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Promoting a Culture of Sustainability at *The Sustainable City*: Characteristic Features of Planned Communities with a Sustainability Focus

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“Promoting a Culture of Sustainability at *The Sustainable City*”

A joint project of UC Davis and AUC

Project Report Number 1.

CHARACTERISTIC FEATURES OF PLANNED COMMUNITIES WITH A SUSTAINABILITY FOCUS

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Executive Summary

Diamond Developers of Dubai, UAE has designed and developed *The Sustainable City*, a mixed use residential community. In support of the objective of promoting a culture of sustainability among the residents, employees, managers, and visitors in *The Sustainable City*, this report presents the results of a literature review of models and best practices for promoting sustainability in planned communities with a sustainability focus. Three approaches, among others, are highlighted: The Natural Step, Ecovillages, and One Planet Living. Two government-sponsored approaches to achieving sustainable communities, The Sustainable Community Plan (UK) and The Sustainable Community Initiative (USA) are also reviewed. All of these approaches stress the importance of a clear vision, adhering to basic principles, strategic planning with well-defined targets, specific indicators to measure progress toward achieving targets, and continuous monitoring and evaluation. The models and approaches place differential emphasis on the various aspects of sustainability. Ecovillages stress participation and social commitment, while One Planet Living focuses on improving environmental conditions and the ecological footprint. The Natural Step and the two government-sponsored approaches are perhaps broader in scope and scale, but they also stress community participation in achieving strategic objectives.

The 20 case study is a purposive sample with the aim of selecting a diverse range of cases relevant to the vision of *The Sustainable City*. The sample reflect various approaches to achieving sustainability while also including diversity of location, size, community type, economic context and financing arrangements. The communities are compared in terms of sustainability vision; strategic plan; approach to operationalizing environmental, social, and economic dimensions; and implementation of the strategic plan. In general, communities varied in terms of emphasis on environmental issues or social issues. Economic issues were perhaps less elaborated in most strategic plans, but there was considerable overlap between social and economic issues in quite a few cases, particularly with regard to the importance of maintaining diversity and affordability in access to residential housing. The economic dimension was relatively more important in communities operating under a cooperative society than in other communities, as should be expected.

Each community vision and plan featured a number of aspects considered as best practices by the community. The best practices were identified by the research team to highlight distinctive aspects that had a measurable and noticeable role towards realizing each community's vision towards sustainability. These best practices are identified either in the comparison or in Annex 1 of the report where each community is described in some detail. Annex 2 provides brief summaries of 12 communities displaying interesting features, but not included among the 20 case studies for various reasons such as lack of documentation, vague vision and/or plan, etc.

Section 5 of the report translates a number of the best practices identified from the 20 case studies surveyed for consideration by *The Sustainable City*. These practices are grouped into eleven topics covering: vision and plan; participation; information; quality of life; community life; learning center; natural resources; transportation; affordability; carbon footprint; and economic incentives.

Section 1. Introduction: Background to this Report

Diamond Developers, a freehold property and real estate development company, has designed and developed a mixed use residential community located in Dubailand, Dubai, United Arab Emirates. It contains 500 homes, and the first residents began moving in in December, 2015. Residential construction is scheduled for completion in 2016. The name of the new development is *The Sustainable City*, and its most distinctive feature is that sustainability is built into the design components in order to minimize the impact on the environment and improve the quality of life of the new community. Each residential unit incorporates practical sustainable living solutions, and the overall design of *The Sustainable City* emphasizes the interconnections among environment, society, and economy. Diamond Developers is promoting sustainability not simply as an environmental goal, but as a vision for making *The Sustainable City* a better place to live for all the members of the community.

Diamond Developers recognizes that although designs, engineering, and technology can provide the tools for sustainability, it is the behavior of people living in *The Sustainable City* that will achieve realization of the vision. Diamond Developers understands that promoting and nurturing a culture of sustainability among the residents, employees, managers, and visitors in *The Sustainable City* is fundamental to achieving its sustainability goal.

The Sustainability Research and Training Program (SRTP) at the University of California at Davis sponsors the project entitled “Promoting a Culture of Sustainability at *The Sustainable City*” of which this is the first project report. The project is jointly implemented by UC Davis and the American University in Cairo through its Research Institute for a Sustainable Environment (RISE). The project is following a modified best practice methodology based on a review of selected case studies of existing planned communities with a sustainability focus, a smaller sample of intensive, field-based case studies of sustainability practices in planned communities in the region with similar environments to *The Sustainable City*, and dialog and assessment engagement with *The Sustainable City* itself during its first year of operation. The objective of the research effort is to identify and adapt best practices for promoting a culture of sustainability at *The Sustainable City*.

This report presents the preliminary results of the first phase of the research. This includes a review of the concept of sustainability as it has been applied to the design of planned communities since the 1980s and a comparison among 20 selected case studies of functioning planned communities with a focus on sustainability from around the world. The results of the comparison are summarized and discussed in terms of their potential application in *The Sustainable City* in Section 5 of the report. Annex 1 of the report provides a brief synopsis of each case study community, with source material for the cases at the end of Annex 1. Annex 2 presents a brief summary of some other examples of planned communities with a sustainability focus that are of interest to the study but were not included in the comparison because of one reason or another, such as lack of adequate documentation or lack of a clear sustainability vision or plan.

This is the first report in a series of reports produced by the project. The second report will present the results of a number of in-depth cases studies of communities with a sustainability

focus located in Egypt in a climate and natural environment similar to that of *The Sustainable City*.

Section 2. Sustainability Concepts and Community Models

Sustainability is the capacity to continue or persist indefinitely. The idea of applying the sustainability concept to human communities achieved global prominence with the publication and wide dissemination of the report *Our Common Future* by the United Nations World Commission on the Environment and Development in 1987. The Commission's definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987:43) has been universally accepted. The emphasis is on meeting human needs now and in the future. In this sense, sustainability is a social issue, not an environmental issue. However, in the report's detailed discussions and conclusions environmental and economic concerns are given an importance equal to social issues. Together, they form the three dimensions of sustainable development. The commission stressed the importance of maintaining a dynamic balance among the three dimensions and the interdependent nature of their relationships. Without conserving and nurturing the environment, neither human society nor economy is sustainable in the long-term. Without a solid economic system that provides for the built environment and physical infrastructure humans need to continue their social existence, as well as trade and commerce and investment, humans cannot sustainably manage their environments nor maintain their social organization and institutions. A sustainable society is a society that respects the principle of equity among its members in both economic and environmental concerns.

The Rio Earth Summit in 1992 adopted the *Rio Declaration* that formally recognized many of the principles of sustainable development presented in *Our Common Future*. The Rio Declaration lists a total of 27 Principles (United Nations 1992). Among these, five principles are commonly cited in the sustainable development literature. They are The Principle of Intergenerational Equity, The Principle of Environmental Justice, The Participatory Principle, The Precautionary Principle, and The Principle of Shared but Differentiated Responsibility. These principles have become incorporated in various ways in the growing global sustainable community movement.

When the sustainability concept is applied to human communities, a sustainable community is defined by Hart (1998) as a community that is able to continue indefinitely within its environment. The community nourishes its members and the environment. It allows all its members to flourish. A sustainable community is not static, but dynamic and constantly changing as it adjusts to the changing needs of its members and the environment. Natural environments are not static, and neither are sustainable communities.

In fact, examples of sustainable communities have been around for hundreds, if not thousands, of years. However, most historical examples have distinctive features that set them apart from the rest of society. In general, this apartness is what defines these communities. Often they are closed religious communities, but they may have other attributes that set them apart, such as a physical characteristic or a shared utopian vision

among community members that segregate them from the rest of society. Because of the separateness and social exclusion aspects of these communities, they are largely not relevant when considering the range and complexity of contemporary planned communities with a sustainability focus.

In the decades since the publication of *Our Common Future*, a number of sustainable community models, including methods to achieve the sustainability goal, have emerged. To a greater or lesser degree, the alternative models of sustainable community have been applied in hundreds of cases around the globe. Most of the examples, however, are found in Europe and North America, the two continents in which the models themselves were first developed.

One of the earliest models of a planned community explicitly incorporating sustainability principles was presented by Karl-Henrik Robert of Sweden in 1989. Under the title “**Eco-Municipalities**,” the model stresses the importance of a shared vision among community members, strategic planning, measureable objectives, monitoring, and continued member participation as the community moves towards achieving sustainability). Robert gave the name **The Natural Step** to his approach to achieving sustainable communities. He starts with what he terms “Causes of Unsustainability” and builds the community sustainability plan around solutions to these four problems (TNS 2000):

1. Increases in concentrations of substances extracted from the Earth’s crust
2. Increases in concentrations of substances produced by society
3. Increases in the physical degradation of ecosystems
4. Increases in the barriers for peoples’ capacity to meet their needs.

It follows that the community vision and action plan is organized into actions to eliminate the four causes of unsustainability at the community level. The first three causes are essentially linked to environmental indicators, including the need to reduce and eliminate pollution, waste, and loss of resources. The fourth combines the Rio Declaration sustainability principles of Intergenerational Equity, Environmental Justice, Participation, and Shared Responsibility.

The Natural Step methodology is intended to enable existing communities to become eco-municipalities that are more and more sustainable over time, with sustainability measured against concrete environmental, social, and economic indicators. To date, the Natural Step model has been adopted mainly by municipal governments. Reportedly, there are over 70 cases of eco-municipalities implementing sustainability plans in northern Europe and North America. In addition, a number of multi-national corporations operating in Sweden have adopted the Natural Step model to reach their own corporate sustainability goals. These include IKEA, Scandic, and Starbucks.

In 1975, a decade before the word sustainability became popular, Richard Register started the **Urban Ecology** movement which later evolved into the vision of **Eco-Cities**. The principles of urban ecology have had a major influence on subsequent national and international efforts at urban revitalization, re-development, and sustainability. Eco-Cities follow 10 basic principles (Roseland 1997):

1. Revising land-use to create green, diverse, safe mixed use communities
2. Revising transportation priorities to favor alternatives to automobiles and emphasizing proximity

3. Restoring damaged urban natural ecologies, such as creeks, wetlands, shore lands, etc.
4. Creating decent, affordable, safe, and convenient housing for a diversity of residents
5. Nurturing social justice and creating improved opportunities for the disadvantaged
6. Supporting local agriculture and community gardening
7. Promoting recycling, appropriate technologies, and resource conservation
8. Working with businesses to support ecologically sound economic activities
9. Promoting simplicity and discouraging excessive consumption of material goods
10. Increasing awareness of environment through activities and educational programs

As with eco-municipalities, eco-cities are essentially projects designed and implemented by municipal governments or local authorities that focus on vision, strategy, plans, and implementation along the three dimension of environment, society, and economy. It is assumed, either implicitly or explicitly, that there is a high degree of participation by community members in the planning process and in the implementation of the plan, as well. In contrast with The Natural Step model and methodology, the Eco-City concept has remained largely within the realm of academia, although a number of USA cities and towns espouse its principles of environmental responsibility and social inclusion in their public policy statements. The Eco-City concept has also been noticeably influential in the formulation of USA federal government programs to revive and re-develop decayed urban neighborhoods and small town communities (see below under Sustainable Communities Initiative). However, there is no single development organization identified with the implementation of the eco-city methodology as there are in the cases of The Natural Step, Ecovillages, or One Planet Living models.

The term “**Ecovillage**” was first introduced by George Ramsey in 1978. By 1995, there were enough adherents to the vision that a **Global Ecovillage Network** was organized following a conference in Findhorn, Scotland, the location on one of the earliest and most established Ecovillages. Some twenty years later, there are dozens of Ecovillages located mostly in North America and Europe. The Global Ecovillage Network has since become something of a clearinghouse of information and initiatives relating to the establishment and functioning of ecovillages worldwide.

Ecovillages are a type of “intentional community” founded with a specific purpose (Ergas, 2010). They are generally small in population and are intended to build community among their members and practice ecological sustainability. Ecovillagers are characterized by agreed common values, well established goals, and shared collective identities. Ecovillagers are committed members of their communities, and there is a high degree of social bonding and reciprocity among members of an Ecovillage. Ecovillagers espouse the mission of spreading awareness of sustainable living and leading by example. An associated feature of Ecovillages is environmental activism. Ecovillages are not withdrawn or isolated from the wider society. Rather, Ecovillages frequently have strong outreach programs. It is commonplace for Ecovillages to offer formal educational and training programs in sustainable living to the general public. Indeed, these programs often provide a source of additional income to the communities, as well as fulfilling the purpose of educating and spreading awareness of sustainability. Ecovillages tend to be located in rural or peri-urban areas and to focus on agriculture and sustainable food systems and diminished excessive use of natural resources. However, urban Ecovillages do exist, usually as neighborhoods within larger urban

settlements. In these cases, urban Ecovillagers tend to be civically engaged and more integrated with the larger society.

In summary, Ecovillages display the following characteristics (GEN n.d.):

- Non-governmental, non-commercial grassroots initiatives
- Residents value and practice communal living (often with communal meals)
- Residents try to minimize government, corporate, or other external sources of resources (such as water, food, energy, etc.)
- Residents have strong sense of shared values, sometimes expressed in spiritual terms
- Villages often serve as research and demonstration sites, with educational experiences for others (classes in sustainable agriculture, renewable energy, ecological buildings, etc.)

It is important to note that, although the Ecovillage movement certainly lays great stress on environmental sustainability (sharing much in common with The Natural Step approach), Ecovillages are also very much in the tradition of other social movements that stress identity, community, and shared values. It is impossible to be a member of an Ecovillage without full personal commitment to one's responsibilities as a member of a tight-knit community. However, in contrast to other intentional communities, such as religious or utopian communities that strive to be self-contained and holistic, Ecovillages are very much engaged and active in the society around them.

The Global Ecovillage Network (n.d.) has developed a set of indicative guidelines called the "Community Sustainability Assessment" that stresses participation in design and planning, sense of community and mutual support, shared common vision, ecologically sound environmental practices, and ethical economic practices. These guidelines can be usefully compared with other indicator guidelines such as those provided by Hart (1998) and Berg and Nycander (1997). However, after reviewing the implementation of indicator monitoring and evaluation programs in five communities Gahin, et al. (2003) concluded that the indicators, *per se*, are not so important in achieving progress toward sustainability as is the process of developing and publishing the indicators within a community. Of course, without actions associated with improving the initial indicator conditions, progress will not be achieved.

In 2003, The UK registered entrepreneurial charity BioRegional and The World Wildlife Fund (WWF), a global environmental NGO, joined forces to develop and promote **One Planet Living** (Riddlestone and Desai, n.d.) The name comes from the concept of the ecological footprint, a quantitative measure of the impact of individuals based on their lifestyles and consumption patterns. According to the estimated ecological footprint of the average UK resident, it would take three planet Earths, not just the one we live on, to support our present consumption of the Earth's limited resources. Hence the name, which is based on the sustainability goal of simple, but high quality lifestyles, that are maintained through reduced material consumption and the sustainable use of resources at a level that can be sustained by just one planet Earth. There are obvious conceptual linkages between One Planet Living and the urban ecology movement.

Based in part on BioRegional's experience working with the BedZED Ecovillage project in London, One Planet Living consists of ten principles of sustainability, as well as a

methodological approach to achieving these sustainability goals. The ten principles include broad, but by now commonly-recognized, standards of sustainability (Riddlestone and Desai, n.d.):

1. Zero carbon (renewable energy and increased energy efficiency)
2. Zero waste (reduced waste production, reuse and recycling, and zero use of landfills)
3. Sustainable transport (low carbon modes of transport, reduce need to travel)
4. Sustainable materials (low energy embodied construction and consumer materials)
5. Local and sustainable food (low impact local sources and reduced waste)
6. Sustainable water (more efficient water use, no water pollution)
7. Land use and wildlife (protect and expand habitats, create new wildlife spaces)
8. Culture and heritage (revive local identity and wisdom, support participation in arts)
9. Equity and local economy (inclusive workplaces, equitable pay, local fair trade)
10. Health and happiness (encourage active, sociable, meaningful lives for good health and well-being)

BioRegional works primarily as a consulting agency for sustainable community projects around the world. Its flagship project, BedZED, is a mainly residential housing project in south London owned by the Peabody Trust in which BioRegional served as the principal consulting firm to address sustainability in the operational design and implementation. BedZED has won numerous UK and international awards as a model of sustainable urban living, and this recognition has been the springboard for the spread of the One Planet Living model worldwide. Other One Planet Living communities are developed with local government authorities, cooperatives and charitable foundations, or with private property developers with an interest in sustainability goals. There are presently twenty or so One Planet Living communities now operating or being constructed. They represent a diversity of community types from urban mixed use residential neighborhoods, to larger-sized suburban and peri-urban communities, to rural tourist destinations employing workers from surrounding village communities. BioRegional is working with local government authorities, cooperatives and charitable foundations, and private developers, all of whom want to create sustainable communities that meet the One Planet Living vision.

The One Planet Living model is actually a process that consists of three continuous-improvement activities (Riddlestone and Desai, n.d.):

1. Gathering information about the present situation and identifying opportunities to meet the standard sustainability targets of the One Planet Living vision
2. Preparing a One Planet Action Plan and revising it as required in later years
3. Implementation of the plan and monitoring annual progress.

Consistent with the founding vision of reducing the ecological footprint to “one planet” levels and achieving carbon neutrality, BioRegional emphasizes planning to reduce overall energy consumption, increase the use of renewable energy sources, and other specifically environmental indicators in its projects. However, recently projects have included more explicitly social targets, such as accessible and equitable housing options for socially and diverse communities. To an extent, these social sustainability concerns appear to reflect the priorities of BioRegional’s local government or cooperative partners, rather than being integral to the general One Planet Living model.

National governments are increasingly prominent in global discussions and actions regarding sustainable communities. In 2003, the United Kingdom launched its **Sustainable Communities Plan**. This is a major Labor government initiative aimed at urban rehabilitation and affordable housing. According to the Plan, a sustainable community is characterized by (Power, 2004):

1. A healthy environment, minimal waste and pollution, and maximum recycling
2. A prosperous economy with minimal resource use and environmental impact and a focus on local jobs and local services
3. Social well-being with safety, security, belonging, support, neighborliness, social cohesion, and integration.

The building block measures of sustainable communities consist of adequate planning and design; minimal energy use and environmental impact; viable local economy; and community organization and neighborhood impact. The Sustainable Communities Plan is being implemented through a series of public-private partnerships in which government agencies and local authorities contract with private companies and foundations to implement projects. Most of the projects being implemented are cases of brown-field urban redevelopment with former industrial areas being converted into mixed use residential communities.

In 2009, the Obama administration announced the launch of **The Sustainable Communities Initiative** (Bent, et al., 2015) with major funding being provided by three federal departments: the Department of Transportation, Housing and Urban Development, and the Environmental Protection Agency. The Sustainable Communities Initiative is based on six “Principles of Livability” (Marsh, 2014):

1. Transportation choices
2. Affordable and equitable housing
3. Economic competitiveness
4. Supporting existing communities
5. Coordinating and leveraging federal policies and investments
6. Valuing communities and neighborhoods to make them healthy, safe, and walkable.

The Sustainable Communities Initiative provides grants to local communities for projects addressing one or more of these principles. The Initiative has also established a Sustainable Communities Learning Network with the Institute for Sustainable Communities (based in the State of Vermont) as the network coordinator. Dozens of communities have taken advantage of the funding and technical assistance opportunities afforded by the Initiative. Many of the projects are specific to a single livability principle, such as public transportation choices, but there are a number of cases in which major re-developments with a comprehensive sustainability theme are being supported.

This brief state-of-the-art review of major themes and developments in applying sustainability concepts to planned communities is given in order to provide background to the method and selection process for the case study comparison among planned communities that follows. Because of their prominence among contemporary communities of this type, we included a number of communities applying either The Natural Step, Ecovillages, or One Planet Living model and methodology in their efforts to achieve sustainability.

Section 3. Case Studies Selection and Comparison

The following sections present the results of a comparative review of twenty selected case studies of planned communities that claim to focus on sustainability as a goal. This is a purposive sample. Our purpose was to select a diverse range of cases relevant to the vision of *The Sustainable City*. Our criteria included communities that are currently operational and can demonstrate reasonable success toward meeting their sustainability goal. In addition, adequate documentation and available information were essential criteria for inclusion in the sample. If adequate documentation on the case was not available, we did not include the community in our comparative sample. Similarly, if the community did not have a clear vision statement including sustainability concepts nor a concrete plan and measures to achieve sustainability, then we did not include it in our sample. However, we did identify a number of communities that did not meet all our selection criteria that are of interest in terms of including sustainability in designing planned communities. These examples are included in Annex 2 Sustainability Projects Not Included as Community Case Studies.

Among the cases meeting our initial criteria, we selected for diversity within a range of parameters. These include:

1. Location (climate, soil, water, coastal, inland, etc.)
2. Population size (small <1500; medium; large >10,000)
3. Situation (urban, peri-urban/suburban, rural)
4. Development type (pre-existing, re-development, new)
5. Economic context (destination, mixed use, and self-contained)¹
6. Financing (public/municipal, public-private or co-operative, and private)².

Although not included in the sample, *The Sustainable City* would be classified by these selection parameters as arid hot desert, medium-sized population, peri-urban location, new development, mixed-use, and privately financed. We could find no case meeting the same description in the available literature on planned communities with a sustainability focus. There are, of course, many new proprietary mixed-use developments in urban areas of the Middle East and North Africa, but very few of them have a sustainability focus. We believe that *The Sustainable City* is almost unique in this regard.

Table 1 lists the twenty selected cases and categorizes each by the six parameters listed above. Virtually all the cases are located in temperate or continental climate zones in the northern hemisphere. The majority (16) are in humid areas with medium precipitation levels.

¹ Economic context is based on a continuum from economically dependent on external factors (such as tourism for destination communities or commuting for bedroom communities) to minimal reliance on external economic factors (such as a self-contained rural farming community).

² Public-private cases generally include a contractual agreement between a government agency and a development organization (either a private corporation or a not-for-profit NGO) that is implementing the community development plan. These agreements specify conditions under which the development project will be implemented. Generally, they also include arrangements for community management following construction completion. Communities governed by a co-operative organization are included in the Public-Private category.

Table 1. Community Case Study Parameters

Name	Climate	Population size	Situation	Development Type	Economic Context	Financing
BedZED	Temperate humid	244	Urban	Re-development	Housing	Co-Op
CloughJordan	Temperate humid	140	Peri-urban	New	Self-contained	Co-Op
Dancing Rabbit Ecovillage	Continental humid	40	Rural	New	Self-contained	Co-Op
Ecovillage at Ithaca	Humid subtropical	240	Rural	New	Self-contained	Co-Op
Findhorn Ecovillage	Temperate humid	300	Rural	New	Self-contained	Co-Op
Fujisawa SST (Smart Sustainable Town)	Humid subtropical	660	Peri-urban	New	Housing	Public-Private
Greenwich Millennium Village	Temperate humid	2300	Urban	Re-development	Mixed Use	Public-Private
Grow Community	Maritime Humid	80	Peri-urban	New	Mixed Use	Private
Hammarby	Continental humid	17,000	Urban	Re-development	Mixed Use	Public-Private
Holiday Neighborhood Boulder	Continental semi-arid	1,288	Peri-urban	New	Mixed Use	Public-Private
Houten	Temperate humid	43,900	Urban	Re-development	Mixed Use	Municipality
Mueller	Temperate	13,000	Peri-urban	Re-development	Mixed Use	Public-Private
OUR Ecovillage	Maritime Humid	60	Rural	New	Self-contained	Co-Op
Sanford Walk	Mediterranean	125	Urban	New	Housing	Co-Op
Sonoma Mountain Village	Mediterranean	4,400	Peri-urban	Re-development	Mixed Use	Private
Tsukuba Science City	Humid subtropical	214,660	Urban	New	Mixed Use	Municipal
West Village, UC Davis	Mediterranean	2000	Peri-urban	New	Housing	Public-Private
Vastra Hamnen	Continental humid	4,326	Urban	Re-development	Mixed	Public-Private
Vauban Freiburg	Temperate	5,000	Peri-urban	New	Mixed	Public-Private
Whistler	Temperate Alpine	9,824	Rural (small town)	Existing	Destination	Municipality

One community is in the semi-arid area of Colorado and three are in the Mediterranean climatic zone of California.

In terms of population size, 9 of the 20 are small and less than 1,200 residents. Eight are classified as medium, and three are large with over 15,000 residents. Tsukuba Science City is by far the largest (and, in fact, the largest representative worldwide) with over 200,000 residents.

The sample includes 5 rural communities (4 of which are small and one medium sized), 9 peri-urban or suburban communities (3 small, 6 medium), and 6 urban communities (2 small neighborhoods, 2 medium, and 3 large).

Our sample includes 12 cases of new development communities, 7 cases of re-development of urban or peri-urban sites (usually former industrial sites), and one case of an existing community deciding to develop and pursue a sustainability strategy to improve its prospects for survival in the 21st century.

There are 4 cases that are predominately communities established for residential housing in which people commute off-site for work and employment and one tourist destination community dependent on visitors for its economic vitality. Ten communities are mixed use with housing, commercial, and limited industrial uses. There are 4 rural and one peri-urban small Ecovillages in the sample that strive to be self-contained and achieve economic self-sufficiency through food production and provision of services.

The sample included four mechanisms for financing community development. Eight of the 20 cases were established through Public-Private Partnerships. In general, these are cases in which a public authority (local or national government) decided on the project and set the general design, construction, and operational parameters. The authority then contracted with private (profit or not-for-profit) firms to build and operate the project. These cases represent both small and medium communities with urban and peri-urban locations. They are mostly mixed use, but 2 cases are housing estates. Seven cases were developed by cooperative associations. Mostly, this is the model followed by the small Ecovillages, with each resident also being a shareholding member of the cooperative that manages the community.

Three of the cases are independent municipalities that can raise taxes and other forms of public financing. There are two cases of private developers building and managing the community. Both cases are in the USA and involve BioRegional as consultants in developing and implementing their sustainability strategy.

Regarding the development and implementation of a formal sustainability plan, 5 of the cases follow the sustainability principles and goals of the Ecovillage Network, 3 cases follow the 1 Planet Living guidelines through association with BioRegional, 4 cases follow a published national policy framework (2 in Sweden and one each in the UK and the Netherlands), and one case is implementing the Natural Step approach. The remaining 7 communities follow their own, independent approach toward sustainability but nonetheless have a formal plan and implementation procedure. However, a number of the “independent” approaches are strongly affected by local context, especially public funding opportunities arising from

national, state or regional, and local government policies and programs, such as funding and grant programs to increase housing affordability, diversity among residents, reduced energy consumption, implementation of renewable energy solutions, and offering alternative transportation options, etc. The Peabody Trust, the owner of BedZED, achieved a landmark in the UK as the first developer sold land by a local government authority at below market value because the proposed development on the land would be a sustainable, low-carbon community.

Section 4. How Communities Operationalize Sustainability

It is obvious from our sample communities that there is no single, commonly accepted definition of sustainability, let alone what constitutes a sustainable community. For the most part, each of our cases was designed and implemented for a different set of purposes and circumstances. A variety of methodological approaches were used. However, we also noticed some striking patterns of similarity within the sample. In this section, we will look at these similarities within the wider diversity of cases.

The comparison is organized along five dimensions. The first is the vision of sustainability and the nature of the plan to achieve the identified objectives. The second dimension is the environmental aspects of sustainability and how these are articulated in the community design and sustainability plan. The third and fourth dimensions deal with social and economic aspects, respectively. The fifth dimension is implementation of the plan and monitoring and evaluation of progress in achieving the sustainability objectives.

The Vision of Sustainability

We selected only communities that included sustainability in their vision of what they want to be and how they want to present themselves to others. Many, though certainly not all, provide a specific definition of sustainability in their vision and/or mission statement. A slightly smaller number provide an explicit sustainability goal around which community design and/or operational plans are organized. The most frequently mentioned single sustainability objective is “zero carbon” or “carbon neutral.” This is followed by “low environmental impact.” Second in frequency, following environmental indicators, is “sustainable community.” It is common to have such qualities as “equity,” “inclusion,” “cohesion,” “well-being,” and “affordability” mentioned as social sustainability indicators. Perhaps not surprisingly, several government funded “sustainable community” projects include a fixed percentage of low-income housing within the community as an indicator of sustainability. A distant third in the sustainability rankings are economic concerns. When mentioned, economic concerns usually relate to levels of employment and income generation within, as opposed to outside, the community. Commuting behavior of community members in terms of mode, distance, and frequency is sometimes also included as an economic and/or environmental indicator.

Given that most of the case studies are either new developments or re-developments seeking to recruit new residents to the community, it is not surprising that a number of sustainability visions combine low environmental impact (reduced carbon, reduced consumption) with an

improved lifestyle or quality of life. Prospective home buyers or renters are encouraged to believe that an environmentally sustainable community is also a socially and economically more rewarding and enjoyable place to live. Life in a sustainable community is safer, healthier, and happier than life somewhere else.

We selected only communities with evidence of a sustainability plan linked to their vision of sustainability. Like the visions, the sustainability plans display a variety of formats and operational programs. As previously mentioned, community plans often reflect recognizable models, such as the Ecovillage model, One Planet Living, or The Natural Step, or national sustainable community programs. Seven out of twenty, however, have developed their own plans and programs independently of standardized models. Among the standardized models, One Planet Living is the most prescriptive in terms of sustainability targets and indicators to reach them. Less uniform in terms of planning and procedures are The Natural Step and the national sustainability plans. Least precise in terms of plans and outcomes are the Ecovillages, although the basic sustainability visions and community constitutions in terms of governance and economic structures are much more consistent among the Ecovillage cases than any other group of selected cases.

Community sustainability plans typically contain a list of objectives or target conditions to be reached over a period of time, usually following the formula “by the year so-and-so, we will have reached a condition such-and-such.” The condition may be either quantifiable (reduced amount of carbon emissions, increased proportion of energy from renewable sources, percentage of low-income residents, etc.) or qualitative (quality of life, satisfaction, informed choices, empowerment, community cohesion, participation, etc.). All good plans include indicators to measure progress towards achieving the desired target, demonstrate the logical link between the indicators and the objectives, and establish ways to collect data pertinent to the indicators. Progress is usually reported in annual reports issued by the governing body of the community.

Communities following the One Planet Living model publish annual reports showing their progress in achieving the common goals of carbon neutrality and reduced material consumption. Reports also include indicators of individual community interest such as energy sources, water consumption and reuse, transportation modes, rate of appliance replacement, waste management, and food supply. Some, but certainly not all, One Planet Living reports include qualitative indicators such as quality of life and community satisfaction (cf. BedZED).

Eco village reports focus on common Ecovillage targets: simple living, low environmental impact, self-reliance, and outreach activities. The Ecovillage at Ithaca community, for example, uses indicators such as the number of community members employed outside the village; the amount of solid waste that leaves the village; the amounts of energy, water, food that the community imports; and other indicators of community self-reliance.

Following The Natural Step model, the Canadian resort community of Whistler has perhaps the most elaborate plan, monitoring, and reporting system of all the communities in the sample. As a mountain ski resort in the Canadian Rockies, Whistler depends economically on its natural environment to attract visitors who patronize its local businesses. Their sustainability plan “Whistler 2020” is extremely detailed, with targets and indicators in many areas. They employ the standard quantitative production and consumption indicators for

environmental conditions, but they also utilize a considerable number of statistical indicators for social and economic conditions. More qualitative measures are used for issues relating to quality of life, such as satisfaction with income among Whistler residents, recreational satisfaction, satisfaction with health and educational services, interactions with tourists (principal source of income in this resort community), and so forth. Whistler has devised and publishes annually the results of their “community life tracking survey” to document their progress toward being a socially and economically sustainable community.

Operationalizing the Environmental Dimension

Most of the sustainability measures applied by communities were directly linked to natural resources and environmental quality. The most common measures and indicators related to either energy or transportation. Water, solid waste, and food systems were also part of the environmental aspect of sustainability designs and operational plans, but not as often as energy and transportation. Some communities measured their progress in the environmental dimension with indicators like the ecological footprint per person, energy consumption per household, water use, waste production, car ownership, and daily mode of transportation.

Energy

Improved energy efficiency and utilizing energy from renewable sources were the most common indicator of sustainability. Seventeen out of the twenty communities surveyed employ solar energy on-site in some way, either through PV panels or solar water heating systems. In locations where net metering can be employed, communities are linked in and feed surpluses to the grid. In other cases (often rural Ecovillages) there are off-grid solar and/or wind turbine systems using battery storage. Dancing Rabbit Ecovillage created a village-wide power cooperative called Better Energy for Dancing Rabbit (BEDR). BEDR was authorized by the community to connect the mainstream grid as long as it committed to exporting twice as much renewable power to the grid as the non-renewable power it imports. This allows BEDR to utilize the grid as if it were a large battery bank and thus avoid the expense and environmental impact of battery systems. This system goes beyond net-zero to have a positive energy balance and impact on the world.

In the Mueller community, an electric garden of “sunflowers,” flower shaped PV panels, provide electricity for the development and feed into the national grid. Excess solar energy also feeds into the grid from Fujisawa. The Findhorn Ecovillage supplies energy from four wind turbines. They have also installed a 250 kW biomass boiler, reducing their emissions by 80%. Other communities that contain a biomass plant to generate heat for hot water and electricity are BedZED, Cloughjordan Ecovillage, Greenwich Millenium Village, and Sanford Walk. Hammerby and Vauban extract biogas to generate electricity from sludge and sewage, whereas Sonoma and Whistler use biodiesel for their machinery and vehicles respectively.

Transportation

In addition to energy related innovations, almost all of the selected communities focus on the transportation sector and the development of alternative modes of transportation. Communities explicitly link transportation modes to energy consumption and carbon emissions. Depending on situation and size, a number of communities mandate “no cars allowed,” others greatly restrict automobile parking or charge high fees, and car- and/or bike-

sharing systems are common. BedZED offers its residents free bicycle repairs. BedZED, Cloughjordan, Dancing Rabbit, Findhorn, Fujisawa, Hammarby, Holiday Neighborhood, Houten, Vastra Hamnen, and Vauban all provide car-sharing programs, which reduce the need for owning a personal car. Many of these car-sharing clubs deliver zero-emissions electric vehicles. Fujisawa provides electric cars, electric scooters and electric bicycles, all under their mobility sharing program. Residents who join the car-sharing scheme in Vauban receive a one-year discount on a public transportation pass. Communities that are completely or nearly car-free include Vastra Hamnen, the Ecovillage at Ithaca, and Vauban. The Holiday Neighborhood offers an annual transit eco-pass to allow free, unlimited access to all local express and regional bus and light rail routes in the Greater Boulder, Colorado area. Tsukuba, Greenwich Millennium Village, Hammarby Sjostad, Holiday Neighborhood, UC Davis West Village have community bus programs.

Grow Community, Hammarby, Houten, and Tsukuba have bicycle sharing programs. The Houten program in the Netherlands is the strongest and most rigorous bike-sharing program in the sample, and this “sustainable city” was deliberately built to prioritize the cyclist. The public bikes, The Houten “OV-Fiets” bicycle sharing scheme charges per 24-hour period, encouraging riders to continue using the bicycle beyond working hours, while simultaneously keeping cars off the road for longer periods of time. Each bike comes equipped with a lock, making it possible to park the bike away from the rental station and use it throughout the day to run errands. In the Netherlands, companies are required to compensate employees for their transport to work. Houten restricts companies from offering compensation for car travel, to further incentivize bicycle use. Houten employees can purchase a tax-deductible bicycle every three years. Houten was so successful in its promotion of bicycle transportation that it had to go back and construct more bicycle parking facilities, especially around the central train station and city center. In Sanford Walk, residents built their bicycle storage area from reused old wooden railway sleepers, in order to avoid producing excess construction waste.

Water

Sustainable water management is a common feature in almost all the case study communities. Not surprisingly, given that most of the communities are located in fairly humid climates, rainwater harvesting and storm drain collection are common measures to improve water supply and reduce water loss. Hammarby in Sweden also uses green roofs and rooftop gardens to reduce rain and storm water runoff from its buildings. Water re-use is also a common sustainability measure. Dancing Rabbit, Mueller, Vauban, and O.U.R. Ecovillage treat their wastewater for use in landscape irrigation. Findhorn Ecovillage boasts a biological “Living Machine” wastewater treatment system. The wastewater in Hammarby wastewater feeds its municipal biodigester plant to provide energy for heating and cooling. West village and BedZED have installed water saving toilets and showers.

Solid Waste

All the communities include solid waste management in their sustainability plans. Waste sorting at source is present in all the communities. But some communities have developed sophisticated waste sorting systems and recycling initiatives. In BedZED, home kitchens are equipped with divided waste bins to promote sorting waste from the start. All the Ecovillages plus BedZED have community composting schemes for organic waste, which is

used in community gardens and allotments. In Hammarby the combustibles of household waste are incinerated for heating and electricity. The waste bins in Hammarby are linked to underground pipes to a central collection station, where the solid waste is transported by vacuum suction. This avoids having a waste truck driving in the residential areas.

In order to reduce the amount of solid waste, Ecovillage at Ithaca initiated a “reuse room” where one can donate clothing, shoes, and some household goods. Anything which is not taken from the room is donated to charity. Whistler also initiated a similar system, “Whistler's Reuse-It Center,” which accepts used household items, furniture, building materials and packed food to redistribute to people in need.

Food

Community allotments that allow residents to grow their own food are a frequent feature of sustainability plans. Not surprisingly, either allotments or a community farm is found in all the rural Ecovillages. In Cloughjordan 50 acres of individual allotments are provided for growing food. In the Ecovillage at Ithaca, housing is allowed on only 5% of the 200 acre site, with two community farms on 95% of the land supplying the residents and the surrounding communities with food. In O.U.R. Ecovillage nine acres of land are dedicated for food production. Because of the lack of good soil, most of the farming is done intensively in raised beds with sheet mulching utilizing recycled cardboard and yard waste. The urban BedZED community has both plot allotments scheme and a vegetable box delivery scheme for its residents.

In addition to food production, a number of communities include food supply systems in their sustainability plans. Local farmers markets are a common feature to encourage consumption of food produced locally and avoid the energy and carbon costs of transporting and storing food from distant locations prior to consumer sale. Another measure is to require food sellers and supermarkets in the community to provide only food items that meet various certification standards relating to food safety and sustainability.

Carbon Footprint

Carbon footprint or level of CO_{2e} is the most common single environmental indicator in the sample of twenty community sustainability plans. Most seek to reduce their carbon footprint, but a few aim to become a carbon neutral or even a zero carbon community. (Carbon neutral means that the community has a net zero balance between its use of carbon emitting products and its production of non-emitting products plus its sequestration or carbon capture. A zero-carbon community uses no carbon-emitting products.)

For example, after Sanford refurbished and retrofitted the co-op, carbon emissions decreased from 228 tons in 2003 to 91 tons in 2008. Findhorn Ecovillage can boast an ecological footprint that is around half of the national UK average. A model carbon footprint study was done of the Somona Mountain Village compared to the California standard. BedZED and Vastra Hamnen aim to become carbon neutral communities, Grow community was perusing a zero carbon status. Talking about carbon neutrality and comparing between different communities is not really feasible or provable without data and baselines to make steps towards reducing emissions.

Operationalizing the Social Dimension

The social dimension of sustainability is the far more difficult to describe or quantify if compared to economic or environmental sustainability therefore it sometimes maybe a neglected element from the three dimensions of sustainability. The term Social sustainability is mainly used within the communities when the “formal and informal processes, systems, structures and relationships actively support the capacity of current and future generations to create healthy and liveable communities. Socially sustainable communities are equitable, diverse, connected and democratic and provide a good quality of life” (McKenzie, 2004)

Communities prioritize the social dimension of sustainability to different degrees and in different ways. Reflecting the relative importance given to the social dimension in the communities’ sustainability visions, the operationalization take various forms. It is difficult to make a quantitative comparison of the different practices, in large part because the underlying purposes are often very different from one case to another.

Nevertheless, a number of things can be stated that are true in all cases. For every case, the vision is more about community than about the environment or the economy. This emphasis is strikingly clear in the Ecovillages and the other co-operative communities. Government initiated projects use the phrase *sustainable community* with equal stress on the two words. The two privately developments also include social terms (community and village) in their titles. These are planned communities, and they are planned *to become communities*. If the plan is to re-develop an existing community, then the plan is to reshape an unsustainable community into a sustainable community.

If sustainability is about community, then the participation of people is the key to creating a community. Recognition of membership and participation in community life promotes changes in personal attitudes and behaviors that reflect the shared beliefs, understandings, and practices of the community as a whole. These shared qualities constitute the culture of the community. Insofar as the culture of the community is in harmony with and contributes to the formal sustainability vision and plan of action, then the community has a “culture of sustainability.”

Community begins with boundaries and a commitment to place. The community exists in space and has territorial boundaries. The community consists of members who recognize the attributes of membership and the responsibilities and rights of membership. Our planned communities are communities of choice. This is to say that members choose to be members. Therefore, there should be recognized benefits of membership, as well as incentives to remain a member.

For convenience, we have grouped the design features and indicators of social sustainability employed by the 20 cases in into eight categories: Identity; Diversity; Inclusion & Affordability; Participation, Education & Learning; Health & Safety; Recreation & Sociability; and Information & Communication. A number of cases included community coherence as an attribute of sustainability. We have included this indicator under both identity and participation.

Shared Community Identity

In order to develop a community that shares sustainability goals, there needs to be a strong community identity, boundary location, and membership qualifications. Name and affiliation are important items in establishing community. Slightly over half the cases incorporate a settlement term (community, village, neighborhood, town, city, etc.) in their name. Others publicize linkage to a wider sustainability movement such as Ecovillages, One Planet Living, eco-cities, etc. All the communities had a fixed location with physical boundaries. It was possible in each case to describe the boundaries and calculate the geographical area.

All the communities had membership requirements. Residence within the community boundaries was qualification for membership in all cases. However, some few communities included as members people who worked in the community but resided elsewhere. Whistler, for example makes a special effort to reach out to and include in its sustainability plans regular and seasonal employees who do not live in the community. They clearly do not, however, include tourists and casual visitors as community members. In some communities, particularly the Ecovillages, a high degree of social and economic participation in community life is a requirement for community membership. In others, residency alone is sufficient to become a member of the community, whether the member is integrated in some form of community life or not.

In all cases, it is clear that membership brings with it certain benefits and responsibilities, as well as incentives for continuing membership.

Diversity

Achieving a diversity of cultural background and socio-economic status among the community members was a stated sustainability goal of a significant proportion of the cases. This was a clear objective in all the government sponsored projects. The assertion was made in these cases that a diverse community was a stronger and more resilient community. Typically, diversity is achieved through various inclusion and affordability schemes relating to housing and provision of services, but mobility and access measures also can be focused on achieving the diversity target. Accessible and affordable public transport from home to work can encourage diversity among residents.

Notably, most of the Ecovillages do not stress the importance of diversity of membership. In fact, one gets the impression that this is not a priority. Rather, identification with the mission and a shared, communal lifestyle is more important. The small size and intensity of interaction within these communities probably do not encourage diversity of socio-economic status.

The bigger communities that offer commercial spaces and services like Vauban, Greenwich Millennium Village, Holiday Neighborhood, and Mueller boast considerable diversity within their social structure. Like BedZED and Whistler, they offer mixed tenure and ownership housing arrangements to accommodate different levels of household income. As mixed use communities, they include employees and other users within the community rather than keeping an identity as strictly residential communities.

Inclusion and Affordability

Affordable, social housing programs were common across our case studies as they were keen on creating healthy and socially diverse communities. Around 50% of BedZED's lodging is dedicated to low-income families (25% of this is social housing). Holiday Neighborhood's vision aimed to reduce the daily commute for the low- and middle-income workers who can't afford to live there by providing an affordable neighborhood with a high density of 20 units/acre. In Houten, 30% of the houses are required to be social housing. In the Mueller community, the Mueller Foundation was established to support affordable housing, offering 25% of the units to wage earners whose household income is below the Austin, Texas regional average. Whistler offers Price-controlled real estate to only resident employees and their families, ensuring that 80% of Whistler's workforce can afford living in the community. The Greenwich Millennium Village has planned for 1,377 homes of mixed-tenure—for sale, rent, shared ownership or managed by the Affordable Housing Association. To maintain a healthy balance between residential owners and tenants, the community has an ordinance disallowing bulk sales of housing properties to real estate speculators. Following the guidelines of the UK Sustainable Communities Plan, the Greenwich Millennium Village philosophy states that sustainable development is as much about establishing an inclusive society as it is about innovative design and architecture.

Participation

Virtually all communities recognize that members' participation is the key to building a strong and resilient community in which all members benefit and enjoy an improved quality of life. The forms the participation takes vary from one community to another. Participation is evident in the development of sustainability plans in a number of the communities. There are formal and informal modes of participation. Municipalities and public-private partnerships have members' associations of various sorts, ranging from home owners associations, to residents associations, to tenants association, to Chambers of Commerce, to school boards, etc. depending on what institutions exist in the community. More informally, communities have public festivals and celebrations, recreational days and sports events, town-hall meetings, and community forums. Volunteerism and voluntary associations are encouraged in many communities.

Although participation is encouraged and highly valued as a quality contributing to sustainability and the success of sustainability plans, we found virtually no case in which participation was quantified and evaluated for its contribution toward realizing sustainability targets. Whistler is a possible exception, since the municipality and its local non-governmental organization partners in the Whistler 2020 plan do keep records of public involvement and contributions.

Education and Learning

It is generally recognized in the sustainable community literature that education and life-long learning are important contributors to achieving sustainability goals. A strong education foundation instills a belief in the value of knowledge and understanding. Understanding imparts tolerance, trust, and respect. Life-long learning allow us to make informed choices so that we can adapt to a rapidly changing world.

For most of the communities studied, a formal educational institution (school, university, or institute) was an essential and integral component to their sustainability plan. There are also

good reasons why receiving an education in the community improves environmental and educational, as well as economic, sustainability. Likewise, having a center for life-long learning in the community was a common feature of the sustainability plans. The life-long learning centers took various forms. It may be a research institute with a community outreach program. It may be a themed museum that engages the community while attracting outside visitors. A training academy that provides non-degree courses in a range of subjects to community members and outsiders is another format for learning. Not surprisingly, most of the life-long learning institutions in the sample communities specialized in sustainability topics, including natural resource management, managing homes sustainably, sustainable food systems and healthy eating, living in green spaces and landscapes, etc.

Twelve of the twenty case studies have a continuing education facility that instructs and raises awareness not only among the residents of the community but also the surrounding communities. Educational initiatives and programs exist in the other eight communities, as well. Sonoma Village has become a major green destination, with 3-5 events with environmental themes each week at their Event Center. They held 200 events in 2014. The Event Center hosts groups with environmental and social sustainability missions and has become a kind of community center for NGOs and environmental groups. Findhorn Ecovillage has a Holistic Learning Center for residents and visitors. In the same vein, Hammarby Sjostad boasts an environmental education center to educate residents and visitors about the environment and sustainable living. Houten, the city in the Netherlands that was built to prioritize cycling over motorized transport, offers educational programs on bicycle health and safety. O.U.R. Ecovillage contains a Sustainable Learning Community Institute with a demonstration site for visitors to learn about natural building, sustainable food production, and leadership. The Ecovillage at Ithaca partners with nearby Ithaca College to provide field courses, educational tours and conferences about sustainability. Dancing Rabbit Ecovillage in Rutledge, Missouri offers a quarterly visitors program, in which the community opens up for one to three weeks for visitors to attend workshops and experience how it is to live in a sustainable society.

Health and Safety

Though the term health was used in many of the examined communities' visions it was almost not present in their sustainability plans or indicators. Ithaca, Cloughjordan, Sonoma, and Tsukuba all mentioned the term health in their vision but gave no practical application of how are they going to achieve a healthy life style. Grow community in their choice of building materials have chosen "healthier alternatives" without mentioning what are they. Houten approached health and safety from the mobility (transportation) perspective offering mobility health and safety programs.

Fujisawa is the only case that gave specific attention to the health and safety sectors. Medical clinics, elder care and nursery facilities inside their wellness square are all included in their sustainability plans. Fujisawa launched the local comprehensive care system that will present health services to the community members based on their health and treatment information. Fujisawa also paid great attention on the matter of the resident's safety.

In their mission to offer a safe environment for their residents Fujisawa decided not to be a gated community due to all the segregation entitled under the term "gated". Fujisawa wanted

to provide a safe, controlled environment for their residents, so Instead of being a segregated gated community Fujisawa decided to be a “virtual gated town”. This was done by replacing the physical wall around the town with a safety barrier of security guards and surveillance cameras. This allowed more outside access to the community and avoided the feeling of segregation between residents and other communities.

Recreation and Sociability

All the cases examined provided outdoor and indoor recreational spaces for the residents. Green spaces and landscaping are a common feature in all communities. A number of communities included sports and social clubs that members could join, although it is not clear in any of the cases if club membership is restricted to community membership. The larger communities, and especially those initiated by government entities, often include public parks and associated amenities.

It is specifically stated in all the sustainability plans that recreations and social intercourse among community members is an important indicator of sustainability, as well as a component of an improved quality of life.

Information and Communication

In a “community by choice,” communication and transparency are essential for recruiting and retaining membership. People like to feel that they know what is going on around them. This reduces anxiety, improves their sense of well-being and safety, and enhances their commitment to place. Providing an initial information packet to residents to help guide them through different matters related to sustainable behavior is common among the communities examined. New residents’ orientation sessions are also commonplace. In a number of cases, the community maintains an office and employs staff to inform and assist residents. In Sonoma Mountain village, the eco-concierge is the place and person where residents can get all of the details about how to lessen their impact on the planet and where to purchase special goods or hear about latest technologies and events. In the BedZED community, a green life information service and life style officers provide information and training for topics such as how to sort waste, save energy and grow your own food. The Fujisawa community offers a transportation oriented “mobility concierge,” who gives transportation options and advice and conducts environmental automobile inspections. Fujisawa created Soy link community interaction platform includes a resource request platform between residents, an alert function for neighbors to prepare each other in case of any common problem, a link to town stores, fan pages and a communication portal between town groups, clubs, and individual members.

In the Greenwich Millennium Village new residents receive a set of guidelines and a packet of information about sustainable living upon arrival. West Village launched residential engagement programs included monitoring the individual usage of each unit and building a personalized energy saving plan for each tenant, sending them messages regarding their usage via text, email, or door-to-door. Whistler initiated “Adopt-a-Youth program” which pairs first-year residents and seasonal employees with Whistler residents to embed a sense of community for new residents. At Ecovillage at Ithaca three meals are shared weekly with the rest of the community, adding a lot of common facilities, to enhance the community spirit.

Based on the experiences of the communities studied, establishing a central location for community members to receive information and find answers to questions is a best practice.

Operationalizing the Economic Dimension

All of the case studies are to a greater or lesser extent economic enterprises, but some clearly prioritize economic issues over others. The private developers who build and operate sustainable communities must return a profit on the enterprise or they will no longer be able to stay in business. Although they might create a sustainable community from the environmental and social dimensions, if the economic returns from the community are not sufficient, then the enterprise itself is not sustainable. Enlightened developers, whether they be proprietary owners or contractors, are seeking win-win situations in which they develop a sustainable community and simultaneously realize a financial profit from the enterprise. We have only two cases of a privately developed and managed community. There are seven cases in which the community is a government owned project being implemented by contracting companies, and one case in which the owner is a public university.

A second category of developer is not necessarily looking to make a profit. These are the not-for-profit cooperatives. Community owned cooperatives are the standard form of governance and economic organization in the five Ecovillages in the sample. Village residents are shareholders in the cooperatives that manage the community and run various enterprises associated with the community (such as farms, housing, shops, utilities, and even schools). As shareholders, elect members of cooperative governing boards. Depending on the size and complexity of the operation, managers may be elected or appointed by the board. Economic surpluses or profits are re-invested in the community. Similarly, deficits are collective liabilities. The community-as-cooperative model obviously works best in small communities where most of the residents personally know each other and all share a sense of belonging to the community and a common stake in its future. The intentionality and sense of mission that characterize Ecovillages certainly encourage cooperative management and economic organization.

Sanford Walk and BedZED, both urban residential communities, are owned by housing cooperatives. In the case of Sanford Walk, the cooperative is made up of the community residents, much like an Ecovillage. BedZED, however, is owned by The Peabody Trust, a large housing cooperative in London that owns and manages many properties throughout the metropolitan area. Whether in BedZED or not, all residents of Peabody properties must join the cooperative society. Peabody is a very large organization, and it can deploy economic resources among all its projects as needed. Unlike a self-contained Ecovillage cooperative, the BedZED community can draw upon Peabody resources in other locations and communities in times of need.

There are three cases in which the community is an independent municipality (or local government authority). These communities mobilize tax revenues and leverage central government funds to implement their sustainability plans. They often call upon private contractors and consultants to implement parts of the plan, but the plan as a whole is owned and managed by the municipality. Financial profit is not the objective of the municipality, but economic vitality is very much an objective. If the sustainability plan does not result in a

certain degree of public economic success and prosperity, then the municipal officials quite likely will lose their positions. We found the Whistler 2020 sustainability plan the most candid in terms of economic sustainability objectives. Whistler is a resort community that depends on tourism for the livelihood of its residents and local businesses. Their sustainability plan contains a number of clear economic indicators relating to number of visitors, hotel occupancy, tourist dollars spent, business licenses issued, employment generated, etc.

Stakeholders into Shareholders

A number of communities have sought to boost economic sustainability by turning stakeholders in the success of the sustainability plan into shareholders investing in the future with a promise of economic return. For example, the Greenwich Millennium Village project in London has announced that residents purchasing homes in the community will own shares in the company managing the community. The residents-as-shareholders approach has an appealing logic and may create a sense of shared ownership and corporate community among residents. However, a number of communities exploring this option also recognize that residential turnover, tenancy conditions, absentee owners, and property re-sales can all affect the degree to which residents can also be effective shareholders. A number of communities, in fact, have placed special conditions on the re-sale market and tenancy contracts in order to encourage residents to feel they have a deeper and more lasting stake in the future success of the community, resulting in a positive attachment and behavioral change towards a long-term commitment.

Economic Incentives for Community Members

The use of economic incentives was common between communities. One way was through offering incentives to encourage the members to act more sustainably. Mueller offered tax deductions and rebates to residential and commercial units that install different efficiency measures. Other type of economic incentives are directed toward the use of biking or mass transportation, such as community bicycle and car-sharing schemes. Some communities operate cooperative buses. Others have a discount card for the residents for use on public transport, recreational facilities, or local shops. The Findhorn community goes as far as having their own currency.

Job Creation and Business Opportunities

All the communities studied created new employment and business opportunities. While some, especially Ecovillages, targeted their own membership for community employment and opened new community-managed businesses, others recognized a social and economic gap between residents and outsiders working in the community on a daily or seasonal basis. Each community has addressed the question of whether or not to include those working in the community who are not resident in the community as community members. A number of communities have set aside housing designated for employees and encouraged those living outside the community and commuting to work to relocate and move into accommodation in the community where they are employed. Decreasing the number of commuters and increasing the number of residents employed in the community is seen as sustainable in several ways: environmentally by reducing travel emissions, socially by enhancing inclusion and social cohesion, and economically by decreasing travel and other costs borne by employees (or employers where travel to work is provided).

A newly emerging employment/business opportunity is working from home. High-speed internet connections and a robust ICT infrastructure in new communities has opened the field for many new enterprises and forms of employment. People conducting their professional and employment activities from home add to the sustainability of their communities in a number of ways. Travel time and costs are reduced. People tend to spend more time locally, including shopping, socializing, and recreation closer to home. The more time people spend at home, the more time they have to interact with and get to know their neighbors.

A number of the communities studied are quantifying these economic sustainability indicators relating to work and employment. Most are consciously trying to maximize the potential for residents to work in their home community. In Ecovillage at Ithaca, 45% of the workforce either works at jobs in the community or works from home. Sonoma Mountain Village's plan is to offer 3,300 new job opportunities for incoming residents. Hammarby has created 5000 job opportunities. BedZED, Mueller, Vauban, and Whistler are all providing incentives for employees to live locally rather than commuting.

The Cloughjordan Ecovillage has inspired its residents to initiate a few green enterprises, such as a coffee shop bookstore selling books on ecology and sustainability called "Sheelagh"; an educational NGO specializing in community resilience called "Cultivate"; a foundation for economic sustainability called "Feasta"; and "Django's" a 32-bed eco-hostel that holds an eco-label certificate from the Green Hospitality program. Grow Community residents create and invest in sustainable business opportunities, such as renewable energy, to generate revenue from the shared amenities.

Another common economic sustainability strategy is for the community to attract corporations and institutions to locate facilities in the community. Essentially acting as investors in the future of the community, private companies and public institutions can provide a major boost to sustainability by providing employment and services. Universities, research institutes, and hospitals anchor a number of the larger new and re-development projects among our case studies. In several cases, a partnership with an international corporation has made a significant contribution to economic sustainability.

Implementing the Sustainability Plan

The development and implementation of the sustainability plan is the responsibility of the governing body of the community. In general, we found that the most elaborate and well-developed plans were those associated with municipalities (3 cases) and public-private partnerships (10 cases) in which companies were contracted for implementation of the project and sustainability plan. Private companies (2 cases) did both planning and implementation. The remaining 5 cases were Ecovillages that had strong vision, mission, and direction, but planning *per se* was more opportunistic. However, the Ecovillages were notably good at reporting their accomplishments.

In some form or another, residents' associations were present in all the communities. The roles they played in managing the community and developing and implementing the sustainability plan differed greatly from one community to another. However, there are some

general patterns among the cases. The degree of resident involvement varied according to the founding vision, the ownership, and the management structure of the community.

The Grow Community, for example, is privately owned by the Asani Company, the main developer of the community, but it is governed and managed by the homeowners' association initially established by Asani. Residents organize themselves into "integration circles" to give the homeowners and renters a supportive place and a voice. In the other proprietary community, Sonoma Mountain Village, the consulting firm BioRegional was engaged to develop the community's One Planet Living Action Plan with the participation of community members and the developer. Implementation is through the community management unit.

The three municipalities, Houten, Tsukuba, and Whistler follow much the same approach. The municipal officials oversee the planning process, engaging with the public stakeholders in various ways (open hearings, commissions, committees, etc.), and seek to implement the plan also through participation of non-governmental organizations and civic groups.

The Public-Private partnerships vary from case to case. Fujisawa SST is a partnership between the Fujisawa governmental authority and the Panasonic Corporation. There is a management company formed for this purpose and a committee representing a community association. The committee is responsible for generating ideas and making recommendations vis-à-vis common spaces, security, maintenance, safety, environment and management of owned properties. This committee also plans festivals, events, seminars and public lectures. The management company provides services based on the recommendations of the committee.

Greenwich Millennium Village, a government re-development project under the national Sustainable Communities Plan, has a similar arrangement to Fujisawa. There is a management company that maintains the site and coordinates services. There is a residents' association that elects Residents' Directors have voting rights in the management company's decision-making process.

It is quite common among all cases that the resident's associations have a degree of management responsibility for the local public spaces around their homes in the community. These include pathways, playgrounds, green spaces, sitting areas, etc. Residents' associations generally set policy and rules governing these spaces, but the community management entity is responsible for implementation. Community associations also typically are involved in the organization of community events, and the associations are provided with meeting rooms and other facilities to conduct their meetings and activities.

As described earlier, almost all of the Ecovillages have a cooperative governance system. Findhorn Ecovillage is typical. There is a governing council of 40 members and a day-to-day management team of 11 people. They all meet regularly to discuss issues and engage in team-building activities. It should be remembered that the total population of the Ecovillage is only 300 people (children included). This means that about a quarter of the adult population is directly involved in community governance and decision-making. While a high degree of public participation may work in the small communities, it is clearly impractical for medium-sized and large communities, and other, more indirect forms of participation in public affairs are to be expected.

Data Collection, Analysis, and Reporting

The different management entities of the examined case studies focused on collecting data specifically on consumption and analyzing them in order to determine their progress. It was common to see that such data was shared with the residents hoping that the residents can alter their behavior once they're aware of their consumption. In the BedZED development, water and electricity visible meters are installed in each apartment so the resident is aware of their consumption. Greenwich Millennium Village also installs energy display devices in each apartment so each resident can gain an understanding about his or her energy consumption. West village is under the Living Learning Laboratory program: applying the latest energy efficient technology while measuring and monitoring how effective they are, to help in developing new technologies in the future.

Hammarby applied a smart dashboard system in some homes in the kitchen to show real-time consumption of energy and water. Fujisawa offers a community information platform, an easy-access, one-stop portal service that enables residents to monitor their energy consumption, receive energy saving advice and other information, and adds points to a system that encourages resident participation in environmental activities.

Section 5. Findings with Potential Relevance to *The Sustainable City*

As a private developer with an emphasis on sustainability, Diamond Developers, while not unique, is an exceptional case. We have examined a number of cases of planned communities with a sustainability focus that are being implemented by private sector real estate developers, but in those cases either the development company promoted an image of sustainability without a clear sustainability strategy, or it engaged an outside entity to assist in developing and implementing a community sustainability plan. The Natural Step or One Planet Living are the most common formats used. In contrast, Diamond Developers is developing its own vision and understanding of sustainability for The Sustainable City. It is not implementing an "off the shelf" model for achieving a sustainable community.

Keeping the individuality of The Sustainable City (hereafter termed TSC) in mind, our review of other planned communities with respect to sustainability plans, indicators and operations identified a number of measures and practices that have potential relevance to TSC as it develops and implements its own sustainability plan. We believe the practices followed by other planned communities with a sustainability focus, regardless of the particular vision or purpose of the individual communities, can be useful for Diamond Developers in designing its own approach for TSC.³

The nature of the literature reviewed in the case study comparisons must be kept in mind. Almost all the available documentation has been prepared by the developers and their consultants, and to a greater or lesser extent, they are promotional in nature. No doubt they provide an overly optimistic interpretation of the reality of the situation. There is little in the way of critical analysis or assessment. Annual reports and sustainability progress

³ Disclaimer: Our knowledge of TSC is limited to our initial visit in December, 2015. The suggestions included in this section may therefore be redundant or irrelevant to current practices at TSC.

measurements often reflect aspirations of the community and its management rather than actual experience. The pictures painted are predictably rosy. In some cases, shortcomings are identified, but the report simultaneously provides a plausible explanation and an immediate remedy. Therefore, it is necessary to read the case study documentation with awareness of the potential disparity between what is on paper and what is on the ground.

Building a Community from the Start

Creating a culture of sustainability in planned communities relies heavily on having a shared vision, a concrete plan and sense of community identity. We believe that TSC has a concrete vision of what it is and where it wants to go. It has a well-articulated understanding of sustainability. We believe the next step is to prepare a sustainability plan for TSC. Diamond Developers is well positioned to do this. The plan could include a description of TSC in 20 to 25 years from now and what it will be like to live there. It can define community boundaries and memberships and set a target of measureable sustainability achievements in the next 20 to 25 years that are related to the vision. A list of indicators that can be used to assess progress in reaching the targets, as well as the means of monitoring and evaluation, could be included in the plan as well.

Inclusion of community members in sustainability efforts is essential to achieving desired goals. Shared vision and commitment can be done in numerous ways, although it is clear from the case studies⁴ that whatever ways are pursued should be followed for the long-term and not simply with episodic or one-time occurrence. New incoming residents may be met by a welcome representative or group, provided with information packs, and given orientation sessions to the life, vision, and sustainability goals on the community. This appears to be a fairly common practice, particularly in the smaller communities. There may be open forum days for people to come together to discuss ideas, voice complaints, and provide suggestions for improvements. Public group sessions help residents feel as if they are genuinely part of the shared community. A successful way to change behavior is bottom-up and consultative approaches to community member participation. This allows residents and community members to directly influence their surroundings. One is much more likely to engage in a certain behavioral change if he or she feels part of the decision-making process from the beginning. (Kennedy, 2010). In some of our case studies, we have found that communities that open the floor up for the residents and stakeholders to have a voice are more successful at attaining a community spirit and creating a certain shared culture. The community cohesion encourages sustainable behavior.

⁴ The specific practices of each case study can be found in Annex 1

Table 2. Translating Best Practices into Suggestions for TSC	
Best Practice Findings	Suggestions for TSC
<ul style="list-style-type: none"> - A concrete vision, plan and identity that is known and published 	<ul style="list-style-type: none"> - Prepare a sustainability plan to include a description of TSC 20-25 years from now and what it will be like to live there - Define community boundaries and memberships - Set a target of measurable sustainability achievements in the next 20-25 years related to the vision. - Create a list of indicators to assess progress
<ul style="list-style-type: none"> - Inclusion and participation - Welcome group or representatives - Group sessions to discuss ideas 	<ul style="list-style-type: none"> - Provide TSC welcome representatives or group, which includes information packs and orientation sessions explaining the life, vision and goals - Form community groups - Create a participation index
<ul style="list-style-type: none"> - Eco-concierges - Community information platform 	<ul style="list-style-type: none"> - Hold periodic orientation sessions to bring new residents together with a facilitator from Diamond Developers to help with the transition - Interactively deliver information, such as having home auditors conduct inspections or provide advice - Have a one-stop location to receive your consumption information and receive points for acting sustainably
<ul style="list-style-type: none"> - Vision maintaining a “high quality of life” 	<ul style="list-style-type: none"> - Have open, green spaces, common areas, functioning and productive community management, and striking the balance between public and private lifestyle - Ensure community members understand and believe in the vision
<ul style="list-style-type: none"> - Community Open Days or Visitor Days for outsiders to experience life within the community - Events hosted - Trainings and workshops offered 	<ul style="list-style-type: none"> - Host a TSC Open Day, where people can come and see how the community functions - Host other community events - Offer workshops and trainings to outsiders to help defray various costs - Offer workshops and trainings and English lessons for staff - Certify the attendees of the training
<ul style="list-style-type: none"> - Learning center, schools or museum to build community 	<ul style="list-style-type: none"> - Build one of these centers as soon as possible so people can start participating or set aside community meeting rooms in the existing construction
<ul style="list-style-type: none"> - Renewable energy and infrastructure - Visible meters and/or smart dashboards installed in homes 	<ul style="list-style-type: none"> - Set up metering and central monitoring unit to receive, record and analyze - Ensure data from utility reaches each house - Extract biogas from sludge and sewage - Export twice as much renewable power to the grid as non-renewable power it imports
<ul style="list-style-type: none"> - “No cars allowed” or car- and bicycle-sharing systems - Bicycle tunnels and bridges built over ring roads so that traffic isn’t interrupted - Car-sharing systems - Public, well-functioning bus - Incentives to ride bicycles 	<ul style="list-style-type: none"> - Create cycling/cart bridges over/under auto routes. - Have a shared, well-functioning bus system - Provide bicycle incentives, such as a bicycle shop, free repairs, and discounts on bicycles - Consider non-carbon vehicle sharing

- Affordable housing	- Consider building housing for low-income staff
- Carbon footprint studies	- Collect data as soon as possible in order to have concrete data for a potential study
- Discount cards	- Discount cards for the mall for the residents
- Point system incentives	- Create a point system with rewards for acting sustainably
- Bus/eco-passes	- Provide a discount for bus passes

Research shows that if the members feel happy and that their community is equitable, then they will act sustainably, because they feel they have a collective responsibility to the environment like everyone other resident. (Kennedy, 2010. 1140). Preparing some sort of participation index is important as an indicator of sustainability. If community members think that everyone else is putting in effort to act sustainably, then they will, too. (McKenzie-Mohr, 1999).

In tandem with establishing a strong community identity is the imperative to establish the criteria for community membership, along with the recognized benefits, responsibilities and incentives for membership in the community. Keeping in mind that this is a community by choice and that members choose to join or leave the community, the identity and role of community members should be understood from the beginning. New members could be given a “Welcome to the Community” packet of information upon arrival. Periodic orientation sessions, say once a week or once a month (depending on the rate of new occupancy) that bring new residents together with a facilitator from Diamond Developers who can aid and assist with the transition for individual households and groups of households together would boost the sense of belonging to a community from the start.

A key feature of the TSC vision is the promise of enjoying a high quality of life without causing a negative impact on the environment. Various features of having a high quality of life include, but are not limited to, having open green spaces and welcoming common areas, having a functioning and productive community management, and striking a balance between public and private lifestyle. A number of the cases share this “have your cake and eat it too” vision. Owing vision is a big part of identity creation. When a resident moves into TSC, it is important that he or she is immediately taught the plan and the vision, in a convincing and enthusiastic way, for there to be instant buy-in. He or she should be given a set of guidelines on sustainable living, which is a practice many of our case studies undertake. If the residents find the goals of the community to be legitimate and embraced and supported amongst other residents, they are more likely to believe as well. (Kennedy, 2010).

From our study, we discovered that community management of common space is essential in engendering a specific culture. Participation, through a shared community identity and membership, community associations and locations for problem solving and communication, is a key indicator of social sustainability. Creating a supportive space for residents to gather and voice their opinions is important. Behavior changes, such as lowering consumption of resources, can be met only if high levels of motivation are present, and giving community members a voice and various avenues for public participation will encourage and motivate. (McKenzie-Mohr, 1999). Positive reinforcement is important to ensure continued practice of the new behavior.

It is a good idea to foster and support community groups that allow residents to participate

in the mission of TSC, discuss progress and potential improvements, and learn from each other. It is possible to measure people's interest in the sustainability vision based on the degree and frequency with which they are participating. TSC could organize a residents committee that suggests ideas and plans events, and a management team, composed of members of Diamond Developers, to meet with the residents on a regular basis. If these two teams collaborate constantly and constructively so that the residents feel they are being heard and their issues being addressed, then the resilience of the community would be strengthened. If disagreement occurs between groups, there needs to be a facility and clear process for problem solving and conflict resolution. These mechanisms for participation and communication are possibly the most important factors for Diamond Developers to consider as it goes about establishing a sustainable community that promotes a culture of sustainability among its members.

Schools, centers for lifelong learning, research institutes, or museums are essential sites for people to come together to share their ideas, learn the latest sustainability advances, and take home solutions and best practices. TSC is planning a school and museum/learning institute in its next phase. The museum could be an ideal location for both information dissemination and community involvement programs. It could also be an appropriate place for a community volunteer program, should volunteerism become a part of the TSC culture of sustainability.

A number of communities we studied run visitor programs. They open up the community for guests to attend workshops and experience how it is to live in a sustainable society. Most of the ecovillages have permaculture demonstration sites and partner with local organizations or universities provide a space for fieldwork to be conducted. TSC could provide a similar visitors' program in which the museum/learning center offers training in various topics geared to the outside community and showcase the latest green technology and sustainable behaviors.

Marketed as a life-long learning, training programs could be a larger business opportunity and help defray the costs of the center. Successful marketing of knowledge and learning would give TSC a reputation as a center of environmental knowledge and sustainable practice. Providing certificates after completing a training course can be an attractive incentive for people to want to take these courses. As well as engaging the outside community, these trainings can be given to the domestic staff and gardeners inside TSC. Having trained and certified staff help lower the residents' utility bills, expresses appreciation from TSC, and contributes to Diamond Developer's overall mission of sustainability. If carefully thought through, TSC could enjoy the status of a "Living Learning Laboratory" attracting international attention.

TSC has only just begun to receive its first residents. Engaging initial residents in the TSC vision from the start is essential in fostering a culture of sustainability. Once more people move in, they will do as they see others doing. Neither the school nor the museum/learning center will be ready in 2016. About half the case studies we have examined have a learning center or an events center separate from their school or museum. It may be worth setting aside community meeting rooms in the existing construction, perhaps in the mall or somewhere in the neighborhoods. These public meeting spaces are important in giving people a location where they can start to build a sense of community and belonging.

Sustainability Measures and Benchmarks

Renewable energy systems and improved energy efficiency are common measures taken to improve sustainability. Seventeen out of the twenty communities surveyed employ solar energy in some way, either through PV panels or solar water heating systems. TSC already has a strategy for using solar energy and incorporated solar energy into every residential unit, as well as many public spaces. Metering is the essential means for monitoring electrical production and consumption in all units and at all levels of TSC. If steps have not already been taken to establish a central monitoring unit that receives, records, and analyses all the metering data, then this should be a priority. Two cases extract biogas from sludge and sewage, which could be an interesting option for TSC.

Efficient and renewable energy infrastructure is common in a purpose-built community interested in achieving sustainability. However, to create a truly sustainable environment, one must study not only the ecological impacts of the infrastructure, but also influence the behavior of the people within the infrastructures, since human behavior is the ultimate detriment to the environment (Cummings, 2012). Behavior plays a significant role in a properly operating a high-tech environment. In some of the studied communities, visible meters and/or smart dashboards are installed in houses and apartments so the residents are aware of their real-time energy and water consumption. TSC should find a way for the data from the utility to reach each house. Gaining access to personal consumption data is essential to controlling, monitoring and reforming behavior.

Although awareness of usage could prompt behavioral change, we have found from our initial literature survey that solely providing information may be insufficient at influencing behavioral change (Kennedy, 2010). Diamond might want to take a step further by employing an “interactive approach” to information delivery, such as having home auditors conduct free inspections and provide advice on personal energy efficiency. Tsukuba offers a community information platform, an easy-access, one-stop portal service that enables residents to monitor their energy consumption, receive energy saving advice and other information, and adds points to a system that encourages resident participation in future environmental activities.

Some of the case studies provide “eco-concierges” to influence behavior, which may inspire Diamond Developers. The case studies provide several interpretations along the theme of eco-concierge or lifestyle officer employed by the community to help members behave more sustainably, but all have the same general goal: to provide information for residents on how to lessen their impact on the planet and what actions to take in the future vis-à-vis waste, energy, water, farming, and shopping. Another type of concierge is the “mobility concierge,” who gives transportation options and advice and conducts automobile inspections.

Whistler developed Village Kiosks that provide an interactive information link to the community website and centralized concierge services offer a convenient meeting place with one-stop problem solving and residence assistance. The Whistler “Adopt-a-Youth” program partners first-year residents and seasonal employees with long-term residents to embed a sense of community in the new residents. The idea of concierges can be applied to TSC. They can give an orientation for new members and instruct them on various functions, such as how to set the thermostat and how to properly dispose of waste. This can make the TSC manual

more personal and effective. This is also another way to ensure a certain type of culture is cultivated.

Since mere awareness is rarely enough to incite significant behavioral change, engaging activities must be undertaken for people to connect with and work towards achieving the community's goal. Sonoma Village's successful Event Center that acts as a community center for NGOs and environmental groups could inspire Diamond Developers to build an event center as well to hold community events and gather together thousands of guests from the region. Sanford Walk holds a "Sanford Open Day," where internal members and outsiders can come and hear the Founder tell the founding story of the development. TSC could do this as well.

Alternative transportation methods are other important indicators of sustainability. Our case studies deal with sustainable transportation in a similar fashion. Some places mandate "no cars allowed," and others with car- and bicycle-sharing systems. TSC is already pretty strong in promoting alternative transport by including electric carts in home purchases, restricting automobile access, offering a \$10,000 subsidy to any resident purchasing an electric vehicle, and providing free electric charging stations. However, there are some other unique ideas from the communities we reviewed from which TSC could benefit. The strongest and most rigorous bicycle-sharing program that could motivate Diamond Developers was undertaken by Houten (see description in Section 4, above). In addition, bicycle tunnels and bridges have been built under and over the ring roads so that neither bicycle nor car traffic is interrupted, which can be replicated on the ring road in TSC. A public, well-functioning and clean bus is another essential transportation sustainability measure.

Social inclusion and community diversity are important aspects of building a sustainable community. Most of the practices our sample communities use to ensure inclusion and diversity are related to affordable housing. This issue is not particularly relevant to TSC. However, other inclusion and diversity issues are of particular relevance to TSC.

The first of these is the distinction between owner-residents and tenants. Since all the housing units will be sold to private owners, and it is expected that many, if not most, housing will be rented to tenants, the TSC residential community may have tenants as the majority of its members. TSC should carefully consider the benefit, responsibility, and incentive structure associated with being a tenant living in TSC, and compare this with a similar calculation for an owner-resident and, indeed, an absentee owner. All three categories are clearly stakeholders in the success of TSC, but their individual and group circumstances will be different. This large number of domestic staff is another aspect that makes TSC unique.

A second consideration has to do with domestic staff. The large number of domestic staff is another aspect that makes TSC unique. Every house in TSC includes a bedroom and bath for live-in domestic staff. It is assumed that the majority of these will be employed by the residents (either resident owners or tenants). Best practice would suggest that resident domestic staff should be included in programs to promote a culture of sustainability at TSC. Since the domestic staff may be engaged with technology, resource consumption, and waste management to even a greater degree than the householders themselves, it is important that the TSC sustainability plan include activities that engage and involve them in acting sustainably. These may be orientation sessions, training programs, and even English language

skills that motivate the staff in a constructive and positive way and encourage them to identify with the TSC community and its sustainability goals.

Offering interesting, educational workshops for the domestic and landscaping staff raises the chances that they will believe in TSC's overall mission. When wage earners work and live in the community, this decreases the need for employee commuting and significantly cuts down on carbon emissions from transportation. TSC designs already include apartments to house employees of the planned institutions such as the school, learning center, and resort. Perhaps Diamond Developers consider building housing for the low-income staff in TSC, since diversity and inclusion are important factors of social sustainability.

Measuring an institution's carbon footprint is the number one tangible indicator that can be identified throughout all of the communities, whether in the form of a quantitative carbon footprint study, in the form of a percentage reduction after retro-fitting, or in the form of a comparison vis-à-vis country standard. If a community aims to be "zero carbon" or "carbon neutral," it is essential to keep a record of the carbon emissions from the very beginning. Having a set of indicators, monitoring those indicators, and setting targets after analysis will help TSC visualize its actual impact on the environment and be motivated to make a difference.

A community carbon footprint (greenhouse gas emissions inventory) is the principle benchmark tool used by the One Planet Living framework. To track progress, a baseline is necessary. Without data, it is impossible to make steps towards reducing emissions. As with any data collection, the numbers reported will never be 100% exact. However, if TSC plans to carry out a carbon footprint study or an assessment of change, data collection should start as soon as possible. Our understanding is that TSC aspires to provide each resident with their personal carbon footprint to be included in the household's water and electricity bill. Conducting periodic carbon footprint studies of TSC would put the residents' personal footprints in perspective and encourage them to identify with the community-wide sustainability goals. The One Planet Living communities in our sample conduct a community footprint study routinely each year and it is included in the annual community report. The footprint and report are done through the office of the "Sustainability Integrator" employed by the community.

As noted previously, the economic dimension is the least developed dimension of sustainability among the twenty case studies. In contrast, the economic aspects are more thoroughly addressed by TSC. Much of the economic planning is related to the target of becoming an energy-exporting community through the extensive use of solar panels. Solar energy is the force that drives TSC. Another economic innovation is that ownership shares in the commercial mall are linked to home ownership, with returns on mall shares being used to fund home maintenance and repairs. Diamond Developers might consider a number of other economic incentives that could be used to encourage sustainable behavior. Many communities provide discount card schemes to residents. TSC could use this to encourage residents to shop in the TSC mall and perhaps use other facilities. The agricultural enterprise planned for TSC is another opportunity to link the economic with the other dimensions of sustainability and further engage community members in community activities.

References Cited in the Body of the Report

- Bent, E., Forinash, C., McKay, H., Perry, D., & Webber, R. (n.d.). *Better Plans for Better Places: How the Sustainable Communities Initiative change the way the country plans for a prosperous future*. Washington D.C. Retrieved from <http://betterplansbetterplaces.iscvt.org/wp-content/uploads/2015/06/BetterPlans4BetterPlaces.pdf>
- Berg, P. G., & Nycander, G. (1997). Sustainable neighbourhoods—a qualitative model for resource management in communities. *Landscape and Urban Planning*, 39(2-3), 117–135. [http://doi.org/10.1016/S0169-2046\(97\)00050-9](http://doi.org/10.1016/S0169-2046(97)00050-9)
- Cummings, N. G. (2012). *Fostering Sustainable Behavior Through Design: a Study of the Social, Psychological, and Physical Influences of the Built Environment*, (May). Retrieved from <http://scholarworks.umass.edu/cgi/viewcontent.cgi?article=2015&context=theses>
- Ergas, C. (2010). A Model of Sustainable Living: Collective Identity in an Urban Ecovillage. *Organization & Environment*, 23(1), 32–54. <http://doi.org/10.1177/1086026609360324>
- Gahin, R., Veleva, V., & Hart, M. (2003). Do Indicators Help Create Sustainable Communities? *Local Environment: The International Journal of Justice and Sustainability*, 8(6), 1–1. <http://doi.org/10.1080/762742063>
- GEN (Global Ecovillage Network). (n.d.). Community Sustainability Assessment. Retrieved March 8, 2016, from <http://gen.ecovillage.org/en/node/5039>
- Hart Environmental Data. (1998). *Sustainable Community Indicators Trainers' Workshop. North*. Retrieved from <http://www.sustainablemeasures.com/Training/pdf/HEDTrMan.pdf>
- James, R. (2010). *Promoting Sustainable Behavior A guide to successful communication*. Berkeley Office of Sustainability. Berkeley, California. Retrieved from http://sustainability.berkeley.edu/sites/default/files/Promoting_Sustain_Behavior_Primer.pdf
- Kennedy, A. L. (2010). Using community-based social marketing techniques to enhance environmental regulation. *Sustainability*, 2(4), 1138–1160. <http://doi.org/10.3390/su2041138>
- Marsh, D. S. (2014). The Sustainable Communities Initiative: Collective impact in practice. *Community Investments*, 26(1), 30–36. Retrieved from http://www.frbsf.org/community-development/files/ci_vol26no1-The-Sustainable-Communities-Initiative.pdf
- McKenzie, S. (2004). *Social sustainability: Towards some definitions*. University of South Australia. Retrieved from <http://w3.unisa.edu.au/hawkeinstitute/publications/downloads/wp27.pdf>
- Mckenzie-mohr, D., & Smith, W. (1999). *Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing*. Gabriola Island, B.C.: New Society Publishers.

- Power, A. (2004). *Sustainable Communities and Sustainable Development a Review of the Sustainable Communities Plan*. Retrieved from <http://sticerd.lse.ac.uk/dps/case/CR/CASereport23.pdf>
- Riddlestone, S., & Desai, P. (n.d.). *Eco-towns , Garden Cities & One Planet Communities - policy and practice , opportunities and challenges*. Retrieved from <https://brightonpermaculture.org.uk/files/gad2014/gad2014riddlestonedesai.pdf>
- Roseland, M. (1997). Dimensions of the eco-city. *Cities*, 14(4), 197–202.
[http://doi.org/10.1016/S0264-2751\(97\)00003-6](http://doi.org/10.1016/S0264-2751(97)00003-6)
- The Natural Step (TNS). (2000). *The natural step framework guidebook. The natural step*. Retrieved from <http://www.ruralsustainability.org/files/TNSFrameworkGuidebook1.pdf>
- United Nations. (1992). *Rio Declaration on Environment and Development. Environmental Conservation* (Vol. 19). Retrieved from http://www.unesco.org/education/nfsunesco/pdf/RIO_E.PDF
- WCED (World Commission on Environment and Development). (1987). *Our Common Future*. New York: Oxford University Press.