A Quality of Life study of ecologically sustainable housing in south east Queensland, Australia

Presenter: Ben O’Callaghan
Researcher (University of Sydney) and Sustainability Consultant (Ecomplish)

Research Team:
Professor Richard Hyde (University of Sydney),
Dr David Wadley (University of Queensland),
Dr Ted Gardner, (NRM),
Anir Upadhyay, (University of Sydney),
Ben O’Callaghan, (University of Sydney).

Outline
- Introduction
- Context
- Model
- Findings
- Conclusions
- Research Team
- Contacts
- Questions
Introduction

Background of the Study
- five year study of two communities in south-east Queensland
- 75 homes and occupants
- Used questionnaire and utility consumption data

Knowledge Gap
Understanding Quality of Life (QoL) at the level of the precinct and community.

Related Problem
How to increase/maintain quality of life, whilst reducing environmental impact.

Questions
Do sustainable design and environmental attitudes have a relationship with Utility (energy and water) Consumption

How satisfied are the people with the residential environmental quality in sustainable housing?
Key factors

• Measuring sustainability through the Quality of Life of communities
  – Role of attitudes, values and behaviour towards the environment
  – Community Satisfaction
  – Environmental impact
• Measuring the potential sustainability of the built environment
  – Urban or neighbourhood design
  – Building design

What is Quality of Life?

• Existential factors
  ◦ Health
  ◦ Community and privacy
  ◦ Economic wellbeing
  ◦ Security
  ◦ Education
• Biophysical factors
  ◦ Site
  ◦ Climate
  ◦ Biodiversity
  ◦ Bioregion
• Behavioural psychological factors
  ◦ Livability
Environmental QoL (QoLe) model

Objective environmental quality
- Attributes of environment
  1. Natural environment
  2. Built environment
  3. Social indicators
  4. Availability of services
  5. Economic activities

Personal characteristics
- Characteristics of people
  1. Socio-demographic variables
  2. Environmental attitudes

Subjective evaluation of the environment
- Satisfaction and well-being
  1. Perceive Residential Environmental Quality (PREQ)
  2. Neighbourhood Attachment

Environmental Quality of Life (QOL)

Environmental and Human well-being
- People- Environment congruity
- Other existential factors

Environmental attitudes - definitions

- **Preservation** reflects a biocentric dimension that considers conservation and protection of the environment

- **Utilization** represents an anthropocentric dimension that considers the utilisation of natural resources

- A short version of Environmental Attitudes Inventory (EAI) proposed by Milfont and Duckitt (2010) is used.

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6. Controls should be placed on industry to protect the environment from pollution, even if it means things will cost more.
   1 2 3 4 5 6 7

7. I would like to join and actively participate in an environmentalist group or already do.
   1 2 3 4 5 6 7
```
Context - Study Location and Approach

- Hot Spot of ‘sustainable homes’ at the Ecovillage in Currumbin

Over 30 National Awards for its design

Able to compare to an estate in the same climate zone.

Access data from Ecovillage homes as they are electronically metered.

Comparisons

<table>
<thead>
<tr>
<th></th>
<th>The Ecovillage</th>
<th>The Observatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot Size (average)</td>
<td>1000 m²</td>
<td>770 m²</td>
</tr>
<tr>
<td>House Size (average)</td>
<td>194 m²</td>
<td>328 m²</td>
</tr>
<tr>
<td>Bed rooms (weighted average)</td>
<td>2.7 (90% houses had 1 - 3 bedrooms)</td>
<td>4.3 (95% houses had 3 - 5 bedrooms)</td>
</tr>
<tr>
<td>Number of occupants per house (average)</td>
<td>2.7</td>
<td>3.4</td>
</tr>
<tr>
<td>Lots Planned</td>
<td>147 residential + 6 commercial</td>
<td>880 residential</td>
</tr>
<tr>
<td>‘Community Facilities’</td>
<td>20</td>
<td>5</td>
</tr>
</tbody>
</table>
Similarities (‘controls’)

- Block size
- Socioeconomic factors: income, age, education
- Climate zone
- Location – distance from beach and shops
- 95% of residents were Owner-occupiers

Note: The developments are not overly dense, hence the building form does not provide the ‘solution’ for high density urban living, however
a. it is likely that there will continue to be some market for such lifestyle choices and
b. The comparison provides insights into QoL triggers and relationships.
The ‘Observatory’ – Comparison ‘Contemporary’ Estate  (Google Earth 2009)

The ‘Ecovillage’  (Google Earth 2009)
Objective environmental quality - comparison

<table>
<thead>
<tr>
<th>The built environment</th>
<th>‘Sustainable’ Community</th>
<th>“Conventional” Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Walkable street</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Connected and Open community</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Mixed land use</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Access to sports fields on foot</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Building energy efficiency</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Building water efficiency</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Water efficient landscaping</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Existing building reuse</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Stormwater management</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Heat island reduction</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Solar orientation of lots</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• On site renewable energy sources</td>
<td>Yes (mandatory)</td>
<td>Not mandatory</td>
</tr>
<tr>
<td>• Wastewater management</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Recycled content in building materials</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>• Solid waste management</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Key Group Differences

*The Ecovillage*

- Prescriptive Building Codes
- Solar passive design: Living area orientation: (North)
- Reticulated LPG Gas
- Recycled materials
- Internal thermal mass
- Energy and water efficient appliances
- Solar electricity generation (minimum 1 kW)
- Solar hot water
- No cats or dogs
- No air-conditioners
- Local food production
- Local businesses
- Waste Recycling
- One large pool

Swale drainage
Information Monitoring and Control System (IMCS)

Installed in most Ecovillage homes as required by the Ecovillage Codes (mostly ‘EcoVision’ systems).

Real time utility data:
- rain water
- recycled water
- solar PV energy generated
- lighting energy
- water pumping energy
- general power outlet energy
- gas used
- temperature, humidity and more

“you can’t control what you don’t measure”
Key Group Differences

The Observatory

- 50% of homes had pools or spas
- Air conditioners
- Various orientations
- No centralised gas available
- Little solar hot water or solar energy technology employed
- Limited improvement in biodiversity
- No significant use of recycled materials

= Standard contemporary Australian estate

Analysis

Energy

- Ecovillage homes using 58% less energy compared to the Observatory (contemporary) estate 9.65 vs 22.76 kWh per day

Net:
When taking into account the Solar PV energy generated (of 5.7 kWh per day) Ecovillage homes use 75% less energy than the contemporary estate
**Energy Consumption by Type**

- **The Observatory**
- **The Ecovillage**
- **The Ecovillage (Solar)**

**KWh, per annum on average**

- **Electricity consumed**
- **Gas consumed**
- **Solar PV Electricity generated**

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**Total Energy Use**

- **SEQ**: 22 kWh/day for electricity, 11 kWh/day for gas
- **The Gap**: 31 kWh/day for electricity, 0 kWh/day for gas
- **Silva Park**: 19 kWh/day for electricity, 5 kWh/day for gas
- **Observatory**: 22 kWh/day for electricity, 0.01 kWh/day for gas
- **Ecovillage Gross**: 7 kWh/day for electricity, 3 kWh/day for gas
- **Ecovillage Net**: 3 kWh/day for electricity, 3 kWh/day for gas

**kWh/hh/day used on average per dwelling**
**Energy Consumption per household**

<table>
<thead>
<tr>
<th>Location</th>
<th>Net Energy Use (KWh, per day on average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>29</td>
</tr>
<tr>
<td>Australia</td>
<td>34</td>
</tr>
<tr>
<td>Queensland</td>
<td>20</td>
</tr>
<tr>
<td>Southeast...</td>
<td>22</td>
</tr>
<tr>
<td>Silva Park</td>
<td>19</td>
</tr>
<tr>
<td>The Observatory</td>
<td>23</td>
</tr>
<tr>
<td>The Ecovillage</td>
<td>6</td>
</tr>
</tbody>
</table>

**Water**

*Similar rates of usage*
- 489 (Observatory) vs 428 (Ecovillage) litres per household/day

*Per Capita*
- 156 litres vs 173 litres per person per day
Residential satisfaction and Neighbourhood attachment – Results

**Neighbourhood attachment**

86% of the Ecovillage residents felt integrated in their neighbourhood.

55% of the Observatory residents integrated.

**Transportation**

100% of Ecovillage respondents were dissatisfied with (public transport) transportation services as there are no public bus or train services locally.

65% of Observatory residents were dissatisfied with it.
Residential satisfaction and Neighbourhood attachment – Results

**Sports and recreation**

80% of the Ecovillage respondents were satisfied with sports and recreational facilities whereas, only 25% of the Observatory residents were satisfied.

**Social relationships**

90% of the Ecovillage residents and

75% of the Observatory residents were satisfied with the overall social relationships with their neighbours.
Key findings

1. Ecovillage demonstrated strong support for pro-environmental attitudes (high Preservation and low Utilization scores)… and the opposite is true in the conventional estate.

2. Overall neighbourhood satisfaction was distinctively higher for the Ecovillage residents and also their priorities were different.

3. The ‘sustainable design’ of a home was the largest independent contributor to reduced energy use, among the variables included in the study.

Conclusions

1. The sustainable design of a house is twice as likely to reduce a home’s energy consumption compared to the influence of environmental attitudes.

2. A high level environmental response, pro-environmental attitudes and high level of perceived satisfaction contribute towards higher levels of environmental QoL (QoLe).

Thus, environmental QoL can form a currency, to evaluate sustainable development at local level.

And such information can help us make more informed decisions on a larger (city) scale.
Acknowledgements

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- The Ecovillage Residents

Contacts

Richard Hyde  
Professor of Architectural Science  
University of Sydney  
Australia  
richard.hyde@sydney.edu.au

http://sydney.edu.au/architecture/

Research Team:  
Professor Richard Hyde  
(University of Sydney), Dr David Wadley  
(University of Queensland), Dr Ted Gardner, (NRM), Anir Upadhay, (University of Sydney), Ben O’Callaghan,  
(University of Sydney).

Ben O’Callaghan  
Sustainable Development Consultant & Researcher  
ben.ocallaghan@ecomplish.com.au

Please contact me if I can assist with your project.