Ecological Design for Community Building

Student Name: Motale Ben Mokheseng

Student Number: 15553019

Course: MPhil Sustainable Development Planning and Management (Renewable and Sustainable Energy)

Module Name: Ecological Design for Community Building

Lecture Name: Prof. Mark Swilling

Date: 11 August 2009

Title of Assignment: Ecological Design for Community Building

Declaration: I hereby confirm that the assignment is the product of my own work and research and has been written by me and further that all sources used therein have been acknowledged.
<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contents...........................................</td>
<td>2</td>
</tr>
<tr>
<td>1. Background &amp; Introduction...................</td>
<td>3</td>
</tr>
<tr>
<td>2. Part A: Literature review....................</td>
<td>5</td>
</tr>
<tr>
<td>3. Part B: Case studies..........................</td>
<td>12</td>
</tr>
<tr>
<td>3.1 Ecolonia, the Netherlands..................</td>
<td>12</td>
</tr>
<tr>
<td>3.2 Auroville, South India.....................</td>
<td>18</td>
</tr>
<tr>
<td>3.3 Lynedoch, South Africa.....................</td>
<td>25</td>
</tr>
<tr>
<td>4. Conclusion.......................................</td>
<td>29</td>
</tr>
<tr>
<td>5. Bibliography....................................</td>
<td>31</td>
</tr>
<tr>
<td>The Journal........................................</td>
<td>32</td>
</tr>
</tbody>
</table>
1. **Background and Introduction**

My family lived in a small village of Bolata (where I grew up), in the former apartheid homeland of QwaQwa in Free State Province in the early 1980s. We lived in a house made of earth material such as clay (adobe) bricks, which my family built themselves. Majority of houses in my village were similar to my family’s and others were built with rock material and soft stones sourced within the boundaries of our village. There was no cement, concrete or mortar used in the house’s top structure. My grandmother still lived in that house until 1990 when she passed on. She used to use a mixture of arid soil and cow dung to plaster the walls and floors of the house. Cow dung was also used as manure for growing vegetation and plants. It was also put out in the sun to dry up and be burnt to provide heat, mainly for cooking.

They grew their own food in their backyards and caught fish in the local river that provided other ecosystem services, such as clean water. They owned cattle, sheep and chicken that provided us with meat and milk during times of scarcity. My father and other men of the village also hunted for meat supplies. If there was insufficient food for the day, the local shop provided fruit, vegetable, meat and other supplies that were locally sourced. We got our water from the local wells that provided natural groundwater and rivers that flew entire year before the government of the time installed communal taps (1 tap shared by 10 households with an average of 4 persons each). We used pit toilets and most of the households that are still in the village still use pit toilets even today. My father and few other men owned a car but the most popular mode of transport in the village was donkey carts and horse-riding.

My mother, grandmother and other senior citizens of the village had the learning and training centre for making craft work (e.g. beading, sewing, knitting, weaving etc) which they sold in the village and the neighbouring villages. My father and other men in the village made their own boots and metal works which they could trade with each other and with other villages and townships. People back then could do several things and no one would be tied down by only one job.

Many people have since left the village to stay in the urban areas and townships in pursuit of a “better” life – better here refers to owning a face-bricked house that is built using large quantities of concrete and cement, driving a privately-owned car, plugging into the wall for electricity use, buying food from the super/hypermarket located some few kilometres away from the township. All these happened when there was a sudden influx of Indian-owned factories, especially clothing and textile, from Durban in the late 1980s. These factories created hundreds of jobs for people of QwaQwa, and as economic prosperity is seen as a sign of success and human development, people did not want to be associated with the old practices of the village that provided them with life without expenses.
However, my family’s house and many others did not necessarily achieve proper north-south orientation to harvest passive solar energy for heating and day-lighting etc. Biomass, especially wood was the main source of heat for space and water heating and cooking, and probability might be high that these wood energy sources were used unsustainably. Dry cow dung was also used to provide heat as mentioned earlier. Thinking about it now, these houses and the lifestyle in the village might not have been modern but certainly achieved what we know now as sustainable living – they sucked less resources and ecosystem services and goods from the natural ecosystems than they provided.

There was no service provision (water & sanitation, electricity, clean water etc) from the government and my family and other families in Bolata found ways of supporting their lives and led healthy lifestyle even though they probably did not realise it. The kind of fulfilling lifestyle back then did not put unnecessary stress, if at all, on the ecosystems (soils, water, air etc) that life depends on. My grandmother was 105 years old when she passed on in 1990 – she was born in 1885.

My grandmother and her generation lived happy and long lives within the carrying and absorptive capacity of nature’s ecosystems. They probably lived without spending a dollar a day but the truth is – they were not “poor”. They planted plants, vegetation and fruit, they owned cattle, sheep and chicken, they build sustainable houses for sustainable livelihoods, all “aimed towards household and community self-reliance” Mollison (1991).

You are probably wondering why I am telling the story of my family in our village of Bolata in QwaQwa, Free State. I believe they lived in harmony with nature, they did not consider themselves superior to other life forms. According to Mollison (1991: 5), “all living things are an expression of life”, and I strongly believe that my grandmother’s generation was the culture that understood this statement so profoundly that they did not, without absolute necessity, destroy any living thing.

Today mankind is faced with global environmental crisis (global warming, degradation of ecosystems, biodiversity loss, depletion of renewable and non-renewable resources) that resulted from both unsustainable use and unequal distribution of natural resources. From this environmental crisis, a number of notions were born (Mebratu 1998, 493), of which “sustainable development (SD) is one to deal with complex ecological” and [social] issues.

Without going into detail of the concept of sustainable development and many ethical issues, value judgements, and interpretations associated with it, I would like to indicate that there are at least three mutually reinforcing objectives of sustainable development that emerge from all the debate about the vagueness and lack of clarity of the concept of SD. These are to:

i. Improve human well-being
Promote human development (wealth, health & education)

ii. Achieve equal distribution of life-sustaining resources
   - Promote equity and justice (all must have equal access to resources)

iii. Maintain ecological integrity
   - Improve environmental justice (live within nature’s carrying and absorptive capacity)

This brings me to a very important and critical concept of ecological design for community building that finds its premise within the realm of sustainable development. The next section discusses the key role that the design, especially of infrastructure and built environment, plays in achieving sustainable development (SD). There are key issues, however, that a question of design gives rise to, such as sustainability becoming central part of the design. Both Sim Van Der Ryn (1996) and Janis Birkeland (2002) say that the design can take into account sustainability. But is it really just a question of appropriate design, or are there powerful interests that will block any attempt to design more sustainable cities and neighbourhoods? Even if sustainable or ecological design becomes the most favoured approach, will this not just result in greener cities and neighbourhoods for the rich to the detriment of the poor? Will developing countries like South Africa need to go beyond just greening of design to include ways of building socially mixed neighbourhoods? Should it be community development approach that “minimises damage” or the development approach that “reverses damage”, and what are the design implications of the two approaches? All these themes would be discussed, with special reference to the design of infrastructure and built environment, in the next section of literature review. They will then be applied to a particular case in section B of the paper.

2. Part A: Literature review

2.1 Can the design take into account sustainability?

“We live in two interpenetrating worlds. The first is the living world, which has been forged in an evolutionary crucible over a period of four billion years. The second is the world of roads and cities, farms and artefacts that people have been designing for themselves over the last few millennia. The condition that threatens both worlds – unsustainability – results from a lack of integration between them”. (Van Der Ryn & Cowan, 1996).

The lack of integration between these two worlds can be addressed by the form of design that strengthens the weave that connects nature with culture (Van Der Ryn & Cowan, 1996). This integration implies that the design must take into account biodiversity loss, resource depletion, collapsing ecosystems, diminishing public
space, and preserves soil fertility and nutrient and water cycles (Van Der Ryn & Cowan, 1996).

According to Birkeland (2002: 3), the poor design of the urban development externalizes and conceals its negative impacts. She argues that the rich tapestry of urban life, however stimulating, masks a resource transfer process that:

- harms human and environmental health
- reduces secure access to food and water
- destroys our life support systems
- chains us to the fossil fuel economy
- reduces public space and natural amenity
- transfers wealth from many to the few
- generates conflict over land and resources
- reduces basic life choices for future generations

According to both Birkeland (2002) and Van Der Ryn (1996) these negative impacts can be avoided as they are not necessarily a consequence of physical development or economic growth, but a function of “dumb design”. The waste and poisons that give rise to the negative impacts mentioned above are not created by people (Birkeland, 2002: 3), but the systems they design. She refers to the design as “Pyramidal Design”, which underpins and describes the industrial development model that is based on extensive use of a large base of natural resources (Birkeland, 2002: 14). “Pyramidal forms of development correspond with pyramidal social structures, where the benefits of development are enjoyed by the few” [rich] to the detriment of the many [poor] as shown in figure 1.

**Figure 1: Pyramidal design systems. Source: (Birkeland, 2002)**

Birkeland (2002) and Van Der Ryn & Cowan (1996), however, believe that the design can take into account sustainability because negative impacts are generated by physical and institutional design which can easily be reversed by the design that is based on positive thinking, not competition. Mollison (1991) in support of both
Birkeland and Van Der Ryn says permaculture (permanent agriculture/culture) is a design system that has “basic life ethic, which recognises the intrinsic worth of every living thing”; hence the design of our systems should be based on cooperation, not competition.

In her own words, Birkeland (2002) says that negative impacts of the poor design of urban development on the environment and [communities] could be reversed by resource transfer through what she calls “Positive Development” that:

- improves human and ecological health, resilience and viability
- increase natural capital, biodiversity, and ecosystem goods and services
- increase secure access to food and water
- enhances urban space for both people and natural processes
- transforms our infrastructure from fossil fuel-driven to solar-powered
- helps correct imbalances in power and wealth
- conserve open space, wilderness and natural resources
- increase life quality and substantive life choices for present and future generations

The design can incorporate sustainability and promote positive development if we can move away from statements such as, ‘the building will use 40% less fossil-fuel energy and 30% less water than typical buildings of the same kind’ (Birkeland, 2002; Van Der Ryn, 1996). That is ‘green buildings’ only aim at reducing negative social and environmental impacts relative to standard building (Birkeland, 2002: 15). We aim for “less bad” design that reduces damage instead of positive design that reverses damage. Sustainability is not just about less resource consumption in the future, but it is about net improvement that the development achieves in human and ecological health over what would have been the case if the development had not been built (Birkeland, 2002: 15).

According to Van Der Ryn & Cowan (1996), positive design offers three strategies for addressing unsustainability: conservation, regeneration, and stewardship. Conservation simply slows down the rate at which resources are consumed, and unfortunately assumes that the damage must be done and the only recourse is to minimise this damage for the development (Van Der Ryn & Cowan, 1996). Some conservation measures include recycling, “denser communities to preserve agricultural land”, adding insulation, fuel-efficient cars, etc. So, conservation alone cannot lead to sustainability since it implies a net loss in resource use.

Regeneration literally means repairing and renewing living tissues. Positive design helps regenerate a world deeply wounded by dumb design. According to Van Der Ryn & Cowan (1996), this may be restoring an eroded stream to biological productivity, renewing soil, or recreating habitat, as is the case with Auroville in India (discussed in Part 2 of this paper). Regeneration not only preserves and protects: it
expands natural capital through active restoration of degraded ecological base and public estate (Van Der Ryn & Cowan, 1996).

Stewardship means living in harmony with other living species and with the physical environment – “it is the wisdom to live on renewable interest rather than eating into natural capital” (Van Der Ryn & Cowan, 1996). Mollison (1991) argues that unsustainability can be addressed through Permaculture as a design system that creates sustainable human settlements. According to Mollison (1991) permaculture refers to both permanent agriculture and permanent culture as mentioned earlier. Permaculture solves unsustainability by using the inherent qualities of nature (plants, animals, landscapes and structures) to produce a life-sustaining system for city and country (Mollison, 1991). The discussion so far has indicated that the design can take into account sustainability and it is important to look at other pressing issues such as vested interests that may block ecological design measures.

2.2 Is it really just a question of appropriate design, or are there powerful interests that will block any attempt to design more sustainable cities and neighbourhoods?

Birkeland (2002) argues that conventional SD criteria and design tools that are currently promulgated by planning institutions and agencies cannot increase sustainability because they do not design for the infrastructure that allows nature to regenerate, flourish, and deliver ecosystem services and goods sustainably. The barriers to design for positive development are not technical or financial – they are purely as a result of polarisation of power, ‘silo-thinking’, institutional norms, and marginalisation of design (Birkeland, 2002). Although there have been an improvement in the environmental policies, regulations and technologies, the trade-offs of environment and human health for poor and toxic forms of development continues. This is in part due to our sustainability and environmental management tools that are still focused on symptoms, such as waste, pollution, and climate change, rather than on tracing problems to their sources in systems design and correcting these root causes (Birkeland, 2002).

We therefore need to redesign existing developments to compensate for or correct the legacy of inequitable resource transfer of the past. In reality, (Birkeland, 2002: 14), the sustainable design can only happen if it does not interfere with special interests. That is to say, life-sustaining resources must be redistributed in ways that do not threaten anyone’s interests. In essence, the design or redesign of development must lead to better life for all (including the rich). According to Birkeland (2002: 14), this can only be achieved if the development enhances the ecological base (life-supporting services) and public estate (shared living environment). Therefore, cities and buildings must be designed to proactively heal the rifts between nature and humans, and the rich and poor.
In urban areas we can essentially increase the horizontal and vertical space for habitats, as we already have multi-storey structures, walls, roofs and alleyways that can be retrofitted to generate eco-services. “Eco-services such as water and air cleaning, heating and cooling, soil production, and sewage and grey-water purification, can be retrofitted into urban areas at less cost than fossil-fuelled redevelopment” (Birkeland, 2002: 16). These eco-services can be provided by ecological design concepts that use natural systems, such as vertical wetlands, breathing walls, sunspaces, solar ponds (Birkeland, 2002; AIJ, 2005). Contemplating life-sustaining patterns and nature’s design strategies (Van Der Ryn & Cowan, 1996), we learn that spider plants are especially good at removing pollutants from air and can be used in living systems that cleans and purify the confined air of office buildings. Wetlands are particularly good as effective components of ecological wastewater treatment system, as they can help remove large amounts of nutrients, neutralise pathogens, and detoxify compounds (Van Der Ryn & Cowan, 1996). But these concepts are often used as add-ons, which simply mean unnecessary extra costs are incurred, instead of incorporating them into the basic structure and fabric of urban development.

Furthermore, these low-cost eco-solutions compete with innovations that are favoured by institutional frameworks, mindsets, as well as power relations and can only benefit bureaucracies and large corporations (Birkeland, 2002: 19). Available low-tech, natural solutions are disadvantaged by subsidies and a lack of life-cycle cost pricing associated with conventional design systems. Resource transfers happen through economic mechanism that obscures their long-term impacts (e.g. externalities, expropriations etc). Current systems are biased in favour of innovations in existing industrial construction and production systems (e.g. investment in ‘clean’ coal or PBMR, instead of solar power). The next section discusses if sustainable design can be an approach for all (rich and poor).

### 2.3 Even if sustainable design becomes the most favoured approach, will this not just result in greener cities and neighbourhoods for the rich to the detriment of the poor?

Buildings accounts for major portion of energy consumption (30-40% of global energy), raw material extraction (50% of raw materials by weight), toxic landfills (40-50% of the waste), greenhouse gas emissions (20-30% of global GHG emissions), generation of waste, and the depletion of soil, water (16% of global freshwater) and timber (Du Plessis, 2002). Grobler (2002) supports Du Plessis by making reference to South African situation when he argues that commercial buildings in South Africa use about 15.8 terawatt-hours of electricity each year and contribute more than 15 million metric tons in carbon emissions. This is because buildings are developed from the current model of “dumb” design that determines the amount of resources, energy and space consumed by people in the wider environment into the future (Birkeland, 2002; Roaf, Fuentes and Thomas, 2003; Edwards, 1999; AIJ, 2005).
According to Birkeland (2002) built environment design can drive social transformation and become a lever for better environmental management. The built environment design could achieve what many environmentalists have long advocated for; equal and efficient distribution of life-sustaining resources could reduce underlying causes of social conflict and improve social justice. Birkeland (2002) however acknowledges that healthy environments and social spaces alone will not bring about social change. Achieving sustainability, by any definition, is the complex and multi-dimensional challenge.

But the design for eco-services would benefit both rich and poor nations. Poor communities in developing world, facing threats to their livelihood due to the loss of both public estate and ecological base could benefit from low-cost, low-tech, net Positive Development (Birkeland, 2002). She maintains that through biophysical interventions and community development programmes in local area, most diseases and injuries could be avoided. For example (Birkeland, 2002), roughly 6000 children die from dirty water each day in poor countries. With appropriate design for water infrastructure and development, dirty water can be prevented by restoring the health, absorptive capacity, and resilience of its source in natural systems, watersheds. It can also be prevented by avoiding earth-moving, tree-clearing or groundwater pollution during the water development. Many home-made, low-cost, low tech strategies, such as clay and coffee ground filters and landscape or building systems can be used to filter and treat water (Birkeland, 2002).

But due to vested interests in existing wealth transfer, many development initiatives in poorer countries are still very capital and resource intensive. Birkeland (2002) makes an example of the Three Gorges Dam in China, which became a single user of land and resources that dislocated hundreds of thousands of poor people and drowned million of hectares of agricultural land and soil.

To achieve sustainability and enhance ecological base and public estate, rural and urban development (what Birkeland refers to as “rurban” development) can no longer be considered as isolated systems instead should be “re-conceived as one symbiotic system” (Birkeland, 2002: 14). Design for positive development implies ‘gardens for living’ that re-couple humans with nature, while de-coupling unsustainable resource use from economic development (Birkeland, 2002: 14). Developing countries like South Africa have an opportunity to adopt the design for positive development, especially in the housing development sector.

2.4 Will developing countries like ours need to go beyond just greening of design to include ways of building socially mixed neighbourhoods?

Consumerism and poor personal choices are sometimes referred to as sources of unsustainable lifestyles. But Birkeland (2002) argues that the design of infrastructure, building systems and construction processes determines the demand
upon the industry to provide materials and products downstream in the market. She maintains that in the context of built environment, people have limited choices to lead sustainable lifestyles (Birkeland, 2002). They are trapped within the vicious circle of unsustainable resource use promulgated by physical and institutional design failure. The design of infrastructure and built environment has locked us into manufactured environments that limit personal choices and will rather continue driving excessive consumption and waste into the future.

Birkeland (2002) also maintains that the design contributes to social problems by creating environments that cause social segregation, alienation, inequity, health problems and ultimately lead to conflict over diminishing resources and space. Poor designs of buildings and built environments contribute directly to degraded environments, ill-health, lack of empathy, crime, and disaffection, undermines communities and create excessive financial liability in the long term (Halliday, 2008).

In support of Birkeland (2002), Halliday (2008) says that consumers certainly do not want leaky, wasteful, inefficient and polluting buildings. She maintains that the problem is more likely that of limited choices and little information on best value alternatives. Therefore (Halliday, 2008), the consumers remain powerless and locked within manufactured environments, and the opportunities for sustainable living are lagging behind consumer preferences in most parts of the world. Halliday (2008) argues that the perceived high cost associated with designing sustainable building and the low perceived value of environmental and social quality have largely prevented positive action except by the most committed.

There are a number of various cases in the world where ecological design has been attempted and success rate in environmental and social gains has been enormous (Beatley, 2000). Examples of such ecological building and city projects are Ecolonia, the Netherlands; Auroville, India; Lynedoch, South Africa; Curitiba, Brazil; and Bogota, Colombia.

2.5 Closing remarks

So far the discussion has served to demonstrate that the design can take into account sustainability and that is not just a question of appropriate design, but also a question of vested interests in the current resource and wealth transfer that may block any attempt to design more sustainable cities and neighbourhoods. It was also indicated that sustainable or ecological design approach will not benefit only the selected few, but will serve to correct the imbalances in wealth and resource transfer, thereby benefiting the poor as well. South Africa, as an emerging economy is faced with multiple development challenges, such as provision of low cost housing, halving unemployment by 2014, poverty alleviation, and extending access to affordable power to 30% of the households still not electrified. These challenges, however, provide opportunities for South Africa to adopt policies that promote
ecological design for our “rurban” development that also include and promote socially mixed neighbourhoods (discussed later, the Lynedoch case in Part B).

All these themes would now be discussed, with special reference to the design of infrastructure and built environment of three developments to showcase design approach for community building that I think the goal was to “minimise damage” and the other design approach that I think the goal was to “reverse damage”, and finally the design of the community development that included ways of building socially mixed neighbourhoods. The first case of Ecolonia, Netherlands, represents a clear demonstration of the energy and resource demand reduction through building and neighbourhood (re)design. The second case of Auroville, India, demonstrates positive development through positive design – going beyond just minimising damage, and the third case of Lynedoch, South Africa, is a combination of minimising damage with aspects of positive design and building socially mixed neighbourhoods.

3. **PART 2: Case studies**

3.1 **Ecolonia, Netherlands**

Initiated in 1991, “Ecolonia was part of an expansion plan in the town of Alphen aan der Rijn, located between the cities of Amsterdam, The Hague, Rotterdam and Utrecht, in what is known as Netherland’s ‘green heart’”. The project was supported by the Netherlands Ministry of Housing, Economic Affairs, Environment and Spatial Planning (Blundell, 1992; Hans, 1995). “It consists of 101 semi-detached and terrace homes within a development of 280 units within an urban extension of Kerk en Zanen numbering 6000 dwellings, south of Alphen”.¹ The Ecolonia project aimed to demonstrate and promote sustainable energy technologies, sustainable building practices, and more sustainable living practices (Blundell, 1992; Hans, 1995).

In 1989, the Netherlands government introduced the National Environmental Policy Plan that was very instrumental in the development of Ecolonia. The Plan, aimed at building industry, targeting mainly housing development, identified three major themes where significant steps needed to be made towards a sustainable and qualitative improvement for the citizens of the Netherlands by the year 2000. The three policy themes of that Plan were Energy Conservation, Life-Cycle Management and Quality Improvement. These themes and their further detailing provided programmatic considerations for the architects involved in the development of Ecolonia, and are referred to later on. Now let us look at the Ecolonia community design informed by the three themes.

¹Information retrieved from: [www.arch.umanitoba.ca/sustainable/.../ecolonia/ecoindx.htm](http://www.arch.umanitoba.ca/sustainable/.../ecolonia/ecoindx.htm)
The concept plan for Ecolonia was developed by Lucien Kroll, well known for his advocacy of an urban development form that fosters a relationship between people and their environment. His ideas are based on principles of natural expansion where a [development accommodates the needs of its community through building resilient ecosystems]. The following are the three themes within which housing schemes were considered in the development of Ecolonia.

- Energy Conservation
- Integral Life Cycle Management
- Quality Improvement

All the ecological design concepts incorporated under the three themes aimed at reducing energy consumption (by at least 25%), reducing water consumption, reducing land use, reducing the rate of raw material extraction, and reducing fossil-fuel use. Also the development of Ecolonia aimed to expand public space and increase amenity. Integral Life Cycle Management and Quality Improvement are discussed with special reference to organic design, water and sanitation, organic agriculture and land use, transportation and economic viability, whilst energy conservation, discussed next, ultimately becomes integral part of the other two themes. All three themes are parts of a whole – sustainability as envisaged by Ecolonia developers.

3.1.1 Energy Conservation

Design Features:

- High thermal insulation

Ecolonia community development walls, roofs and floors were insulated using material with \( R_c = 4 \, \text{m}^2 \, \text{K}/\text{W} \) for walls and roofs, and \( R_c > 3 \, \text{m}^2 \, \text{K}/\text{W} \) for floors. Here “high insulation or R value refers to the insulative properties of materials, the higher the R value, the better the insulation. The practice of using higher R value insulation, in conjunction with tight building practices yields good results providing an environment that is efficient and comfortable. High insulation may mean increased short-term cost, but this will be offset over time by reduced fuel costs and a more comfortable living environments”, (www.arch.umanitoba.ca/sustainable/.../ecolonia/ecoindx.htm).

- Windows with a high thermal resistance

Double-glazing with external shading (roller-blinds) was used in Ecolonia. Windows (single or double glazing) are available in differing states of emissivity. Emissivity “relates to the amount of heat loss allowed by a window. The greater the number of panes in a window, the less emissivity it has. The creation of dead air spaces or air buffers between the panes further
decreases the emissivity of the window”. Ecolonia designers also used Low-E glass that reflects up to 90% of long-wave radiation (heat), but allows short-wave radiation (light) in. “Low-E glass will tend to keep heat energy inside the building during the winter, and keep heat energy outside the building during the summer”, (www.arch.umanitoba.ca/sustainable/.../ecolonia/ecoindx.htm).

- Compact building style

Smaller single family dwelling unit sizes designed for Ecolonia development was a major driver of social transformation and were replicated in other developments in the Netherlands “as the social and demographic profile of family and other household arrangements changes. Smaller unit sizes are designed to make more efficient use of interior spaces while retaining solar and ground access”. Higher density buildings create a “more compact, efficient and affordable residential development. Net densities for smaller unit sizes in Ecolonia range from 7 to 14 units per acre” (about 4050 square meters). The benefits of compact building style include: “lower impact on the natural environment, more compact and accessible neighbourhoods which promote community, potential for public transit integration, reduced infrastructure expenditures, reduced costs for materials and construction, and reduced servicing, maintenance and energy expenditures (life-cycle costs)”, (www.arch.umanitoba.ca/sustainable/.../ecolonia/ecoindx.htm).

- Solar energy for passive and active heating and hot water

The buildings should be designed in a way that maximises solar access and minimises wind exposure. The buildings in Ecolonia achieved correct orientation that was well aligned with the streets. In so doing Ecolonia increased human comfort through maximising passive solar energy and the demand for external energy was reduced. Buildings in Ecolonia were designed to collect solar energy with windows acting as the main collection source. This was done using passive designs: proper orientation building with 50 - 60% of the building glazing oriented to the sun (south exposure in northern hemisphere and north exposure in southern hemisphere) and active designs: solar collectors to warm an interior space of the building, but solar collectors collect solar heat mechanically by using additional external electrical energy to operate pumps, motors etc. Solar Water Heaters were used for water heating as well.

3.1.2 Organic design that considers the natural cycle (durability and maintenance)

Design Features:
• Raw materials from the natural carbon cycle, such as wood cellulose, natural paints, resins were used in the development of Ecolonia, and cement was used only for later recycling
• Recycled material, such as rubble and concrete granulate were used in the ground floor and plaster board derived from flue gas desulphurisation
• Windows and frames made of local softwood, with hardwood lintels and sills and other easily replaceable materials and reusable components were used in Ecolonia.
• “Recycling is seen as the third stage of energy and material conservation in the Reduce-Reuse-Recycle ‘trilogy’”. Materials to be recycled are timber and lumber, cabinetry, doors, and other wood items. Also precast and pre-stressed concrete slabs, steel structures and cladding, glazing, and other modular construction elements.

3.1.3 Water and sanitation

Design features
• Reducing water consumption

In Ecolonia rainwater is harvested and used for irrigation, toilet flushing and car washing. Retention pond has been constructed at the centre of the Ecolonia community site. Mole drains are used to conduct water to the pond where “it is cleansed by a variety of wetland species, such as reeds and cattails. These vegetative filters help in breaking down the pollutants in water collected from road surfaces and chemical residues, in some cases leached from lawns and gardens”.

• Constructed wetlands

This is sewage treatment that is different from the conventional sewage system where the sludge sinks to the bottom of the pit for anaerobic decomposition to take place. In Ecolonia, “shallow ponds are populated with water hyacinths and bull rushes that aid the natural processes of the sun rays, oxygen supplied by wind moving the water, and bacteria and algae are present in the pond. The plant material can remove large quantities of nitrogen and phosphorus, as well as sucking up toxins such as heavy metals and phenols into their plant biomass”. Furthermore, this plant material can be harvested and incinerated to dispose of the toxins and provide heat. “The effluent is free enough of any pathogens that it can be sprayed on the land to irrigate crops, thus returning water to the ground that has been cleansed in a distinctly more natural way”, (www.arch.umanitoba.ca/sustainable/.../ecolonia/ecoindx.htm).

• Precipitation
Precipitation can be a great source of water for garden and greenhouse irrigation. When channelled inside a building, it can be used for many purposes: flushing toilets, washing clothes, watering indoor plants. “During temperate seasons, rainwater barrels can supply necessary moisture for a garden or herb plot, free of civic water consumption or sewerage charges. Eaves troughs can be emptied into purposefully designed barrels that have bottom mounted hose fittings allowing the gravity forced water to supplement natural precipitation when necessary”.

- Water-saving showers, taps and toilets

Most of water-saving devices used in Ecolonia include faucet aerators with a discharge rate as low as 2 litres/minute, low flow shower heads with flow rates between 6 and 10 litres/minute, high efficiency toilets with flow rates between 2 to 6 litres/flush.

Other water-saving concepts and devices are front loading clothes washing machines using up to one third less the amount of water as conventional top loading models. Considerable water savings can be generated by not using the dish unless it is absolutely necessary and only when it is full. “Other water savings can be achieved by leaving a jug of water for drinking in the refrigerator so that it will remain cold, and the use of soaker or neoprene osmosis hoses on the lawn or in the garden”.

3.1.4 **Organic agriculture and land use**

Design features

- food cycle

Organic techniques, such as composting, mulching, and using liquid and solid waste as fertilizer are used in Ecolonia. “It is an alternative to releasing toxic contaminants from herbicides and chemical fertilizers into the soil, surface and ground water. Organic techniques are important in long term use of the land for food production and the sustainability of soil because it recycles energy, nutrients and minerals with minimal damage to the local water supply and wildlife”, ([www.arch.umanitoba.ca/sustainable/.../ecolonia/ecoindx.htm](http://www.arch.umanitoba.ca/sustainable/.../ecolonia/ecoindx.htm)).

3.1.5 **Transportation**

Design features

- Traffic reconfiguration
Ecolonia is bounded on the west by a slow-traffic route from the city centre to the educational park, Archeon. An objective in designing Ecolonia was to reduce the amount of car-based transportation. Winkel centrum, is the local centre to the north of Ecolonia that provides a range of shops within a ten-minute walk to the regional rail station. The town-centre of Alphen aan den Rijn is about fifteen-minute walk from the station.

Within Ecolonia, walking and cycling are the main modes of transport resulting in low levels of noise, and improved safety. Car-based routes that are found in Ecolonia are designed for slow speed. The weakness of the traffic system in Ecolonia is that it does not make clear the separation between the different types of traffic. There are no marked parking bays or separate areas for cyclists and pedestrians. Areas designed for play and common areas are also often parked on.

### 3.1.6 Economic viability

Local employment opportunities created by the development of Ecolonia included two hairdressers and one doctor. Since Ecolonia was designed in such a way that there is good access to employment centres in the region, many of its residents already had stable jobs before moving to it. Moving to Ecolonia, among other reasons was precisely to be closer to the places of work.

There were housing “subsidies of 6,000,000 Dutch guilders that were contributed by the Ministries of Economic Affairs, Building Construction, Regional Planning and Environmental Protection”, all aimed at achieving the objectives of the Environment Policy Plan (NMP).

Modern energy and resource efficient community designs such as Ecolonia may appear to be more expensive at the outset, when compared to the cost of traditional community designs, “but the short term costs are offset by the long term benefits resulting from thoughtful planning and innovative design. The operating costs of these homes are significantly lower than those built in the surrounding community following normal practices” – business as usual (BAU) scenario.

### 3.1.7 Closing remarks

The community development project of Ecolonia was not aimed at ‘green’ residents but to demonstrate that environmental considerations in housing design can be attractive to all. According to Blundell (1992) & Hans (1995) environmental aspects of Ecolonia were found to be attractive and relevant to the home buyers and many of them stated that their environmental awareness has increased since moving to Ecolonia.
Ecolonia showed that more sustainable housing is possible in the Netherlands residential building sector. The initial step has been taken and those involved have learned a great deal and indicate they have developed their capacity to go further in future projects.

According to Van Der Ryn & Cowan (1996), positive design offers three strategies for addressing unsustainability: conservation, regeneration, and stewardship as mentioned in Part A. Conservation simply slows down the rate at which resources and energy are consumed, and unfortunately assumes that the damage must be done and the only recourse is to minimise this damage for the development (Van Der Ryn & Cowan, 1996). According to me, Ecolonia community development project achieved more of conservation and stewardship than regeneration for addressing unsustainability, though there were areas where positive design based on positive thinking was achieved, such as constructed wetlands, use of natural paints, passive solar harvesting, composting, and rainwater harvesting. But most design measures in Ecolonia, such as recycling, denser communities to preserve agricultural land, adding insulation, installing water-saving devices, and transportation were employed to reduce damage, than contributing to a net social and environmental gain. According to both Van Der Ryn & Cowan (1996) and Birkeland (2002) conservation alone cannot lead to sustainability since it implies a net loss in resource and energy use.

We will now discuss the second case of Auroville, International Township situated in South India, to demonstrate positive development through positive design – going beyond just minimising damage.

### 3.2 Auroville, India

Auroville, the International Township, “envisioned by spiritual leader Sri Aurobindo Ghose and his spiritual partner, Mirra Alfassa, better known as the Mother, is situated in the state of Tamil Nadu near Pondicherry, South India and was founded on the 28\textsuperscript{th} of February 1968” by the Mother (kundoo, 2007). People from more than 120 countries across the world and various states of India came together to place handfuls of earth from their homelands in an urn, to symbolise the birth of town dedicated to peace and international collaboration and understanding, “a site of material and spiritual research for a living embodiment of an actual human unity”.

Government of India, Foundations in USA and Europe, NGOs in India and abroad, all have collectively funded various development programmes in Auroville. People of Auroville have made significant contribution in terms of sustainable resource and energy management of the Auroville project. Today Auroville is a growing international community owned by all who live in it with highly successful multifarious activities, such as environmental regeneration, alternative energy, organic farming, village development, music, theatre, and art.
Amongst many of Auroville’s achievements, are its land reclamation and reforestation work. More than 2,500 acres (one acre = 4,047 square meters) of desert-like land have been transformed into a lush of green space. An impressive contouring and building of small check-dams have significantly improved the life-support potential of the whole Auroville and surrounding area, not only conserving but preserving soil and water ecosystems. More than 2 million forest trees, fuel trees, and fruit have been planted.²

The “original town plan of Auroville is based on a spiral galaxy model”, initially conceptualised by the Mother. The plan provides for four zones – Residential, International, Industrial, and Cultural – which have since taken shape and continues to grow. At the centre of the town is the Peace area (the heartbeat of the town) consisting of the lake, trees, parks and gardens, with the nucleus, Matrimandir (the place of concentration), and surrounding the zones is the lush of green area called Green Belt (as shown in figure 2).

Figure 2: Auroville town structure based on spiral galaxy model.³

Next, we discuss sectors of development of Auroville based on planning policies developed by designers, and as envisioned by the Mother: Residential, Industrial, Education and Culture, International, Building Development, Water, Energy, Solid waste, Traffic and Transport, Health, Green Belt and Bio region. Collectively these sectors are discussed under Physical Infrastructure and Social Infrastructure.

² Information retrieved from the website: http://www.auroville.org
³ Diagram retrieved from the website: http://www.lucywood.co.uk/wp-content/uploads/2008/06/city_diagram.gif
The development of all the two types infrastructure is aimed at holistic approach to sustainability as envisaged by Sri Aurobindo and the Mother, and implemented by Auroville developers.

### 3.2.1 Social Infrastructure

The “social infrastructure in Auroville will consist of two distinct parts namely the facilities needed by the residential population (which is predominantly located in the Residential Zone) and the other facilities that will be part of the main function of the Auroville Universal Township. The latter will be located mainly in the International and Cultural Zones', [http://www.auroville.org](http://www.auroville.org).

#### 3.2.1.1 Residential and Industrial

The social infrastructure required for serving the residential population is proposed to be at four levels namely: “Cluster or community level, serving a population of 250 persons, Sector level, serving a population of 1000 persons, Neighbourhood level, serving a population of 5000 persons, and City/District level, initially serving a population of 15,000 persons with an ultimate target of 50,000 persons”, [http://www.auroville.org](http://www.auroville.org).

The following services are provided at different levels with some levels providing more than one services:

**Health**

- Hospital
- Clinic and emergency facilities

**Education**

- creche
- primary and high school and university

**Recreation**

- community parks and playgrounds

**Commercial**

- shopping
- guest houses
- restaurants and tourist centre
3.2.2 Physical Infrastructure

3.2.2.1 Water Supply

Ecological concepts such as watershed management, water harvesting, wastewater recycling, prevention of saline intrusion, aquifer storage and recovery and water conservation are all parts of Auroville’s water management system.

One of Auroville’s major run-off channels is the utility canyon with potential to store water, and as a result check-dams were built to hold water back and prevent it from flowing down the canyon. During heavy rains, “the excess water flows over a spillway, a lower area in the middle of the dam, to be held back by the next check-dam further down”. This approach allows the topsoil carried by the water to build up behind each check-dam as the flow of water is stemmed and hence become a fertile seedbed for nature to sow and regenerates. The idea is to allow nature to take over again, as the roots begin to increase the “rate of percolation of the harvested rainwater. The canyons are special types of biotope for flora and fauna which we must protect, and not destroy”, [http://www.auroville.org](http://www.auroville.org).

3.2.2.2 Sewerage and Sanitation

Septic tanks, “leach pits and root-zone treatment of sewage for compact communities” have been experimented with in Auroville’s Cultural zone, International zone and the Green Belt area. “Separate and partially centralised systems of collection and treatment are mainly used in Industrial and Residential zones of Auroville to avoid potential contamination of groundwater”. “Sanitation will be done through the use of a variety of night soil disposal methods, such as toilets and latrines of various designs” in a way that ensures that underground water resources are not polluted, [http://www.auroville.org](http://www.auroville.org).

3.2.2.3 Energy Conservation
Use of solar, wind and biomass energy is among the major demand and supply side management interventions employed in Auroville. About 150 houses in Auroville “use solar photovoltaic (PV) electricity and solar water heaters (SWH) for their energy requirements. In addition, 140 solar water pumping systems and 30 wind pumps are operational in Auroville to meet gardening and irrigation requirements. Specially designed biogas systems are used to process animal and vegetable wastes to produce methane gas for cooking and organic fertilizers. Auroville in co-operation with Government of India Departments has installed a 36.3 KW solar photovoltaic power plant close to the Matrimandir, which is the largest stand-alone solar power plant in the country. A unique solar bowl has also been installed on the roof of the Solar Kitchen, which generates enough energy to cook meals for about 1 000 persons a day for the Auroville community”, (http://www.auroville.org).

“However, due to limitations of technology and high cost, Auroville still draws its power the Tamil Nadu Electricity Board (TNEB) grid. In order to fulfil its energy objectives Auroville is considering two important avenues: To build a wind farm in southern Tamil Nadu that would supply energy to the TNEB grid, which could be drawn at Auroville, and to build gasifier plants in Auroville to draw energy from biomass resources in the region. Proposals for pilot plants of 3 MW total capacity are under consideration. Solar photovoltaics (PVs) will serve as the main energy source, backed up by the Tamil Nadu Electricity Board (TNEB). Alternative sources of energy will be incorporated. Solar panels will be installed on the rooftops. Auroville’s approach would consists of both Demand Side Management (reducing wastage) and Supply Side Management from renewable sources of energy”, (http://www.auroville.org).

3.2.2.4 Building Materials

In most of Auroville earth was used in all parts of the building, from foundation to the roof. The proper management of earth resources was carried out to allow for a perfect integration of the excavations with the buildings and landscape. Auroville Earth Unit researched and developed appropriate building-with-earth technologies that stabilised the earth. Types of earth technology used in Auroville are Compressed Earth Block (CEB), technology that represents a combination of modern technology with traditional practice, and Rammed Earth Block (REB) technology.

Advantages of earth as a building material are:

- Earth is a local material
- Contribute to sustainable development
- Requires a lot of semi-skilled workforce
- Technology is easily adaptable and transferable
- Contribute to the thermal comfort and positive atmosphere
- Energy and monetary costs are much lower than with most other material
3.2.2.5 Solid Waste

In Auroville, separation of solid waste takes place at the source (paper, plastic, metal, glass, organic, batteries etc), and composting of organic waste are among solid management practices that aim to achieve zero waste situation. Some waste is incinerated to produce electricity. “Non-recyclable waste like glass, PET, rubber, and batteries are stored away in a special storage facility until acceptable eco-friendly disposal solution is found”, (http://www.auroville.org).

3.2.2.6 Traffic and Transport

Exclusive pedestrian and cycle paths that are aimed at reducing polluting traffic are key transport design features in Auroville. The road network consists of four types of roads: City Ring Roads – 30m wide roads connecting four main zones proposed for use by non-polluting vehicles, and Internal Distribution Roads – 30m wide roads for non-polluting vehicles and 3m wide paths is reserved for pedestrians and cycling.

3.2.2.7 Green Belt

A belt of green area surrounding the four zones of Auroville achieves healthy and productive working environments in Auroville and surrounding neighbourhoods. “It is a field laboratory for best practices in environmental sustainability, food security, and development of urban-rural linkages”, (http://www.auroville.org).

The “Green Belt Zone has three broad categories of land use, viz. Agriculture and Farming, Forest and Land Regeneration and Recreational areas. Their development is designed to promote land regeneration, bio-diversity, water management, environmental restoration and technology transfer of the above activities for wider application”, (http://www.auroville.org).

Agriculture and Farming

“The western part of the Green Belt, consisting of natural drainage channels and village settlements, is reserved for intensive agricultural development. They cover approximately 500 hectares”. They are utilised to set up prototype farms for raising appropriate crop varieties that can be efficiently produced in differing geographic conditions in Tamil Nadu, in order to replicate them for the benefit of farmers in these areas. Auroville’s ongoing work in water management, soil conservation, organic farming and seed collection, which is being carried out in collaboration with state, national and international research institutions and agencies, will promote food security and optimise the agro-economic potential both locally and nationally.

Forest and Land Regeneration

The eastern part of the Green Belt is “developed with dense plantations of trees, and this acts as a barrier against cyclone-strong winds coming from the coast, which
were until recently the main cause for soil erosion and degradation of land. This part of green belt covers about 560 hectares of land. They are used to intensify the ongoing work of land regeneration, to re-establish indigenous forest vegetation, to propagate biodiversity through gene pools and seed banks, and to institute zero-runoff parameters and practices”. The forests attracted birds that brought with them seeds from trees elsewhere. A negative feedback loop was created which resulted in today’s green lush of Auroville. Another important role played by this part of the Green Belt is to carry out wastewater treatment and recycling, solid waste management and experiments for producing alternate energy through the use of biomass and wastes. In this regard Auroville is already collaborating with state and central government agencies.

Recreation

Green Belt also provides “open air recreational facilities for the inhabitants. About 256 hectares of land has been designated for this purpose, which will also include a botanical garden and agro and social forestry for the benefit of neighbouring villages”. Another purpose for the part of the Green Belt is to provide modern burial and cremation site and services.

3.2.3 Closing remarks

Auroville encompasses innovation, low energy and material consumption, barrier-free architecture, cost-effective technology and indigenous low impact materials. Industrial sector is aimed at establishing clean and non-polluting industries through promotion of small and medium enterprises. The objective is to expand local employment and promote local economic development (LED), “increase vocational training for youth, encourage local entrepreneurship, promote good working environment for workers and encourage efficient management practices”, (http://www.auroville.org).

Auroville is now a centre for international studies on humanity, culture, ecology, environment and transdisciplinary approach to sustainable development. It is the place where knowledge of culture, art, craft and technology is forever synthesised. Emphasis on local indigenous systems and a wide range of medical knowledge sourced from the world over for good healing practices makes Auroville a healthy place to live at.

In addition, Auroville provides cultural activities such as live music, art galleries, theatre, cinema and sporting codes including soccer, tennis, basketball and volleyball. Classes are offered on everything from African Dance, Aikido and Yoga, and Aerobics. A wide variety of restaurants are available serving Indian and western cuisine
I think it will be safe to say that the conception and design of Auroville managed to strengthen the weave (Van Der Ryn & Cowan, 1996) that links nature with culture. The design of Auroville town development certainly took into account biodiversity loss, resource depletion, collapsing ecosystems, diminishing public space, and preserved soil fertility and nutrient and water cycles. Van Der Ryn & Cowan, (1996) say that regeneration literally means repairing and renewing living tissues, whilst Birkeland (2002) argues that positive design helps regenerate a world deeply wounded by dumb design. The design of Auroville literally healed the land that was severely degraded and built capacity for land to regenerate natural capital and absorb waste. The discussion will now shift to South African case of Lynedoch Eco-village.

3.3 Lynedoch, South Africa

Lynedoch Eco-village “is the first ecologically designed socially mixed community”, co-founded by Eve Annecke (also the director of Sustainability Institute), and is situated in Stellenbosch near Cape Town, South Africa. Basically what used to be a huge and ugly corrugated iron dump has been redesigned and renovated to have what we now know as the first South African eco-village housing Sustainability Institute, Primary School, Pre-school, offices and many more. In addition to social infrastructure, there is ecologically designed physical infrastructure based on the principles of positive design such as water, sanitation, electricity, roads and telecommunications.

Lynedoch Eco-village is managed by Lynedoch Development Company (LDC), a section 21 company (non-profit company). The board which is made up of academics, professionals and local community leaders was set up 2000 to build “an inclusive living and learning community that would showcase sustainable living in practice”. Forming part of this eco-village is the non-profit Trust, Sustainability Institute (SI) which “acts as the animator of the design innovation, institutionalisation and community building”, (http://www.sustainabilityinstitute.net/lynedoch-ecovillage).

SI mobilizes “intellectual capital, research networks and sense of vision-in-practice that makes projects credible in the eyes of debt providers, the Development Bank, local banks, local authorities, and the buyers of the property”.

Sustainability of Lynedoch Eco-village was envisioned to achieve social sustainability through the design of proper social infrastructure, ecological sustainability through design of proper physical infrastructure, and economic sustainability through prudent management of financial resources. We will now look at social sustainability and what social infrastructure is in place to achieve a truly social mixed eco-village.

---

4 Most of the information here is retrieved from: http://www.sustainabilityinstitute.net/lynedoch-ecovillage
3.3.1 **Social Sustainability**

Social sustainability at Lynedoch Eco-village has two dimensions to it: one is governance and the other is achieving social mix.

3.3.1.1 **Governance**

As a developer, Lynedoch Development Company (LDC) has development rights and as a result raised funds, managed the construction of infrastructure and community building aspects of the development. “Lynedoch Home Owners Association (LHOA) was established as a section 21 company” to be responsible for service delivery when local authorities approved the development. LHOA is constituted by property owners and LDC. “The most important document is the Code of Conduct which defines the way the community would like to live on daily basis”, ([http://www.sustainabilityinstitute.net/lynedoch-ecovillage](http://www.sustainabilityinstitute.net/lynedoch-ecovillage)).

3.3.1.2 **Achieving Social Mix**

The participatory planning process mainly included prospective buyers who one way or another faced the problem of not being granted loans by the bank. This problem initially posed a threat to achieving socially mix objective of Lynedoch community. However, “the participatory planning process resulted in innovative sale system whereby the buyers have possession and occupation rights, but ownership is achieved only after the house has been paid up. In addition to this, enabling legal and financial arrangement allowed buyers, both subsidy and non-subsidy, to choose their plots”, ([http://www.sustainabilityinstitute.net/lynedoch-ecovillage](http://www.sustainabilityinstitute.net/lynedoch-ecovillage)).

In addition to this the Lynedoch Eco-village has the following social infrastructure to meet service requirements of the inhabitants of the eco-village and visitors:

Education (creche, primary and Sustainability Institute), Recreation (gardens and playgrounds), Commercial (guest houses and shop), Culture (cinema and sports) and Services (offices, water and electricity, wastewater treatment)

“The most important aspect of the social sustainability of Lynedoch Eco-village is the centrality of children in both spatial structure of the development process and the social dynamic that characterises daily life”. We are now going to discuss ecological sustainability of Lynedoch Eco-village.

3.3.2 **Ecological Sustainability**

The following systems have been constructed based on ecological design:

3.3.2.1 **Water and Storm-water**

Lynedoch Eco-village has dual water supply system in place. Potable water is supplied by municipal water line directly to each unit with “one meter for the whole development (included is the free water allocation of 6000 litres to each unit
connected to the system). Secondly, there is recycled water supply to each household to be used for toilet flushing (which reduces potable water consumption by 40% per house) and irrigation (which reduces potable water consumption by 60%)

(http://www.sustainabilityinstitute.net/lynedoch-ecovillage).

Storm-water runoff is conveyed in open channels and pipes into a dam located at the bottom of the site. The savings are huge, with “low-income households saving 90% of their normal monthly water bill and middle-income households saving around 70%”, (http://www.sustainabilityinstitute.net/lynedoch-ecovillage).

3.3.2.2 Household Effluent

The “grey and black effluent from households passes through septic tanks where the main solids are deposited, and proceeds on to a Vertically Integrated Constructed Wetland at the bottom of the site where aerobic treatment takes place on top of the Wetland (which where the effluent enters) and anaerobic treatment takes place at the bottom of the Wetland as effluent sinks down. Thereafter, it goes into a dam, from where it gets pumped into storage tanks at the top of the site for onward delivery into the households for toilet flushing and irrigation. The grey and black effluent from the guest house and main building is channelled directly into a Biolytic Filter which is an engineered micro-ecology consisting of a peat filter inoculated with earthworms which treat the solids in an aerobic environment which results in treated water that has retained the primary nutrients (nitrogen and phosphorus) for reuse as a natural organic fertilizer”. Biogas digester produces methane that will be used to cook.

3.3.2.3 Energy

The following energy measures have been adopted and implemented at Lynedoch Eco-village:

- Solar Water Heaters (SWH) for each house saving 60% of energy costs
- Gas stoves: no electric stove allowed
- North-south orientation, proper insulation, overhangs, thermal and geothermal systems
- Low energy lighting – 11 kW power saving by Compact Fluorescent Lights (CFLs) and 2 kW power saving by Low Energy Diodes
- Street lights – Low Energy Diodes are “powered by solar panels, i.e. once off capital cost”
- Micro-grid generation using solar, wind and hydro power technologies that feeds into national grid (5 kW PV system and Wind turbine)
- Tradable Renewable Energy Credit (TREC) as possible source of financing other energy initiatives at the site
3.3.2.4 **Refuse**

LHOA manages municipal refuse collection – "members required to separate their refuse into five separate containers (paper, glass, plastic, cans and organic waste). LHOA is responsible for collection of separated refuse and selling to recyclers. Recycling is a small business operated by local people. Composting depot is used to process organic waste for use in the community gardens". Only 5% of solid waste is targeted to reach landfill.

3.3.2.5 **Housing**

There are about five housing design types at Lynedoch Eco-village ranging “from single residential dwellings to semi-detached houses and terrace housing”. Architectural Guidelines are available for buyers to generate their own designs. A large number of subsidy buyers cannot afford to appoint a contractor and they will build their own houses, and there are also non-subsidy buyers who do not appoint a contractor and wish to build for themselves. The main building material is “adobe brick (clay and straw) or a compressed cement-soil brick (with 5% cement content). A community-based sustainably managed forest harvesting project in Mozambique has agreed to supply hardwoods for the manufacture of windows and door frames in order to prevent the use the Meranti which is the most widely used hard wood in the Western Cape but which is imported from unsustainable forests in Indonesia and Brazil. However, aluminium has already been used in the development because although it has a high embodied energy content, it is maintenance free, insulates well, does not need to be painted and is very durable, also can be reuse" (design for disassembly), ([http://www.sustainabilityinstitute.net/lynedoch-ecovillage](http://www.sustainabilityinstitute.net/lynedoch-ecovillage)).

3.3.3 **Economic Sustainability**

What often happens is that poor households, which are the majority in South Africa, are placed on the peripheries of the cities, far away from employment and shopping centres. The problem is that the “R20 000 plot in a marginal poverty-stricken area probably has a market value of less than R20 000. In Lynedoch Eco-village, a R20 000 plot is worth at least R100 000 on the open market. The challenge is to make sure that the intended beneficiaries remain the beneficiaries”.

“LHOA imposes on all property owners through its constitution severe restrictions on resale by making sure that the seller of property first offers to the LHOA and only then can the offer be made to third party at a price not lower than that proposed by LHOA. There is also a provision that allows the LHOA to approve or disapprove a potential buyer, which together allows the LHOA to ensure that the community remains committed to the vision and values of eco-village”.

Savings and Credit Cooperative (SACCO) was established by LDC in partnership with SI to provide “non-secured loans to poor people based on their savings record".
3.3.4 Closing remarks

Lynedoch Eco-village showed that ecological design can be at the heart of design process for urban development in South Africa.

“It is possible to develop child-centred socially mixed communities, and in particular this can best be done with cooperation of municipalities. If spatial integration of low- and high-income households takes place, it becomes possible to create all sorts of markets that incorporate rather than exclude the urban poor – in particular housing markets that promote rather than disrupt community building, financial markets that build relational capital and therefore reinvestment rather than suck resources out of poor areas, and food markets that increase household nutrition levels at lower costs to the end user and higher returns for the farmer, (http://www.sustainabilityinstitute.net/lynedoch-ecovillage).

4. Conclusion

Since waste will be generated from people’s daily activities, then the focus should shift from the symptoms (pollution, waste etc) to built environment (cities, buildings, landscapes, products) as a space that could generate healthy ecological conditions, improve life-support services, reverse the impacts of the current systems of development and improve quality of life for all (Birkeland, 2002). This, however, will require a different design approach of urban development – our basic approach to institutional and physical design and practice must change. We have to rethink our built environment – from the patterns of our buildings and cities to the materials we use to build them and the sources of energy we use to drive them (Du Plessis, 2002).

In order to create low-cost, low-tech, ecologically sustainable cities, we must enter into a new paradigm of sustainable design; one that aims to make cities and buildings ecologically productive, ecologically efficient, and socially inclusive. Birkeland (2002) argues that even if cities and buildings can be carbon neutral, energy neutral, and zero waste, they would still not qualify as sustainable. To be truly sustainable, she maintains, cities must build resilience of ecosystems by increasing health of bio- and eco-sphere. My grandmother’s village was once the centre of a largely self-sufficient system that produced a family’s livelihood, its food and fibre, and its tools. Thus, we should rethink our buildings and cities’ metabolism, and begin to change the value systems that create aspirations which eventually shape our human settlements.

Ecolonia showed that more sustainable housing is possible in the Dutch residential building sector. The initial step has been taken and those involved have learned a great deal and indicate they have developed their capacity to go further in future projects.
Auroville is now an important bioregion where people participate in “sustainable development, continuously improve sanitation and water supply, improve housing through cost-effective techniques, and engage in innovative research programmes and better agriculture practices”, (http://www.auroville.org).

Lynedoch has become a centre for learning innovative sustainable energy, water and sanitation, solid material and housing solutions. It showed that it is possible to “ecologically designed urban systems and built forms that can save households money and they can reduce the operating costs of municipal infrastructures (in particular the infrastructures required to deliver water, sanitation, solid waste removal and energy)”, (http://www.sustainabilityinstitute.net/lynedoch-ecovillage).

“We cannot recreate nature, but we can design for nature by creating the infrastructure for natural systems to unfold in their own way” (Birkeland, 2002: 17).

There is one timeless way of building – “it is a process which brings order out of nothing but ourselves, it cannot be attained, but it will happen of its own accord, if we will only let it” (Alexander, 1979).
5. Bibliography


