

- Zero or minimal energy use. Passive systems rely basically on the natural mechanisms of conduction, convection, radiation and evaporation, and use little or no external energy.
- Simple and reliable operation. Passive systems are usually built as an integral part of the structure using familiar building materials such as bricks, wood, concrete and glass and so no special skills are needed to maintain or extend them.
- Low cost and multiple use. Perhaps the best examples are windows, which, when properly located, provide views, daylight, ventilation and passive solar gains at appropriate times.
- Good performance. Research has shown that well-designed passive systems perform well, both in terms of energy savings and thermal comfort.

Most passive and low-energy systems rely on designing the building to take advantage of a good climate and to provide protection from harsher conditions.

#### 3.5.1.1.1 Hot climates

Over hundreds of years, traditional peoples have displayed excellent adaptation to the climate through the use of passive design. Varying microclimatic conditions have led to specific design responses. For example, in traditional courtyard houses of the Middle East, underground rooms and deep passages sometimes leading to a well, cistern or water canal draw cool, moist air into the rooms above. Scoops on the roof direct winds down to lower rooms. The air is cooler as it passes through the masonry shafts, and wet clay jars at the bottom moisten and cool it further. It is intelligent to study local traditional architecture to see what you can adapt to take advantage of sun and wind, and to reduce energy waste in lighting, heating and cooling.

The ecolodge's latitude is a factor in deciding the best orientation for buildings. Your position in relation to the equator is important because the sun shines from both the south and the north depending on the time of the year. From latitude 10 degrees north and south of the equator, changes in climate can become apparent. The following guidelines are for those areas that have a hot climate.

#### GUIDELINES

1. Traditional passive design should be used when drawing up an ecolodge, paying particular attention to the area's architecture where the lodge is planned.
2. Study the history of the area's climate and the suitability of materials you propose to use, taking into account the worst conditions you can expect.
3. Many different passive design techniques are found in traditional architecture in relation to the sun. For example, long roof-overhangs protect and shade the walls, compact settlements increase shade, and natural floor finishes do not reflect the sun. Many indigenous peoples used thick insulating walls and roofs made of mud and grass to cool the hut during the day and heat it at night. Elongated floor plans are commonly used to minimize internal heat gain and maximize exposure for natural cross-ventilation.
4. Unlike temperate regions, the equatorial zone receives sunlight shines from the south for six months (late September to late March) and from the north for six months (late March to late September). In the Southern Hemisphere, a north-facing building can take advantage of natural light while using solar radiation to heat interior spaces during the colder months; of course, this is helped by thoughtfully positioned windows. To naturally cool the southern and western sides of the north-facing lodge during hotter months, the architect should design shading devices along useful traditional lines, incorporating balconies and covered porches. In the Northern Hemisphere the situation is exactly reversed. The wise use of plants and landscaping can provide additional shade and screening that protect the building from intense radiation of the equatorial sun.
5. In climates with high diurnal (day/night) temperature changes, use techniques such as the so-called Trombe wall, which consists of storing solar energy in a sun-facing wall made of heavy masonry such as brick, stone, block or earth, with a dark-colored surface facing the sun. As the sun's rays shine on the wall, generated heat is stored and circulated passively (especially during the evening and at night) through wall vents into the living areas. The wall can have window openings, with double or triple glazing fixed close in front and forming a cavity between the two surfaces, creating a greenhouse effect.
6. Use the courtyard concept as an efficient natural climate moderation in hot, arid climates. The inside rooms open onto galleries that give shade and access to rooms. Thick outside walls have few small windows and the roof can have a series of wind scoops to help air circulation.

Ensure that your design takes advantage of the sun and elements — and protects against them. Ventilation, shade and insulation are key, as is cyclone protection in vulnerable tropical zones.



7. Covering the roof partially or entirely with grass integrates the building with the surrounding ground and takes advantage of temperature-moderating effects of the earth.
8. Another solar wall technique is water-container walls, which use water drums or columns (painted black for better heat absorption) as heat stores instead of masonry. Vents should be incorporated toward interior space. Water is more efficient than masonry as a thermal store but is extremely heavy and needs regular maintenance to prevent or repair leaks and algae growth.
9. Remember that the sun can be a significant liability in hot climates, but is rarely a liability in cold climates.
10. Consider using radiant barriers in attics or ceilings and in exposed walls. These foil barriers reflect up to 96% of radiant energy and are one of the most cost-effective measures for preventing heat transfer into the building.
11. Remember that temperature is a liability in climates where it is consistently too hot or too cold. Areas that are very dry or at high elevation typically have the asset of large temperature swings from daytime heating to nighttime cooling, which can be flattened through heavy/massive construction to yield relatively constant indoor temperatures. In areas with cold winters, try to capture as much solar light (and its heat) as possible during this season, using large windows facing the sun's path.
12. When sun shading is difficult, use the next best alternative, which is to reflect as much light as possible by painting the roof and outside walls white; be sensitive to glare and impact on natural and cultural settings.
13. Use landscape elements to optimize natural ventilation and, consequently, to avoid unnecessary energy consumption. Evergreen trees (trees that do not shed their leaves or needles) and raised earth mounds (also called berms) can protect against undesirable prevailing winds.
14. Use the overhead canopy of deciduous trees to provide excellent filtration for the sun's warming rays in summer months. By preserving and supplementing the deciduous tree canopy, you can keep heat loss down in winter and keep heat intake at a minimum during hot summer months.
15. Limit the use of air conditioning to areas where rigid control of humidity and temperature are strictly necessary, such as in rooms where you might have computers or certain fragile research technical equipment. Design approach should generally use as much as possible cross-ventilation techniques for enhancing comfort. Ceiling fans are good alternatives to air conditioning in most areas, and can be used in conjunction with air conditioning to enhance air circulation and reduce the air conditioning load.
16. If absolutely necessary, thin your tree canopy rather than remove trees to allow sun and breezes to pass through while still maintaining its natural character.
17. When solar gain causes conditions too hot for comfort:
  - a) Use overhangs to shade walls and openings.
  - b) Use site features (and vegetation, if available) to provide shading to exposed side walls.
  - c) Use shading devices such as louvers, covered porches and trellises with natural vines to block sun while allowing breezes and natural light.
  - d) Orient broad building surfaces away from the hot late-day sun (only northern and southern exposures are easily shaded).
  - e) Use light-colored wall and roofing materials to reflect solar radiation, but be sensitive to glare and impact on natural/cultural settings.
  - f) Use shutters and screens in tropical and subtropical climates, avoiding glass and exposures to direct solar gain.
18. When climate is predominantly too hot for human comfort:
  - a) Minimize solid enclosure and thermal mass.
  - b) Maximize roof ventilation.
  - c) Use elongated or segmented floor plans to minimize internal heat gain and maximize exposure for natural cross-ventilation.
  - d) Separate rooms and functions with covered breezeways to maximize wall shading and induce ventilation.
  - e) Isolate potential heat-generating spaces such as kitchens and laundries from living areas.
  - f) Provide shaded outdoor living areas such as porches and decks.
  - g) Capitalize on cool nighttime temperatures, breezes or ground temperatures (in some places it is common to build underground).

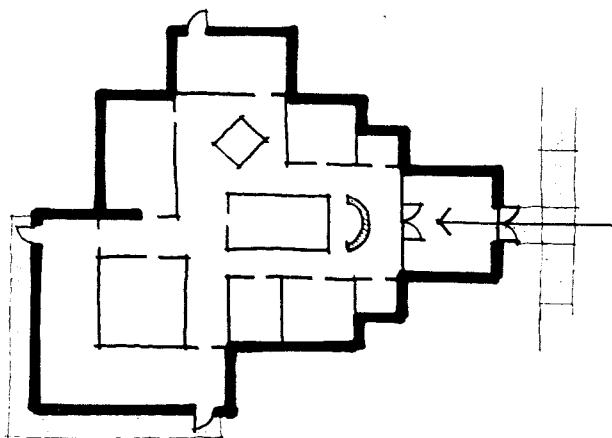
#### 3.5.1.1.2 Cold climates — winter-time heating

The goal of all passive design heating systems is to capture the heat within buildings and release that heat during periods when the sun is not shining. Passive solar heating refers to the use of the sun's energy to

heating living spaces, without mechanical devices. For passive solar heating in winter, the ecolodge needs all the sun it can get. In this approach, the ecolodge buildings or some elements take advantage of the natural energy characteristics of materials and air created by exposure to the sun.

### GUIDELINES

1. Orient the ecolodge to the south or slightly east of south. The buildings should be elongated on an east-west axis and the south face should receive sunlight between the hours of 9 a.m. and 3 p.m. (sun time) during the heating season. To take advantage of the heating provided from this orientation, the buildings should have south-facing windows and little or no north-facing windows. However, remember to follow the "thermal mass" common rule of thumb, which states that the south-facing windows should not exceed 7% of the total floor area unless the building has some means of heat storage.
2. Cavity-fill walls if appropriate, or apply internal and external insulation to solid walls.
3. Increase airtightness through caulking and weather-stripping. This keeps cold air out and prevents warm air from escaping.
4. Add additional insulation to roofs and walls during construction.
5. Put reflective foil on outside wall radiators.
6. Insulate hot- and cold-water tanks and lag pipes.
7. Add internal lobbies or enclosed porches to outside doors. Entrances bring in not only visitors and employees, but also cold air. One way to decrease cooling in winter is to protect entrances from cold air and winds.
8. Increase solar gain. Add solar windows, solar walls and sun-spaces. Fit solar panels to heat or preheat water.



9. Install double- or triple-glazed windows and use insulated night-window shutters.
10. Add shelter from hot summer sun and catch cool breezes by using shade trees and plantings, earthcover, roof and moon shades, verandas, thermal chimneys and wind scoops.
11. Increase shelter from cold prevailing winter winds by using plantings, earthcover and mounds.

#### 3.5.1.1.3 Cold climates — summer-time cooling

Passive design techniques can help towards cooling ecolodge buildings during summer.

### GUIDELINES

1. Plant large shade trees on the east and west sides of your ecolodge. This will supply needed cooling shade.
2. Design wing walls. These are vertical exterior walls placed perpendicular to adjoining windows to enhance ventilation through windows. These can be seasonally used, being covered with vegetation in the summer.
3. Install operable windows at opposite ends of the buildings to ensure air flow.
4. Design thermal chimneys to reinforce the effect of rising hot air to induce air movement for cooling purposes. These could be operable skylights or vents placed at the top of an open-peaked roof.

#### 3.5.1.2 Active design

Active design implies the use of certain technological devices to enhance the use of solar energy in buildings. In the case of ecolodge design, it is wise to use only low-energy active designs (which require a minimum of sophisticated technology and external energy sources), such as flat-plate water heaters and photovoltaic systems.

The strong sun in many parts of the world allows for the use of low-energy active solar systems as an ecologically sustainable source of energy. Despite the comparatively higher start-up costs of such technology, the popularity of solar energy is increasing, and solar water heating systems are commonplace in countries such as Greece.

##### 3.5.1.2.1 Solar water heaters and other applications

Solar water heaters are highly recommended, particularly in places with consistent sunlight. Solar technology is economical, easy to install, and virtually free



to run (solar pool heating can recoup its initial costs within two years). Solar systems are often boosted by gas or electric water heating, which is a sensible and economical compromise in areas with low sunlight hours.

In many countries (not only the industrialized ones), different high-efficiency models are being manufactured, and they may also be built in situ. They basically consist of flat-plate solar collectors (with a metallic frame, normally of aluminum) that contain a coil or loop (preferably made out of copper piping) painted black to absorb more solar energy, using a cover of tempered glass (to achieve a greenhouse effect). Solar cooking saves energy, does not heat up your kitchen and tastes better. There are many commercial versions to choose from and plans available for making your own. The successful use of "green" alternative solutions to everyday requirements will earn interested respect in the local community.

### GUIDELINES

1. Mount solar collectors below your cold water storage. As cold water is fed into the collectors by gravity it is heated and returned to the upper tank and as hot water is less dense than cold, a circulation (the thermosyphon effect) develops that gradually heats all the water in the tank. By a pipe this solar heated water is stored in a thermotank (a tank covered by a thermal insulation material), from where it is distributed to the ecolodge's different water taps. Using a small water pump may increase efficiency.
2. Site and position your solar panels carefully to take advantage of the greatest amount of sunlight possible, throughout the day and across the seasons. In tropical regions, under normal conditions (about one and a half hours of good morning sunlight), solar panels will achieve a water temperature well above 40° C.
3. Consider using solar water heating and solar-assisted circulation for swimming pools.
4. Use solar energy for natural drying of a variety of foodstuffs and clothes.

#### 3.5.1.2.2 Solar energy photovoltaic systems;

A good option in isolated areas is the use of photovoltaic cells (based on the use of silicon) for converting solar energy into electric energy (12 volts DC). Some systems offer both options of 12 volts DC and any voltage and frequency (Hz); using the second alternative, the battery obviously drains down faster, however the DC-AC conversion device is called an inverter and usually operates in the 85-95% efficiency range. Photovoltaic

(PV) cell technologies offer a number of choices: monocrystalline, polycrystalline, semicrystalline, various thin-film chemistries and amorphous silicon. All these technologies are now available commercially (fundamentally Japanese, German and U.S. producers) and all have different comparative advantages. In every case, electric storage is by lead-acid or no-maintenance gel cell batteries, similar to those used in golf carts.

PV systems are safer and more environmentally-friendly than kerosene lanterns and dry cell or automotive batteries that are widely used in developing countries for lighting and powering small appliances. PV systems reduce reliance on expensive imported fuels.

Although there are many variables, a typical ecolodge room could be powered by batteries of 300 amp hours at 12 volts, including a four-day reserve. Prices and operation costs vary somewhat but have generally been decreasing in recent years, rendering this a highly competitive alternative, especially in remote locations. Solar water pumping is particularly effective where water needs rise with hotter conditions.

### GUIDELINES

1. Avoid locating photovoltaic systems on the shadow areas of buildings. Study the shadow pattern before placing solar panels.
2. Study the costs, benefits and drawbacks of different options for any PV technology you will use in your ecolodge. Remember that typical monocrystalline silicon cells have an efficiency of about 10-20%, but are more expensive than polycrystalline cells (which have a 4-5% efficiency). Amorphous cells are even cheaper but also less effective. Crystalline cell modules with 36 cells should be used instead of 32-cell "self-regulating" modules. In general, high-quality systems will out-perform cheaper ones, underlining a project's sustainability. Energy conservation is of paramount importance and paybacks are virtually instantaneous from savings in energy production and storage equipment.
3. To attain a higher efficiency in your PV system, use efficient fluorescent lights (CFL or tube lights) instead of incandescent lights (efficiency of the former is over 35 lumens per watt, while the latter is only 12 lumens per watt). Reflectors over your lights will help spread otherwise wasted light.
4. While "deep-cycle" (marine-type) traction batteries are preferable for use in PV systems, they are initially expensive and difficult to replace locally. For these reasons, automotive batteries are presently more commonly used. Nevertheless,

well-maintained traction batteries are the only serious option for a PV system of any substance; they can be bought with clear cases, which help staff monitor acid levels, and will outlast vehicle batteries (which are built with much thinner plates for starting engines) many times over. Finally, they can be dismantled and re-conditioned, so you won't be responsible for a growing stack of hard-to-dispose-of dead batteries.

### 3.5.2 Wind

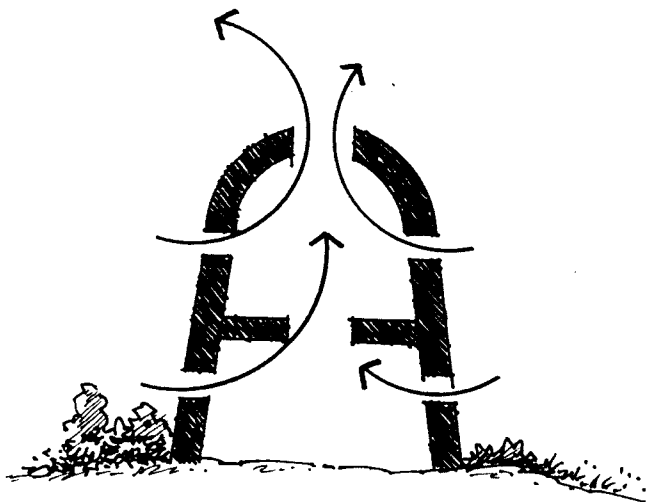
#### 3.5.2.1 Passive design

The architect should take the prevailing wind direction into account when siting and orienting buildings, structures and outdoor areas such as courtyards, in order to create natural ventilation and cooling. Traditional architecture includes many examples, particularly in coastal regions, where cool breezes are channeled for ventilation through the use of internal courts and wind-catches. The following guidelines are for those areas that have a hot wet (tropics) or hot dry (desert) climate.

##### 3.5.2.1.1 Hot climates

#### GUIDELINES

1. Consider seasonal climatic variations (solar angle, temperature, rains, trade winds, etc.) in the architectural design.
2. Your design should also consider natural wind conditions to create spaces that require a minimum of artificial ventilation.
3. In general, foster in your design cross-ventilation, which implies placing openings in opposite and parallel walls to allow a natural airflow from outside to cool and refresh inside. In this way



you may be able to do without conventional air conditioning systems, which consume large amounts of electricity and, if freon-type refrigerants are used, also cause damage to the ozone layer. Of course, increasing air movement helps evaporation from the skin and makes occupants feel fresher and more active. Fortunately, many hot areas have prevailing winds that can cool the ecolodge by natural ventilation.

4. In a dry climate, air blowing into the ecolodge can be moistened by allowing it to pass over water in a pool, in earthenware containers and wide shallow bowls, or through damp cloth or vegetation. In cross-ventilation, from one side of a building to the other, cool air enters, preferably at low level, and expels warm air through windows or vents at high level. To enhance cross-ventilation, design floor plans with an elongated, rather than compact, layout. Building over water, misting towers and misters is also very effective in dry climates.
5. Natural air conditioning can be made from used oil drums simply by erecting a short intake ventilation stack (one drum high), some distance from the building. Air comes into the building via a tunnel (made of drums) deeper than 1 meter below the soil, which cools the air from the intake and draws it into the room.
6. In tropical and subtropical areas, minimize the use of glass windows, leaving openings (covered only by mosquito netting) that will enhance natural ventilation.
7. As already mentioned above, in general try to avoid the use of air conditioning and foster the use of cross-ventilation instead. If heat is excessive and becomes unbearable (even with cross-ventilation), try using ceiling fans, which have proven their effectiveness for almost a century in hot places. Evaporative coolers can work well in humidity lower than 30-40%. Table and floor fans are usually more effective than ceiling fans, and can be moved to where they are needed and are more efficient. In any case consider timers on fans so that they will not be left running in vacant rooms.
8. Use wind scoops (commonly used in some parts of the Middle East, northern Africa and coastal parts of eastern Africa, such as the malqaf or bacar, which catch cool breezes at roof level and channel them down a shaft to lower-level living areas). High pressure on the windward side and low pressure on the leeward side of the building ensure that cool air is sucked downward.



9. Develop different types of passive thermal chimneys (which use the "thermal-stack" effect to induce ventilation), working on the principle of convection (see point 5 above).
10. Install window lattices and screens, such as the Egyptian ornamental wooden-peg mashrabiya, to allow air to filter freely into rooms while additionally reducing the strong glare of direct sunlight. Also, create openings above doors, generous protected areas, terraces, pergolas, etc. Take advantage of exterior vegetation to channel breezes inside the building.
11. Use wind generators to pump water from wells.
12. Take a note of wind patterns when creating an energy-conscious landscape. Masses of evergreen trees, pines and/or hardwoods (where appropriate) can divert cool breezes that would have normally swept through your lot to confront your ecolodge. Landscape materials can also be used to direct breezes into spaces to enhance natural ventilation.

#### 3.5.2.1.2 Cold climates

##### GUIDELINES

1. Draft-proof windows and doors and seal air leaks in unused fireplaces, floorboards, skirtings, ducts, electric switches and power outlets in outside walls.
2. Use pelmets at the top of window frames and fit heavy, lined curtains or insulating blinds and shutters to all windows. Double or triple glaze windows.
3. Insulate walls, floors and roof spaces.

#### 3.5.2.2 Active design

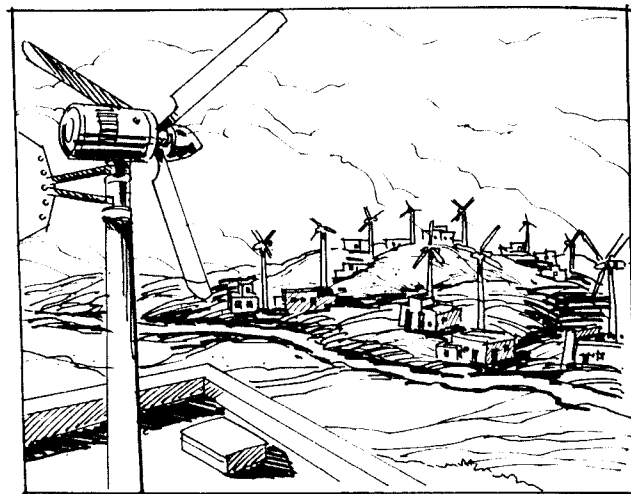
Another alternative for generating electricity in an ecolodge is the use of wind power. Wind generators may be used at sites exposed to high wind velocities. Wind power is almost twice as efficient as photovoltaic energy, and several brands of generators are readily available, but wind energy is still far less popular than solar at present. Nevertheless, rapid technological changes are taking place in wind power — indeed, the year 2001 was the fourth year in a row that wind power was the cheapest form of energy on the planet at utility scale and it will be wise to keep abreast of future developments.

People are so fascinated by the prospect of wind-power generation that they occasionally make the investment before they know for certain that their site will actually be cost-effective for wind power. An average minimum

wind speed of 10 to 12 mph is a must; check with local airports, weather stations, and some government agencies to ensure you have a good site for wind generation.

##### GUIDELINES

1. Windmills should be used by ecolodges that are located along the coast, in deserts, mountain-tops and along lakes, where there is likely to be enough wind.



#### 3.5.3 Natural Gas

By extracting the gas naturally produced by solid waste, biogas offers many sound benefits such as waste and wastewater processing, methane production for heating, cooking and refrigeration, and making compost for soil enhancement. A major portion of your energy needs for the ecolodge may be met through biogas, providing you have enough waste.

Simple biogas-producing devices generate energy from the gasses produced by decomposing organic matter, including crop residues or domestic wastes in an oxygen-deprived environment, such as garbage dumps. The resulting biogas — a mixture of methane, carbon dioxide, and trace amounts of other gases — can be used directly for fuelling gas refrigerators, stoves, absorption-chillers, and water heaters.

##### GUIDELINES

1. Use biogas to directly fuel gas refrigerators, stoves, absorption-chillers, and water heaters, which only need simple re-jetting (which amounts to changing a nut with a hole in it — a jet — for one with a larger hole). In many countries, equipment manufacturers will typically supply the right jets for biogas if you ask them.
2. Use gas-fired engine generators if you are sure you have enough gas reserves to support it.

Proven heavy-duty propane generators will be more reliable and quieter than the diesel-converted models of some US manufacturers. Be careful when buying used equipment, ensuring that the equipment is reputable and reliable, make sure that it is fully and warranted, that parts are readily available, and service is quickly available.

3. Extract biogas from landfills as this converts potentially explosive methane into energy, thus reducing the risk of it infiltrating the air and buildings near those sites.
4. Some conventional food crops that are high in starches and sugars can also be fermented to produce ethanol — a relatively, clear-burning, high-energy fuel. It may be feasible to negotiate with neighboring farmers to produce fuel crops such as oilseed rape.
5. Biogas might also be used in the production of ice at off-peak periods to sustain the marketability of local produce or the fishing industry.

### 3.5.4 Geothermal

Geothermal energy is heat from rocks and water deep in the earth that are continually heated by the decay of radioactive elements and the intrusion of molten rock known as magma. The stored heat can be extracted and used to warm buildings or generate electricity. Hot springs are the most popular of the many geothermal energy options. Yet, while the potential is enormous, only a very small fraction of geothermal energy can be recovered at costs that make it competitive in the energy market.



Hot springs around the world have provided heat for bathing and cooking for thousands of years. Two thousand years ago, the Romans and Japanese bathed in geothermally heated pools. In Iceland, people cooked with geothermal heat as early as the ninth century.

Unfortunately, some of the best potential sites for geothermal energy are areas of great natural beauty, such as America's Yellowstone National Park, or other environmentally sensitive areas. Several environmental groups have opposed plans to develop a major geothermal resource on the island of Hawaii near the Kilauea volcano, because they believe that the power stations would damage the rainforest found there. Biologists are finding many unique forms of life in geothermal areas and care should be taken to avoid biological impacts.

### **GUIDELINES**

1. Contract expert geological and biological surveys to assess the impacts and capacity of your resource and to guide any exploitation of potential geothermal energy.
2. Wherever and whenever possible, use geothermal energy (geysers, thermal springs, underground steaming) to generate hot water for bathrooms and kitchens, for cooking, and to provide indoor space heating.
3. Use a geothermal heat pump to 'pump' heat from a low-temperature source (such as the ground) to a reservoir at a higher temperature (indoor air). For summer, simply reverse the flow to pump heat from indoors and re-injecting it back into the ground.
4. Geothermal fluids should be injected back into the reservoir or disposed of in lined evaporation ponds, avoiding the pollution of lakes, rivers and groundwater. Geothermal water can contain high levels of dissolved salts and significant amounts of toxic substances. Re-injection has the added advantage of maintaining the pressure within the geothermal reservoir, extending the life of the field.

### 3.5.5 Generators

With the advances in technology, some very energy-efficient and pollution-free generators are being developed, however, they have their drawbacks, of course. The most common objections to various natural-energy generators are their visual and environmental impacts. Remember, there is no such thing as “free” energy and use this technology only when it is absolutely necessary and appropriate: no-one will thank you for sacrificing habitat or wilderness for a row of ecolodge dishwashing machines. The two types of generators that will be discussed are hydro and diesel generators.

#### 3.5.5.1 Tidal or current generators

Small-scale hydroplants are generally comprised of Pelton wheel generators (commercially available in many countries) that operate from high-head, running streams of water. They are reliable and cost-effective, and can be serviced by competent mechanics with hydraulic and electrical skills. Low-head generators are also available but generally at a higher cost. Storage batteries can be used to buffer peak electrical demands. It is important to note that the stream or river flow must be at least 13 km/h (8 mph) for the power generation to be effective.

There are also wave-action generators, which are comprised of hydraulic or pneumatic pumps that pressurize an accumulator to drive motor/generators. These systems can stand-alone or be disguised by incorporating them into docks and other shore emplacements. They work well wherever there is small wave action, such as in harbors and marinas, or in seashore facilities. Storage is designed into the system to meet electrical demands. They work best where demand is intermittent, such as for cycling pumps. There are also propeller type generators that can be placed in a flowing stream or tidal currents.

Micro-hydro generators are a viable renewable energy source. The micro turbines with a 5" runner can have their intake on the edge of the stream w/o dams and discharge superior oxygenated water back into the stream some way downstream. This power source is the cheapest form of energy available in most cases and can be as low as \$0.05 kWh. An efficient system can produce up to 72 kWh/day per unit.

#### **GUIDELINES**

1. Consider this valuable resource when looking for property, it can be very cheap and reliable energy.
2. Hydroelectric also holds the highest potential for negative environmental impacts, very careful design, planning and installation must combine to prevent irreversible impacts.

3. Always return hydro tail water back to the source stream, and in such a way as to avoid erosion and stream silting.

#### 3.5.5.2 Insulated diesel generators

The insulated diesel generators are fully enclosed and insulated for whisper quiet operation. This is very crucial considering that most ecolodges are situated in pristine areas and noise pollution can affect animal behavior. These generators have a two-stage direct fuel injection which contributes to quiet operation by reducing engine knock. And it also reduces vibration and improves operating efficiency.

It should be noted that the three main objections to traditional diesel generators is the noise pollution, the use of fossil fuels and the disposal of the waste diesel.

#### **GUIDELINES**

1. Consider purchasing those generators that are insulated and produce less than 70 dB from a distance of 7m. Make certain your generator will power the loads you want — proper sizing is very important.
2. Hire an electrician to wire your diesel generator. There will not be a problem with grid (utility) interaction if you do. If a generator is turned on while connected to the utility, electricity can “backfeed” into utility lines, and create energized power lines. If the power is out in a given area, an energized (from the generator source) line can create major problems (like death) for utility line people servicing those lines. Also, repair persons generally ground a power line they’re working on, and that may create a damaging situation for the running generator. If the utility lines “come back on”, and the generator is not isolated from utility power, damage to the generator and your appliances is very likely to result.
3. Always make sure that your ecolodge circuits are disconnected from the utility prior to starting your generator. Before re-connecting to the utility, make certain your generator is off and all protective breakers are in place.
4. Hire a qualified service person to repair your generator, which will require regular servicing.
5. Locate your generator in a well-ventilated place, like outdoors or in a separate, ventilated shed.
6. Store fuels safely and in proper containers and locations. Re-use the waste diesel and do not dispose in neighboring lands.



### 3.5.6 Wood Combustion

In some areas, wood may be the principle source of fuel. Whatever the reasons for using wood, ecolodges need to use their fuel resources to the best possible advantage.

Although efforts are being made to halt deforestation and charcoal production, and to improve the efficiency of stoves, much remains to be done before the process of fuelling with wood and charcoal becomes sustainable. Within lodges, especially in Africa, staff workers often use wood for their cooking. It is also used for fireplaces within the lodge, and in many instances, is used to heat water for guest showers. Wood heat is an energy source commonly used in Northern Canada. Sophisticated, high efficiency wood stoves are being used for space heating.

Ecolodge operators should not only assist in reversing the contribution to deforestation caused by burning wood, but also subsidize its own energy needs by commissioning elsewhere, or growing on-site, an equivalent volume of wood to that burnt by the lodge. However you power the settlement, the use of low energy fittings remains a responsibility attached to promoting your operation as an ecolodge.

#### **GUIDELINES**

1. Plant fast-growing trees in plantations, farms, along roads, and on unused land in the vicinity of the protected area, for the ecolodge's own source of wood. It is important to choose the right species of tree; fast, straight, dense-growing; and able to burn economically.
2. Contact local businesses able to donate or sell waste wood such as old pallets, timber off-cuts or sawdust and waste paper able to be compressed into efficient "logs" for burning with a simple (commercially available) press.
3. Help conservation authorities in managing forests neighboring the protected areas, and use windbreaks and boundary "buffer zone" plantings, as potentially valuable sites for intensive wood cultivation. Boundaries with cereal crops or firebreaks often prove the best solution in terms of planting quick-growing "sacrificial" (i.e. can be back-burnt or bulldozed to halt the spread of fire) tree species with good access to sunlight.
4. In Northern climates, consider using pellet stoves, which use waste wood in an automatically regulated manner.

### 3.5.7 Hybrid Systems

The energy systems discussed above can be combined into hybrid systems, in which one technology supplements the other. For example, wind power can provide energy during times when stormy or rainy weather makes solar power ineffective.

Co-generation should also be considered. A typical example of co-generation is where electricity is produced on-site and excess steam or cooling water is used to provide hot water and central heating on the domestic side, and, via a heat exchanger, it can also be used for chilling and cooling through air-conditioning. The result is a closed recirculating system that is energy efficient.

### 3.5.8 Low-Energy Lighting

The illumination of buildings is responsible for a high proportion of electricity consumption in many countries around the world (around 20% in the US). Lighting is also one of the easiest areas to make the biggest impact on cutting energy consumption. Currently, new low-energy lighting options can cost-effectively save more than half of the energy used in buildings around the world. The standard incandescent bulb is the cheapest lamp to buy, but the most expensive to operate. An incandescent bulb uses 10% of electrical energy to create light, and 90% to generate heat. Ecolodges should be a showcase for saving on electricity consumption and you should rule out the use of high-energy consumption lighting equipment and hazardous materials early in the design stage.

The latest entry in the high-efficiency lighting arena is LED technology, which will dominate the lighting industry in the next few years. They shine in low-level lighting applications like path lighting. They produce virtually no heat, are the same color as moonlight and will not disturb wildlife, will maintain your night vision, have very low maintenance with a 100,000 hour life (20 years at 12 hrs/night) and at .07 watts each their efficiency is remarkable. 1 km of path lighting will use 200 LED lights and use only 14 watts of power! This low power consumption makes LED's ideal for powering with solar energy and a small, inexpensive PV system will provide path and security lighting regardless of the primary site power availability.

One of the most valuable assets a lodge has to offer its guests is the incredible night sky that is only available at a lodge that is removed from the light pollution of dense development. It is amazing how common it is to find the night sky bleached out by inappropriate outdoor lighting design of resorts.

## GUIDELINES

1. Take the first step towards environmentally conscious lighting and carefully consider opportunities for natural lighting. Sunlight should be incorporated wherever possible to increase the quality of the indoor environment, provide a more natural ambience, and reduce lighting loads.
2. Specify, wherever possible compact fluorescent lamps (CFL's), solid-state electronic ballast, imaging specular reflectors, "smart" light bulbs with built-in controls, and LED's. CFL's have an efficiency of over 35 lumens per watt, vs. 12 lumens per watt for incandescent lights
3. Understand that interior paint colors and finish textures affect the quality of interior light; white finishes will reflect the maximum amount of light, while soft-textured surfaces will help to reduce glare.
4. Appropriate application is the most important aspect of energy efficient lighting systems. Typically, good lighting design will include ambient lighting for general background definition, task lighting for individual work, and accent lighting to feature certain areas or objects.
5. Strive to minimize outdoor architectural and landscape lighting, and never aim lights up at the sky. Use cut-off shields where necessary to protect nocturnal wildlife. Consider planning for a telescope, which can be the most popular feature at a resort with a great night sky.

### 3.6 SUSTAINABLE TECHNOLOGY AND MATERIALS SELECTION

The sustainability of an ecolodge can be determined, in part, by the choice of building technologies and materials used, and the level of care taken during the construction process. Unfortunately, many traditional lodge architects and builders have not regarded ecological factors as their concern.

A successful scenario for an ecolodge may involve a combination of traditional and modern building technologies and materials that have the least ecological impact, and are most efficient in use and maintenance-friendly over the long-term. Carefully planned and executed construction can be considered the cornerstone of successfully sustainable development.

We have already mentioned that ecolodges are often situated in remote, perhaps pristine areas, often with difficult access, particularly for heavy plant and equipment — and also, skilled construction workers are likely to be thin on the ground — and with labor, you

get what you pay for. None of these considerations is unusual, however, it is vital that you take the most appropriate decisions related to construction materials and procedures based on what you know you can achieve within your limitations.

## GENERAL GUIDELINES

1. Consider factors of climate (e.g. humidity, high temperatures and excessive sun radiation, among others) in order to schedule work stages and to choose the most suitable building materials.
2. If access by road or water implies covering long distances, consider the fact that transporting materials from far away implies high freight costs and fuel consumption, raising the environmental price of the development; so, look for light materials that are easily supplemented and repaired on site.
3. Keep it simple. Be aware of the teething and supply problems faced by pioneers of new systems and technologies: don't become a guinea-pig — remember that asbestos was a wonder material in its time. Remember, too, that building "systems" go out of fashion and maintenance easily degenerates into expensive running repairs in the absence of ready spare parts or expertise.
4. Whenever possible, use local building materials or process building components from local raw materials, but do not deplete rare natural resources.

### 3.6.1 Construction Activities

After selecting sustainable building technologies and materials, the architect should strive to ensure that the construction phase of the ecolodge development has minimal impact on the natural environment.

## GUIDELINES

1. Identify the most suitable building method for the site and type of project to develop, considering environmental, economic, cultural and time factors.
2. To be sustainable, your ecolodge should preserve natural resources on the site and minimize disturbance of the area's flora and fauna during construction. This can be achieved in part through utilizing traditional building materials and construction methods that can be found locally, reducing transport and pollution, and are less likely to need heavy, noisy plants and equipment.



3. Sustainable construction aims to avoid: non-renewable resources and energy; air, soil, water and noise pollution; erosion of the site and roads; or destruction of vegetation by project vehicles and irresponsible storage of materials. Extra care should be taken on sites located within or bordering protected areas, or those adjacent to sensitive areas such as wildlife water holes.
4. Whenever possible, use renewable energy sources such as solar power when using modern tools. If the lodge is to be powered with renewable energy, install the energy system first and build with it and get the most out of your investment while protecting the environment during the construction phases. Building materials should also be pre-cut and prefabricated off-site, storage spaces should be carefully selected prior to construction, and any areas affected by construction should be restored and re-vegetated.
5. Write clear conservation clauses with corresponding penalty costs into contractor agreements. Establish specific do's and don'ts to avoid problems and loss of habitat and species. It is also recommended that ecolodge contract documents include formal guidance and a checklist for achieving sustainable construction. Also, a sustainable-construction booklet should be provided for contractors, and an appointed environmental officer should monitor construction activities. Keep in mind that this booklet must be able to potentially settle disagreements on breaches of your conservation standards: Keep it clear and unambiguous. Consider adding a "boiler plate" template of eco-specifications to this book. Incentives above contractual obligations could be given for tree and vegetation retention, etc., to provide additional insurance against environmental degradation.
6. To avoid risk of erosion and release of construction wastewater and mud that possibly contain fine sediments, apply a lining system of the construction site using appropriate filter materials.
7. Develop a detailed construction plan schedule (using the Critical Path Method (CPM) or similar technique) where you clearly specify each of the steps to be taken and when, the responsible parties in executing each job, the flow chart of activities, and the cash flow. Don't rely on improvisation and don't assume that contractors and subcontracting tradesmen will naturally be free on the dates you guess you need them — part of contracting is agreeing to the proposed work schedule.
8. Once the location of the lodge has been established, limits of construction should be determined. These areas should be fenced off and signed noting that no construction material storage, vehicles or other activity be allowed to disturb these areas.
9. Check that your building materials, tools, plant, equipment and crew are readily available before you start to build. Ensure secure storage and parking for the duration of construction phases. Remember that the greater the distance between construction activities and storage facilities, the slower the job done and the greater the costs of transport and, particularly, security.
10. Emphasize the importance of creating the least negative impact during construction. Your building site should be clean with minimal disturbance to the surrounding environment and it should discourage scavenging wildlife.
11. Try to strike the right balance between use of traditional and modern building methods, including modular-designed prefabricated components that are designed to be easy to assemble or place on site (be careful to establish the exact environmental impacts and costs of bringing larger, heavier, completed prefabricated units onsite). Take each case on its merits, as there are no fixed recipes to guide you.
12. Hand-excavate foundations whenever possible (avoiding heavy machinery to minimize environmental impact).
13. Avoid any runoff during construction as this can cause damage to adjacent properties. If it is likely that erosion or surface runoff may be a problem, then erosion control devices, such as temporary silt fences, will be required throughout construction.



### 3.6.2 Construction Techniques

#### 3.6.2.1 Traditional construction technology

It took many centuries, indeed millennia, for humankind's shelter and settlement to evolve to intricately woven communities that respond entirely to climate, material resources, cultural and economic needs of society. In many cases, poor communications meant that people had to live in communities and cooperate in the use and management of common local resources.

Traditional construction technologies now need to be rediscovered, re-evaluated and marketed at a wider scale, and used at an increased rate in designing ecolodges. However, take care not to mistake the trappings of ignorance and great poverty for sublime genius: be certain you understand the function of the devices you might use, and find out why they went out of use. An ecolodge is not a traditional hut, and today's tourist has different needs and ways of living to the area's natives and pioneers.

Once armed with the history of your options and your present parameters, you can adapt or improve on old ideas with great effect, rather than copying ancient mistakes. You also can bridge important gaps between your target client group's expectations, (including fire, plumbing and electrical standards) and beautiful forms from the past. Be careful that your use of modern materials is not obvious when reproducing original features; poor copies of respected forms can inspire derision or even cause insult.

#### **GUIDELINES**

1. Use traditional technologies as they have many benefits. For example, the production and use of traditional tools requires low energy and has minimal impact on natural resources. Construction techniques require the use of human-powered tools and are locally developed. Furthermore, these techniques necessitate the use of local skills, labor and knowledge; and in this way, contribute to the local economy. Also, the use of traditional construction tools and methods can render the ecolodge more authentic within its cultural context, and can fit closely into the fabric of the people's lives, allowing neighboring communities to identify with the lodge.
2. The architect should incorporate traditional building technology in the design and construction of the ecolodge wherever possible. Examples of traditional technology include dried clay bricks, reeds, grass, and other natural building

materials using sun and wind, and use of hand-made, human-powered tools, such as sieves, shovels and trowels. A traditional construction method, found frequently in lodges along coastal areas, is the technique used for building thatch roofs: sun-dried palm fronds are carefully arranged by hand into two-foot square "tiles," after which they are overlapped and tied with locally grown sisal ropes to mangrove battens.



#### 3.6.2.2 Modern construction technology

In the search for sustainable technology, however, architects should not discard modern knowledge. At times, modern building technology can be of significant ecological value to the ecolodge, through energy-efficient tools and methods of construction.

Any modern technology that you choose should preferably be regionally available and guarantee easy assembly on site, it must be understood by the people who are going to install and maintain it, and replacement parts must be quickly and cheaply available.

It is possible to combine traditional technologies with modern construction, but this must be done in a skillful and creative way, avoiding contradictions and pastiches.

#### **GUIDELINES**

1. Do your research: ensure that any modern technology that you choose to apply in your ecolodge should be proven environmentally friendly, non-hazardous, energy-efficient, and should be respectful of local cultural conventions.
2. Consider applying energy-efficient methods of construction such as hand-operated vibrators for sisal-cement roofing sheets, block-presses for making stabilized earth blocks, appropriate passive and active solar technology, and clean modern prefabrication systems for building.

3. Use modern construction technology that meet criteria such as low energy costs and minimum pollution associated with production, procurement and transportation, as well as contribution to the local economy.

### 3.6.3 Materials Selection

The architect should carefully consider the building materials used for the ecolodge, drawing on traditional materials wherever possible and combining these with modern materials whenever more suitable.

#### **GUIDELINES**

1. Analyze what proportion of biodegradable and non-biodegradable materials you will be using in your project.
2. Choose building materials that are energy efficient, use low energy in production, transport, and use, and, where possible are made locally.
3. Specifically apply the "life-cycle" approach to each stage of your building process. This is also referred to as the "cradle-to-cradle" analysis. Analyze how much "embodied" energy the building material takes over its entire life. This means taking into account the energy consumption of the different construction stages: from the extraction of raw materials through manufacture of major products and secondary materials, to transporting materials and products from source to project site; on-site installation, cleaning and maintenance over its useful life; and finally, the energy eventually used in its demolition, dismantling, relocation or disposal.
4. Analyze the availability of local sources for the material that you wish to use. When using this material, are you generating local hand labor and providing local economic benefits?
5. Use building materials that are abundant and renewable, and whose manufacture has low impact on the environment from where it has originated.
6. Consider using building materials that produce low waste and are capable of being reused and recycled, thereby saving the vast amounts of energy spent on processing raw materials. Using salvaged windows, doors, beams, slates, roof shingles, bricks, tiles and even furniture is an environmental option even cheaper than recycling materials.
7. Make a comparative analysis of the advantages of using local materials vs. materials brought from elsewhere, taking into account the following

factors: economics, time, distance covered, environmental impact, and socio-economic benefits to the local community. Think in long-term socio-economic and environmental terms and not only on the short-term benefits to your business.

8. Consider if you can recycle or reuse the material at the end of its life cycle in a structure.
9. Find out whether you are generating by-products (especially toxic or noxious ones) during maintenance. Does the material require special finishes or treatments that may produce health or safety risks?
10. Only use those building materials that do not emit harmful vapors, particles, toxins or other pollutants into the environment either in manufacture or use.
11. Building materials should be produced via socially fair means, which include, as a minimum, equal opportunities, good working conditions and fair wages. Direct sales from cooperatives in the developing world to consumers in industrialized countries should be encouraged.
12. Work out the amounts of waste resulting from fabrication or installation and compare with alternative materials. Are you really taking the right choice of materials?

#### **3.6.3.1 Traditional materials**

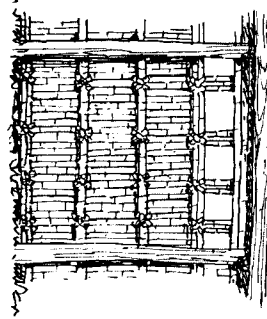
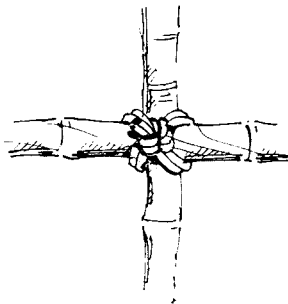
The architect should use traditional building materials for the ecolodge wherever possible. Some examples include: thatch and leaf used in roofs to cool the hut; coral stones (cut from the ground, not from the living reef) used to build foundations and walls; timber poles serving as structural members; locally produced timber used for doors and windows; and mud rammed to make walls and floors.

The use of traditional building materials has many advantages. For example, such materials are always derived from natural resources and do not contain any synthetic products, making them environmentally friendly. They have low energy costs and pollution associated with their production. Since they are locally procured, they require little energy for transport to the site. Furthermore, they make use of expert local labor in their production, and so contribute to the local economy. Also, they are well adapted for use in local climatic conditions, and in most cases, are less expensive than their modern counterparts.



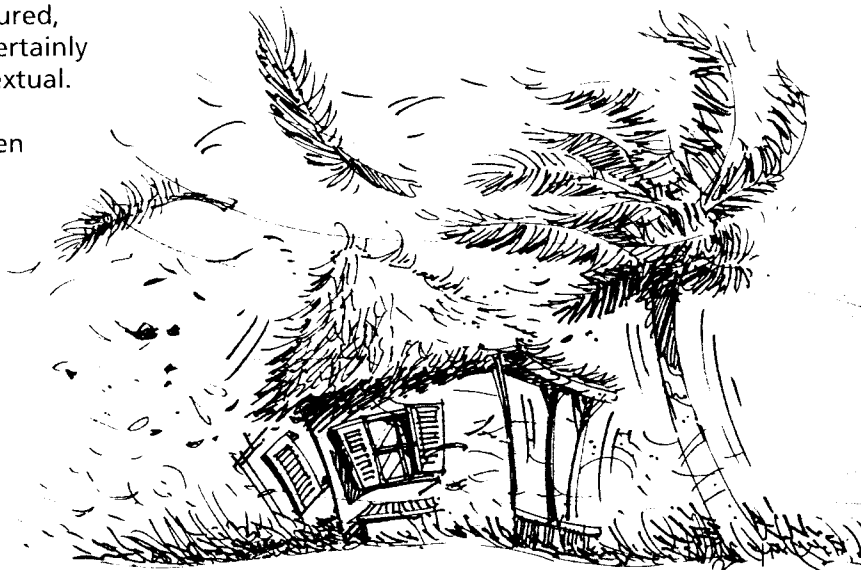
## GUIDELINES

1. Whenever possible, employ materials that are naturally found in your area (rock, stone, clay, wood, reed, bamboo, thatch palm, straw, etc.) and whose extraction is reasonably easy and low-impact. Only when some of these materials are scarce or correspond to threatened plant species should you opt for bringing materials from elsewhere.



2. Carefully evaluate traditional building materials when addressing issues of availability, durability and cost-effectiveness. First, the architect should ensure that the materials used are renewable and abundant in supply. The materials should also be durable and not require frequent replacements; they should be able to withstand the forces of nature, particularly given the fact that the ecolodge will frequently be larger than the structures for which they were traditionally used. Also, the materials must be cost-effective. The architect should note that in some instances, traditional materials may be less expensive in the short-term, but more so in the long-term. For example, the popular thatch used in many tropical coastal roofs is locally procured, readily available, renewable, and certainly both physically and culturally contextual. However, the use of thatch is quite uneconomical in the long-term given its high replacement ratio. It also provides habitat for spiders and other insects; it can be a fire hazard and is not ideal for rainwater catchment. Put everything on the balance before taking a decision.

3. When choosing building materials for the ecolodge, the architect should also consider the environmental management of the source of the building materials. For example, irresponsible extraction of raw materials — such as limestone for cement — can lead to environmental degradation of quarries.
4. Building specifications should reflect the environmental and conservation concerns as related to timber products and other building materials. If you use wood, it is important to know its source. Use lumber and other products made from woods that have been deemed as sustainably produced by a reputable certification organization. Currently, little of this timber is available, but supplies are growing. To support sustainable forestry practices, wood certified by such organizations as the Scientific Certification System, Rainforest Alliance, Forest Stewardship Council, etc., should be used in construction. At least one salvaged wood product could be utilized to support the efforts of small-scale lumber companies that recycle forest products, which would otherwise be disposed of in landfills or burned in incinerators.
5. Look for traditional building materials salvaged from demolished buildings, railroads, etc. Salvaged wood, for example, have a distinct advantage; they are the highest-quality representatives of their species, having originated from old growth forests many years ago.
6. If applicable, take into account seismic considerations, as well as the effects of strong winds like cyclones and hurricanes when building your structure.



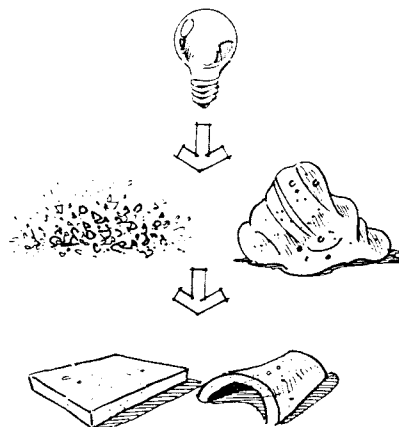
7. Whenever possible, use traditional building procedures (or at least, be based on them) and try to employ local expertise and labor in the construction process in order to generate regional socio-economic benefits.
8. If you need finishes or paint as a protective treatment on wood products, you should preferably use those that are based on organic substances and not synthetic chemical compounds, which are normally non-biodegradable and often toxic. Also consider the ability of your paint system to breathe; allowing timber to behave naturally helps keep it sound and can prevent rotting. These are some natural treatments and paints that are normally available:
  - a) Borax wood impregnation treatment that protects wood against fungus and insects (instead of typical commercial treatments, which usually contain toxic arsenic or creosote). Pulverized borax salt particles lodge in the wood, preventing insect eggs from hatching. Wood also can be soaked in the ocean for several weeks, then dried for use; the salt provides an effective termite treatment for softer woods, which can absorb it.
  - b) Wood-pitch impregnation made from resin-oil and beech-wood distillate; especially suitable for outdoors wood protection since it is water-resistant yet allows the wood to breathe.
  - c) Wood sealant and primers made of natural resin oil (instead of using synthetic preparations based on polyurethane, which can be allergenic).
  - d) Stains and pigments derived only from vegetable and mineral sources, dispersed in natural binders.
  - e) Pure turpentine (this natural thinner and cleaner is distilled from a resinous oil derived from balsa wood). Care should also be taken with other "natural" solvents and distillates such as linseed oil and citrus based products.
  - f) Pure beeswax for producing a soft sheen on all kinds of interior wood (also gives a pleasant indoor scent).
9. Whenever possible, use in construction those trees that have fallen due to natural causes (wind, river erosion, etc.).
10. Bear in mind that traditional materials are often combustible. Take the risk of fire very seriously and consult with fire experts on property protection, smoke detectors, fire extinguishers, fire doors, means of escape, fire prevention, staff training and drills, access for fire fighting units, and water and pressure availability.

### 3.6.3.2 Modern materials

In cases where traditional building materials fail to fulfill requirements of availability, durability, cost-effectiveness, performance and/or source, the architect should seek modern materials that do. However, modern materials should also meet other requirements such as low energy costs and pollution associated with production and procurement, as well as contributing to the local economy. In using modern materials, the architect should emphasize the use of environmentally friendly materials such as ceramic tiles made from crushed light bulbs and recycled clay; or decking from a composite of sawdust and bits of plastic that are long-lived, durable and easy to apply, repair and maintain. As with natural materials, they should be tested and tried over several generations. In most cases materials that improve building performance should have priority over a lower performing but more eco-friendly alternative. Energy performance should be goal one.

### GUIDELINES

1. Incorporate modern building materials with good energy conservation values, such as high-rating insulation that retains heat in winter and keeps buildings cool in summer.
2. New materials used should be non-toxic, should easily blend in with traditional materials, and should resist climatic extremes, such as humidity and temperature (especially in tropical areas). Also, prefer light materials that are easy to transport and assemble on site. This usually calls for compromise, so decide your priorities.
3. Locate and use as many recycled materials as possible. Search out industry organizations that list suppliers of various materials.
4. Use environmentally friendly building materials, such as ceramic tiles made from crushed light bulbs and recycled clay, and decking from a composite of sawdust and bits of plastic.

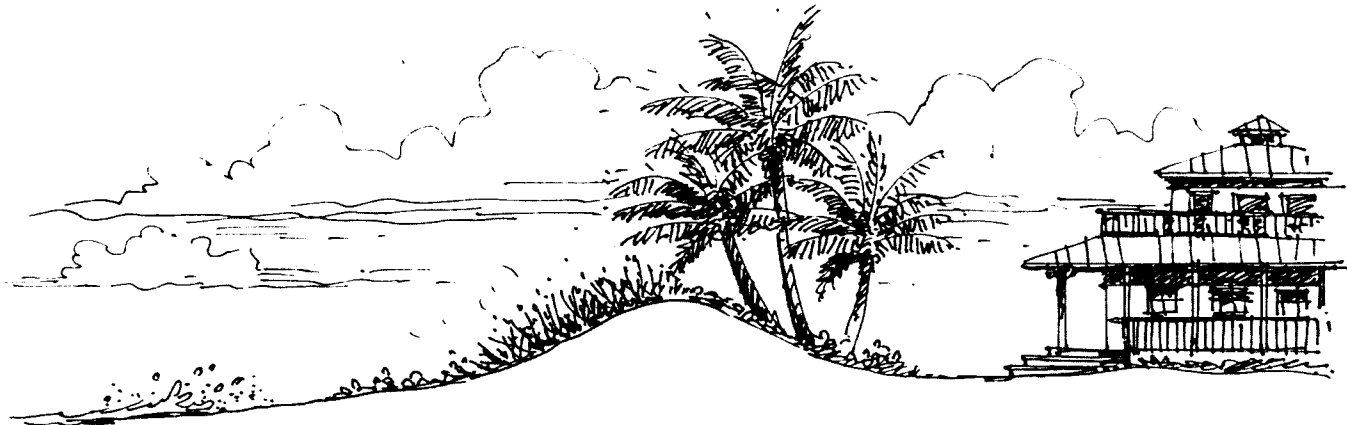


### 3.7 ECOLOGE DESIGN IN COASTAL AREAS

Most of the general guidelines included in this chapter equally apply to ecolodges in coastal areas. Following are some specific guidelines that should be of particular interest for ecolodge design in coastal areas.

#### GENERAL GUIDELINES

1. Once a clear zoning scheme has been set up, define those activities that will take place in the sea, the coast, and inland around your lodge. Remember that if it is to be truly an "eco"-lodge, it has to attract and satisfy "eco" tourists who are primarily looking for natural assets, not artificial commodities.
2. Understand that marking boundaries of marine or coastal protected areas (and/or areas with high tourism value) may be unnecessary, except for beaches where sea turtles or sea birds nest. In tourist zones, however, strategically placed markers, signs or buoys can contribute to enforcement by encouraging visitors to follow trails (land and marine) and informing them of your zoning system while reinforcing it.
3. Moor buoys to mark snorkeling and diving sites and to prevent anchor damage on reef structures. Marking "marine protected" area boundaries with buoys may be expensive and difficult. In such cases, the site's boundary should be determined and its buffer zone or outermost boundary extended two or more kilometers seaward from some discernible feature (beach or reef crest) to control poaching. Navigation features (e.g. boat channels and dangerous reefs) should be marked with buoys to internationally recognized codes, consulting with the nearest coastguard or maritime authority to ensure that you meet your responsibilities under local maritime regulations.
4. Use sign boards above water as it is essential in critical terrestrial areas (turtle nesting beaches, bird nesting or roosting colonies, dangerous marshes, and vulnerable sand dunes) to which the public would normally have ready access. They remind people of entry restrictions, inform tourists of behavior codes, carry educational information, and warn people of potential hazards. It may be necessary to fence off particularly sensitive habitats to discourage public entry.
5. Obviously, no untreated wastewater (grey or black) or other wastes (especially non-biodegradable) should be discharged to the sea. This would ruin the resource base of any ecotourism industry on the coast.
6. Avoid execution of any work liable to affect the natural coastline or modify it, by protruding into the sea or retracting from it. Avoid landfilling in coastal area ecolodge development. Site the ecolodge a sufficient distance inland from the highest high-tidal shoreline. In the case of coral reef areas, it should also respect any existing reef protection line (RPL).
7. In every ecolodge, at least 50% of the coast should be left undeveloped in order to maintain predominantly natural focus of the project. This may be unavoidable, perhaps where you are restoring a degraded site, when you will be planting new endemic trees and shrubs according to a restoration plan.
8. Natural processes should be used for beach restoration and safeguarding. Often, traditional resort beaches use heavy engineering equipment to artificially groom and supplement their preferred beach setting. However, natural features such as native plants (planting vegetation to trap and hold the sand), are usually much more effective, and certainly cheaper, in achieving long-term shore stability, especially where dunes are concerned.





9. Your coastal ecolodge should take **into** account the landscape, seascape, biodiversity, and marine and coastal ecosystems, including fishery resources, minimizing all environmental impacts. Do not destroy coastal dunes and the natural vegetation and avoid having negative impacts on nesting and spawning grounds. Strictly avoid the construction of large artificial lagoons or swimming pools with direct discharge to the sea. If there is a strong, ecologically feasible rationale for installing an artificial alternative to the sea, a filtered seawater pool can be blended in with your accommodation by using natural colors such as beige to paint the pool floor and walls, and giving it a more natural shape.
10. To avoid the risk of erosion and the release of fine sediments and/or turbidity matters from your construction, apply a lining system of the construction area using appropriate filter materials. Alternatively, in coral reef areas, a properly designed turbidity-proof barrier should be built around such construction elements within the reef protection line (RPL).
11. Avoid complicated marinas, embankments and jetties, which are counter to a natural image and ecotourism activity. Provide a simple jetty for small vessels. Apply appropriate systems such as a pump-out facility for controlling all sources of pollution from boats/ships. Strictly prohibit jet-skis and the like.
12. Sewage systems using seawater should not be encouraged due to a series of treatment problems. Waste-water must not be discharged directly into the sea without proper treatment. Infiltration of treated waste-water is only appropriate if geotechnical investigations show that aquifers will not be polluted. Microbiological inspection must be performed at intervals. Make sure that unfiltered wastewater is not shunted through the soil/underground directly to the littoral zone and coral reefs. Particular attention should be paid to the impact of nutrients. In desert areas, wastewater should be reused for irrigation after proper treatment and disinfection. Wastewater not used for irrigation and not filtrated at the producing lodge must be collected in tanks and transported for other uses, e.g. tree farms or to the desert for filtration/irrigation.
13. Consider water supply and management very seriously, as fresh water is a major problem in many coastal areas. Your options are to make water conservation a feature of your ecolodge experience by capturing and using rainwater; delivering or piping water from afar, or installing a desalination plant, which many would argue renders your development unsustainable in nature and therefore not an "eco" lodge. So think carefully. If you do want to explore desalination, don't look to sophisticated technology or large machines, since these produce too much concentrated high-salinity waste (normally at least 5m<sup>3</sup> per day), which may not be dumped into the sea. Instead of a big machine, consider a smaller, simpler one.
14. The best source of seawater for desalination is from beach holes or other underground seawater sources (as far as possible from your lodge). This activity should not interfere with tourism activities such as snorkeling or diving. Brine water from desalination plants must not be filtrated into the soil or discharged to the sea without sufficient treatment in order to avoid adverse effects of increased salinity or temperature on the biota or soil.
15. In coral reef environments, deep beach wells are recommended in selected, previously identified locations. In other locations, discharge to the sea is commercially accepted if the pipes are not visible and the discharge takes place from vertical pipe extensions in water deeper than 15m. The difference between the effluent's salinity and the ambient salinity must not exceed 10%. Also, temperature must be lowered to the ambient temperature before discharge. It is the extent to which you can exceed these minimal stipulations that the sustainability of your water management, which is always a critical point with "eco" development, will be judged.
16. As the owner of a coastal lodge, it is important for you to keep a log or record book to indicate the impact of the establishment's activity on the environment, in accordance to local regulations. Take samples and make tests as deemed necessary to control your impacts and verify the implementation and progress of restoration and sustainable management practices.
17. Remember that you must be able to defend your proposal to impose any development that will have a significant impact on natural and beautiful ecosystems. Your responsibilities deepen with each square foot you move into pristine areas and may well last a lifetime, yet in comparison, your right to exploit the natural world lasts only as long as your impacts are positive. The genuine ecotourists you most need to impress have walked into sites like yours across the world, and perhaps erected nothing more than a tent. Their repeated patronage is your mark of success as a viable, ecologically sound business.



18. Strictly avoid any operation dealing with hotel ships and big pleasure cruisers. These "floating hotels" normally cause enormous environmental impacts and put a competitive stress on the land-based tourist industry (including yours) and may lead to privatization demands on the marine and coastal waters.
19. If, on the other hand, you feel you need to compromise the ecological values of the area in order to accommodate the demanding entertainment needs of clients who have no natural interest in those values, pause to reconsider, and reconsider.

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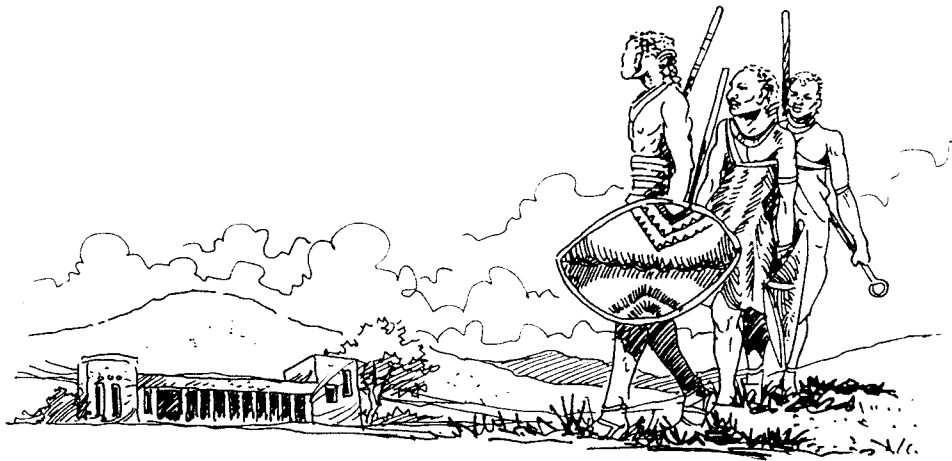
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*“When the full power of the human imagination is backed by the weight of a living tradition, the resulting work of art is much greater than any that an artist can achieve when he willfully abandons his traditions.”*

—Hassan Fathy



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## CHAPTER 4

# SOCIO-ECONOMIC AND CULTURAL IMPACT

Ana Báez

Turismo & Conservation Consultores S.A.

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## 4.0 SOCIO-ECONOMIC AND CULTURAL IMPACT

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## 4.1 INTRODUCTION

The need for integration and participation of neighboring communities both in tourism projects and in the conservation of natural resources has been greatly emphasized over the past 10 years. In theory, an ecolodge project should create jobs and promote sustainable development of the area and community involved, from the environmental, cultural and economic point of view. In practice, this has proven to be no easy task. However, it is not impossible.

One of the main challenges is the race against time. Most communities lack experience in tourism and therefore need time to develop a mature response to today's "tourism culture," in much the same way as they developed that of agriculture, fishing, etc. While education and ongoing training aid the process, the ability to identify the existence of a true "attitude and aptitude" in the community — both of which are fundamental for the success of this type of activity — is of much greater importance.

In the majority of developing countries, tourism has been looked upon as a viable complement for solving the pressing needs of local communities, particularly rural and indigenous. Nevertheless, it should not be allowed to create unrealistic expectations or lead to a situation that could unleash bigger problems such as degradation through ill-advised exploitation of resources, or stimulating local rivalries, in the near future. Apart from involvement and participation of local communities in ecolodge development, we have to recognize that tourism will have negative impacts and we should attempt to minimize them.

Ecolodge projects designed with a medium and long-term perspective have had great success in achieving healthy and fruitful community participation. Those that have gone so far as to consider themselves just another member of the community and acted as such, are the ones that have had the best results.

This chapter is divided into four main categories:

- Cultural Factors
- Values and Traditions
- Community Participation
- Community as Developers

## 4.2 CULTURAL FACTORS

It is of fundamental importance to objectively research and document the various aspects of neighboring communities: their origins; how they are organized; their economic, political and social activities; the principal resources, traditions, beliefs; etc. In this way, you will have a better sense of the community environmental conditions and cultural characteristics

to minimize negative impacts, to design and operate an ecolodge in balance with the surroundings, and to become more productive economically.

To minimize impacts on local culture and develop the chances for strong socio-economic relationships, it is important to invest in a participatory planning process. This strategy will bring opportunities to each of the "actors" to express their concerns, strengths and limitations even before the project is in place.

Knowing the economic situation of neighboring communities and their production structures is vital. It is a mistake to pretend that, in the short term, communities can transform traditional production systems and work experience to become service providers with international standards.

## GENERAL GUIDELINES

1. Avoid competing with the community by involving residents as participants and beneficiaries and making them allies in the process and in projects to be developed. Local communities often compete for use of the same natural resources that have potential for tourism.
2. Avoid developing projects without first having discussed it with representative members of the community, because their expectations could be seriously affected by the project, and vice versa.
3. Avoid creating expectations, which make the already deteriorated economic conditions from which many of them suffer even more difficult.
4. Familiarize yourself with the political and institutional aspects of local communities and how they work in the area.
5. Familiarize yourself objectively with the socio-economic context of the community and clearly identify what your role should be. Do not abuse your position, economic or political.
6. Ask permission to develop the ecolodge project, respecting local procedures and authorities.
7. Take whatever time is necessary to establish a presence in the community: speak with its members, establish what its role will be and open an ongoing communication.
8. Learn from the community. The opportunity to learn and teach goes both ways — what you can receive from and give to the community and what the community can receive from and give to you.

9. Develop your project from the start with the community's active participation. Find out what community members think of your project and how they define it in their own terms.
10. Respect the community's structure and particular dynamics. Learn to understand that dynamic, their language and their concept of time.
11. Identify the most important crops and products (economic activities) that can serve and support the ecolodge, or those that could be promoted as future sources of development.
12. Promote the development of small business for subcontracting certain services, such as local transport, food products, arts and crafts, guiding, tours, etc.
13. Generate and/or support opportunities for economic development and improvements in the quality of life of the community, including those that aren't necessarily related to your project.
14. Facilitate opportunities for employment during all phases of the project's development and operation, and at all levels of responsibility. As much as possible, maintain a representative number of local employees at all levels of the organization.
15. Try to maintain an ongoing program to teach, educate and train local employees; or, in some cases, support organizations that promote the training of local people.
16. Avoid taking sides or strongly identifying yourself with one particular group before the community gets to know you and before you have achieved an objective understanding of the community.
17. Identify people who are interested in being trained for more specific jobs and greater responsibility.
18. Develop the administrative policies of the project and consider work stability, salary scales, incentives and relationships with other productive sectors, etc.
19. Promote the participation of local or national partners in the project.
20. Stimulate the development of joint venture projects between nationals and foreigners — preferably when there is pre-existing national legislation to encourage them.
21. Promote the participation of local or national partners in the creation of a plan in which the community and the employees have some type of participation (incentives) from benefits generated by the ecolodge.
22. Use "written agreements" for contracting services, responsibilities and relationships between the community and the ecolodge.
23. Make every effort, initially, to enter into agreements with organizations that represent the various interest groups of the community, and only later consider agreements with individuals.
24. Whenever possible conduct an economic feasibility study to measure the economic costs and benefits for the community resulting from the proposed ecolodge. Include aspects such as the impact to/of nature preservation, objectives in the area of influence, income and employment multipliers, etc. This study will help the community to understand your project's level of impact.

