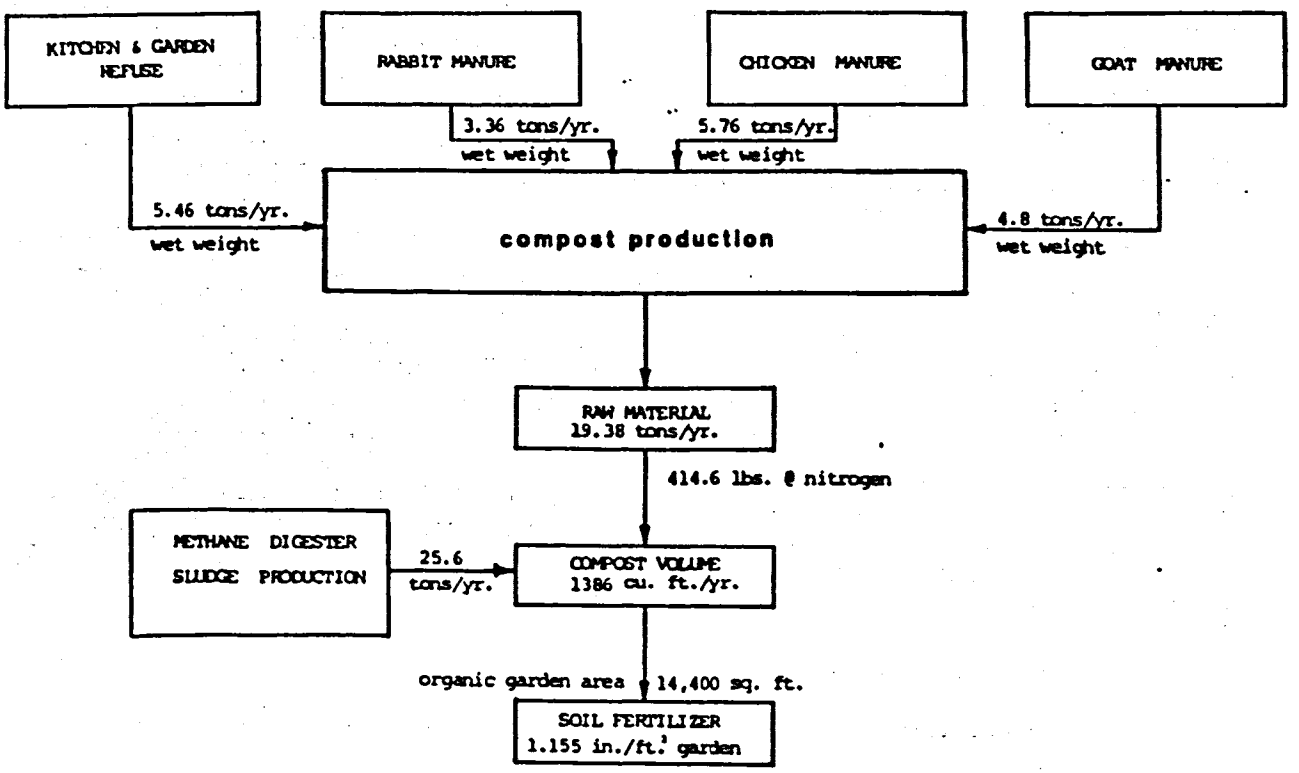


FIGURE 9: COMPOST PRODUCTION FOR SOIL FERTILIZER

SUMMARY

Energy Self-Reliance

By collectivizing major appliances into common kitchen and laundry facilities, and collectivizing appliances which are periodically used into lending libraries, 2389 equivalent kilowatt-hours of 1980 residential energy consumption can be saved. Weatherizing and insulating homes conserves 1925 KWHR. Proper maintenance of heating and cooling systems, shading, ventilating, and passive retrofits together save an additional 4897 KWHR of 1980 residential energy consumption.

The equivalent of 173 KWHR are conserved by producing methane for cooking fuel. All total, the 1980 residential energy consumption (equivalent to 12829 KWHR) could be reduced by 73% through the implementation of energy conservation outlined by the Urban Eco-operative System. The remainder of 1980 energy consumption (3455 equivalent KWHR) is provided by the installation of 500 sq. ft. of flat-plate photovoltaic collectors producing 2 watts per sq. ft. The annual production output of the photovoltaic system is 4000 KWHR completing the 100% energy self-reliance scenario of the Urban Eco-operative System. See Table 4 for a summary of energy supply processes contributing to energy independence. (Source: Integral Urban House, Olkowski, Table 3.6, p. 60)

ENERGY DELIVERY PROCESS	EQUIV. 1980 ENERGY CONSERVED
Functional Adaptation	2389 KWHR
Energy Conservation	1925 KWHR
Power Supply	4000 KWHR
HVAC Supply (includes solar hot water)	4897 KWHR
Fuel Supply	173 KWHR
Total Energy Supply	13384 KWHR
Total Equivalent 1980 Energy Consumption	12829 KWHR
Energy Self-Reliance in Relation to 1980 Consumption	104%

TABLE 4: ENERGY DELIVERY PROCESSES IN DEVELOPING LOCAL SELF-RELIANCE

Water Self-Reliance

Water consumption for irrigation of gardens, orchards, and greenhouses requires 7464 gallons per day. Methane digesters consume 168 gallons per day while domestic consumption is 4000 gpd (50 gpd per capita). Reclaimed water accounts for 6590 gallons consumed each day by life-supporting processes leaving a daily deficit of 6050 gallons which is supplied by municipal sources to refill underground reservoirs. The total daily consumption of water for all the processes on site providing 100% energy and over 80% food self-reliance for 80 persons is 25% less than the water consumed on the national average by 80 persons to supply domestic water needs alone.

Only 27% of the of the water required to irrigate the 44,550 sq. ft. of agricultural land area is provided by municipal sources directly. The larger portion of irrigation water, 73%, is provided by water reclaimed from other sources of production and consumption on-site. When greenhouse production is included in total agricultural production, reclaimed water provides 75% of irrigation requirements. (see Table 5 below). Reclaimed water provides 52% of overall water requirements to sustain local life-support processes. (see Table 6 below)

IRRIGATION SOURCE	SUPPLY (gpd)	% OF TOTAL
Domestic Greywater	3200	43
Municipal Water	1882	25
Oxidation Pond Effluent	1008	13.5
Surface Run-Off (rain)	678	9
Return Water Flow	696	9.5
Total Agricultural Irrigation	7464	100.0

TABLE 5: SOURCES OF TOTAL AGRICULTURAL IRRIGATION REQUIREMENTS

WATER SUPPLY SOURCE	SUPPLY (gpd)	% OF TOTAL
Municipal Water (pumped)	6050	48
Reclaimed Water	6590	52
Domestic Greywater	3200	25.2
Domestic Wastewater (sewage)	800	6.3
Methane Digester Supernatant	208	1.6
Oxidation Pond Effluent	1008	8.0
Return Water Flow	696	5.5
Surface Run-Off (rain)	678	5.4
Total Water Consumption	12640	100.0

TABLE 6: SOURCES OF TOTAL WATER CONSUMPTION

Food Self-Reliance

Organic fertilizers and livestock feeds are locally produced by composting, digested sludge, grain crops, forage crops, and root crops. The food supply processes of the Urban Eco-operative yield 80.7% of the national average per capita consumption of food calories. (see Table 7 below)

More than two times the amount of food (by weight) consumed on a national per capita average would be available for local per capita consumption. Individuals in the Urban-Eco-operative consume four times as many vegetables and twenty-five percent more fruit than the national average. They would eat 44% less meat, 34% less dairy products, 54% less fats, and 93% less sugars and non-alcoholic beverages.

Food to be locally produced is free of: pesticides, artificial preservatives, artificial flavoring and coloring, stabilizers, and other synthetic additives. Assuming grains and cereals will remain staples providing nearly 20% of dietary requirements, without the land area to produce them locally in sufficient quantity, they will remain food commodities purchased in the market.

The energy diet of local individuals will typically consist of 31.5% vegetables 3.5% fruits, 19.3% grains and cereals, 15.2% meats, 21% dairy products, 9.3% fats, and .2% sugars compared to national averages of 3%, 2%, 18%, 25%, 32%, 19%, and 2% respectively. Calories obtained from vegetables will rise 700%, while calories from meat, dairy products, and sugars decrease on an average of 73%. (Source: Integral Urban House, Olkowski, 1979)

The upper limit of local food self-reliance is achieved at 80.7% since grain and cereal crops can not be produced on the land area available for human consumption needs. The Urban Eco-operative member's diet contains 7.2% less calories and twice the food by weight in comparison to national per capita averages. All food locally produced would be organically grown in the natural balance of an urban ecological system supported by a renewable economy of indigenous resources.

TABLE 7: URBAN ECO-OPERATIVE SYSTEM ANNUAL PER CAPITA FOOD CONSUMPTION

FOOD CATEGORY	lbs/yr	%diet	calories/yr	%energy diet	%energy diet national average
Vegetables	2250	76.2	337,470	31.5	3
Fruit	189	6.4	37,800	3.5	2
Meat & Eggs	162	5.5	162,300	15.2	25
Dairy Products	187.5	6.4	225,000	21.0	32
Fats*	25	.8	100,000	9.3	19
Sugar	10	.3	1,750	.2	2
Subtotals	2824	95.6	864,320	80.7	82
Grain & cereals**	129	4.4	206,400	19.3	18
Totals	2953	100.0	1,070,720	100.0	100

* Estimation of available fats produced on site including orchard production of nuts.

** The production of grain requires more land area than is available on-site. Grains and cereals will be purchased from regional farmers directly or from the marketplace. Grain and cereal consumption is assumed to be the same for a member of the Urban Eco-operative System as for the average American based upon per capita consumption figures.

BIBLIOGRAPHY

BIBLIOGRAPHY

Anderson, Russell E., Biological Paths to Self-Reliance: A Guide to Biological Solar Energy Conversion (New York: Van Nostrand Reinhold Company, 1979).

Belanger, Jerome, The Homesteader's Handbook to Raising Small Livestock (Emmaus, Pa.: Rodale Press, Inc., 1974).

Berger Cost Files, 1980 Western Edition, (New York: Van Nostrand Reinhold Company, 1980).

Bishay, Ali, William G. McGinnies, and others, Advances in Desert and Arid Land Technology and Development (Hardwood Academic Publishers, 1979).

Bloomfield, Lincoln P., Irirange C. Bloomfield, The U. S., Interdependence and World Order (New York: Foreign Policy Association, 1975).

Branch, Diana S., Tools for Homesteaders, Gardeners and Small Scale Farmers: A Catalog of Hard to Find Implements and Equipment (Emmaus, Pa.: Rodale Press, Inc., 1978).

Britz, Richard, The Edible City Resource Manual (Los Altos, Ca.: William Kaufmann, Inc., 1981).

Brown, Lester R., Building A Sustainable Society (New York: W. W. Norton and Company, Inc., 1981).

Brown, Lester R., Gail W. Finsterbusch, Man and His Environment: Food (New York: Harper and Row, Pubishers, 1972).

Brown, Lester R., The Twenty-Ninth Day: Accommodating Human Needs and Numbers to the Earth's Resources (New York: W. W. Norton and Company, Inc., 1978).

Brown, Norman L., editor, Renewable Energy Resources and Rural Applications in the Developing World (Boulder, Co.: Westview Press, 1978).

Burby, Raymond J. III, A. Fleming Bell, Energy and the Community (Cambridge, Mass.: Ballinger Publishing Company, 1978).

Burns, Scott, Home, Inc.: The Hidden Wealth and Power of the American Household (New York: Doubleday and Company, Inc., 1975).

Chapman, Paul W., Chicken Raising Made Easy (New York: Doubleday and Company, Inc., 1943).

Clayre, Alasdair, editor, The Political Economy of Cooperation and Participation (Oxford: Oxford University Press, 1980).

Craig, John G., Multi-National Co-operatives: An Alternative for World Development (Saskatoon, Saskatatchewan: Western Producer Prairie Books, 1976).

BIBLIOGRAPHY

Daly, Herman E., Steady-State Economics: The Economics of Biophysical Equilibrium and Moral Growth (San Francisco: W. H. Freeman and Company, 1977).

Dasmann, Raymond R., John P. Milton, Peter H. Freeman, Ecological Principles for Economic Development (London: John Wiley and Sons Ltd., 1973).

Deacon, Ruth E., Francille M. Firebaugh, Family Resource Management: Principles and Applications (Boston: Allyn and Bacon, Inc., 1981).

DeRupp, Robert S., Eco-Tech: The Whole Earther's Guide to the Alternative Society (U.S.A.: Delacorle Press, 1975).

Dorf, Richard, C., Energy Resources and Policy (Reading, Mass.: Addison-Wesley Publishing Company, Inc., 1978).

Douglas, William O., The Three Hundred Year War: A Chronicle of Ecological Disaster (New York: Random House, 1972).

Dresser, Peter Van, Development on A Human Scale: Potentials for Ecologically Guided Growth in Northern New Mexico (New York: Praeger Publishers, 1973).

Goodman, Louis J., Ralph N. Love, editors, Biomass Energy Projects: Planning and Management (New York: Pergamon Press, 1981).

Goodwin, John W., Agricultural Economics (Reston, Virginia: Reston Publishing Company, 1977).

Harlan, Jack R., Crops and Man (Madison, Wisc.: American Society of Agronomy and Crop Science Society of America, 1975).

Heflebower, Richard B., Cooperatives and Mutuals in the Market System (Madison, Wisc.: The University of Wisconsin Press, 1980).

Henderson, Hazel, Creating Alternative Futures: The End of Economics (New York: Perigree Books, G. P. Putnam's Sons, 1978).

Hertzberg, Ruth, Beatrice Vaughan, Janet Greene, Putting Food By (Brattleboro, Vt.: The Stephen Greene Press, 1975).

Hommel, Rudolf P., China at Work: An Illustrated Record of the Primitive Industries of China's Masses, Whose Life is Toil, and Thus an Account of Chinese Civilization (New York: The John Day Company, 1937).

Illich, Ivan, Toward a History of Needs (New York: Pantheon Books, 1978).

Jackson, C. I., editor, Human Settlements and Energy: A Seminar of the United Nations Economic Commission for Europe (Oxford: Pergamon Press, 1978).

BIBLIOGRAPHY

Jeffers, John N. R., An Introduction to Systems Analysis: with Ecological Applications (London: Edward Arnold Publishers, Ltd., 1978).

Kaufman, George G., Money, the Financial System, and the Economy (Boston: Houghton Mifflin Company, 1981).

Knowles, Ralph, Energy and Form (Cambridge, Mass: MIT Press, 1974).

Leckie, Jim, Gil Masters, Harry Whitehouse, Lily Young, Other Homes and Garbage: Designs for Self-Sufficient Living (San Francisco: Sierra Club Books, 1975).

Livingston, John A., One Cosmic Instant: Man's Fleeting Supremacy (Boston: Houghton Mifflin Company, 1973).

Lobell, John, The Little Green Book: A Guide to Self-Reliant Living in the 1980's (Boulder, Co.: Shambhala, 1981).

Logsdon, Gene, Small Scale Grain Raising (Emmaus, Pa.: Rodale Press, Inc., 1977).

Logsdon, Gene, Successful Berry Growing: How to Plant, Prune, Pick and Preserve Bush and Vine Fruits (Emmaus, Pa.: Rodale Press, Inc., 1974).

Mazria, Edward, The Passive Solar Energy Book (Emmaus, Pa.; Rodale Press, Inc., 1979).

McCallum, Bruce, Environmentally Appropriate Technology: Renewable Energy and Other Developing Technologies for a Conserver Society in Canada (Hull, Quebec: Canadian Government Publishing Centre, 1978).

McCullagh, James C., editor, The Solar Greenhouse Book (Emmaus, Pa.: Rodale Press, Inc., 1978).

McGrath, Mary Jean, editor, Guidelines for Cooperatives in Developing Economies (Madison, Wisconsin: The International Cooperative Training Center, 1969).

Merrill, Richard, Thomas Gage, Energy Primer (New York: Delta Publishing, 1978).

Meynell, Peter-John, Methane: Planning a Digester (New York: Schocken Books, 1978).

Nelson, Paul V., Greenhouse Operation and Management (Reston, Va.: Reston Publishing Company, Inc., 1978).

Odum, Howard T., Elisabeth C. Odum, Energy Basis for Man and Nature (New York: McGraw-Hill Book Company, 1976).

Odum, Eugene P., Fundamentals of Ecology (Philadelphia, Pa.: W. B. Saunders Company, 1971).

BIBLIOGRAPHY

Olkowski, Alan, Jim Benson, County Energy Plan Guidebook: Creating A Renewable Energy Future (Fairfax, Va.: Institute for Ecological Policies, 1979).

Olkowski, Helga, Bill Olkowski, Tom Javits, The Integral Urban House (San Francisco: Sierra Club Books, 1979).

Philbrick, Helen, Richard B. Gregg, Companion Plants and How to Use Them (New York: The Devin-Adair Company, 1966).

Rana, J. M., Multi-Purpose Cooperative Societies in Southeast Asia (New Delhi: International Cooperative Alliance, New India Press 1974).

Reagan, J. A., Energy Conservation for the Home or How to Lower Your Utility Bill (Tucson, Az.: The University of Arizona, 1975).

Regier, Henry A., A Balanced Science of Renewable Resources with Particular Reference to Fisheries (Seattle, Washington: Sea Grant Publication, University of Washington Press, 1978).

Reichler, Richard, Employee Stock Ownership Plans: Problems and Potentials (New York: Law Journal Press, 1978).

Reynolds, Henry, and others, Home-Tech Restoration and Renovation Cost Estimator (Washington D. C.: Home-Tech, Inc., 1980).

Rifkin, Jeremy, Entropy: A New World View (New York: Bantam Books, Inc., 1981).

Rodale, J. I., editor, The Encyclopedia of Organic Gardening (Emmaus, Pa.: Rodale Press, Inc., 1959).

Rozwenc, Edwin Charles, Cooperatives Come to America: The History of the Protective Union Store Movement, 1845-1867 (Philadelphia, Pa.: Porcupone Press, 1975).

Sale, Kirkpatrick, Human Scale (New York: Coward, McCann, and Geoghegan, 1980).

Schumacher, E. F., Small Is Beautiful: Economics as if People Mattered (New York: Harper and Row, Publishers, Inc., 1973).

Smith, J. Russell, Tree Crops: A Permanent Agriculture (New York: The Devin-Adair Company, 1950).

Spaulding, C. E., A Veterinary Guide for Animal Owners (Emmaus, Pa.: Rodale Press, Inc., 1976).

BIBLIOGRAPHY

Terleckyj, Nestor E., editor, Household Production and Consumption (New York: National Bureau of Economic Research, 1975).

Thomas, John, A. G., editor, Energy Analysis (Boulder, Co.: Westview Press, Ltd., 1977).

Todd, John, Nancy Jack Todd, Tomorrow is Our Permanent Address: The Search for an Ecological Science of Design as Embodied in the Bio-Shelter (New York: Harper and Row, Publishers, 1980).

Toffler, Alvin, Future Shock (New York: Random House, 1970).

Toffler, Alvin, The Third Wave (New York: Bantam Books, Inc., 1981).

United States Department of Agriculture, Yearbook of Agriculture, 1938 (Washington D. C.: United States Government Printing Office, 1938).

Van der Ryn, Sim, The Toilet Papers (Santa Barbara, Ca.: Capra Press, 1980).

Wagar, Warren W., Building the City of Man: Outline of a World Civilization (New York: Grossman Publishers, 1971).

Wallace, Daniel, editor, Energy We Can Live With: Approaches to Energy That Are Easy on the Earth and Its People (Emmaus, Pa.: Rodale Press, Inc., 1976).

Ward, Leo R., Ourselves, Inc.: The Story of Consumer Free Enterprise (New York: Harper and Row, Publishers, Inc., 1971).

Wilson, Alex, Thermal Storage Wall Design Manual (Albuquerque, N.M.: Modern Press, New Mexico Solar Energy Association, 1979).

Wolf, Ray, editor, Organic Farming: Yesterday's and Tomorrow's Agriculture (Emmaus, Pa.: Rodale Press, Inc., 1977).

Wright, David H., Co-operatives and Community: The Theory and Practice of Producer Co-operatives (London: Bedford Square Press of the National Council of Social Services, 1979).

Yepsen, Roger B. Jr., editor, Organic Plant Protection: A Comprehensive Reference on Controlling Insects and Diseases in the Garden, Orchard, and Yard Without Using Chemicals (Emmaus, Pa.: Rodale Press, Inc., 1976).

Zimmerman, Larry W., Glen D. Hart, Value Engineering: A Practical Approach for Owners, Designers, and Contractors (New York: Van Nostrand Reinhold Company, 1982).

BIBLIOGRAPHY

PAMPHLETS:

"Arizona Solar and Weather Information", Western Sun, September, 1980.

"Catalogue of California Model Solar Projects", Office of Appropriate Technology, State of California, 1981.

"Energy Conservation For the Home", John A. Reagan, University of Arizona, 1975.

"Evaporation from Open Water Surfaces in Arizona", Cooperative Extension Service, University of Arizona, Folder 159, April, 1970.

"Finance Facts Yearbook", National Consumer Finance Association, 1970, 1973, 1978, 1980, 1981.

"Growing Vegetables in the Home Garden", U. S. Dept. of Agriculture, Home and Garden Bulletin No. 202, 1980.

"How to Raise Rabbits and Chickens in an Urban Area", Ecology Center, Berkeley, California, 1979.

"Local Energy Initiatives: A Survey of Cities and Counties, California 1980", Office of Appropriate Technology, State of California, 1980.

"Mixed Land Uses and Residential Property Values in the Tucson Metropolitan Region: Implications for Public Policy", Than Van Cao, Dennis C. Cory, Agricultural Experiment Station, University of Arizona, Technical Bulletin No. 241, 1981.

"Nutritive Value of Foods", U.S. Dept. of Agriculture, Home and Garden Bulletin No. 72, 1978.

"Planning Solar Neighborhoods", The California Energy Commission, State of California, April, 1981.

"Residential Paper Recovery: A Community Action Program", Office of Solid Waste, U.S. Environmental Protection Agency, Washington D.C.

"Rural Wastewater Disposal Alternatives, Final Report", Office of Appropriate Technology, State of California, September 1977.

"Tax Guide for Small Business", U.S Dept. of the Treasury, Internal Revenue Service, Publication No. 334, November, 1980.

"1980 Tucson Area Familiy of Four Budget Study", Phillip T. Kolbe, Division of Economic and Business Research, University of Arizona, March, 1981.

"Tucson's Historic Districts: Criteria For Preservation and Development", Dept. of Community Development, City of Tucson, June, 1974.

BIBLIOGRAPHY

"Working Together: Community Self-Reliance in California", Office of Appropriate Technology, State of California, 1981.

PERIODICALS:

"Energy and Urban Transportation", Hari N. Khanna, Arizona Business, January, 1979.

"Family Budgets", Monthly Labor Review, Jan. 1980, Aug. 1980, Dec. 1980, Aug. 1981,

"Food Prices: Taking a Bite out of Your Consumer Dollar", Nat De. Gennaro, Arizona Review, Second Quarter, 1981, pp. 24-32.

"Leading America's Economic Slowdown: The Productivity Problem", Lester C. Thurow, Arizona Review, Second Quarter, 1981, pp. 3-13.

"Tucson Tomorrow": 1978 and 1980.

OTHER REFERENCES:

"Environmental Planning for Urban Self-Reliance: Biological and Technological Solar Energy Conversion Systems for Small-Scale Production", Ronald E. Wheeler II, Unpublished Manuscript, Copyright, 1982 by Ronald E. Wheeler II.

"Self-Reliance Through Self-Provisioning", Ronald E. Wheeler II, Unpublished Manuscript, 1982. (Summarized in Appendix B)

"The Urban Eco-operative Concept: Prospectus for a Twenty-First Century Urban Re-Settlement Plan", Ronald E. Wheeler II, Unpublished Manuscript, Copyright, 1982 by Ronald E. Wheeler II. (Partially Reprinted in Appendix A)