TECHNICAL PAPER

INCLUSIVE TOURISM

ENVIRONMENTAL MANAGEMENT AND CLIMATE CHANGE

International Trade Centre

EXPORT IMPACT FOR GOOD

INCLUSIVE TOURISM

ENVIRONMENTAL MANAGEMENT AND CLIMATE CHANGE

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International Trade Centre (ITC)
Inclusive Tourism: Environmental Management and Climate Change.
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Training manual focusing on how to manage tourism developments in terms of the environment, especially in the context of climate change and global warming – tackles specific effects, impacts and issues of climate change related to tourism; provides advice and guidance on the implementation of Sustainable Environmental Management (SEM), which comprises a set of management processes and procedures allowing tourism ventures to operate in environmentally sound ways, and to analyse and reduce the environmental impact of their activities; includes bibliographical references (pp. 87-88).

Descriptors: **Environmental Management, Climate Change, Tourism and Travel Services**.

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English

The International Trade Centre (ITC) is the joint agency of the World Trade Organization and the United Nations.

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About the International Trade Centre and its Inclusive Tourism Programme

The International Trade Centre (ITC) is the joint agency of the World Trade Organization and the United Nations. ITC's mission is to enable small business export success in developing and transition-economy countries, by providing, with partners, sustainable and inclusive development solutions to the private sector, trade support institutions and policymakers.

The Inclusive Tourism Programme was established to foster the tourism industry's potential to contribute to development and poverty reduction. It aims to reduce the negative impact of tourism and instead enhance linkages between local vulnerable men and women living in and adjacent to tourism destinations and the tourism sector. The programme promotes interventions that create inclusive tourism business models, promoting stakeholder partnerships and the inclusion of local producers and service providers into tourism supply chains. It enables local producers and service providers to supply the required goods and services and provides buyers with the skills to develop sustainable partnerships with local producers. The programme assesses potential local supply capacity and facilitates access to markets, thus reducing the amount of products and services imported from external suppliers.

The Programme emerged from the Export-led Poverty Reduction Programme (EPRP) that was initiated in 2002 and has been implemented in 27 countries in three main sectors: agriculture, crafts, and tourism. EPRP assisted vulnerable producer communities in developing countries in gaining access to international and tourist markets so as to increase pro-poor income, create jobs and contribute to improving livelihoods.

The potential value chains are numerous and relate to all the products and services that an international tourist may require while enjoying holidays. By matching labour-intensive products and services in demand with the capacities of poor communities, the Programme creates new job and income opportunities, develops a basis for the accumulation of capital and technology and provides the foundations for fostering other dimensions of economic and social development in the beneficiary communities.

Adopting a local approach to economic development, it works directly with the poor to integrate them into the tourism value chains. In this context it has a focus on 'mainstreaming', that is, to link poor communities to major tourism destinations in contrast to community-based tourism (CBT) that tend to deal with isolated rural communities which have little or no prior tourism development. Economies of scale indicate that such 'mainstreaming' has a greater capacity to reduce poverty than the pro poor tourism approach of much rural CBT development.

The **Inclusive Tourism Opportunity Study Guidelines** are used to guide counterparts and consultants to reveal suitable inclusive tourism project opportunities, using a value chain approach to identify linkages with tourism stakeholders and to integrate key sectors such as agriculture, crafts, artistic performance and services into the tourism value chain.

The **Inclusive Tourism Training Modules** are used in a train-the-trainer scheme at the implementation stage of projects to capacitate project stakeholders in the areas of agriculture, hospitality services and creative industries product development and linkages to the tourism industry as well as managing environmental impact.

This **Core Training Module** provides an introduction to the tourism sector, and how it can contribute to poverty reduction. It provides an overview of the potential involvement of local people and ways to expand the tourism supply chains, while recognising socially and environmentally sustainable practices.

The **Opportunity Study**, which will be undertaken in potential project areas, will determine where the training modules should be implemented, which of the modules (if not all) should be implemented, and to whom the training should be offered.

The Opportunity Study Guidelines and the training modules help facilitators in different project phases:

Project design

- **Opportunity study guidelines**
  Facilitated by:
  - National and international ITC consultants
  - Government and/or project partner

Project implementation

- **Training modules**
  Facilitated by:
  - ITC project coordinator
  - Project partner(s)
  - National and international ITC consultants
  - Resource persons

Project expansion/replication

Facilitated by:

- Government
- Project partner(s)
- Trade promotion organizations

The target audience includes micro, small and medium-sized enterprises (MSME's), producer groups, association representatives, governmental bodies, community institutions and non-governmental organizations (NGOs) and the tourism industry (tour operators, Hotels, Restaurants) who will find useful information for developing their businesses.

For further information about the Inclusive Tourism Programme, please visit:
http://www.intracen.org/exporters/tourism/

Inclusive Tourism Programme Modules

The **Core Training Module** provides an introduction to the tourism sector, and how it can contribute to poverty reduction. It provides an overview of the potential involvement of local people and ways to expand the tourism supply chains, while recognising socially and environmentally sustainable practices.

The **Module on Agriculture** uses international examples to provide a realistic account of what interventions and partnerships are possible between agro products and the tourism industry, including the challenges that both producers and buyers may face. The aim of the module is to provide farmers and fishermen with the tools they need to assess the viability of accessing tourism markets, and buyers with the skills to develop sustainable partnerships with local producers.

The **Module on Environmental Management** is a tool on how to manage tourism developments optimally in terms of the environment, especially in the context of climate change and global warming, with the need for governments, businesses, communities and people to 'act locally while thinking globally'.

The **Module on Handicraft Products** indicates ways for handicraft producers in developing countries on how to become better integrated in the tourism value chain in order to increase their income, and to provide facilitators with the know-how to develop sustainable business linkages between handicraft producers and tourism markets.

The **Module on Tourist Hospitality Management** is a tool to train employees in the hospitality sector. It describes how the hospitality and catering industry operates optimally while fulfilling guest expectations and needs.

The Module on Artistic and Cultural Performance shows ways to develop local artistic and cultural talents as well as trade services in developing countries through the tourism value chain.

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Contents

Symbols

Briefly stating the goals and **objective** of the following segment. Pointing out the knowledge that should be obtained at the end of the session.

Indicating the **heading;** how will the subject be covered and the links between this subject and others.

Providing **key definitions** and **reference** of issues.

Providing the **"recipe"** of concepts or instruments. Listing the different steps to be taken in the implementation of the concept.

Giving **examples** to illustrate statements and showing experiences, or introducing **exercises** for the practical application of subject.

Formulating a **summary** of the principal statements having been covered in a session in an effort to stress the most important facts in a checklist format.

Acronyms

CC	Climate change
CBT	Community-based tourism
EPRP	Export-led Poverty Reduction Programme
GDP	Gross domestic product
GGEs	Greenhouse gas emissions
GHGs	Green house gases
GW	Global warming
IT	Inclusive tourism
ITC	International Trade Centre
IPCC	Intergovernmental Panel on Climate Change
MMHP	Mini- and micro-hydro electricity power
MSMEs	Micro, small and medium-sized enterprises
NTO	National Tourism Organization
ODI	Overseas Development Institute
RAPS	Remote area power systems
PPT	Pro poor tourism
SEM	Sustainable environmental management
SMEs	Small and medium-sized enterprises
ST-EP	Sustainable Tourism as a tool for Eliminating Poverty
TSIs	Trade support institutions
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEPTIE	United Nations Environment Programme, Division of Technology, Industry and Economics
UNWTO	UN World Tourism Organization
WMO	World Meteorological Organization
WTTC	World Travel and Tourism Council

Module outline

The 'Environment Management' manual is intended to be a tool to teach trainers on how to manage tourism developments optimally in terms of the environment especially in the context of climate change and global warming, with the need for governments, businesses, communities and people to 'act locally while thinking globally'.

'Acting locally' in this Manual is encapsulated in sustainable environmental management (SEM), that is, a set of management processes and procedures that allows a tourism activity or venture to operate in an environmentally sound way and to analyse and reduce the environmental impact of its activities. Information on efficient and effective energy use, reduction in wastes, recycling and re-use and guidelines on environmental management for eco-hospitality are provided in this module.

The key elements of SEM in terms of eco-hospitality are energy consumption, waste minimization, waste recycling and re-use.

Target audience

Local communities, the tourism industry and trade support institutions (TSIs).

Trainers and consultants will learn the value of private sector/public sector/community partnerships to understand how communities in developing countries can be 'mainstreamed' into the tourism industry to engage in a wide range of activities to improve their economic and social well-being through sustainable environmental management in the context of adapting to climate change and global warming. These linkages will foster the poverty reduction goals of ITC's Poverty Reduction Programme.

The target audience thus extends to include major tourism businesses such as hotels and resorts, tourism authorities (particularly at the destination level), micro, small and medium-sized enterprises (MSME's), producer groups, association representatives, community institutions and non-governmental organizations (NGOs) who will find useful information for integrating environmental management into their tourism related operations.

In any manual on environment management for the tourism industry it is fundamental that the broader picture of climate change and global warming constitute the framework within which action is undertaken. In effect the tourism industry at all levels and in all its multi-dimensional roles has a need to adapt to climate change and a responsibility to contribute to mitigating the effects of climate change and global warming through the application of sound environmental management actions, techniques, technologies and processes.

The second section of this manual therefore broadly sets out the major factors and issues of climate change; and it then focuses on specific effects, impacts and issues of climate change related to tourism. The succeeding sections cover SEM and provide practical steps at the local level that tourism ventures, businesses and operations can take to adapt to climate change and contribute to mitigating its effects.

This Handbook is designed to provide a wide range of pragmatic advice and guidance on the practical implementation of sustainable environmental management, but it is based on the theories and concepts outlined in the Core Handbook.

Albert Einstein, the most famous scientist of the twentieth century, once said:

'There is nothing so practical as a good theory.'

In the Core Handbook we examine:

1. Inclusive tourism in the context of supply chain and value chain analysis;
2. 'Backward and forward linkages' into the broader economy and society;
3. The concept of holistic community development which indicates that tourism must not be isolated from other aspects of social and economic development but be fully integrated.

An understanding of these different concepts will allow the TSI or consultant to 'think outside the square' and recognise that there are many activities which do not necessarily involve a community dealing directly with tourists, but which nevertheless interact indirectly with tourists or may be dependent upon tourism as the source of income, and which may be appropriate for community participation or uptake.

Training has in part changed in nature since its principal objective is no longer just the acquisition of knowledge or the adaptation of behaviour but also includes broader objectives and content with a focus on intangible aspects, including behaviour, logical reasoning, problem solving, general and professional culture and values.

Its core is building capacity – enhancing the ability of individuals, institutions and organizations to perform functions effectively and sustainably. In this context capacity building through a Train-the-Trainers' manual such as this is not a passive approach but part of a continuing process (Simpson et al., 2008). Capacity building consists of three basic elements (Alaerts et.al., 1991, cited in Simpson et al, 2008):

1. Creation of an enabling environment with appropriate political and legal frame-works;
2. Institutional development, including community participation;
3. Human resources development and the strengthening of managerial systems.

The training module is particularly aimed at helping facilitators in different project phases, which are within ITC's poverty reduction programme framework:

- **Opportunity study**, facilitated by:
  - National and international ITC consultants;
  - Government and/or project partner.
- **Project implementation**, facilitated by:
  - ITC project coordinator;
  - Project partner;
  - National and international ITC consultants;
  - Resource persons.
- **Project expansion/replication**, facilitated by:
  - Government;
  - Project partner;
  - Trade promotion organizations.

The target audience further includes MSME's, producer groups, association representatives, community institutions and non-governmental organizations (NGOs) who will find useful information for integrating environmental management into their tourism related operations.

Plate 1. Seedlings, re-forestation project, Bachang, Tibet, China

Section 1 Climate change issues and tourism

Global warming and climate change set the context in which sustainable environmental management for tourism development will be implemented. The issue of climate change is now firmly entrenched in the global agenda and critical negotiations for a greenhouse gas emissions framework continue. The UN World Tourism Organization considers that the tourism and travel sector must address the climate change issue and participate in reducing the impact of greenhouse gas emissions from tourism activities. 'UNWTO has embraced the challenge of responding by establishing collaborative partnerships, raising awareness, developing guidance and providing support.'

It suggests that: 'The time is right for all those involved to forge ahead. Any further delay in action will result in consequences for the tourism industry and the people who depend upon the sector' (UNWTO 2009, p. 3). The UNWTO introduces a cautionary note, however arguing that: 'The role tourism plays in less developed countries needs to be taken into consideration in any discussions on emission reductions. Tourism contributes to sustainable development, poverty reduction and the Millennium Development Goals. Any framework agreement should not disproportionately disadvantage those most dependent on tourism' (UNWTO 2009, p. 17).

Definition

Climate change is any long-term significant change in the 'average weather' that a given region experiences.

Average weather may include average temperature, precipitation (rain and snow) and wind patterns. It involves changes in the average state of the atmosphere over durations ranging from decades to millions of years. These changes can be caused by dynamic processes on Earth, external forces including variations in sunlight intensity, and more recently by human activities (Intergovernmental Panel on Climate Change, 2007).

Despite uncertainty about the magnitude of future changes in climate at both global and regional scales, there is scientific consensus that climate change is a major global challenge which will increasingly affect environments, societies and economic sectors around the world.

Global atmospheric concentrations of greenhouse gases (GHG) such as carbon dioxide (CO_2) methane and nitrous oxide have increased markedly, with many scientists contending that the increases are a result of human activities (fossil fuel use, land use change, and agriculture, etc.) since 1750. The global mean temperature has increased approximately 0.76°C between1850-1899 and 2001-2005.

As the Intergovernmental Panel on Climate Change (IPCC) declared in its fourth climate change assessment report: 'Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level' (IPCC, 2007a). A range of IPCC emission scenarios has projected that, with continued GHG emissions above current rates, global average surface temperatures will rise by 1.8° C to 4.0° C during the 21st century.

Even if GHG concentrations were stabilised at current levels, a significant warming of the earth will occur resulting in many changes in the global climate system (IPCC, 2007a). These include changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones (IPCC, 2007a).

It is expected that climate change will result in a number of economic and non-economic impacts throughout the world. Projections at the continental scale suggest significant increases in mean annual temperatures, coupled with reduced annual rainfall in some places, increased rainfall in others, melting of the polar icecaps and high alpine snowfields and glaciers, and rising sea levels. This will place strain on

natural resources: habitats will undergo significant change and many animals, birds, insects, reptiles and plants will be unable to adjust and/or unable to migrate out, with some species facing extinction.

Many industries, especially tourism, are dependent for their survival on these resources that will be at risk. In addition, the increased risk from extreme events like bushfires, tropical cyclones, floods and droughts is likely to result in considerable economic costs to many countries.

Tourism all around the world relies heavily on natural resources and so will be strongly affected by climate change. However, the degree to which climate change impacts on different regional tourism activities, in terms of economic and non-economic consequences, depends at least in part on how well the local tourism industry and the natural resources on which it relies, can adapt to climate change (Turton, Hadwen, Wilson, Jorgensen and Simmons, 2009).

Plate 2. Cover of Fifth Report of the UN Intergovernmental Panel on Climate Change

1. Climate change adaptation and mitigation

The IPCC endorses two main responses to climate change: Adaptation and Mitigation.

Definition: Adaptation

Adaptation to climate change consists of initiatives and measures to **reduce the vulnerability** of natural and human systems against actual or expected climate change effects. Climate change adaptation, as referred to in the technical report, are those strategies that can be implemented to **build resilience and resistance** in systems, whether they be environmental, social, economic or business systems.

Definition: Mitigation

Mitigation of climate change involves taking actions to **reduce green-house gas emissions** and to **enhance sinks** (any process, activity or mechanism that removes a greenhouse gas or aerosol – such as planting trees – or a precursor of a greenhouse gas or aerosol from the atmosphere aimed at **reducing the *extent* of global warming**). This is in distinction to adaptation to climate change which involves taking action to minimize the *effects* of climate change.

Based on the current widely accepted scientific consensus that the world is entering a period of changing climate it is important from a planning perspective that tourism businesses adapt and react now to climate change. While mitigation efforts are undeniably important in terms of slowing the rate of climate change, the fact that the climate system has already changed (and is projected to do so irrespective of mitigation efforts, at least in the short- to medium-term) suggests that investment in climate change adaptation is a sensible course of action. This view applies to all industries that depend on natural assets for their sustainability, including tourism.

Adaptation is seen more as a medium to long-term action, while mitigation mechanisms involve the short to medium term development and deployment of new technologies such as fuels and the like. Both are clearly linked and may act for or against each other. For example, increased use of air conditioning may be an adaptation to counter increased temperatures, but its use of energy (arising from fossil fuels) will act against mitigation. Adaptation strategies can be effective at varying time scales, from the immediate to medium- to long-term planning horizons. Furthermore, adaptation strategies are not necessarily costly to businesses, communities, the environment or people and may in fact yield substantial economic and non-economic benefits. In contrast, mitigation activities will not always yield immediate climate or business/community results, by virtue of the long turn-around time in the climate system.

2. Climate change and tourism

The United Nations and its technical agencies such as the United Nations Environment Programme (UNEP), the World Meteorological Organization (WMO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the UN Intergovernmental Panel on Climate Change (IPCC), and the UN World Tourism Organization (UNWTO) have taken a leading role in examining the implications of global warming and climate change for tourism. The UNWTO, with support from WMO, UNEP and UNESCO held the First International Conference on Climate Change and Tourism in Djerba, Tunisia in 2003. Following a series of international workshops sponsored by the UNWTO, a review report on tourism and climate change, including impacts and adaptation, changes in tourism demand patterns, emissions from tourism, and mitigation policies and measures was commissioned and presented at the second International Conference on Climate Change and Tourism, which took place in Davos, Switzerland, in October 2007.

The outcome of this conference was summarized in the Davos Declaration (UNWTO-UNEP-WMO 2007a), which requested the tourism sector to '… rapidly respond to climate change, within the evolving UN framework and progressively reduce its greenhouse gas (GHG) emissions'.

The Davos declaration

The Davos declaration recorded the following conclusions:

- Climate is a key tourism resource, and with its close connections to the environment and climate itself, tourism is considered to be a highly climate-sensitive sector.
- Climate change is not a remote future event for tourism, as the varied impacts are already becoming evident at destinations.
- Changing climate patterns are likely to alter major tourism flows.
- Least developed countries and small island developing states might be particularly affected.
- Impacts of climate change on the tourism sector are expected to steadily intensify.
- At the same time, the tourism sector is a contributor to climate change; GHG emissions from transport and accommodation.
- Tourism is a vital economic factor and contributor to the UN millennium development goals (MDG) and the most important economic sector for 47 of the world's 50 least developed countries; thus it is essential that the tourism industry plays its part in mitigating emissions and helping poorer regions adapt to climate change.
- While different sectors must work together there are distinct contributions to be made by governments, tourism authorities, the private sector, communities, consumers (tourists), the research community and media networks (UNWTO 2007).

Plate 3. Sea level rising, Tahiti

3. Impacts of climate change on tourism

A significant number of studies of the effects and implications of climate change for tourism have emerged from the Davos conference with broad consensus that there are four main areas of interest/concern:

1. Direct climatic impacts on destinations and operations,
2. Indirect environmental change impacts,
3. Impacts of mitigation policies on tourist mobility (transport for example is assessed as contributing between 70%-80% of all tourism related emissions of 'greenhouse gases' and pollution), and
4. Indirect societal change impacts.

3.1. Direct climatic impact

Climate is a major determinant of the kinds of attractions and activities that will be possible at given locations – such as sun-sea-and-sand tourism or skiing and other snow sports.

- Direct climate variables include temperature, sunshine hours, precipitation, humidity and storm frequency, and part they play with respect to tourist decision making and activities, as well as destination choice.
- Climate is a principal driver of global seasonality in tourism demand.
- The climate of a specific location will exert direct consequences on operating costs - heating requirements, cooling needs, snowmaking, irrigation, food and water supply, and insurance costs among others.
- Thus, changes in the length and quality of climate-dependent tourism seasons (e.g. summer holidays or winter sports) could have considerable implications for the ability of a destination to retain its competitiveness and therefore its profitability and sustainability.

On the other hand, destinations which previously were relatively unattractive due to climatic conditions (e.g. with short, cool summer seasons) may be the beneficiaries of rising temperatures (e.g. Canada, Scandinavian countries), according to some reports (such as the 2006 Stern Review on the economics of climate change). Studies indicate that a shift of attractive climatic conditions for tourism towards higher latitudes and altitudes is very likely.

3.2. Indirect environmental impacts

Since environmental conditions are such a critical resource for tourism, a wide-range of climate-induced environmental changes will have profound effects on tourism at the local and regional destination level. These include the following:

- Changes in water availability;
- Biodiversity loss (e.g. deterioration of coral reefs (bleaching) from Ocean temperature rises have already been recorded and many tropical destinations face both marine and terrestrial loss of biodiversity);
- Reduced landscape aesthetic;
- Altered agricultural production (e.g. food and wine tourism);
- Increased natural hazards;
- Coastal erosion and inundation;
- Damage to infrastructure;
- The increasing incidence of vector-borne diseases in locations previously free of them (e.g. malarial mosquitoes are now found in the South American Andes at altitudes 1000 m higher than three decades ago because of warmer temperatures).

All these factors will impact tourism to varying degrees. In contrast to the varied impacts of a changed climate on tourism where there will be both positive and negative impacts in different locations, the indirect effects of climate induced environmental change are likely to be largely negative.

Importantly, there remain major regional gaps in our knowledge e.g. of how climate change will affect the natural and cultural resources critical for tourism in Africa (c.f. Simpson and Hall 2008), the Caribbean, South America, the Middle East and large parts of East Asia (Simpson et al., 2008; Turton et al, 2009).

Plate 4. Gruyere, Switzerland, and Pongwe Beach, Zanzibar

3.3. Impacts of mitigation policies on tourist mobility

Policies that aim to mitigate anthropogenic causes of climate change, such as reductions in GHF emissions from transport (especially air travel) may have an impact on both international and domestic tourist flows (Simpson et al. 2008; Gössling et al. 2008).

- As noted transport has been identified as the major source of GHG emissions and measures designed to reduce the impacts are likely to lead to an increase in transport costs and may foster environmental attitudes that lead tourists to change their travel patterns (e.g. switch transport modes or destination choices).
- The European Community for example is introducing restrictions on aircraft loads to reduce emissions from 2012, and many long-haul routes that were previously flown non-stop may require an intermediate refuelling stop, incurring increased costs (Commission of the European Communities 2006).

Because of mitigation measures such as this, air travel will face the greatest challenge and long haul destinations will be particularly affected as costs increase. Cruise ship operations are also likely to be affected by costs of mitigation to reduce their emissions and liquid and solid waste pollutants.

Plate 5. Storm clouds over Mindanao, Philippines

3.4. Indirect societal change impacts

According to some analysts (e.g. Simpson *et al.,* 2008; Hall *et al.,* 2004) climate change could pose a risk to future economic growth and to the political stability of some nations; and as the effects of global warming and climate change intensify, so national and international security risks will steadily increase.

- Any such reduction of the global gross domestic product (GDP) due to climate change would reduce the discretionary wealth available to consumers for tourism and have negative implications for anticipated future growth in tourism.
- Climate change associated security risks have been identified in a number of regions where tourism is highly important to local-national economies (e.g. Stern 2006, Simpson et al., 2008).
- For example a one metre sea level rise off the coast of Viet Nam would result in 70% of the Mekong Delta becoming uninhabitable and 18 million people, one fifth of the population, would need to be resettled. In addition the Delta produces 3 crops of rice per year at present, providing 80% of the country's needs: most of this would disappear. The combination of forced resettlement and massively decreased agricultural productivity could place enormous strains on the governance of the country (Wassmann et al., 2004).

International tourists are averse to political instability and social unrest, and negative tourism-demand for climate change security hotspots, many of which are believed to be in developing nations, are evident (Hall et al., 2004).

Plate 6. Hong Kong, China Airport

Since environmental conditions are such a critical resource for tourism, a wide-range of climate-induced environmental changes will have profound effects on tourism at the local and regional destination level. These include the following:

- Changes in water availability;
- Biodiversity loss (e.g. deterioration of coral reefs (bleaching) from Ocean temperature rises have already been recorded and many tropical destinations face both marine and terrestrial loss of biodiversity);
- Reduced landscape aesthetic;
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All these factors will impact tourism to varying degrees. In contrast to the varied impacts of a changed climate on tourism where there will be both positive and negative impacts in different locations, the indirect effects of climate induced environmental change are likely to be largely negative.

Importantly, there remain major regional gaps in our knowledge e.g. of how climate change will affect the natural and cultural resources critical for tourism in Africa (c.f. Simpson and Hall 2008), the Caribbean, South America, the Middle East and large parts of East Asia (Simpson et al., 2008; Turton et al, 2009).

4. Tourism and adaptation to climate change

The United Nations Development Programme recommends four general guidelines for adaptation to climate change, which while not specific to tourism, nevertheless provide a relevant framework that can be applied to tourism (Lim et al. 2004).

4.1. Place adaptation in a development context

A country's capacity to undertake sustainable development can be negatively affected by climate change in key areas such as water resources, agriculture, energy, health and biodiversity. As a result the process of adaptation in any sector cannot proceed in isolation but needs to be seen holistically with an integrated strategy (Lim et al. 2004).

Application to tourism: Because tourism is a service sector reliant upon many other sectors and where those other sectors are influenced by climate change the impacts will flow through to tourism. Hence it is fundamental that the process of adaptation by the tourism sector be placed within the broader context of national policies and strategies for sustainable development and that cooperative linkages be constructed with other affected sectors and their approaches to adaptation.

4.2. Build on current adaptive experience to cope with future climate variability

In many countries sectors of the national economy have already moved to cope with climate change: alternative energy, innovative agricultural practices, engineering construction and design, water storage and conservation, protection of biodiversity – all of these have amassed significant experience in adapting to changing environmental conditions (Lim et al. 2004).

Application to tourism: Many of the coping mechanisms adopted by other sectors will be directly applicable to a wide range of tourism ventures, operations and activities (e.g. alternate energy, innovative engineering and design, protected area management). The tourism sector should take advantage of adaptations in other sectors and involve a range of tourism stakeholders as wide as possible in exposing them to the experience and expertise with adapting to current climate variability that will be available.

4.3. Recognition that adaptation occurs at different levels, especially at the local level

Adaptation can be undertaken strategically at the national level but implementation is often required at the local destination, business or project level. Climate change is not just a challenge for governments and in different sectors involvement of industry is critical, as their operations are and will be affected principally (Lim et al.2004).

Application to tourism: At the national level governments in many countries have moved to establish a tourism-specific strategic response to climate change (e.g. the Australian 'Tourism Action Plan on Climate Change', and the Maldives Climate Change Trust Fund which focuses on tourism and fisheries as the mainstays of the economy). However, one of the impediments to adaptation below the level of government is that the SMEs that make up the bulk of the tourism industry in most countries (usually between 80%-90%) lack the awareness, knowledge, skills and often the capital required to take effective action. These smaller enterprises operate on small overheads with little or no capital or capacity to implement major adaptation and mitigation strategies. Only where a need becomes imperative – such as with coastal erosion that may threaten an individual property or a destination – is action likely to be taken. Precautionary action in advance is still not common, even though in many cases action taken now will be cheaper than in the future.

4.4. Recognition that adaptation is an ongoing process

Most adaptation frameworks recognise that adaptation will be an iterative process of implementing and evaluating strategies as climate conditions continue to evolve over the course of this century (Lim et al. 2004).

Application to tourism: Tourism is no different from other sectors in this respect and stakeholders at the national, regional and local levels will respond to changing circumstances. This is already evident in some places where the impacts of climate change is manifest (e.g. low lying coral atoll island resorts susceptible to sea level rises; mountain ski resorts experiencing decreased natural snow falls).

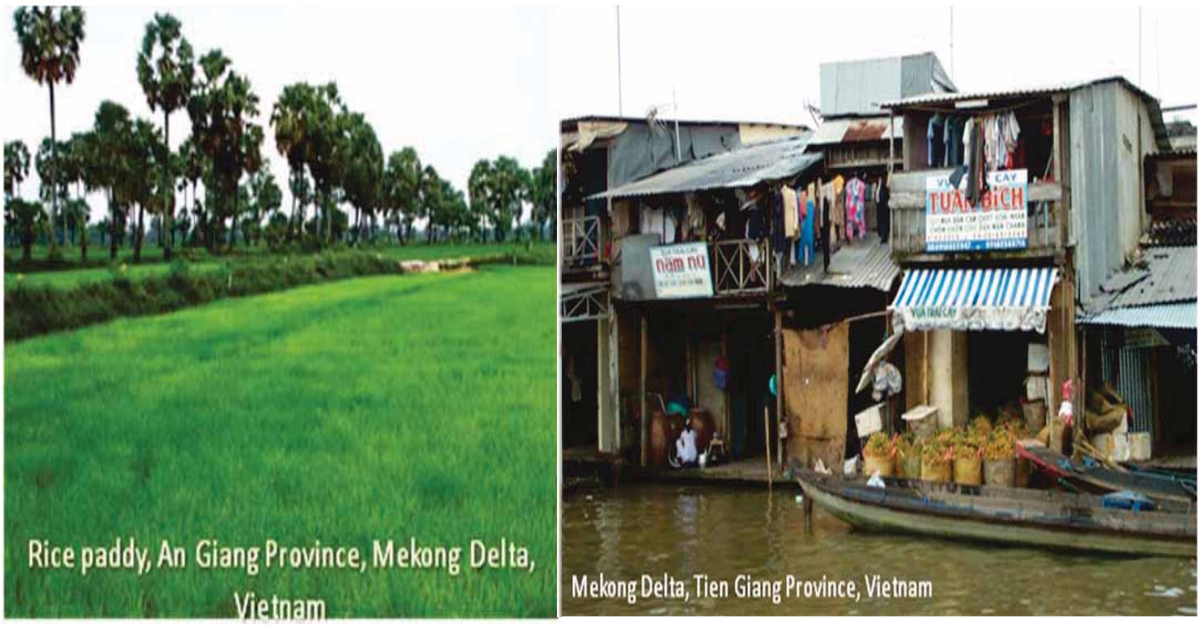
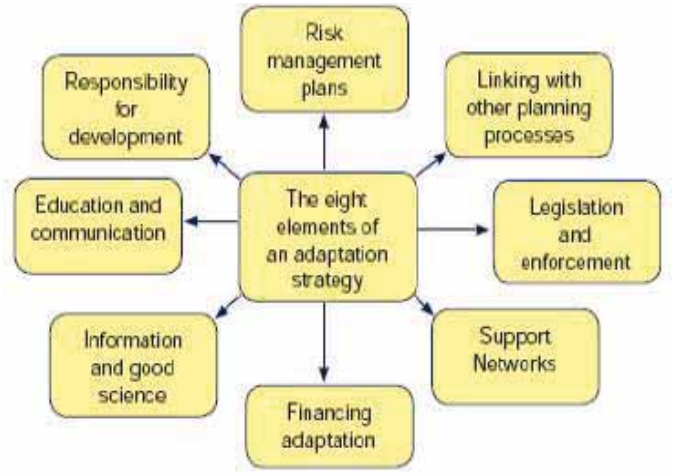


Plate 7. Rice paddy and Mekong River Delta, Viet Nam

4.5. Eight key elements for an adaptation strategy

The various adaptation frameworks identified above contain a number of common key elements that should be considered for any adaptation strategy. Tompkins et al. (2005) summarize many of these common elements in figure 1.

Figure 1. Essential elements of an adaptation strategy



Source: After Tompkins et al. 2005 – 'Surviving Climate Change in Small Islands'.

Importantly, while all of these elements are necessary, the degree to which they are emphasised depends on the specific adaptation process and the stakeholders involved. Where climate change has been identified as a known risk, but little information exists to evaluate the types and severity of climate change impacts on the tourism sector, then substantial investment in information and science may be required.

In other nations and destinations where the nature of climate change risks are well established, the implementation of a formal planning process to engage tourism stakeholder and allocating responsibilities would be a more appropriate focus.

5. Potential barriers

It is clear from both the science and stakeholder input that climate change projections will have both economic and non-economic impacts across touristic destinations worldwide. While not all of these changes are necessarily negative, many are and they constitute significant adaptive challenges. In many destinations there are considerable legal, community, institutional and resource limitations that inhibit, or at least are perceived to inhibit, the timely implementation of adaptation and mitigation strategies. Interestingly, this is despite the fact that the sustainable use of resources, especially water and energy, as an adaptation strategy clearly represents best practice and has been shown to save businesses money.

Also, while economists emphasise that the longer adaptations are postponed the more remedial action will cost, many operators note the uncertainty surrounding climate change projections and modelling, and are therefore concerned about over-investment in adaptive practices that may in fact turn out not to be necessary to the extent forecast by some scientists.

A study of regional destinations in Australia revealed that one of the major perceived limitations to adaptation and mitigation was the high proportion of Small and Medium-sized Enterprises (SMEs) that characterises regional tourism. 'Specifically, concern revolved around the fact that these smaller enterprises operate on small overheads with little or no capital or capacity to implement major adaptation and mitigation strategies. Very few SMEs are able to plan on time frames longer than a couple of years.

As a result, making changes now (with associated costs) to address threats that may or may not eventuate in 10, 40 or 60 years time is not something that many of these smaller operators are willing (or able) to do' (Turton et al. 2009, p. 7). This barrier is reflected very strongly in developing countries and the UNWTO emphasises that governments in these countries will need to be pro-active in supporting adaptation efforts because the SME tourism sector cannot do it without such support (UNWTO 2009).

Despite the concerns and limitations outlined, climate change adaptation is generally viewed by major tourism industry bodies as necessarily based on the precautionary principle. Because tourism is one of a number of activities that occurs within communities, all of which draw on natural resource capacities and local infrastructure, adaptation for tourism destinations should be part of the general community management processes.

Further, climate change adaptation, and to a lesser extent mitigation, needs to be incorporated as part of the ongoing processes of 'destination management' and (community/resource) 'risk management' (Turton et al. 2009). The strategies required to address both the overarching adaptive capacity and the range of individual climate change impacts need to be tailored for each type of business within different regions. The long term impacts of climate change may be quite different from one product to another and from one region to another.

Some businesses have built infrastructure which may be very costly or difficult to upgrade or alter, some are mobile operators that have the capacity (over time) to amend tour programmes in response to destination changes, and some have no physical assets (e.g. nature and cultural walks and talks) and could therefore more easily make changes to what is being interpreted and where the product might be situated, possibly at little or no cost (Turton et al. 2009).

6. Response levels

The complexities of climate change require different responses by different levels of society to the challenges with those tourism is confronted. The following points represent a consensus gleaned from a dozen different studies and reports (including the UNWTO, the WTTC, the IPCC, and the Stern Report,) and on what needs to be carried out by governments, industry associations, tourism business, and communities, much of it compiled by Turton et al. 2009.

6.1. Potential governments' actions

- Participate actively in international efforts to adapt to and mitigate climate change impacts and support research to improve the accuracy of climate modelling.
- Carry out climate change risk assessments at the national, regional and local levels of natural assets, develop strategies to minimize risk, and establish long term monitoring.
- Promote integrated planning across the areas of tourism, agriculture, natural resources, energy, water, infrastructure and health.
- Provide resources to local authorities to deliver regional development coordination since they often know more about local conditions.
- Support sustainable environmental management with policy for land planning, building codes and infrastructure development, and establish incentives for alternative energy, resource minimization, re-use and re-cycling.
- Incentives should cover best practice management to assist operators to reduce their environmental impact, e.g. through rebates, tax benefits, etc. and schemes to support innovation and promote 'model' tourism businesses and organizations wanting to adapt to climate change.
- Provide information about the new carbon economy to enable tourism operators to assess the impact on their business and develop a 'carbon' audit for the sector.
- In this context provide appropriate funding for low carbon emission infrastructure development (e.g. roads, telecommunication, wharves, airports, etc.) that support tourism.
- Given that water is one of the most critical resources necessary for all human and indeed biological life on earth, and is predicted to become even more critical, governments should involve tourism operators and representative bodies in the development of a national 'water policy', and make a concerted effort to plan for water use for 2020, 2050 and 2070. This needs to cover quantity and quality (i.e. potable water – quality up to human consumption standards), water recycling, regulation of usage levels, changed irrigation techniques, etc.
- Examine rationalising energy use allowing for the concept of decentralization – localized production of energy including the use of non-fossil resources to generate power such as solar, wind, methane digestion – to overcome transmission losses and dependence on the national grid.
- Work with the tourism industry to promote education and training about climate change, adaptation and mitigation

6.2. Potential tourism organizations' actions

- Provide a tourism 'voice' for government planning and resourcing.
- Develop stakeholder networks through which climate change threats and opportunities can be identified, relevant policy changes to operators can be communicated, ideas can be generated and disseminated, resources can be pooled, and priority actions can be implemented, monitored, evaluated for stakeholders.

- Lobby governments to provide better incentives for operators to shift to 'greener' business practices.
- Develop and market the country's destinations as 'clean green'—particularly targeting international markets sensitive to the carbon costs of travel such as Europe.
- This will require producing visitor information outlining how the country's destinations are tackling climate change, including the promotion of operators engaging in good business practice.
- Undertake research with government into expected and actual changes in visitor behaviour in key markets in response to changing weather conditions and proposed adaptation plans.
- Explore opportunities where operators can work with the local community on specific adaptation projects as a means of building relationships and support for tourism.
- Conduct workshops and seminars to update the tourism operators and representative organizations on the likely impacts of climate change and adaptation strategies. Use these to demonstrate new technologies for adaptation.
- Provide training for the tourism workforce and formally recognise such training (e.g. through merit certificates issued by the NTO) so the value of the training is accorded real value and so recognised by industry.

6.3. Potential businesses' actions

- Keep up-to-date with the latest research and adapt accordingly.
- Consider how the new carbon market could impact business practices.
- Reduce environmental impact by moving to more efficient use of water, means of transport, taking up renewable energy sources, reducing energy consumption, improving waste management practices and keeping informed of future climate projections. Utilise SEM (sustainable environmental management) as the foundation for all operations.
- Obtain environmental accreditation. (Note: this can be expensive for SME's, so assistance needs to be provided for operators including auditing, education and certification, possibly by the NTO).
- Utilise accreditation to reputable systems/institutions for marketing advantage.
- Develop and implement offsets or more efficient means of transport.

6.4. Potential communities' actions

- Lobby the government and the local tourism industry for support in tackling climate change.
- Establish networks or partnerships with local tourism businesses to monitor environmental changes, to disseminate findings and to encourage further research.
- Educate the local tourism industry about the beliefs and values of local residents with the view to building support for adaptation in the tourism sector.
- Reduce energy use, water use and carbon footprint.
- Provide greater education of, and communication with, the public, tourism operators and service providers.
- Become involved in social mapping exercises to determine community impacts from climate change.
- Continue to build resilience through strategic management of weeds, pests and fire and waste management.

7. Climate neutral certification

7.1. Carbon neutrality

Having a net zero carbon footprints is called Carbon Neutrality, and is applied to those situations where net zero carbon emissions can be achieved by balancing a measured amount of carbon that has been emitted with an equivalent amount that has been sequestered or offset, or by purchasing enough carbon credits to make up the difference. The term is commonly used in the context of processes that release carbon dioxide such as transportation, energy production and industrial processes (Wikipedia).

7.2. Climate neutral concept

The carbon neutral concept is expanded to the climate neutral concept when other greenhouse gases (GHG) are measured in terms of their carbon dioxide equivalence—the impact a GHG has on the atmosphere expressed in the equivalent amount of CO_2. The term climate neutral is used to reflect the fact that it is not just carbon dioxide (CO_2), that is driving climate change, even if it is the most abundant, but also encompasses other greenhouse gases regulated by the Kyoto Protocol, namely: methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulphur hexafluoride (SF_6) (Wikipedia).

The potentially devastating consequences of climate change make citizens and consumers, large corporations and small businesses, government and retailers all beginning to investigate the climate change credentials of their various clients and supply chains. As a result, climate neutral certification programmes are beginning to appear. They are designed to provide guidelines for best practice for organizations and individuals seeking carbon neutral status, with the emphasis on reducing and/or avoiding carbon emissions first so that only unavoidable emissions are offset. Although there is currently no international certification scheme for carbon or climate neutrality, some countries have established national certification schemes that serve as an orientation for the growing number of conscious individuals and organizations. Examples include Norwegian Eco-Lighthouse Programmes and the 'No CO_2 Certification Program' offered by the Australian Carbon Reduction Institute. The latter provides a framework for businesses and organizations to measure, reduce and offset their climate change impacts. It harnesses the power of consumer trends, logo recognition and credible action to simultaneously reduce carbon emissions and enhance company brands. It consists out of five steps:

Figure 2. Carbon reduction institute 5-step process

Source: http://www.noco2.com.au/web/page/about_the_noco2_program.

8. Agro-eco tourism certification and marketing

In the context of the climate change issues that confront the tourism industry and consistent with the ITC's Inclusive Tourism development initiatives, certification programmes that testify the sustainability and authenticity of products and experiences can make an important contribution to the goals of ITC's Poverty Reduction Programme. Many of the agro-eco tourism certification schemes with their focus on sustainability incorporate aspects of climate change adaptation and mitigation.

8.1. Agro-eco tourism

Under the right circumstances, ecotourism has proved to be one of the most effective means to finance biodiversity conservation. In most rich biodiversity areas, actual revenue flows for ecotourism are better than non-timber forest products and biopharmacy, and comparable only to agro-forestry (European Preparatory Conference 2002). Because the dominant land use around protected areas and buffer zones is agriculture and forestry, eco-tourism is an opportunity for the creation of additional income to farmers/foresters and to generate financial means for the management of protected areas, especially where governmental park management agencies have little resources.

Whereas eco-tourism is nature-based and agro-tourism is farm-based, agro-eco tourism is a combination of both. The symbiotic relationship between eco-tourism and agriculture that can be found in agro- eco tourism is a key element of an environmentally and socially responsible tourism in rural areas. Rural hospitality offers new employment and income generating opportunities for rural populations, including agro-eco tourism as expression and cultural exchange of agricultural practices, artistic heritage and craftsmanship, and culinary traditions. The rural landscape, usually a combination of wild and agro-ecosystems, is one of the most important resources for tourism development. It is obvious that a diversified agricultural landscape, with semi-natural habitats, has a greater aesthetic and recreational potential over uniform, degraded and/or polluted agricultural areas. In Europe, agri-environmental policies often promoted organic agricultural activities as a most effective means for landscape conservation: for example, the European Union Life Environment project run by the French Federation of Parks and Reserves adopted extensive animal husbandry to prevent the negative impacts of unmanaged forests on some botanical meadow species and to promote a landscape quality attractive to tourists. Examples from the Alpine Region showed that agriculture (e.g. in Carinthia, Austria) maintained an ecological value much more attractive to tourists than areas where agriculture activities were extremely reduced. Tropical countries that harbour extraordinary biodiversity have an untapped potential for generating tourism business around biodiversity-rich farms. For example, shade cacao and coffee farms have a higher biodiversity than forest habitats: families could receive money for visitors access to their land for bird-watching or could be actively involved in the agro-eco tourism (see examples 3 and 4 in the annex). Agro-eco tourism in certain locations provides a strong economic incentive to small farmers to commit to biodiversity-friendly agriculture management.[1]

8.2. Agro-eco tourism certification

An agro-ecotourism certification programme aims to achieve the status of a globally recognised brand which assists travellers to choose and experience genuine and authentic tours/experiences/destinations that have triple bottom line credentials, i.e. they are environmentally, socially and economically sustainable. A valid, independently assessed certification system assures travellers that products so labelled are backed by a strong well-managed implementation strategy of sustainable practices.

[1] **Source:** El-Hage Scialabba N. and D. Williamson. 2004. The Scope of Organic Agriculture, Sustainable Forest Management and Ecoforestry in Protected Area Management, in Environment and Natural Resources. Working Paper No. 18, Environment and Natural Resources Service, Sustainable Development Department, FAO, Rome. http://www.fao.org/docrep/007/y5558e/y5558e00.htm

Certification programmes in travel and tourism are important tools for distinguishing genuinely responsible companies, products, or services from those that are merely using ‘eco-’ or ‘sustainable’ labels as a marketing tool to attract consumers.

Certification may be a powerful market-based tool. It links players in the value chain by guaranteeing or certifying to users (tourists and tourism intermediaries) that suppliers (tourism providers) adhere to a specific set of standards and indicators of sustainable practices. In this age of globalization and increasing tourism to the most remote destinations, the certification label provides the trust and confidence bridging the various market players.

An example is the Australian Eco Society’s NEAP – Nature and Ecotourism Accreditation Programme. Claimed as a world first, it was established in 1996 as an industry initiative that was developed in response to the need for a system to identify genuine and authentic nature and eco tourism products in Australia. NEAP provides industry, protected area managers, clients and communities with an assurance that a nature-eco tourism product will be delivered with a commitment to best practice environmental management and the provision of quality experiences.

Typically, agro-eco tourism certification schemes will include:

- Adoption of policies and a strategy to achieve sustainability through the ‘triple bottom line’ approach, i.e. environmentally, socially and economically responsible operations and activities.
- Evidence of support by a tourism business for social, cultural and natural heritage and elimination of any practice that could be damaging to these elements.
- A commitment to adhere to industry codes of practices where they exist.
- The waste minimization model of reduce, reuse, and recycle underpins the operation of the product.
- A framework within which performance can be continually improved to attain best practice standards.
- Construction maximises the use of renewable and recycled materials and has involved practices to minimize environmental impacts. With reference to site disturbance and landscaping, the operation involves minimal disturbance and any areas disturbed are rehabilitated to restore ecological processes.
- Drainage, soil and water management: Site drainage reflects the natural site topography and the operation does not cause soil loss, or impacts such as erosion and sediment pollution to down-slope lands and waterways. Operations involve minimal use of an ecologically sustainable supply of water. Sewage and effluent is minimized and has no significant environmental impact.
- Energy usage is reduced and alternative energy forms (natural lighting, passive heating and cooling, solar power, etc.) are incorporated.
- Nature tourism and eco tourism operations involve minimal air pollution, and noise pollution is controlled to enable customers to experience the natural sound-landscape.
- Preference for employment of local people, including opportunities for women and youths, with provision of adequate training.
- This list is not comprehensive but covers the main points found in most ecotourism certification programmes and has been compiled from: Green Globe 21; the Australian Nature and Ecotourism Accreditation Programme; Nature’s Best, Sweden; and EcoClub, Greece.

Plate 8. Agro-ecotourism, Quzhou village, Anhui Province, China

8.3. Marketing: creating sufficient supply and demand

Sustainable tourism certification programmes, tourism businesses, funders and policymakers who assume that certification will automatically attract tourists and intermediaries and generate revenues are underestimating the challenges of the marketplace. Certification is only one step: it must be accompanied by a marketing strategy. Marketing strategies are dynamic and interactive. They are partially planned and partially unplanned. A flexible marketing strategy allows the programme to react to changes in the marketplace. A marketing strategy in turn informs the marketing plan. The marketing plan contains a set of specific activities required to successfully implement a marketing strategy.

In order for markets to be interested in certified products (demand), there must be sufficient numbers of alternatives and options (supply). There must be a critical mass of certified products. While certification is steadily increasing, this is not yet the case:

- By 2007, total certified products in Europe were estimated to be between 6,000 and 10,000, in Latin America's four programmes there were 168 certified accommodation and tour operators; and globally less than 15,000 certified business and products.
- With certification programmes spread unevenly around the world there are limited opportunities for consumers to learn about certification. At the same time there is a proliferation of certification schemes with few that have global recognition.
- Tourism operators and other marketers cannot give preference in their catalogues if there are not enough quality certified products in their market.
- Most green tourism labels have several dozen or at most a few hundred – not thousands – of certified businesses or products. One of the most successful programmes, Nature's Best in Sweden, began in 2002 but by 2007 had certified only 75 companies and about 300 activities.
- Most sustainable tourism certification programmes are nationally based, operate only regionally and have limited consumer recognition.
- The two main exceptions are Blue Flag (beaches in Europe) and Green Globe 21, both of which operate in many countries and have gained considerable market recognition.

- Blue Flag – 3200 beaches and marinas in 39 countries across Europe, South Africa, Morocco, NZ, Canada and the Caribbean.
- GG21 first developed in 1990s by WTTC undergone numerous revisions, strengthened and expanded its criteria and procedures. Now based in Aust, has certified 300 operations and facilities in 75 countries.

Despite the challenges and current limitations, certification when applied validly offers different stakeholders a diverse range of benefits.

For businesses, certification provides:

- A competitive advantage in marketing their products.
- A framework to assist the business in the implementation of ecologically sustainable practices.
- An internationally recognised brand for use in promotion and marketing.
- Listing with similar products by reputable agencies, for example, the Rainforest Alliance's Sustainable Tourism Certification Network of the Americas.
- A demonstration of ethical business values.
- Reduction of costs over the long term.
- Avoidance of being lumped with 'green-washed' business that are not ecologically sustainable but claim to be.

For tourists, certification provides:

- A recognised means for identifying genuine and authentic products and thus
- A contribution to visitor satisfaction.
- Responsible marketing, providing clients with an accurate and responsible depiction of what to expect from the product and how to respect the natural and cultural environments visited.

For protected area managers, certification provides:

- Sustainable management of landscapes around national parks, reserves, etc.
- Protection of buffer zones.
- Conservation of biodiversity through evidence that the impacts of nature tourism and ecotourism products have been minimized.
- Minimal disturbance of wildlife.

Marketing

The UNEP report: 'Marketing Sustainable Tourism Products' (2007), provides valuable guidance on marketing and the model is simple and applicable for agro-ecotourism and certification programmes. The full report is free and available from their website: www.uneptie.org/pc/tourism/documents/ marketingsustainabletourism/marketing sustainable tourism.pdf.

Plate 9. **Thoi Son Island Women's Group river trips, Tien Giang Province, Mekong Delta, Viet Nam**

Section 2 Sustainable environmental management

Sustainable Environmental Management (SEM) is a set of management processes and procedures that allows a tourism activity or venture to operate in an environmentally sound way and to analyse and reduce the environmental impact of its activities. The key elements of SEM in terms of tourism and hospitality are energy consumption, waste reduction, waste recycling and re-use (the three 'R's'). Waste recycling and waste re-use open up possibilities of creating export oriented businesses. These linkages will foster the poverty reduction goals of ITC's Poverty Reduction Programme. In this section trainers will first learn about the major environmental impacts of tourism as the foundation for the subsequently explored ways in which SEM can make a positive contribution to the economic and social well-being of stakeholders involved in inclusive tourism.

1. Environmental concerns and their impact on tourism

Negative impacts from tourism occur when the level of visitor use is greater than the environment's ability to cope with this use within the acceptable limits of change. Uncontrolled conventional tourism poses potential threats to many natural areas around the world.

It can put enormous pressure on an area and lead to impacts such as soil erosion, increased pollution, discharges into the sea, natural habitat loss, increased pressure on endangered species and heightened vulnerability to forest fires. It often puts a strain on water resources, and it can force local populations to compete for the use of critical resources.

Source: UNEP: http://www.uneptie.org.

There are many forms of tourism development (e.g. eco tourism, agro tourism, etc.) in many different sites all over the world and each will have a range of different environmental impacts according to the type of development and the particular ecosystem in which it has been located. In general however, we may categorize the diversity of environmental impacts as those which:

1. Deplete local natural resources;
2. Cause land and ecosystem (habitat) degradation; and those which
3. Result in pollution.

All three are inter-related and point to the need for sound environmental management if adverse impacts are to be avoided or minimized.

1.1. Depletion of natural resources

Where natural resources are already scarce, tourism can add pressures on them.

- **Fresh water**

Fresh water supply is critical in many parts of the world. Tourism development invariably results in increased consumption through such facilities as hotels, resort swimming pools, and golf courses. Studies show that most tourists use more water when on holiday than at home and a UNEP study suggests that in Mediterranean resorts one tourist uses up to 440 litres of water per day, twice the amount that inhabitants of an average Spanish city use.

If water for tourism uses is pumped from wells and the groundwater table, it can lower the level of both and also cause salinity.

Tourism over-use of water can result in four main points of concern:

1. Water shortages, especially for local communities;
2. Degradation of water supplies;
3. Generation of a greater volume of waste water, which in turn can;
4. Create pollution of soils, beaches, and degrade other resources such as corals.

Golf tourism has resulted in hundreds of golf courses being constructed throughout the developing world, each using a huge amount of water every day. In some areas (e.g. Bali), there has been excessive extraction of water to the detriment of irrigation for rice paddy and other local farming activities. Golf courses also require huge amounts of fertiliser - Nutrient rich run-off can pollute streams and beaches.

- **Tourism puts pressure on other local resources**

When an area is opened up for tourism for the first time – or is expanded significantly – it often puts pressure on a range of local resources such as energy (especially fuel wood for heating and cooking), food and other raw materials. The tourism-induced demand may result in shortage of supplies and that in turn can result in three main points of concern:

1. Food shortages for locals (this can be a very real problem in highly seasonal tourism regions where destinations may have ten times the resident population for the high season);
2. Higher prices for locals because of scarcity, often made worse because more food and other supplies once available locally have to be transported into the region so the costs of transport, previously not part of the price, have to be added to the cost;
3. Increased exploitation or extraction of these resources aggravates the physical and biological impacts associated with the increased demand. For example, local fish stocks may be depleted because of the requirements of resorts in a coastal location. Forests may be depleted with resultant loss of biodiversity, erosion and land degradation.

1.2. Land and ecosystem degradation

An ecosystem is a geographic area of all living organisms (animals, plants, microorganisms and people) and the way they interact in their habitat (through the natural cycles of their physical surroundings such as air, soil, and water).

The ecosystems most threatened with degradation are ecologically fragile areas such as alpine regions, rain forests, wetlands, mangroves, and coral reefs – areas of high attraction for tourism. Wetlands often play a key role in an ecosystem not just for resident plants, birds and animals but for migrating species, are sometimes drained and filled for tourism development.

In comparison, tourism development may be much smaller than urban sprawl, industry and manufacturing, mining development, clearance of forests for farmland, etc. Nevertheless tourism can put significant pressures on important land resources in attractive sites because of its consumption of fossil fuels, its utilization of land (often fertile soil) for construction and recreational facilities such as golf courses, its reclamation of farmland, forests and wetlands for building sites, its use of forests, wetlands and wildlife as attractions, and harmful disposal of wastes that causes pollution.

Deforestation caused by construction needs of tourism (timber for building) and fuel (e.g. along trekking routes in countries such as Nepal) is an area of significant impact. Alpine forests may be destroyed for ski runs, coastal mangrove forests may be 'reclaimed' for marinas, and other forest types may also be degraded by inappropriate forms of tourism activity (e.g. horse riding, which introduces feral weeds and exotic plants through horse droppings).

Beaches and other coastal sites, lakes, riversides, mountain tops and slopes, are sought after locations for many tourism developments. These areas are usually transitional zones, often characterised by sensitive or species-rich ecosystems, so the potential for adverse impacts is considerable.

Coastal zones are often severely impacted by tourism development because of such activities as:

- The construction of marinas and breakwaters which affect tidal flows and currents;
- The inappropriate siting and construction methods of buildings and other structures on sand dunes and sometimes over the water (e.g. bungalows in lagoons in tropical countries, as in the Caribbean and the South Pacific);
- Roads, paving and other constructions may destroy land-sea links essential for such mammals as turtles and their breeding sites on beaches;
- The removal of coastal vegetation and other habitat, thus depleting coastal zone animals and marine animals (mangroves are essential as fish 'nurseries', for example);
- The extraction of building materials such as sand, gravel, rocks and pebbles, and coral (the Philippines, Maldives, Fiji and Sri Lanka are just a few of the many examples of this); and
- Pollution of coastal habitats by disposal of toxic wastes (chemicals, sewage, detergents, etc. into the sea.

Severe erosion and the depletion of marine resources is the unhappy result for many coastal zones due to inappropriate forms of tourism development and activity. Such destruction of course destroys the very attractions which brought tourism in the first place and emphasises the need for sustainable practices across the entire spectrum of tourism development and activities.

Habitat can be degraded by tourism leisure activities in other different ways. For example, uncontrolled wildlife viewing which results in too many tourists getting too close to animals may put them under stress, particularly when the sighting of animals is accomplished by chasing them in vehicles and aircraft.

Their behaviour will be affected to the extent that they may abandon their young or fail to mate (examples of this have been recorded with safari tourism in the game parks of Kenya and the United Republic of Tanzania). Boats seeking out marine mammals such as whales and dolphins may have the same effect.

Plate 10. Severe erosion of a beach resort, Andaman Coast, Thailand

- **Habitat degradation and impacts on wildlife**

'Free range' wildlife touring can also result in habitat destruction as vehicles leave roads and tracks to get close to animals, flattening grasses, breaking small plants and shrubs and compacting soils. Cave habitats are particularly sensitive to development and many caves opened up for tourism are unable to maintain their natural state and populations of highly adapted life forms because of light, noise, and increased humidity and carbon dioxide levels caused by the presence of tourists.

- **Physical impacts**

Land clearance for construction development purposes and some forms of tourist activities may result in a range of physical impacts.

- **Construction activities and infrastructure development:** Construction of hotels, resorts, theme parks, restaurants and other recreation facilities for tourists, coupled with infrastructure development such as airports, roads, dams and power supplies create obvious physical impacts. Poor planning and construction with any of these will lead to adverse environmental impacts such as degradation and/or loss of wildlife habitats and diminished scenic quality.

- **Trails:** Trails are of particular concern. Constant use tramples vegetation, compacts the soil, accelerates run-off which often leads to erosion and gullying, and this damage may trigger loss of biodiversity and other impacts such as increased siltation of streams. Hardening of trails destroys all vegetation but may prevent erosion. Raised boardwalks which allow plants to grow underneath, which do not obstruct groundwater and surface water flows, and which allow animals to move freely underneath, may alleviate impacts.

- **Turbulence:** Turbulence from water-based pleasure craft utilised for tourism can create wash which undermines banks of rivers and lakes and can cause stress to marine organisms; and uncontrolled anchoring (dropping anchors on top of reefs, sea grass beds and other fragile sites), together with activities such as snorkelling and scuba diving are recorded as significant agents of damage and destruction of coral reefs and other marine habitats.

1.3. Pollution

Other forms of tourism-caused pollution are similar to those of any other industry – air emissions; noise; solid waste and littering; waste water; releases of oil, chemicals and other toxic wastes; and visual pollution.

Indicative list of wastes

Wastes are categorized into two basic forms:	**Sometimes these terms may be described as:**
1. Organic; and	1. Bio-degradable; and
2. Solid.	2. Non-biodegradable.

Different forms of tourism activity will produce different wastes.

For example, a craft-based venture producing silverware jewellery for souvenirs (e.g. Celuk village, Bali) will produce very different wastes from a wood-carving community venture in The United Republic of Tanzania or a trekking venture in Nepal or a small resort in Fiji. A large three star hotel (as owned by the Tibetan communities in Jiuzhaigou National Nature Reserve in Sichuan Province, China) will of course produce very different waste from home stays in village Thailand.

Air pollution

Emissions related to transport, especially via air and road, and energy production for hotels and resorts are responsible for most tourism–related air pollution. The CO_2 emissions of aircraft have a global impact, with tourist travelling accounting for about 70% of all air travel (ICAO Annual Report, 2002).

Noise pollution

Noise pollution is an increasing problem in many areas as tourism activities create noise problems for adjacent communities. At the same time, the 'wilderness experience' for trekkers may be destroyed by sightseeing helicopters and light aircraft overhead and eventually reduce tourism. In many destinations the noise of aircraft, tour buses and cars is invasive, and recreational vehicles such as snowmobiles and jet skis which produce high noise levels also cause stress and irritation. In the United States in winter time snowmobiles are an increasing source of annoyance and there is some evidence that their use has adverse impacts on wildlife behaviour. A study of winter visitation to Yellowstone National Park in 2000, for example, indicated that of 128,000 tourists, 11,000 arrived in coaches, 41,000 arrived in private vehicles, but 76,000 toured the park by snowmobile. Snowmobile noise could be heard 70% of the time at 11 of 13 sample sites, and 90% of the time at 8 sites. At the Old Faithful geyser, snowmobiles could be heard 100% of the time during the daytime period studied. Their off-road mobility and high noise levels caused animals to alter their natural activity patterns (Yellowstone National Park report, 2001).

Solid waste and littering

All over the world, tourism and tourists are responsible for generating solid waste and litter. Waste disposal is a serious problem and inappropriate disposal results in pollution of the natural environment and public spaces. National parks, trekking routes, rivers, lakes, beaches, road verges, the sea, cultural heritage sites – all show signs of pollution from solid wastes and litter. Cruise ships, once notorious for disposal of wastes at sea, are now more closely regulated, and increasingly the tourism industry is moving towards acceptable practices and better environmental management.

Wastewater

There are many examples of wastewater polluting beaches, rivers, lakes and land surrounding tourist attractions, harming flora and fauna and causing potential health problems to humans and wildlife. Sewage is a major pollutant often associated with inappropriately designed tourism development. Sewage is

nitrogen- and nutrient-rich and even treated discharge into water systems can cause algae 'blooms' in rivers, lakes and the sea which can impact on many forms of wildlife in these ecosystems. This is because the algae blooms eventually decay and create oxygen-starved 'dead zones.' Low oxygen levels, a condition called 'hypoxia,' combined with higher summer water temperatures, begin an ecological chain of events that severely impacts water quality and marine life. Nutrient-rich run-off is particularly damaging to coral reefs because it stimulates the growth of seaweeds which smother the coral, endangering their ability to survive.

Oil, chemical and toxic wastes

While tourism is only a minor generator of these kinds of waste by comparison with heavy industry, the location of many tourism developments in pristine places and fragile ecosystems means that there is a particular responsibility to minimize adverse impacts by effective storage and disposal regimes. One drop of petrol can contaminate 5000 litres of water.

Untreated discharge of detergents from resort laundries and kitchens can pollute rivers and beaches and destroy marine life. Chemicals for pest control can be highly toxic and their storage and disposal must be carefully monitored. Inappropriate management of these items may compromise the health of not only the environment, but also humans.

Visual pollution arises from inappropriate sitting of buildings and other construction and inappropriate design features which do not blend with either the natural environment or the cultural milieu in which they are located. In some destinations there is unsightly sprawl of tourism complexes and ribbon development along coastlines, rivers, lakes and roads.

The intention is excellent. Rubbish bins are made of recycled truck tyres and the signage is very clear – but still more rubbish ends up outside rather than inside the bins!

Bokum Sator National Park, Cambodia

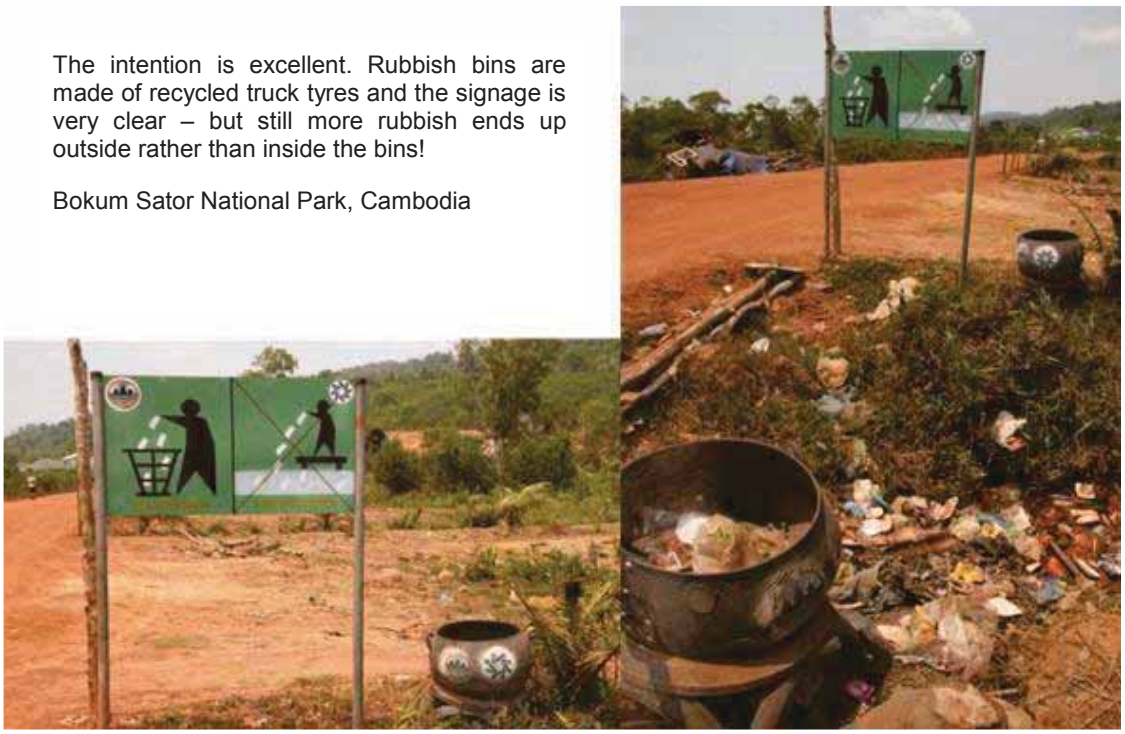


Plate 11. Rubbish bins in Bokum Sator National Park, Cambodia

2. Cleaner production – key elements

During the last three or four decades there has been a clear evolution towards a positive attitude by governments and industry regarding protection of the environment. The United Nations Environment Program (UNEP) suggests that this is perhaps due to the development of win-win strategies, such as **Cleaner Production.**

UNEP describes cleaner production as:[2]

> The continuous application of an integrated preventive environmental strategy to processes, products, and services increases overall efficiency, and reduce risks to humans and the environment. Cleaner Production can be applied to the processes used in any industry, to products themselves and to various services provided in society.

For Production Processes, Cleaner Production results from one or a combination of conserving raw materials, water and energy; eliminating toxic and dangerous raw materials; and reducing the quantity and toxicity of all emissions and wastes at source during the production process.

For Products, Cleaner Production aims to reduce the environmental, health and safety impacts of products over their entire life cycles, from raw materials extraction, through manufacturing and use, to the 'ultimate' disposal of the product.

For Services, Cleaner Production implies incorporating environmental concerns into designing and delivering services.

In the context of Cleaner Production, waste is considered as a 'product' with negative economic value. Each action to reduce consumption of raw materials and energy, and prevent or reduce generation of waste, can increase productivity and bring financial benefits to enterprise. The key difference between pollution control and Cleaner Production is one of timing. Pollution control is an after-the-event, 'react and treat' approach. Cleaner Production is a forward-looking, 'anticipate and prevent' philosophy.

(Compost from My Tho tourist city waste management site), Tien Giang Province, Viet Nam

Plate 12. Tan Lap Community recycling

[2] **Source:** UNEP: http://www.uneptie.org/pc/cp/understanding_cp/home.htm#definition.

Cleaner Production describes a preventative approach to SEM

It is neither a legal nor a scientific definition to be dissected, analysed or subjected to theoretical disputes. It is a broad term that encompasses what some countries/institutions call eco-efficiency, waste minimization, pollution prevention, or green productivity but it also includes something extra.

Cleaner Production refers to a mentality of how goods and services are produced with the minimum environmental impact under present technological and economic limits.

Cleaner Production does not deny growth, it merely insists that growth be ecologically sustainable. It should not be seen only as an environmental strategy, but also for economic considerations.

Cleaner Production is a 'win-win' strategy. It protects the environment, the consumer and the worker while improving industrial efficiency, profitability, and competitiveness.

Source: UNEP: http://www.uneptie.org/pc/cp/understanding_cp/home.htm#definition.

In terms of reduction of waste a simple example would be: Use more physical effort and sandpaper rather than purchasing paint stripper, which is toxic and poses problems of safe disposal.

Making products with recycled materials instead of raw materials uses 30% to 55% less for paper products, 33% less for glass, and a massive 90% less for aluminium.

In terms of energy consumption there is often significant waste in the way energy is produced and consumed, and reduction of waste may be possible.

In our approach to Sustainable Environmental Management (energy minimization, waste reduction, re-cycling and re-use) often ‘hi-tech’ processes will be inappropriate, given that we are working in developing countries.

For example, we can gather aluminium cans for crushing, but treating and refining them for use in new aluminium products is a sophisticated engineering process that requires major capital investment beyond the reach of impoverished communities in developing countries. Unless there is such a re-processing plant in the developing country, then gathering and crushing for bulk export is the appropriate response. Making products with recycled materials instead of raw materials uses 30% to 55% less for paper products, 33% less for glass, and a massive 90% less for aluminium.

An example of organic waste recycling for agriculture and aquaculture comes from a village homestay venture in Mendi in the highlands of Papua New Guinea: pig waste is used as fish food, and also for production of bio-gas (methane) used as a cooking fuel.

For more on biogas/methane see page 47.

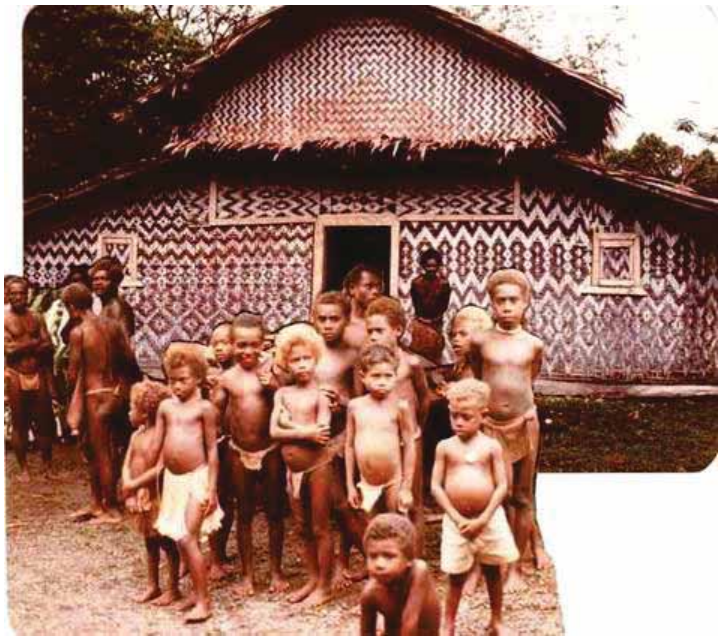


Plate 13. Highlands village, Papua New Guinea

3. Energy consumption

This section is designed to provide an overview of approaches to **minimising energy consumption** in tourism enterprises. A range of energy saving technologies and alternative technologies are presented.

At the end of this section TSIs should have an appreciation of why energy reduction is essential and how the application of appropriate technologies can assist in improved environmental management and savings for the bottom line.

3.1. Introduction

There are two main situations to be considered for energy consumption and reduction by CBT ventures:

1. Operations which are able to access the national electricity grid; and
2. Those which are outside national and regional power grids, where some form of energy is essential, must produce their own 'stand alone' energy.

The latter are sometimes referred to collectively as Remote Area Power Systems (RAPS). In the first case, patterns of electricity use and energy – efficient devices and equipment will be the major ways in which to reduce energy consumption. The second, prevalent in many developing countries, provides opportunities to adopt environmentally responsible technologies for renewable energy such as use of solar and wind power.

Both of these situations benefit from the application of Passive Energy, that is, the design and construction of buildings to utilise solar energy for both heating and cooling independent of any manufactured power source. Building design may be allied with appropriate forms of landscaping to enhance passive energy gains.

We will thus start by looking more closely at Passive Solar Energy, before examining Grid-based Energy Reduction, and then Alternative Energy and Remote Area Power Systems.

3.2. Passive energy

The windows, walls, and floors of a hotel or another building can be designed to collect, store, and distribute solar energy in the form of heat in the winter and reject solar heat in the summer. This is called passive solar design or climatic design because, unlike active solar heating systems, it does not involve the use of mechanical and electrical devices, such as pumps, fans or electrical controls to move the solar heat.[3]

The physics of heat movement

To understand how passive energy works we need to take a brief look at the laws of physics. As a fundamental law, heat moves from warmer materials to cooler ones until there is no longer a temperature difference between the two. A passive solar building makes use of this law through three mechanisms:

1. **Conduction** is the way heat moves **through materials**, for example a spoon standing in a hot cup of coffee conducts heat through its handle and into the hand that grasps it.

2. **Convection** is the way heat **circulates** through liquids and gases. Lighter, warmer fluid rises, and cooler, denser fluid sinks. Warm air rises because it is lighter than cold air, which sinks. This is why the second floor of a house will be warm, while the basement stays cool.

3. **Radiant Heat** moves **through the air** from warmer objects to cooler ones. Thus a brick wall absorbs heat and then radiates it out into the room. Opaque objects absorb 40% to 95% of incoming solar radiation from the sun, depending on their colour – darker colours absorb a greater percentage than lighter colours. Bright-white materials or objects reflect 80% to 98% of incoming solar energy.

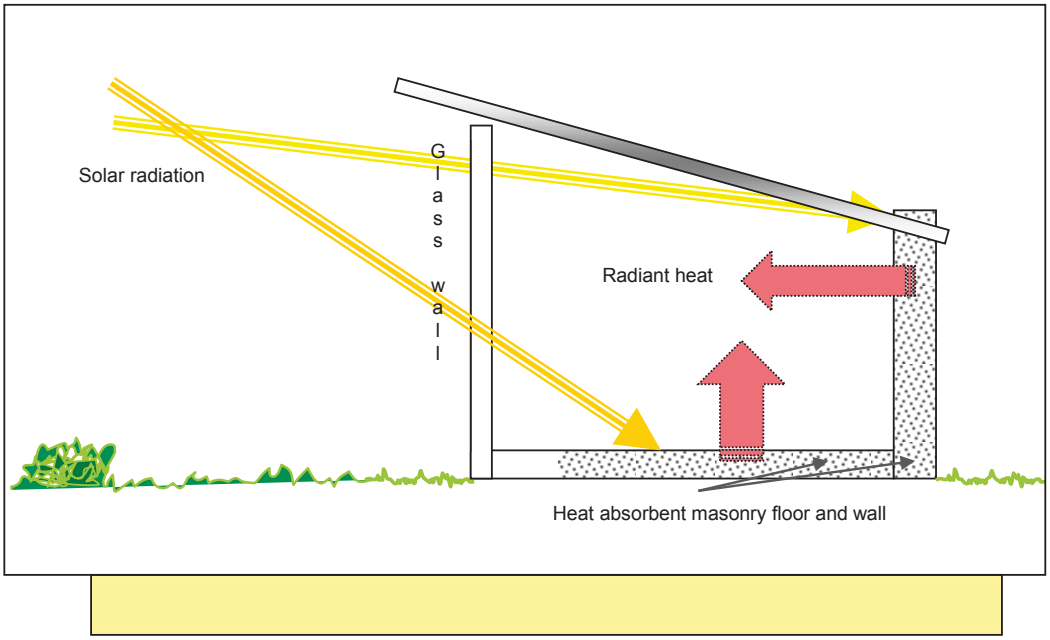
The solar resource

The sun is of course the source of solar energy and every year it transmits an enormous amount of energy to Earth. It is virtually inexhaustible and a renewable source of energy which, unlike fossil fuels, will never be depleted. Sunlight which reaches the ground is converted into heat but we are not very good at capturing it: if even only a small percentage could be acquired the entire world's energy needs could be met. One of the problems is that the sun only shines during the day, it is not evenly distributed, and therefore methods of storing the sun's energy for release at night are very important.

Passive solar heating of buildings is one way this can be done. When sunlight (solar radiation) penetrates a building through glass windows and strikes the interior it is converted into heat. This heat can then be captured by increasing the thermal mass of a building. Heat can be stored in concrete, brick, rock and water by simply increasing the temperature of these materials.

[3] **Source:** U.S. Department of Energy: http://www.eere.energy.gov/erec/factsheets/eehouse.html.

Figure 3. Passive energy for heating a building



Of these four, water can store the greatest amount of heat per unit volume. Painting walls and roofs in dark colours also increases absorption of heat. By orienting a building along the east-west axis and installing large glass windows on the wall facing towards the equator – south in the northern hemisphere and north in the southern hemisphere – the greatest amount of sunlight can be captured in winter, but solar gain will be minimized on afternoons in summer when the sun is in the west and cooling rather than heating is desired.

Window glass, however, is generally not a good insulator, and increased solar heat gain during the day can be offset by loss of heat through windows at night. In developed countries, double and triple glazing (two or three layers of glass separated by vacuums) is used to decrease the heat loss, but it is very expensive. A much cheaper but still effective way to reduce heat loss through the glass is to place wooden shutters (lined with material as an insulator) over windows at night.

Environmentally, the use of passive solar techniques has almost no negative impacts, unlike other fuels which give off air emissions and so pollute the atmosphere and contribute to global warming.

For centuries traditional dwellings in many societies have been designed to incorporate passive solar techniques for both heating and cooling. But in the last 200 years fossil fuels in developed countries and increasingly in Third World countries have become the preferred energy source because of their cheapness and abundance, and this has led to passive solar building design being abandoned.

In the last two or three decades a better understanding of the pollution caused by such fuels and their contribution to global warming has led to alternative renewable energy sources gaining increasing attention. For example, the Kyoto Agreement (2001) which laid out global benchmarks for reducing greenhouse gases has encouraged many countries to set targets for decreasing their consumption of fossil fuels.

This endeavour has been assisted by greater realization of their finite quantity/volume and escalating prices. Passive solar energy is a key component of alternative energy and it can make a valuable contribution towards creating a more sustainable energy future.

Solar water heating

Solar water heaters can be either active or passive. An active system uses an electric pump to circulate the heat-transfer fluid; a passive system has no pump. Passive systems have no electric components to break. This makes them generally more reliable, easier to maintain, and possibly longer lasting than active systems. These systems use the sun to heat either water or a heat-transfer fluid, such as a water-glycol antifreeze mixture, in collectors generally mounted on a roof.

The heated water is then stored in a tank similar to a conventional gas or electric water tank. Solar water heaters can operate in any climate. Performance varies depending, in part, on how much solar energy is available at the site, but also on how cold the water coming into the system is. The colder the water, the more efficiently the system operates. In almost all climates, it will be necessary to have a conventional backup system. In fact, many building codes require that there is a conventional water heater as the backup.

Solar water heaters may be a good investment. They are cost competitive in many applications when the total energy costs over the life of the system are taken into account. Although the initial cost of solar water heaters is higher than that of conventional water heaters, the fuel (sunshine) is free. In addition they are environmentally friendly.

To take advantage of these heaters, it is necessary to have an unshaded, south-facing location in the Northern Hemisphere, or a north-facing location in the Southern Hemisphere, such as a roof, on the property.

There are three main types of Passive Solar Water Heating Systems

1. **Batch heaters** have two names – the common name is ‘bread box’ solar heater, and the technical term is ‘**integral collector storage systems**’. Batch heaters are simple passive systems consisting of one or more storage tanks placed in an insulated box that has a glazed side facing the sun. A batch heater is mounted on the ground or on the roof – make sure the roof structure is strong enough to support it.

   Batch heaters are inexpensive and have few components – in other words, less maintenance and fewer failures. In climates where freezing occurs, batch heaters have to be protected from freezing. Where insulation to prevent freezing is not possible (e.g. in extreme northern and southern latitudes) they need to be drained for the winter – but that is when the need for heating is greatest so alternative heating devices are required.

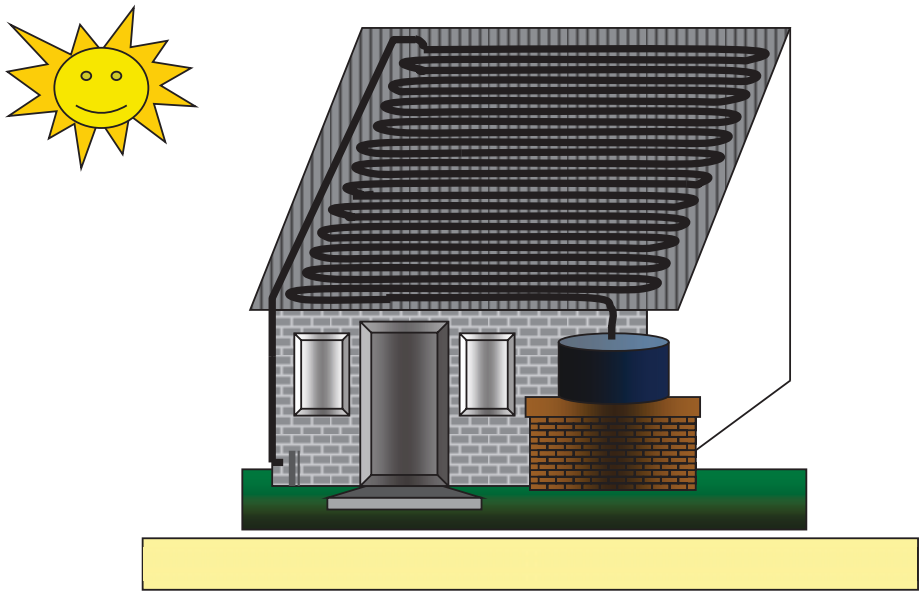
2. **Thermo-siphon systems** rely on warm water rising, a phenomenon known as natural convection, to circulate water through the collectors and to the tank. In this type of installation, the tank must be above the collector. As water in the collector heats, it becomes lighter and rises naturally into the tank above. Meanwhile, cooler water in the tank flows down pipes to the bottom of the collector, causing circulation throughout the system. The storage tank is attached to the top of the collector so that thermo-siphoning can occur. These systems are reliable and relatively inexpensive but require careful planning in new construction because the water tanks are heavy. They also need to be protected from freezing or else drained for the winter in cold climates.

3. **Adaptive idiosyncratic** passive solar hot water systems

   (a) The spaghetti system

   There is a range of ideas that work with greater or lesser efficiency according to climate, ambient temperatures, and sunshine hours. The simplest method is to take about 200 m of black rubber or plastic hose and then loop it up and down that side of the roof which faces the sun. Water is trickled slowly through the hose which absorbs the sun’s heat and the warm water is fed into a collecting tank which is also painted black (and thus also absorbs the sun’s heat), or wrapped in an insulation blanket. This has been called the ‘spaghetti system’ (see figure 4).

Figure 4. The spaghetti system-passive solar hot water heating



(b) 'Bottled' passive solar water heating

A second method is similar but usually installed on the ground where it can catch all-day sun. This method also has the advantage of re-using waste material, in this case plastic or glass bottles. The bases of the bottles are removed and they are then threaded onto a hose-pipe and spread out to catch the sun. Water is run slowly through the hose. If the hose is placed on bare ground (brown or black soil, or rocks) or sheets of black plastic then the heating process is improved by the heat-absorptive capacity of the underlying material. In temperate climates a collection tank of 500 litres or more will keep water warm until about 9 o'clock at night in non-winter months (see figure 5).

Passive solar cooling

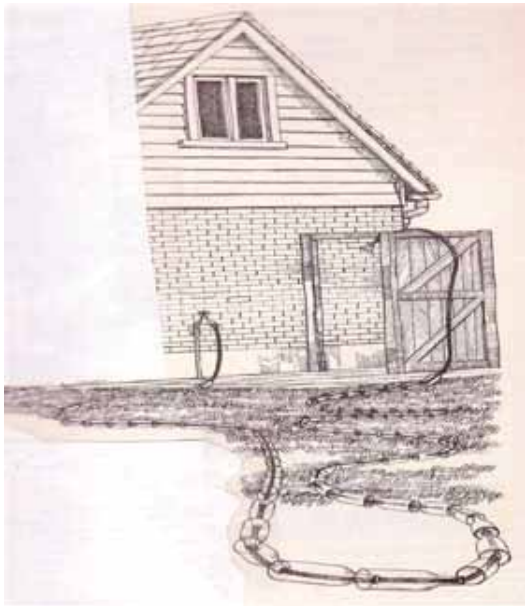
In addition to passive solar heating of water and buildings the same energy can be used for cooling hotels, homestays, etc. There are three common methods of passive solar cooling:

1. **Natural ventilation** (wind). By designing windows or other openings in buildings to capture prevailing winds or create cross draughts the natural flow of air through a building can be greatly increased and help to keep the building cool;
2. **Painting buildings** a light colour to reflect sunlight and keep them cool is also a passive solar construction technique;
3. **Landscaping** can be used for both passive heating and cooling.

Landscaping is a very good method for passive heating and cooling. Planting trees, shrubs, vines, grasses, and hedges can be an excellent long-term investment for reducing heating and cooling costs, while also bringing other improvements to a community. This is because a well-designed landscape will:

- Cut summer and winter energy costs dramatically;
- Protect buildings from winter wind and summer sun;
- Reduce consumption of water and pesticides; and
- Help control noise and air pollution.

Figure 5. Bottled system



(Seymour, J. 1976)

According to computer models devised by the U.S. Department of Energy, carefully positioned trees can save up to 25% of a building's energy needs for heating and cooling.

- **Summer:** Because cool air settles near the ground, air temperatures directly under trees can be as much as 25°F (14°C) cooler than air temperatures above exposed bitumen roads on a hot summer's day. Plantings of trees, and also vines to grow on the walls of buildings, can thus be very effective for cooling buildings.

- **Winter:** In winter, the same trees planted as a hedge can deflect cold winter winds over a building and thus lower heating costs.

Figure 6. Passive solar cooling

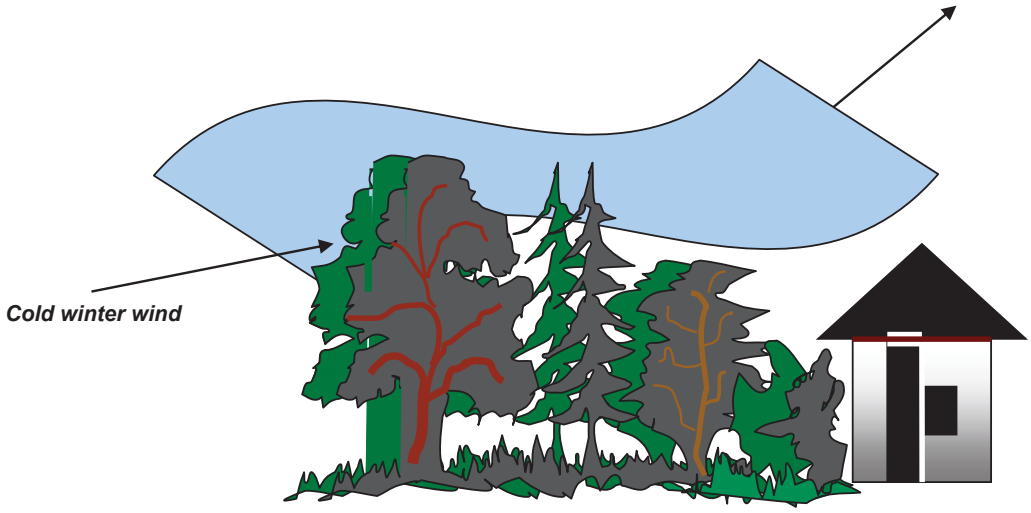
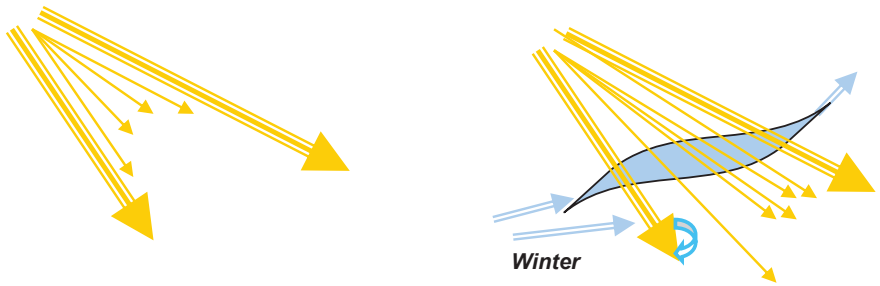


Figure 7. Deciduous trees and passive solar energy



Passive summer cooling **Passive winter**

Deciduous trees can perform both cooling and heating functions. In summer their leafy mass can shade a building from the sun. But in winter, when they lose their leaves they can let sunlight through to shine on a building, and at the same time create an effective barrier to deflect cold winds.

Some species of trees, bushes, and grasses require less water than others so by planting trees and shrubs which are native to an area and thus adapted to its climate, landscaping can also save on water. Some species are naturally more resistant to pests, so using these types of plants the use of pesticides can be reduced.

Good landscaping can also be used to make barriers to reduce noise and dust pollution. Probably the best example of the latter is Beijing where the Chinese Government has planted a buffer zone of more than 12 million trees around the city to protect it from summer dust storms.

There are other good environmental benefits from planting lots of trees and carrying out landscaping that is appropriate to the climate. Trees and vegetation create habitat for wildlife, they control erosion, protect water supplies, provide food, and because they absorb carbon dioxide and release oxygen into the air, they are excellent for helping to reduce pollution of the atmosphere.

Conclusions about passive solar energy

- For many different forms of tourism, passive solar energy has the **potential to supply a large proportion of the energy** needed and thus reduce energy consumption and costs.
- It is effective for warming buildings:
  - Designed along the east-west axis, with
  - Windows facing towards the equator, and
  - With increased thermal mass such as block walls to capture the heat.
- Passive solar energy can provide both heating and cooling.
- Landscaping is an invaluable additional passive solar energy method for:
  - Reducing energy needs which;
  - Contributes to both heating and cooling;
  - Depending upon the way trees and plants are used and positioned in relation to buildings.

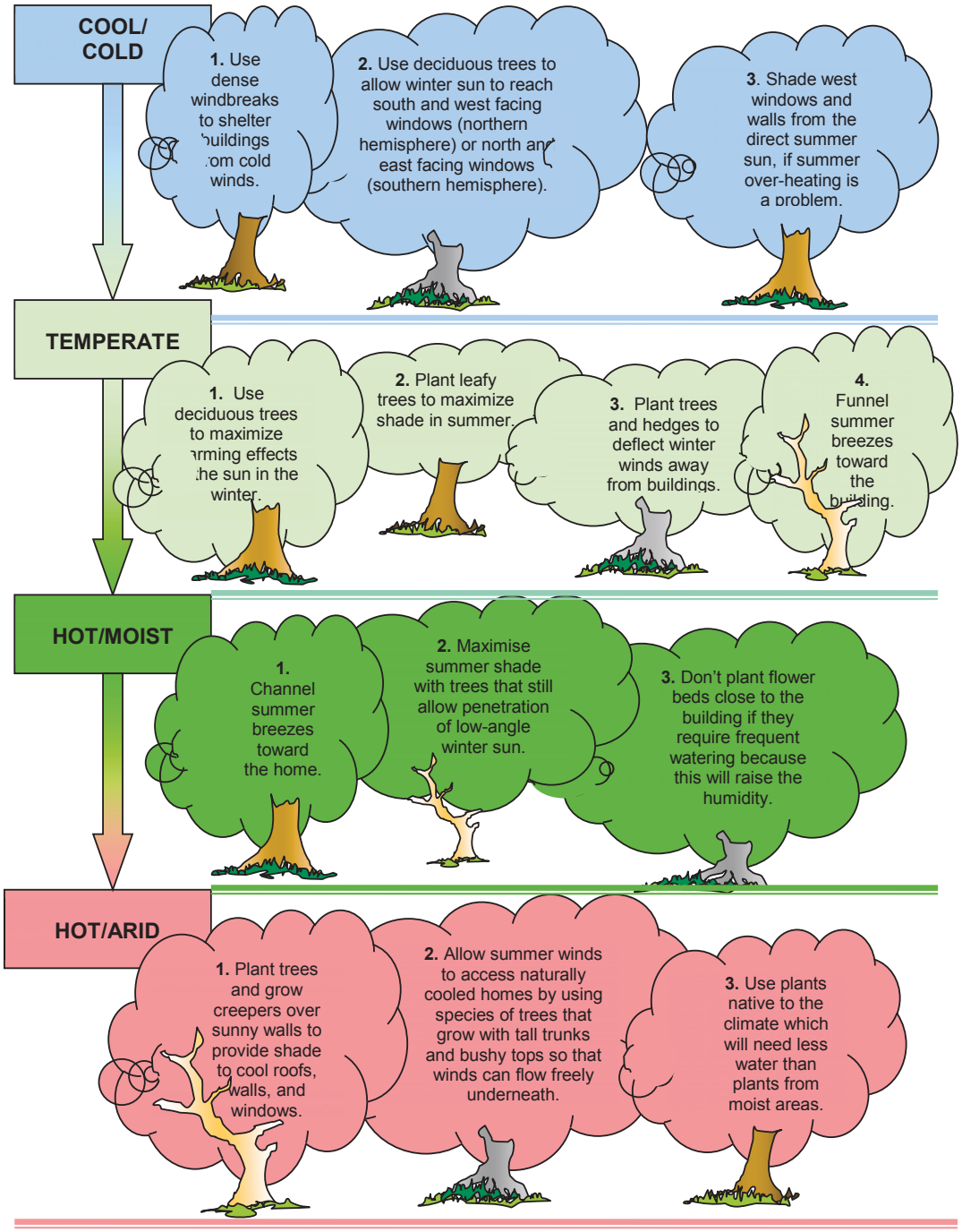
- Before we began to use fossil fuels as if they would never run out, societies routinely built to utilise available solar energy for heating, cooling and lighting.
- In recent years, much more attention has been directed towards maximising the potential for passive solar energy.
- Passive solar energy is one of the cleanest sources of useful energy for buildings and so is environmentally beneficial.
- It is also often the least expensive possible source of useful energy for buildings so applications of different methods in developing countries are particularly invaluable.

Passive solar energy is a key component of alternative renewable energy and it can thus make a valuable contribution towards creating a more sustainable energy future.

See the following page for the general guides for landscaping that can be used for different climatic zones.

Plate 14. Windbreak of pine trees (Cupressus macrocarpa), in a cool temperate climate, Otago Peninsula (40'S), New Zealand

Figure 8. Landscaping for passive solar energy in different climatic zones



3.3. Electricity grid energy

Where a tourism venture is connected to the local electricity grid it will rarely be economical to make its own electricity with its own stand alone power system. However there are many ways in which consumption and costs can be reduced. The most important loads to consider are guest room usage, water heating, cooking, space heating and cooling, and refrigeration.

Hotels/resorts and guest rooms

An increasingly common technique used all over the world is to have each room individually wired and the electricity supply activated with a plastic insert attached to the room key. Every time the guest leaves the room they must withdraw the plastic insert to take the key with them, thus automatically switching off the electricity. In this way, air conditioners, radios, fans, lights, TVs and other appliances cannot be left on, consuming electricity unnecessarily. Additionally, select an appropriate light globe for the situation: an entrance light to a room for example may need to be only half the wattage of a reading lamp.

Other approaches to reduce energy costs include dimming lighting in corridors later in the evening; circuiting for minimal lighting levels for security; and installing sensor switches that are activated when needed in thoroughfares or outside buildings and in the grounds of a property.

In the recent past, low wattage incandescent globes have been installed to reduce electricity costs. There are now (2010) new alternatives that offer better savings and in many parts of the world standard GLS incandescent lamps are being phased out in favour of double envelope halogen replacement globes available in the standard Bayonet Cap (BC) and Edison Screw (ES) versions. Typically they are 30% more efficient than the lamps they replace. They are also dimmable which as well as allowing greater control over than ambience, will also save power. Other options for reduced power consumption include self ballasted compact fluorescent lamps (CFLs) also typically available in BC and ES versions. These are appropriate where constant light levels are required, and where lights remain switched on, and are easily retro-fitted into existing light fittings.

Fluorescent lamps and tubes are generally not dimmable and require some minutes before they are working to their maximum brightness. They also have an optimum temperature range for maximum output typically approximately 25°C. Light output will fall if the ambient temperature exceeds this temperature. Fluorescent lamps are also unsuitable in very cold situations.

There is a general association of fluorescent lamps with a cool blue white character. While this might be appropriate for office and retail lighting where a clinical ambience is desired, it may be a bit harsh where a warmer earthier ‘welcoming’ ambience is required. Warm white fluorescent lamps would be a more appropriate choice in those circumstances.

It can be useful to understand the difference between general lighting, and task lighting. Task lighting is very often achieved with spotlights – highlighting certain features of a space. There are many types of lamps that can be used to achieve this type of illumination with varying efficiencies. Light emitting diode (LED) technology has improved greatly offering further options for special effects and other efficient lighting applications.

Applications for special effects illumination include out-door and landscape lighting. This is most effective when care is taken to conceal the light source from the observer so they are not distracted by points of glare. Typical applications might include up-lighting under trees, lighting up the sides of buildings, etc. Rope lights and ‘fairy’ lights can also be used to good effect. Coloured light sources can also be utilised to enhance features which might otherwise have been overlooked.

Case study: treetop adventures – Northern Tasmania – Australia

This Eco-tourism venture allows participants to experience exploring the forest canopy suspended more than 50 m above the ground from a zip line cable run in a forestry reserve near Launceston, Tasmania. Group tours are escorted across a number of 'cloud-stations' through the forest canopy throughout the day in all weather conditions. The tour takes approximately 3 hours.

A decision to undertake night-time tours – adding to the operation's repertoire and creating a further unique experience – had the proprietors exploring special effects lighting to enhance the serenity of the exercise. They decided on a colour-change LED option to illuminate each of the cloud-stations through the forest canopy as well as lifting parts of the landscape – including the Pipers River with discretely placed spot and flood lighting. A system of 'off-grid' power sources (12 v automotive batteries) with inverters was developed along with colour changing and fixed colour LED spotlights positioned to highlight aspects of the forest adventure to create a unique tourist attraction.

Plate 15. Hong Kong, China tourist on Tasmania's treetops adventure

The cost of running a light source will be determined by its wattage. Lower wattage high output lamps like CFLs and LEDs will cost more initially but should more than pay for themselves in terms of longer life and reduced running costs. Automation of aspects of the lighting systems – e.g. by using sensors and timers, will also provide energy saving opportunities.

With the increasing popularity of fluorescent types of lighting, there also needs to be an awareness of the requirements for their safe disposal at the end of their life. They contain small amounts of toxic substances (mercury) and it is desirable that they remain separate from the normal waste stream. In many parts of the world there will be collection agencies that can ensure that they are dealt with appropriately.

Water heating

A general rule of thumb for a western household is that heating water for showers, cooking, dish-washing and laundry costs about one seventh of the total electricity or gas bill. Different countries will have different tariffs for use of grid electricity but the costs of heating water will always be a major part of the total cost of electricity. So the way to reduce electricity consumption and costs is to look for ways to reduce the amount of hot water that is used, to maximise the efficiencies in heating the water, and to use simple timers to switch appliances on when cheap off-peak power is available (e.g. washing machines).

There are four main 'destination points' in hospitality businesses that are end users for hot water: taps, showers, washing machines, and dish washers. The last two appliances are typical equipment in tourism businesses in western countries, and most modern resorts and hotels in Third World countries will also have them installed. Many rural CBT ventures in developing countries however will wash laundry and dishes by hand so these details about appliances are attached in an annexe.

Taps

A leaky tap not only wastes water but can cost dollars if not repaired. A leak of one drip per second can cost US$ 1 per week, yet could be repaired in a few minutes for less than that, so always monitor taps for leaks.

Showers

As noted earlier, people on holidays tend to use much more water, especially for showers and baths, than they do when at home. Installing 'low-flow' showerheads and tap aerators can save significant amounts of hot water. Low-flow showerheads can reduce hot-water for bathing by 30%, yet still provide a strong, invigorating spray. Faucet aerators, when applied in commercial and multi-family buildings where water is constantly circulated, can also reduce water-heating energy consumption.

Notices in guest rooms asking guests to save water and power by turning off the hot-water tap while shaving or brushing teeth, instead of letting the water run can also be a practical step in reducing water-heating costs. Another polite notice in the bathrooms asking guests to limit their time in the shower can also result in significant savings.

A quick test can help to work out if your shower is a good candidate for a low flow showerhead. Turn on the shower to the normal pressure, hold a one gallon (3.8 liter) bucket under the spray, and time how many seconds it takes to fill the bucket. If it takes less than 20 seconds, a low-flow showerhead will definitely save water.

Other ways to reduce hot water costs

One simple step for reducing water-heating energy costs is to lower the thermostat setting on the water heater. Many manufacturers set water heaters at more than 140°F (60°C), but in fact 120°F (48.9°C) is satisfactory for most needs. Consider solar or instant gas heaters as the main source of power for heating water.

In some countries, gas may be cheaper than electricity, so check out the relative costs and see if it is more cost effective to switch from grid power to gas. If you plan to be away or close the business for an extended period of time (at least 3 days), turning the water heater thermostat down to the lowest setting, or even turning the heater off completely, can help achieve additional savings. However care must be taken in turning the water heater thermostat down to the lowest setting, because below 120°F there is a danger of incubating Legionella, which can be fatal.

Insulate hot-water pipes and the storage tank: In cool and cold climates, heat loss from pipes can be reduced by insulating hot water pipes wherever they are accessible. Make sure that only insulation material is used, such as strips of fibreglass which could be neatly taped around hot water pipes.

Using off-peak power to heat water: Most hospitality businesses and accommodation providers use more hot water in the evenings and mornings than at other times of the day. This usage contributes to the 'peak load' on the grid, and higher rates often apply. Lower rates may be charged at 'off-peak' times and it may be possible to lower electricity bills if you can take advantage of these rates. Use by guests (e.g. hot showers, lights in their rooms, etc.) cannot really be controlled; but it may be possible to organize both kitchen and laundry schedules for using hot water for washing that coincides with low peak rates.

3.4. Alternative energy and remote area power systems (RAPS)

The third component of our consideration of energy consumption relates to CBT ventures which are not on the power grid. In such circumstances alternative power systems are utilised. They range from the 'old' technology of diesel generators which on a global basis often remain the most common form of off-grid power because of their reliability and relative mechanical simplicity, to 'new' alternative technologies designed to harness the power of the sun and the wind, and even tides.

Applications of alternative energy are often allied with innovation in design of appliances such as water heaters and stoves, and in this section we shall briefly examine both alternative energy and appliances.

Solar energy

The basics of solar energy were covered in the section above on passive solar systems so here we shall focus on its active application for RAPS. As already noted, solar technologies use the sun's energy and light to provide heat, light, hot water, electricity, and cooling, for homes, businesses, and industry. Active solar technologies include photovoltaics, concentrating collectors, solar hot water and space heating systems, and cooling systems.

The technology of active solar energy systems will normally require an expert technician to help a community install the right system for their tourism enterprise. For this reason only a brief outline of different solar technologies is provided below; the tourism trainer/adviser will need to bring in a solar energy expert to help.

Photovoltaics (PV): Photovoltaic solar cells, which directly convert sunlight into electricity, are made of semiconducting materials. The simplest cells power watches and calculators and the like, while more complex systems can light houses and provide power to the electric grid. Most PV cells are made of crystalline silicon.

PV solar cells are only part of the system. The other components are referred to as the **'Balance of System (BOS) Components'**. They include everything in a photovoltaic system other than the photovoltaic cells, such as mounting structures, tracking devices, batteries, power electronics (including an inverter, a charge controller, and a grid interconnection if the RAPS is to be linked into the grid), and other devices.

Thin film photovoltaic cells use layers of semiconductor materials only a few micrometres thick, attached to an inexpensive backing such as glass, flexible plastic, or stainless steel. Because the quantity of semiconductor material required is far smaller than for traditional PV cells, the cost of thin film manufacturing is far less than for crystalline silicon solar cells.

Concentrator Collectors: Concentrating solar power technologies use reflective materials such as mirrors to concentrate sunlight onto a PV cell. This concentrated heat energy is then converted into electricity. Some concentrating collectors are mounted on a two-axis tracking system to keep the collector pointed toward the sun.

Stand-Alone Photovoltaic Systems: Stand-alone photovoltaic systems can be more cost-effective than extending power lines from a grid and they are especially appropriate for remote, environmentally sensitive areas, such as national parks, cabins, and remote villages. In rural areas, small stand-alone solar arrays are used in many small resorts in developing countries. Direct-coupled systems need no electrical storage because they operate only during daylight hours, but most systems rely on battery storage so that energy produced during the day can be used at night. Some hybrid systems combine solar power with additional power sources such as wind or diesel and battery banks.

Photovoltaic is expensive to produce because of the high cost of semi-conducting materials. A CBT venture will need to carry out a careful analysis of costs to determine the most efficient system (see Vulelua Island Resort case study).

Solar hot water and space heating and cooling

Solar hot water heaters use the sun to heat either water or a heat-transfer fluid in collectors. A typical system will reduce the need for conventional water heating by about two-thirds. High-temperature solar water heaters can provide energy-efficient hot water and hot water heat for large commercial and industrial facilities.

Active solar hot water systems use electric pumps, valves, and controllers to circulate water or other heat-transfer fluids through the collectors and into a storage tank. They are usually more expensive than passive systems but are also more efficient. Solar water heaters are also characterised as open loop (also called 'direct') or closed loop (also called 'indirect').

Open-loop active systems: Open-loop active systems use pumps to circulate water through the collectors. This design is efficient and lowers operating costs but is not appropriate if the water is hard or acidic because scale and corrosion quickly disable the system. These open-loop systems are effective in warm sunny climates such as South East and South Asia, most parts of Africa, the Caribbean, the Mediterranean, and the South Pacific. They should never be installed in climates that experience freezing temperatures for sustained periods. They can be installed in occasionally freezing climates, but insulation must then be used to guard against freezing and burst piping.

- **Closed-loop active systems**: These systems pump heat-transfer fluids (usually a glycol-water antifreeze mixture) through collectors. Heat exchangers transfer the heat from the fluid to the water stored in the tanks. Double-walled heat exchangers prevent contamination of household water.

Closed-loop glycol systems are popular in areas of extended freezing temperatures because they offer good freeze protection. However, glycol antifreeze systems are more expensive to buy and install, and the glycol must be checked each year and changed every 3 to 10 years.

- **Pumps in active systems**: The pumps in solar water heaters have low power requirements, and some companies now include direct current (DC) pumps powered by small solar-electric (photovoltaic) panels. PV panels convert sunlight into DC electricity. Such systems cost nothing to operate.

Environmental benefits

Solar water heaters do not pollute the environment. A community which can install and operate such heaters in its tourism ventures thus avoids the air pollution (e.g. carbon dioxide, nitrogen oxides, sulfur dioxide, etc.) that results when fuel (wood, kerosene, etc.) is burned to heat water. Over a 20-year period, a solar water heater represents the equivalent of more than 50 tons of carbon dioxide emissions that grid electricity powered by fossil fuels generates for a similar-size electric water heater.

Active solar cooling

As water evaporates, it cools the air. **Evaporative cooling systems**, usually appropriate for hot dry climates, can be powered with solar technology. In humid climates, **desiccant evaporative cooling** systems use the same evaporative concept to cool air, but they include a device to dry incoming air. Evaporative cooling is a CFC-free and energy-efficient way to cool commercial buildings. In absorption solar cooling, an absorption device uses a heat source, such as natural gas or a large solar collector, to evaporate refrigerant and distribute cool air with a powered fan.

Mini- and micro-hydro electricity power (MMHP)

MMHP technology is a useful way of providing power to houses, workshops or villages that need an independent electricity supply. For many remote areas beyond the reach of a national grid, MMHP is the only economic electricity option. It is environmentally friendly energy, renewable, and locally available where rivers and streams have sufficient flow throughout the year. There can be quite a range of benefits:

- MMHP plants can reduce traditional fuel consumption and so make a contribution to a better environment. They are particularly effective where they are able to replace fuel wood.
- Community Involvement. If the construction of a MMHP scheme is taken up as a community project, a high degree of involvement by villagers can be generated. Their strong interest to have electricity can motivate them to contribute time and labour; and experience in countries as diverse as the United Republic of Tanzania, Solomon Islands, Guatemala, India and Nepal indicates that this can lead to strong community participation in other conservation and development projects.
- MMHP can contribute to improved health, especially in situations where it replaces smoke-filled kitchens (and houses) that may previously have burned wood, animal dung or coal for cooking and heating.
- Provision of electricity which supplies lighting at night opens up opportunities to work in the evenings, to develop cottage industries using the power, or to study.
- Ownership of a MMHP plant based on the personal contributions of many villagers may empower a community and increase their pride and self-esteem.
- Management of a micro-hydropower scheme by the community can lead to capacity building through institutional strengthening and personal development because a village electrification committee must deal with the technical, administrative and financial management of the scheme.

In the Annapurna Conservation Area of Nepal, for example, lodges with access to MMHP recorded decreases of up to 45% in firewood use over a full year (ICIMOD, 1996).

There are some drawbacks to MMHP schemes. First they involve a relatively high capital cost (these costs can vary quite considerably, depending upon the technical specifications required for building a dam or barrier to hold back water in a specific location). Technical expertise will almost always have to be brought in from outside to set up the plant and maintain it for a period of two or three years while community members are trained in its technology.

A MMHP plant will require more land than a diesel generator, for example, which can be located and relocated anywhere quite easily. And there may be specific locations that are inappropriate; for example, no suitable water source within economic distance of the tourism venture. All the households in a community must be mobilised to contribute more or less equally to the project: if this does not occur disputes can break out which can disrupt the operation of the facility. Regular payment of tariffs could become a problem for cash-poor villagers where-as tourism operators by virtue of being in the cash economy will tend not to face this problem. Despite the above drawbacks, MMHP plants in some circumstances will prove more viable economically than other forms of power such as diesel generators for example, on the basis of `life-cycle costs and returns', because no fuel is required.

The pelton turbine: In areas where communities have access to water dropping from a height but which is low in volume and insufficient to drive a normal A-C hydro turbine, a micro version of the hydro-power technology of the Pelton turbine could prove viable for meeting small electricity needs. Invented in California during the gold rush days of the 1850's, gravity-fed high-pressure water is projected onto buckets situated on the periphery of an impeller wheel to impart a torque on the turbine impeller which is co-axially linked to a generator.

The Pelton is a very efficient process of extracting the energy from the flow of water and if the ‘head’ (the height from which the water drops) is more than 100m it will achieve an efficiency rating of more than 90%.

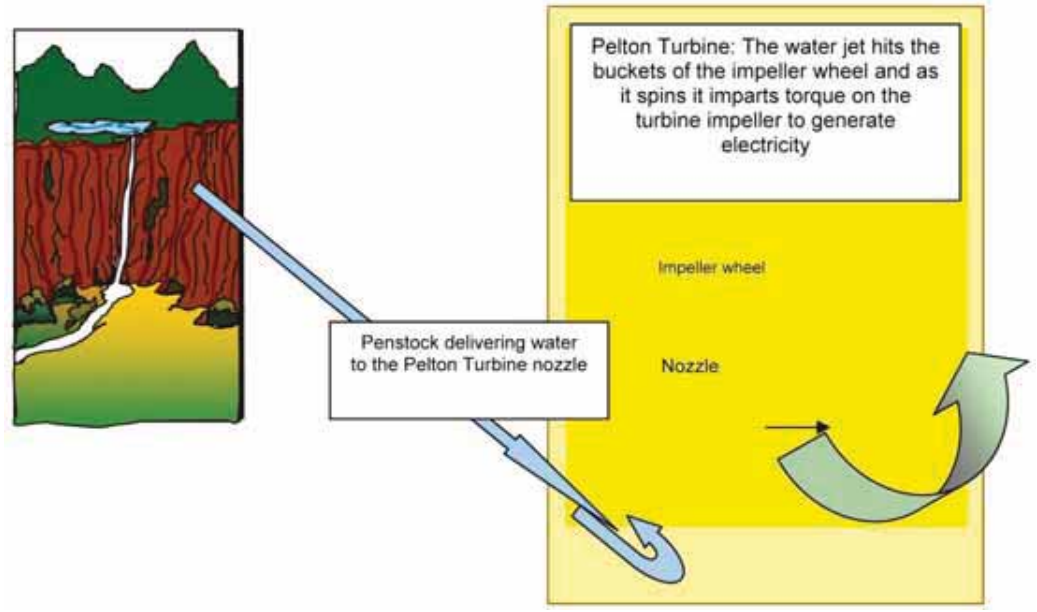


Figure 9. Pelton system

A miniaturised version of a Pelton turbine, called the **Peltric Set**, has been developed for isolated mountain communities in Nepal where they have been designed with capacities ranging from a few hundred Watts to around 100kw. In the Annapurna region, which receives the highest number of trekkers in Nepal each year and where many villages have lodges, peltric sets provide electricity for lighting households (1kW of electric power can light 10-12 rural households); charging batteries (electricity can be stored in the battery in the day-time); or operating radios, televisions, and VCRs.

The peltric set was developed as one of several alternative energy technologies to reduce the use of wood for heating and fuel because the high volume of tourism was threatening the alpine forests of Nepal. The Kathmandu-based International Centre for Integrated Mountain Development (ICIMOD) has provided the following summary of the characteristics of the adaptation of the Pelton turbine to Nepal's Himalayan communities.

Peltric set technology: Suitability for mountain use

Advantages: The peltric set technology can be used to provide electricity to rural and remote areas especially in the mountainous regions which suffer from low plant and low load factor, poor communication and no transportation.

- It is a small individual micro hydro plant that can generate electricity sufficient for five to ten houses by the smallest unit available, e.g. 60 watts.
- It is easy to install, operate, and maintain.
- It economises on transmission and distribution costs as the generating set can be located near user households.
- Comparatively, the electric power generated by the peltric generating set has a low cost per unit. Actual cost, however, is dependent upon site specific conditions.
- It can be afforded by an individual or a small group of interested households.
- It is cheaper to install because:
- It only needs a small channel to convey the small quantity of water;
- It is easy to transport (weight 35kg);
- It uses HDPE pipes for penstock pipe (light, inexpensive and readily available);
- it can be installed within two days; and
- It can be operated using the break pressure tank of rural water supply and sprinkler system pipelines.

Environmental and efficiency implications:

- The electric power generated by a peltric set can be used for lighting, heating water, and cooking in low-watt cookers, reducing dependence on firewood for these purposes. Thus, it has positive environmental implications.
- Its operation and end uses create no pollution at any point.

Source: ICIMOD, 1997. Manual of rural technologies with implications for mountain communities.

Wind power

Wind power, like solar energy, is available on site for zero cost. It has been used for centuries, and many people will be familiar with the Netherlands designed windmill and those from the Greek islands where wind power was captured mainly for grinding mills for flour.

In many places where there is sufficient wind throughout the year the technology of wind-generated electricity may be able to compete economically with other forms of power. Its biggest drawback is the variable wind speeds that are inevitable no matter how much wind there is in the course of a year. However, there is high output of energy in low wind speeds and a wide range of working wind speeds. Wind energy potential increases very rapidly with increasing wind speed. In fact, if wind speed doubles the energy content goes up by a factor of eight.

Plate 16. Traditional Netherlands windmill

Plate 17. Traditional Greek windmill, Mykonos

Large wind turbines are used primarily in arrays, called 'wind farms.' These huge machines require high wind resources because they must compete with conventional generation (coal, natural gas, oil, and nuclear) at the wholesale level. Advances in technology in recent years have improved their efficiency to the point where many grid systems now have wind farms as supplementary sources of power generation. Large wind turbines are generally not used in 'off-grid' applications. Small wind systems are used primarily for individual homes, businesses, or facilities off-grid.

A variety of windmills of different capacities are available to suit local conditions. Relatively high initial cost can be a deterrent to their use, and non-dependability of wind 'supply' is also a limiting factor for some sites. However wind systems can be added to existing diesel generators to provide 24-hour power to overcome the latter problem.

Tourism uses wind power for:

- Generation of electricity,
- Heat generation (heating water, air space),

- Agro-processing, and
- Pumping water.

For further information see http://www.darvill.clara.net/altenerg/wind.htm or http://greenterrafirma.com/DIY_Wind_Turbine.html.

Bio-gas (methane)

Another alternative energy technology is the production of combustible gas from faecal waste (chickens, pigs, cows, etc.). Methane is produced by taking the dung from animals and extracting inflammable gas from it in usable quantities. In more scientific terms it is the process of anaerobic fermentation of organic matter – allowing organic matter to decay in the absence of oxygen.

Where a tourism enterprise has access to significant amounts of animal manure, this can be an efficient method for producing a cooking and heating fuel, which will reduce consumption of firewood considerably, as is the case in Ng'iresi, the United Republic of Tanzania where electricity for heating the village homes come from a bio-gas set-up.

Methane is made with a 'digester', a sealed container from which air is excluded. Animal manure is mixed with water to form a slurry and this is fed into the digester from a collecting tank. This tank needs to be insulated in cooler climates (for example, by wrapping it in straw) because the process only works effectively at temperatures close to body heat. The digestion process takes about 14 to 35 days depending upon the temperature inside the digester.

The gas bubbles up through the slurry to the top of the digester tank. A pipe runs from the top of the digester to a gas storage container and as the pressure builds up in the digester the gas is siphoned off to the storage tank. A gas delivery pipe takes the gas to the point of use (e.g. a kitchen stove).

It is very important to install a brass or copper fine mesh flame trap at the entry to the delivery pipe to protect the gas holder in case air gets into the line and causes a back-burn. The gas produced from this process is called bio-gas and is about 60% methane (the inflammable fuel component) and 40% carbon dioxide.

The spent sludge at the bottom of the digester has to be removed every two months or so and is an excellent manure that can then be spread on a compost heap or direct to farm and garden.

Use of slow combustion woodstoves for water heating

A wood stove essentially is a metal or brick or mud container for a fire. Cast iron or brick-lined, welded plate steel construction provide greatest efficiencies and most western designs use these materials. A modern wood stove has an inlet for combustion air and an outlet for combustion gases, the smoke. Most modern stoves are airtight and allow the amount of combustion air that feeds the flame to be controlled.

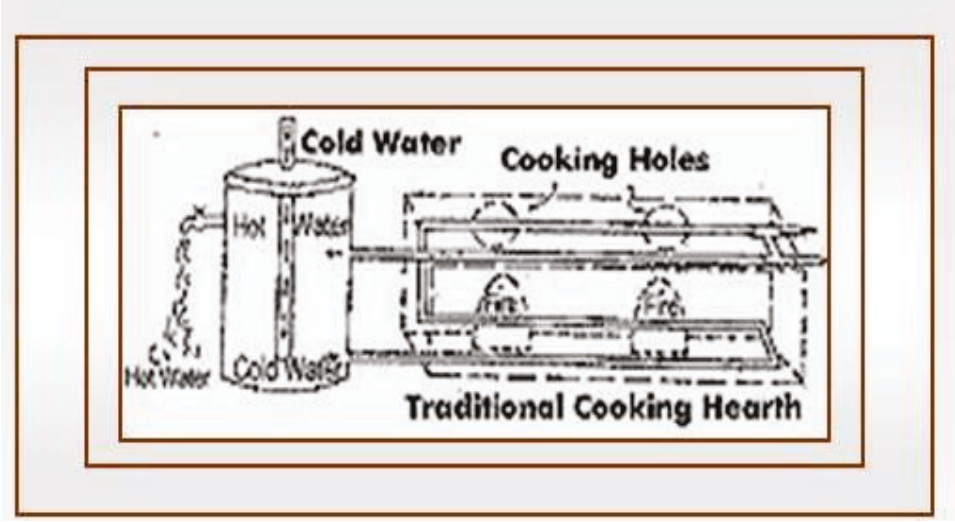
This control allows a wood stove to burn far more efficiently than a traditional open fireplace. The improved design of modern wood stoves in western countries results in 75% to 90% overall efficiency, that is, they convert up to 90% of their fuel to heat. Concern about particulate emissions and the dangerous gases and toxins carried by wood smoke have forced changes in design, too. Although old wood stoves gave off up to 50 grams of particulates per hour in smoke, new certified stoves give off about 5 grams. Woodstoves can provide both space heat and hot water.

A few woodstove manufacturers sell dual use systems or retrofit kits. It is also possible, however, to retrofit some woodstoves with a 'do-it-yourself' installation, by coiling copper or galvanised pipe on the outside of the stove. Water is heated as it passes through the piping and is discharged into a storage tank which may be constructed backing onto the stove so that it absorbs heat directly from the stove itself.

A hot water heat exchanger placed inside the stove can lower the temperature so far that it might reduce combustion efficiency and thus increase the amount of smoke produced.

Nepal provides another good example of this technology for water heating where a system called a back boiler has been taken up by virtually all trekking lodges in the villages along the Annapurna Trail. The traditional method of providing hot showers for trekkers was to fill a 200 litre drum and surround it with firewood and to burn it all day, which was a highly inefficient method. To reduce the large amount of firewood that was required for this purpose, a new fuel-wood saving device, namely the back boiler was introduced by the Annapurna Conservation Area Project of the King Mahendra Trust for Nature Conservation (KMTNC).

Figure10. Nepal backburner



This is a water heating technology in which cold water is circulated through a hearth and hot water is received continuously. Thus a Back Boiler heats water continuously.

The system consists of:

- A cooking hearth (traditional or improved),
- A galvanised iron drum of about 220 litres' capacity, and
- A pipeline from the water drum to and through the hearth and back to the water drum.

Cold water is run into the water drum and from the bottom it is circulated through the hearth under gravity. The water is heated through the heat generated in the hearth. The hot water in the pipeline passing through the hearth returns to the same water drum on top of the cold water already contained inside. Hot water can then be received directly from it (see diagram above).

Suitability for mountain use advantages:

- The back boiler is very simple to build and operate,
- It is fairly inexpensive.

Environmental and efficiency implications tourism uses wind power for:[4]

- It reduces significantly the amount of fuel wood needed for heating water.

[4] **Source:** Banskota, K. and B. Sharma. 1996.

- It has been estimated that an average of 675kg of fuel wood is saved per month, per lodge during the peak tourist season in Ghandruk in the Annapurna Conservation Area of Nepal; a net reduction of 23% in fuel wood use.
- This technology is suitable for cold and very cold climates. It is currently widely used in the Annapurna Conservation Area, Nepal.

A CBT resort remote area power system

The small resort of Vulelua Island in Solomon Islands demonstrates the challenges of developing an environmentally sound energy regime in a fragile site. What might appear to be the optimum solution environmentally may have other environmental drawbacks that indicate the need to strike a balance with a range of technologies to ensure the sustainability of the tourism operation.

Vulelua Island, a small resort in Solomon Islands about 7' south of the equator, presented its developers (foreign investors in partnership with the local Melanesian community) with a series of challenges in providing the resort with energy. The low coral island is five acres in extent, covered in thick tropical rainforest with coconut palms rising to 25 m, about 10 m above the forest canopy. The resort consisted of eight bungalows set in a rough circle around the perimeter of the island, a central complex (dining room/restaurant for 100 people, guest reception and office, commercial kitchen, bar, small souvenir shop, and first aid room); a mini-conference room/games room for table tennis, and table games such as chess and cards etc.; and three other outhouses – a storehouse for petrol, paint, pest control sprays and other inflammables; a boat house and workshop (carpentry, mechanical repairs, electrical and plumbing work); and a laundry. Power in the bungalows was needed for lights, fans, shavers and hairdryers (but no air conditioners, radios or TV sets). The main complex had refrigerators, freezers and other electrical equipment in the main kitchen and bar, ceiling fans but no air conditioners in the restaurant, and lighting throughout the main complex. Two electric pumps were needed to deliver water to small raised tanks at all of the buildings on the island, which allowed showers and flush toilets to receive water by gravity feed. Cooking used a mixture of gas (cylinders), and fuel wood for traditional umu (in-ground 'ovens' using heated volcanic rocks), and barbecues.

The pre-determined policy for the Resort was to use passive energy for cooling buildings, so bungalows were designed in Melanesian style, raised on stilts with louvre windows and thatch roofs to allow natural circulation of air and cooling from the constant sea breezes, supplemented by ceiling fans but no air conditioners.

Not a single mature tree was cut down in order to provide constant shade for cooling from the tropical sun, which accounted for the irregular positioning of the different buildings. All of the buildings of the resort were positioned inside the tree line and from 100 m away the island appeared uninhabited. Solar energy was to be the main power source.

However, practical considerations intruded on the decision to use solar energy. First solar panels could not be installed without clearing some of the trees to allow enough sunlight hours to strike the panels. This was rejected on fundamental environmental grounds because closed forest cover is necessary to maintain the integrity of small islands in times of cyclones (hurricanes). The tree cover deflects the winds over the island.

A break in the cover can quickly result in denudation and cyclonic-driven waves can then destroy the island. A lesser reason, but important for reducing energy needs, was that by maintaining full tree cover all buildings were shaded from the hot tropical sun. The alternative 'solution' – towers on which to install the panels above the tree canopy – was also rejected because of unacceptable visual pollution: an array of towers would have destroyed the vision of a pristine wilderness.

Importantly, solar technology was not advanced enough to provide the amount of power necessary for the Resort to run the refrigerators, freezers, washing machines, other electrical equipment and water pumps without a huge number of panels and a bank of deep-cycle lead acid batteries (about 300) with an inverter. The estimated cost of panels plus batteries and inverter was twelve times greater than a diesel generator, and the batteries would have required replacing every 2-3 years (because of the salt-saturated environment) at a much higher cost than fuel for a generator.

The economics of solar panels and batteries could not be justified because their cost could not be recouped. A further consideration for rejecting the solar-plus-battery bank system was made on environmental grounds: the lack of an industrial incinerator in the country meant that the resort was unable to dispose of the batteries safely. A hybrid RAPS consisting of solar panels + generator + batteries was thus rejected on both environmental grounds and cost.

Wind power was investigated but was unacceptable on grounds of:

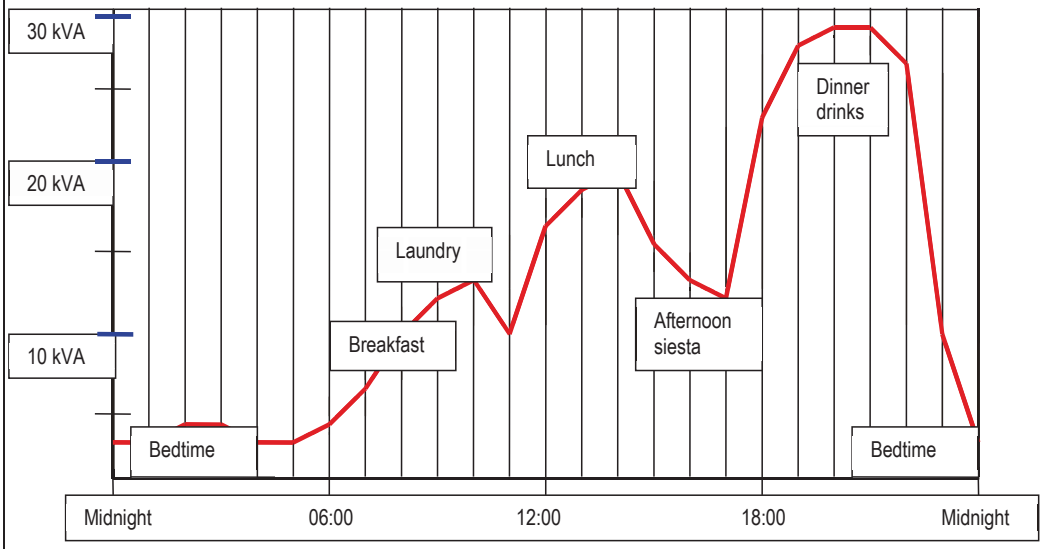
- Insufficient winds at different times of the year, so back-up power would be needed;
- The need for towers to be placed around the island above the tree canopy thus causing visual pollution;
- The same need for a bank of batteries; and cost.

In the circumstances, the developers decided that a limited number of photovoltaic solar panels for hot water for each bungalow would be effective (up to 5 hours sunlight per bungalow could be obtained without cutting down any mature trees); but the better option as the main source of energy would be the diesel generator.

An assessment of energy needs indicated that a 30 kVA generator would be necessary to handle peak power demand. One of the problems with diesel generator technology is that it cannot be 'turned down' so a generator sized to handle peak power is necessary. A 24 hour audit indicated that demand would vary from just 2-3 kVA in the early hours after midnight and before dawn, rising to about 12-14 kVA mid-morning (laundry), 18-19 kVA at lunchtime, and peaking at 27-28 kVA each evening between 18:00-22:00.

So, for 20 hours a day the 30 kVA generator would be producing power greatly in excess of need and thus wasting significant fuel.

Figure 11. Vulelua Island Resort – pattern of 24 hour power use



…It was therefore decided to purchase three generators of differing outputs – 5 kVA, 10 kVA and 15 kVA, linked to an automatic monitor which could switch on the optimum size generator or generators according to demand. Thus, when demand was low only the small 5 kVA generator would operate. When demand peaked all three generators would operate simultaneously. In addition, in an effort to minimize noise pollution it was decided to run the island on 18 hour power only, so that all generators ceased to function between midnight and 06:00.

During this time small battery torches and kerosene lamps were the only source of light. Freezers and refrigerators were able to maintain their effectiveness without power for those 6 hours by locking them and not opening them at all.

Through these measures the resort was able to establish an environmentally sound power regime, and achieve significant reductions in energy consumption:

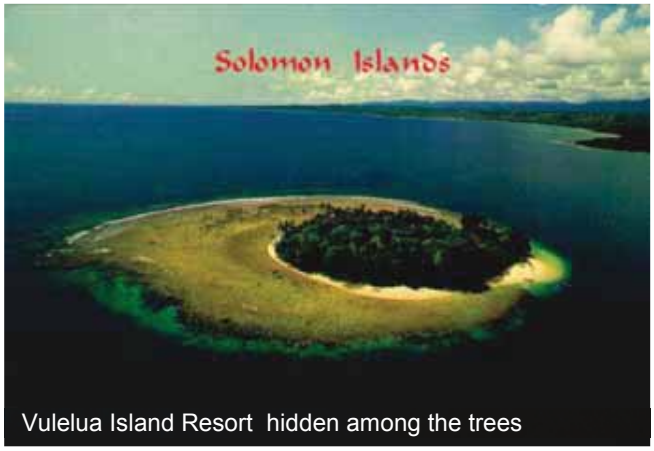
1. Retaining all mature trees on the island for shade and cooling;
2. Constructing environmentally adaptive bungalows;

3. Using photovoltaic cells for water heating;
4. Raising water tanks to reduce the need for electric pumps on each bungalow;
5. Installing different sized generators to handle different demand levels; and
6. Introducing the six-hour 'no power' schedule.

These combined methods achieved significant savings in diesel fuel costs while protecting the island from cyclonic damage by retaining maximum rainforest cover.

However, there was an environmental cost in that diesel is a fossil fuel, and when the large 15 kVA generator was operating for 4 hours each evening its noise could be heard on most parts of the island.

Recent advances in operating diesel generators demonstrate that they can run on vegetable oils (e.g. palm oil), and use of such renewable energy sources would eliminate the use of fossil fuel and lower air pollution.



Vulelua Island Resort hidden among the trees

Plate 18. Vulelua Island Resort, Solomon Islands

4. Waste minimization

This section examines the issue of responsible waste management in the touristic sector from the viewpoint of waste minimization. At the end of this section you will have an understanding of the key points about waste prevention or waste reduction and the fact that waste prevention is not recycling, although these two waste management strategies are often confused. Recycling is an effective way to manage waste materials once they have been generated and forms the contents of sections 4 and 5. Waste prevention actually reduces the amount of material used and therefore the amount discarded.

Because waste treatment and disposal are often major, long-term environmental problems in the tourism industry, pollution prevention and waste minimization techniques are especially important for the tourism industry. We learnt in section 2 that Cleaner Production is a forward-looking, 'anticipate and prevent' philosophy; and waste minimization throws the emphasis squarely onto that 'anticipate and prevent' philosophy.

The United Nations Environment Programme (UNEP) defines waste minimization or pollution prevention as 'a focus on a strategy of continuously reducing pollution and environmental impact through source reduction - that is eliminating waste within the process rather than at the 'end-of-pipe'. (This latter phrase refers to the fact that until the 1990s most efforts went into waste management after wastes had been produced, i.e. when they came out at the end of being used).

The United States' legislation defines waste minimization as 'source reduction practices that reduce or eliminate waste generation at the source; and environmentally sound recycling practices, where source reduction is not economically practical.' However, for the purposes of this Handbook, we shall retain the UN and European definition which distinguishes between waste minimization as waste prevention and waste reduction, with recycling treated separately.

4.1. Benefits

Waste prevention often results in substantial savings through reduced purchasing costs and more efficient practices. It also can reduce waste disposal costs. In addition, waste prevention has environmental benefits, including reduced energy consumption and pollution, and conservation of natural resources. Practicing waste prevention can improve customer relations by demonstrating a company's concern about the environment.

It can also enhance employee relations by involving employees in the company's waste reduction programme; and it can reduce pressures on landfill capacity. All over the world countries are struggling with the mountains of waste that must be handled each year and landfill sites are increasingly problematic.

Fiji is a case in point. As its population expanded and more and more people moved to the capital, Suva, began to dispose of its municipal wastes on a mangrove shoreline in the harbour just 3 km from the heart of the city. Sixty years ago the site was outside the city. But by 1980, the western suburbs had expanded more than 5 km past the site.

By 2000, the mangroves had disappeared under an artificial hill half a kilometre long, 250 m wide and 15 m high, a range of toxic pollutants had leached into the sea with disastrous effects on local marine populations, the dump harboured a huge population of rats and was a potential health hazard, and the smell of rotting garbage wafted over the western suburbs.

Despite being aware of the problems, it took the Government nearly twenty years to locate an alternative site, which was finally commissioned in 2006.

Waste prevention is a critical component of sustainable environment management and is a component that has significant capacity to provide substantial cost savings.

4.2. Steps in waste minimization

Step 1. Whatever the kind of Inclusive Tourism operation, the first step is to make a conscious decision to put a 'Waste Minimization' program in place. The actual components of that program can be defined as the trainer works with the community to implement this decision. This is very important because in the first instance, reducing waste is related to changing behaviour and creating a culture of productivity and waste minimization among people at all levels of the community.

Step 2. Adopt a 'corporate policy' that has full management support for and widespread employee involvement in waste minimization.

Step 3. Introduce a systematic way of identifying waste sources.

Step 4. Carry out periodic waste minimization assessments.

Step 5. Work out a creditable way of allocating social and environmental costs as well as financial costs/savings for waste minimization.

4.2.1. Step 1: Reducing and minimizing waste

Power, water usage, fuels and packaging are the key areas that need to be examined closely for ways to reduce consumption.

A common method for **reducing power consumption** in guest rooms is to have the key attached to a small plastic card which must be placed into a slot to activate the electricity. Since the key will be removed each time the guest leaves the room it will automatically shut down equipment and appliances such as air conditioners, ceiling fans, lights, etc.

As noted in the previous section on energy, alternative energy systems such as passive solar systems and even landscaping have a capacity to make substantial reductions in power consumption. The choice of energy-efficient models of equipment and appliances can also make a significant contribution to power reduction.

Lowering the thermostat of hot water heaters, and using energy-saving settings on clothes dryers, refrigerators, dishwashers and washing machines will also make worthwhile savings. Install lower wattage incandescent light bulbs where bright lights are not required, or replace them with compact fluorescents. These new lamps are more expensive but they last much, much longer, and can save three-quarters of the electricity used by incandescent. The best targets to replace are 60-100 W bulbs used several hours a day.

Water wastage may be reduced by making sure that pipes and taps are repaired the moment a leak appears; that toilet cisterns are not constantly 'running' because of a faulty seal; and by utilising 'low-flow' shower heads and aerators. Where gardens are maintained as part of a CBT venture, then only watering in the cool of the evening or by drip irrigation will reduce water loss through evaporation. Mulching of all plants will also keep the soil moist and save water.

Fuel consumption can also be reduced with alternative systems and adaptive technologies, such as the back-boiler described in the previous section.

Reduce waste by buying sensibly and accurately, that is, buying products with minimal and/or recyclable **packaging**, and take into account recyclability of packaging. Try to reduce stock keeping in order avoiding the expiry of food, and source locally if possible in order to reducing fuels for the transport. Apart from this one could consider serving smaller portions, and offering second servings. Avoid using disposals, such as plastic tumblers, plates, cutlery, etc. Check if there is a supplier that takes some used bottles back and if the local council provides recycling collection services, or 'try to get a (council) bottle bank on your parking

lot, or have your own bottle bank, share with colleagues and pay together – pull resources; use colour coded bins for different recyclable wastes.'[5]

Do not throw waste into rivers or the sea and do not burn it on site, in particular, not plastics, oils and other chemicals, since they cause black smoke and poisonous gases.[6]

4.2.2. Step 2: Corporate policy on waste management

The involvement of all staff is essential of the full benefits of a coordinated waste management system are to be realized because it requires every staff member to contribute to the smallest detail related to their particular tasks and duties.

4.2.3. Step 3: Systematize ways of identifying sources of wastes

One way to implement Step 3 is to carry out a comprehensive audit of wastes generated by the tourism business or activity, and then see whether steps can be taken to eliminate or reduce any of them. Community participation can be strengthened by getting community members commit to implementing three significant waste prevention activities of their choice, monitoring progress, and reporting annually on the estimated amount of waste avoided.

The following example (over page) of typical waste generation for a small resort provides an indication of the way in which different wastes can be identified for each 'department' of the operation. Each item can then be examined individually in terms of whether it might be a candidate for waste minimization action or recycling. Note that the list which follows is **indicative only;** different kinds of resorts would produce different kinds and quantities of wastes. The main aim is to be **comprehensive** with the audit.

Example of wastes

1. **Office/Reception**
   - Paper (stationery, brochures, wrappings, envelopes, etc.)
   - Pens, pencils, etc.
   - Old equipment (old model computers, etc.)
   - Electrical equipment beyond repair
   - Non-paper stationery (old staplers, scissors, etc.)
   - Containers all kinds
   - String
   - Stamps
2. **Kitchen/dining room/restaurant/inorganic wastes**
   - Containers
   - Glass
   - Plastic (including cellophane bags)
   - Foam packaging
   - Damaged utensils, crockery, cutlery
   - Electrical equipment beyond repair

[5] http://www.brass.cf.ac.uk/uploads/waste.pdf.

[6] *Ibid.*

3. **Organic wastes**

- Vegetable matter
- Meat scraps
- Bones
- Liquids
- Grease
- Cooking oil
- Paper (wrappings, bags, paper towels, old menus, etc.)
- Cardboard (boxes, containers)
- Fabrics (hessian bags, string, etc.)
- Tablecloths, napkins, etc.
- Some wood/timber wastes (cooking, heating fires)
- Ash (e.g. from wood fires, barbecues).
- Laundry: Soaps, detergent water

4. Guest rooms

- Paper (ranging from daily newspapers to travel brochures, writing paper, etc.)
- Containers (glass, plastic, cardboard – toiletries, etc.)
- Bottles (mini-bars, water, etc.)
- Soft furnishings (curtains, rugs, cushions)
- Old linen (bedcovers, sheets, etc.)
- Electrical equipment beyond repair
- Hard furnishings (beds, chairs, other furniture)
- Fittings (plumbing, electrical, etc.)
- Discarded paperbacks, magazines
- Telephone directories (once per year)
- Food scraps
- Grey water (showers)
- Sewage (black water)

5. Maintenance department

- Fuels, oils, paints, etc.
- Toxic wastes (termite sprays, wood preservatives, pest poisons (eg for rat control), disinfectants, etc.)
- Tools
- Electrical equipment
- Spare parts, disused/outdated components
- Containers of all kinds
- Worn tyres
- Building materials (bricks, hardened bags of cement, timber off-cuts, etc.)
- Bolts, nails, screws, etc.

6. Marine division (if a seaside/lake/river-based venture)

- Disused craft (dinghies, canoes, etc.)
- Old engines, outboard motors
- Old sails, ropes, wire stays
- Spare parts no longer needed
- Fishing gear of all kinds
- Scuba gear discards

Plate 19. Ma'asai Tented Camp, Serengeti, United Republic of Tanzania

Plate 20. Sinalei Beach Resort, South Coast, Samoa

4.2.4. Step 4. Carry out periodic assessments

Having identified all possible sources of waste, the next step is to measure the amounts that are produced by each source. This assessment will then allow targets to be set to reduce the production of waste over designated time periods, say every 6 months or 12 months. It is important to undertake periodic checks otherwise progress achieved from the initial effort may not be maintained. It is thus very important to measure waste production accurately, with the first assessment taken before minimization action is introduced setting the benchmark by which future reductions are to be measured.

A checklist for action: set targets

- Monitor the relationship between the number of tourists and the amount of waste produced by the tourism venture (e.g. 1 full bin per bed night).
- Set targets for reducing the amount of waste produced (e.g. reduce by 5% each year).
- Monitor reductions in the volumes of waste that is produce.
- Set targets for the recycling and reuse of waste

Having drawn up a list of terms where waste could be prevented or minimized, a checklist to deal systematically with each one should be applied. It could consist of five columns, as follows:

Column 1: The items.

Column 2: Identify possible actions for each item to prevent or minimize waste.

Column 3: Designate responsibility to a specific individual for follow-up actions and monitor the results achieved over time.

Column 4: Assign a priority to suggested actions, including the time for tasks to be completed.

Column 5: Estimate cost savings achieved and other benefits obtained.

4.2.5. Step 5. Calculate social, environmental and financial costs/savings

Work out a creditable way of allocating social and environmental costs as well as financial costs/savings for waste minimization. This will allow individual actions or components of the programme to be justified not only in dollar terms but in terms of contributions to community well-being.

Some examples of waste minimization in small resorts

Waste prevention includes a wide variety of activities to reduce the amount of waste generated. Some examples include:

➢ **Office/Reception: Using supplies and materials more efficiently**

Changing staff operations to increase efficiency, reduce waste, and conserve materials is a useful way to achieve waste prevention. There are quite a few ways to reduce paper use. For example:

- Make it compulsory to do double-sided photocopying, which can cut paper costs by 10% to 40%.
- Draft reports can be printed on the reverse side of sheets of paper that have already been used once.
- Piles of such paper can be kept and stored next to the printer for re-use.
- Print only the exact number of copies necessary.
- Circulate the one copy to several recipients.
- Limit the distribution of correspondence and reports to only those who really need ‘hard copies.’
- Re-use file folders and envelopes, and for inter-office memos use scrap paper.
- Re-use packing materials (cardboard boxes, ‘bubble’ wrapping, string, ribbons).

Other measures

- Use recycled, chlorine-free paper.
- Buy ‘recharged’ cartridges for laser printers, copiers, and fax machines if available. They not only reduce waste, but also typically save money.

- Used stamps can be collected and sold in bulk lots. Alternatively, three or more stamps could be put into small recycled plastic bags and sold as souvenirs to guests.

Make a standard policy to purchase high quality, long-lasting supplies and equipment that can be repaired easily. Initial cost or purchase will be greater than for cheap items, but advantages of greater durability include:

- Fewer discards.
- Lower maintenance costs.
- These items will stay out of the waste stream longer.
- Reduction in disposal costs.
- Savings overall because these items will be replaced less frequently.

➢ **Kitchen/dining room/restaurant**

Re-useable items

Using durable, re-usable products rather than single-use materials can be an effective waste prevention strategy. For example:

- Instead of disposable paper/Styrofoam plates and cups and plastic knives, forks and spoons it may be more cost-effective to use ceramic plates and cups and metal cutlery which can be washed and used time and time again.
- The latter items are more expensive but a one-time investment for reusable items will end the cycle of constant purchasing and discarding involved with disposable items.
- However, reusable containers for food must be carefully cleaned to ensure proper hygiene and one possible drawback is that washing will use water which may be in short supply, and detergents which are potentially pollutant.

Disposable items

In some instances it may be possible to go the other way and use cheap locally available materials as disposable items. For example:

- All over the tropics where coconuts are grown, after husking and removal of the white ‘meat’, the half shells could be re-cycled as cups and small plates. Many CBT resorts in the South Pacific and the Caribbean use coconut shells in this way.
- After use they can then be re-cycled as fuel, or perhaps crunched up and used as mulch.
- Concentrated products often require less packaging and less energy to transport to the store, saving money as well as natural resources. For example, a small bottle of orange concentrate when mixed with water may be the equivalent of 20 or more large, plastic bottles or containers.

Food and beverages

Bulk food and beverages purchases are a frequently used means to cut down on waste by replacing buying small, individually packaged/bottled amounts. Liberty's Lodge, Apo Island, in the Philippines, for example, last year used large refillable water containers for drinking water, a small initiative that saved the use of over 6000 plastic bottles (http://www.responsibletravel.com/Policy/Policy900028.htm).

- Fruit and vegetables are often available unpackaged and so any required amounts can be purchased.
- For food items, choose the largest size or amount that can be used before spoiling.

Packaging

- Packaging serves many purposes, the primary one of which is to protect and contain a product.
- It also can prevent tampering, provide information, and preserve hygienic integrity and freshness.
- But some packaging is designed mainly to enhance a product's attractiveness or prominence on the store shelf.
- Since packaging materials account for a large volume of the waste that is generated, they provide a good opportunity for reducing waste.
- When choosing between two similar products, select the one with the least unnecessary packaging. In addition, keep in mind that as the amount of product in a container increases, the packaging waste per serving or use usually decreases.

➢ **Maintenance department/workshop**

Adopt practices that reduce waste toxicity

In addition to reducing the amount of materials in the solid waste stream, reducing waste toxicity is another important component of source reduction. Some jobs may require the use of products containing hazardous components. If you do need to use products with hazardous components, use only the amounts needed.

- Use rechargeable batteries where possible, to help reduce garbage and keep toxic metals found in some batteries out of the waste stream. Another alternative is to look for batteries with reduced toxic metals.
- Buy water-based (rather than oil- or solvent-based) paint and other water based materials.

Nevertheless, toxicity reduction can be achieved by following some simple guidelines:

- Take actions that use nonhazardous or less hazardous components to accomplish the task at hand.
- Instead of using pesticides, for example, plant marigolds or garlic in the garden to ward off certain pests.
- Use some physical method, such as sandpapers, souring pads, or just a little more effort, to achieve the same results instead of e.g. toxic paint stripper.
- Use safer alternatives to carry out some tasks. For example, lemon juice is a good substitute for polishing some metals such as copper. Bees wax can be used to polish wooden furniture instead of commercial products using chemical formulas.

Containers

- Containers are always useful around workshops. Wash and reuse empty glass and plastic jars, milk jugs, coffee tins, dairy tubs, and other similar containers that otherwise get thrown out; they make good containers for storing leftovers as well as buttons, nails, thumbtack and other bits and pieces.
- Some of them such as empty coffee tins, make fine flower pots.
- Left-over paint can be used to decorate these pots, instead of disposing of the paint which, if oil-or solvent-based. Will contain toxic materials.

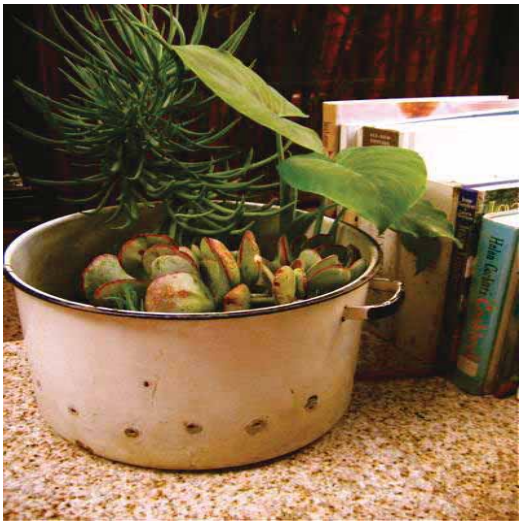


Plate 21. Recycled containers

➢ **Housekeeping/guest rooms: consider reusable products**

- For cleaning guest rooms and bathrooms instead of buying cleaning cloths and sponges, use worn linen, curtain materials, napkins and discarded cloth of all kinds, which can be washed over and over again.
- Look for items that are available in refillable containers. For example, some bottles and jugs for beverages and detergents are made to be refilled and reused, either by the consumer or the manufacturer.
- Remember, if your goal is to reduce solid waste, think about re-usables

5. Solid waste management

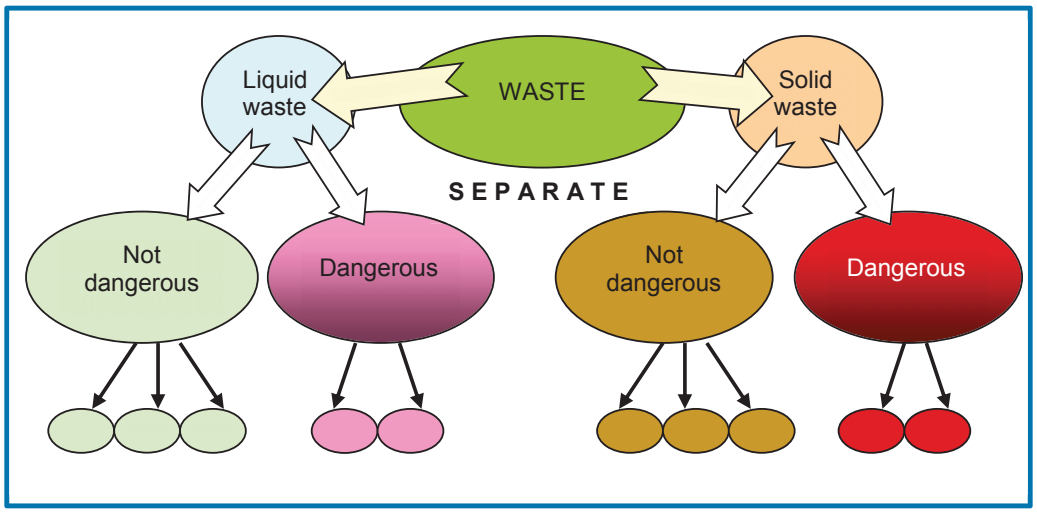
The aim of this section is to provide an outline on how to manage solid wastes for the mutual benefit of the tourism industry and associated communities. The first step is to use a flow chart to identify different types of wastes – liquids and solids, hazardous and non-hazardous – and how they should be separated out in order to set up an appropriate management strategy. Examples from different countries are provided to illustrate how issues and problems of solid waste have been managed in other inclusive tourism ventures. At the end of this section, you will be able to apply your understanding of solid waste management to a variety of inclusive tourism ventures.

5.1.1. Introduction

Recycling of solid wastes offers opportunities to create small businesses which may be export-oriented. By managing wastes and sometimes engaging in primary processing a 'new' product may be produced which will enable an Inclusive Tourism venture to market the product either locally or overseas. The first step is to separate out toxic wastes from non-toxic wastes, and then actively pursue opportunities to recycle solid wastes which may safely be handled.

This flow chart gives an overview of a systematic approach that can be used to separate different wastes according to their toxicity:

Figure 12. Flow chart for separating solid and liquid waste



Once the solid wastes have been separated according to their toxicity, they may be sorted according to whether they are organic (bio-degradable) or non-organic. Paper in its various forms (office paper, cardboard, rolls or cylinders, packaging) is a major source of solid waste. Plastics of all kinds also form a major class. Sewage is another. In this section we will focus on the non-organic solid wastes, so that paper products and sewage will be covered in the following section on organic wastes.

As with other wastes is essential to start with an audit, so that you know how much waste you have of a particular class. Specific items of waste may then be considered for recycling and reuse.

5.1. Waste plastic

Plastics (whose scientific name is polymers) receive a huge amount of bad publicity because of the litter problem that occurs when recycling and re-use are not practised. But plastics in many shapes and forms have become so widespread because they have many good qualities. They have a high strength to weight ratio, they are waterproof, they are very good for electrical insulation, they have excellent thermal properties, and they are resistant to acids, alkalis and solvents. The latter property of resistance means also that they take a very long time to degrade and plastics have been found in rubbish dumps many years later in virtually the same condition in which they were originally discarded.

Most modern plastics are made from petrochemicals although originally they were made from cellulose (plant fibres). Most plastics fit into two different types, thermoplastic and thermosetting and it is necessary to be able to distinguish between the two in order to undertake effective recycling or re-use. Several technical terms will be used to explain the differences but you do not need to worry too much about them. At the end of the day it should be understood HOW the plastic materials react to different treatment (e.g. heating them) and WHAT they may be utilised for. The two key points to remember are:

- Thermoplastics **soften** when heated.
- Thermosetting polymers **harden** when heated.

Thermoplastics make up 80% of the plastics produced today. Examples of thermoplastics include:

- **High density polyethylene** (HDPE) used in piping, automotive fuel tanks, bottles, toys;
- **Low density polyethylene** (LDPE) used in plastic bags, cling film, flexible containers;
- **Polyethylene terephthalate** (PET) used in bottles, carpets and food packaging;
- **Polypropylene** (PP) used in food containers, battery cases, bottle crates, automotive parts and fibres;
- **Polystyrene** (PS) used in dairy product containers, tape cassettes, cups and plates;
- **Polyvinyl chloride** (PVC) used in window frames, flooring, bottles, packaging film, cable insulation, credit cards and medical products.

Source: The World Resource Foundation.

Thermosets make up the remaining 20% of plastics produced.

They are hardened by curing and cannot be re-melted or re-moulded and are therefore difficult to recycle. They are sometimes ground and used as a filler material. They include:

- **Polyurethane** (PU) – Coatings, finishes, gears, diaphragms, cushions, mattresses and car seats;
- **Epoxy** – Adhesives, sports equipment, electrical and automotive equipment;
- **Phenolics** – Ovens, handles for cutlery, automotive parts and circuit boards.

Source: The World Resource Foundation.

5.1.1. Recycling

In the consumer-driven societies of western countries the consumption of plastics has multiplied at a tremendous rate over the past thirty years. Scarce petroleum resources are used for producing an enormous variety of plastics for an even wider variety of products. Many of them have a life of less than one year and are then discarded. In many instances the costs of trying to reclaim these plastic products are uneconomical because they are often labour intensive.

Recycling plastics can also be difficult because a lot of plastic products are made up of more than one kind of polymer or there may be some sort of fibre added to the plastic (a composite) to give added strength. Because plastics are generally non-biodegradable, they create a major litter problem. Most plastics in the western countries are dumped in landfills.

In developing countries per capita use of plastics is much less than in industrialized countries, although it is also growing rapidly. When we look at Inclusive Tourism in developing countries, the opportunities for recycling plastics are much better because:

- Labour costs are lower;
- In many countries there is an existing culture of reuse and recycling, with a system of collection, sorting, cleaning and reuse of 'waste' or used materials. Plastic bags will be used many times over for storing many different items because they are waterproof, insect-proof, and lightweight. They are thus prefect storage containers for people living in houses with little furniture, cupboards, refrigerators, waterproof floors, etc., as in the western world;
- There is often an 'informal sector' which is already engaged in small-scale recycling because this activity provides one path to earning a small income in the monetised economy, perhaps the only opportunity for the urban poor;
- Transportation costs are often lower, eg wheelbarrows, ox carts or bicycles;
- Innovative use of scrap machinery often leads to low entry costs for processing or manufacture. India has proved a leader in making all sorts of machinery to deal with waste plastic products, for example.

Plastics fact file – Europe

- More than 20,000 plastic bottles are needed to obtain one ton of plastic;
- An estimated 100 million tons of plastics are produced each year;
- The average European throws away 36kg of plastics each year;
- 4% of oil consumption in Europe is used for the manufacture of plastic products;
- Some plastic waste sacks are made from 64% recycled plastic;
- Plastics packaging totals 42% of total consumption and very little of this is recycled.

Source: http://www.itdg.org/html/technical_enquiries/docs/recycling_plastics.

5.1.2. What kinds of plastics can be re-cycled?

Not all plastics are recyclable. There are **4 types of** plastic which are commonly recycled:

- Polyethylene (PE) – both high density and low-density polyethylene;
- Polypropylene (PP);
- Polystyrene (PS);
- Polyvinyl chloride (PVC).

If you look at the list of different types of plastic above you will see that all of these four are thermoplastics, that is, they can be heated and melted. Because they have different properties it is necessary to sort them out carefully when setting up a recycling business. For example, the agricultural sector will generate a lot of waste in the forms of plastic bags for fertilizers, chemicals, and various kinds of packaging, sheets of plastic, plastic containers, and possibly plastic piping from irrigation systems. An industrial sector will generate plastic wastes in the form of packaging, sheets, plastic wrapping, and so forth. Commercial waste is often available from shops, supermarkets, wholesalers, workshops, and craftsmen.

Identifying different kinds of plastics

A simple test to sort out first whether a product is a thermoplastic or a thermoset is to heat a piece of wire to just below red-hot and press it into the material:

If the wire penetrates the material it is a **thermoplastic** – if it does not it is a **thermoset**.

The next step then is to work out what type of thermoplastic you have so they can be separated out and sorted for processing. There are three simple tests to help you determine this: The **water test**; the **burning** (and after-smell) test; and the **scratch test**.

- **The water test:** Add a few drops of liquid detergent to some water in a bowl, drop in a small piece of plastic and see if it floats.
- **Burning test:** Apply a flame to the plastic material. Does it burn? If so, what colour? And what does it smell like?
- **Fingernail test:** Can a piece of the plastic be scratched with a fingernail?

Simple tests for distinguishing different types of plastics

Plastic type	Water test	Burning	Burning after-smell	Scratch
Polyethylene (PE)	Floats	Blue flame with yellow tip, melts and drips	Like candle wax	Yes
Polypropylene (PP)	Floats	Yellow flame with blue base	Like candle wax – not as strong as PE	No
Polystyrene (PS)	Sinks	Yellow, sooty flame – drips	Sweet	No
Polyvinyl chloride (PVC)	Sinks	Yellow, sooty flame. Does not continue to burn if the flame is removed	Hydrochloric acid	No

Source: http://www.itdg.org/html/technical_enquiries/docs/recycling_plastics.

5.1.3. Small-scale recycling

Many communities will be too small by themselves to generate enough plastic wastes to set up a re-processing plant. In these cases, a business activity would be restricted to collecting and sorting the plastic wastes and selling them to larger collector or to a processing plant. However, in the context of Inclusive Tourism and mainstreaming community contributions to the tourism activity of a destination a community-based venture could be located in the vicinity of major resorts which produce plastic waste and it may be that from the community base a viable re-cycling business could be established. ITC's Bahia project in Brazil is one example of this approach.

Depending upon the types of plastics that are available and the quantities, a decision could be made about what kind of plastic recycling business could be set up as an adjunct by local communities. The following list of possible activities are set out in order of increasing difficulty, from simple to more complex.

5.1.4. Plastic recycling business I: Collection, cleaning and sorting

Step 1. Set up a regular collection system. This might involve just one person or several. It may be aimed at collecting the plastic wastes from a number of hotels and resorts in a major destination, such as Bahia..

Step 2. Set up a cleaning system. This may simply mean brushing down some plastic wastes to rid material of dirt or other encrustations, or it may mean hand washing the material and then drying it. Use passive solar for drying wherever possible.

Step 3. Sort out the material. It could be separating:

- Polymers by type – thermoplastic or thermoset;
- By product – bottles, or plastic sheeting, or bags, etc.; or
- By colour.

Step 4. Bundle up the plastic waste into the kind of package required by a bulk buyer. For example, plastic sheets may need to be tied up in bundles of 10 kg each.

Step 5. Transport the washed and sorted plastic wastes to a bulk buyer.

A lot of the plastics available from these sources will be polyethelene, often contaminated with food scraps and other material, and will require careful cleaning. In Asian cities this type of waste is common and there are often hundreds of people engaged in collecting and cleaning such plastic wastes.

The **construction industry** (including both residential and commercial buildings) also produces many different kinds of plastic wastes and these will be plentiful where a tourist destination is expanding rapidly.

5.1.5. Plastic recycling business II: Size reduction

With most plastic wastes there is a requirement to reduce the different and varied bits and pieces that have been collected. This is because:

- Larger plastic waste must be reduced to a size which can be processed by small machines;
- Reducing the bulk will make the material denser and thus easier for storing (less space needed) and transporting to a bulk buyer or processing plant; and
- Reducing the material can make it suitable for further processing.

Plastic wastes which have been reduced in size to meet buyers'/processors' needs will normally be worth more (value added).

Steps 1-3. The same as for those in Business **one**.

- Use one or more techniques to reduce the size of the material (eg cutting, shredding, agglomeration, pelletising – see below for details of each technique)
- Package the waste according to buyers'/processors' requirements
- Transport the washed, sorted, reduced plastic wastes to a bulk buyer or processor.

5.1.6. Plastic recycling business III: Manufacturing

Plastic wastes can be used to make literally thousands of different products. In western countries, the market for recycled plastic products is limited due to difficulties in establishing a consistent quality of the recycled plastics and often highly regulated minimum standards.

In developing countries, particularly those where raw materials are very expensive, there is a wider scope for using recycled plastic material – from hose and pipes to insulation material for buildings, from sandals and

shoes to kitchen and gardening utensils, from plastic buckets to waste paper baskets – which can collect more waste and keep the recycling process going!

All of these processes will require machinery and access to some form of power and will therefore include a capital cost and running costs that are absent from simpler, less complex waste recycling businesses.

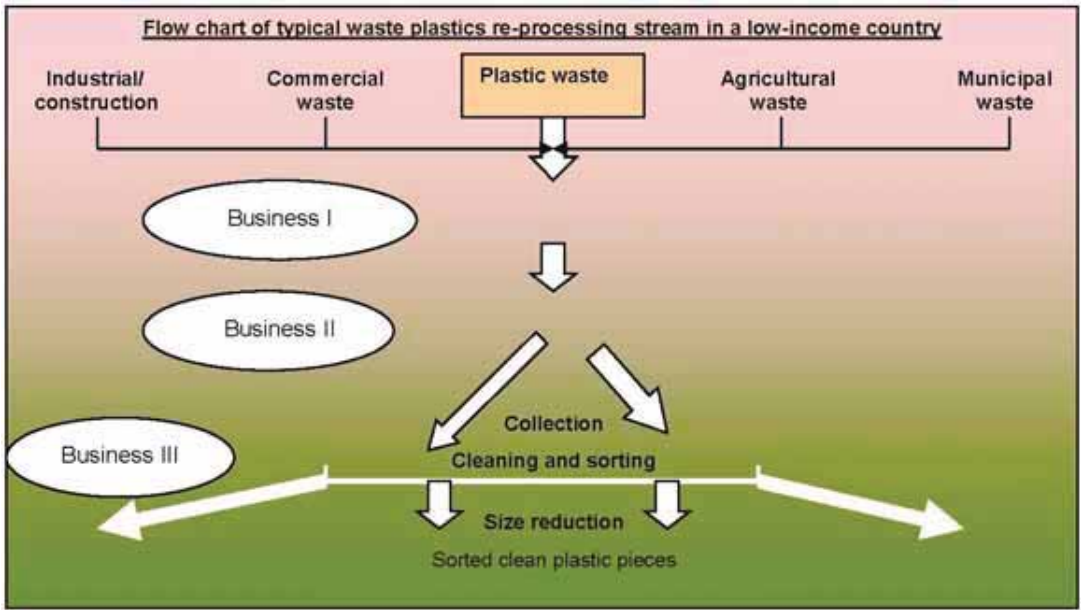
Plastic recycling business III: Manufacturing

There are four common methods of manufacturing from recycled plastic wastes.

1. **Extrusion.** The extrusion process used for manufacturing new products is similar to that outlined above, except that the end product is usually in the form of a continuous hollow tube of plastic piping or hose. It is not pelletised of course but will be sold as tubing and piping.
2. **Injection moulding.** The first stage of this process is identical to that of extrusion, but then the molten plastic is pushed through a nozzle into a split mould. This method is used to make moulded products such as plates, bowls, buckets, and so on.
3. **Blow moulding.** As with the previous manufacturing processes, heating the plastic to a molten form is the core. Compressed air is used to ensure that the mould is filled in a single 'flow'. This method is used to make closed vessels such as bottles and other containers.
4. **Film blowing.** Film blowing is a process used to make such items as garbage bags. It is a technically more complex process than the others described above and requires high quality raw material input. The process involves blowing compressed air into a thin tube of polymer to expand it to the point where it becomes a thin film tube. One end can then be sealed and the bag or sack is formed. Sheet plastic can also be manufactured using a variation of the process described.

These three business models are depicted in the following Flow Chart to illustrate the typical; waste plastics processing stream in a low-income country:

Figure 13. Flow chart of waste plastics processing stream



Source: After Lardinois, I. and A. Van de Klundert. 1995.

5.1.7. Machinery for recycling plastics

Machinery for recycling and processing plastic wastes varies in size and sophistication. In most developing countries it is not possible to find new equipment which can be purchased off-the-shelf, so machinery will either have to be imported, manufactured locally, or improvised. Within the informal sector, the latter is usually the most common method of procuring equipment and the level of improvisation is often admirable and ingenious. Check out recycling businesses close to where the Inclusive Tourism project is located and it may be possible to source locally made equipment for your recycling business.

5.2. Rubber tyres

Tyres have proved to be a difficult material for recycling and re-use once they have outlived their once-only capacity for re-treading (adhering a cap of new rubber tread over the worn surface). While there have been numerous, often ingenious, ideas for their disposal, they remain a major item of landfills in many countries.

The United States is one of the few countries to develop a major market for used tyres, where almost 80% of the millions of discarded tyres are now recycled. The largest single recycling/reuse market for scrap tyres is ground rubber used in rubberised asphalt – approximately 12 million tyres per year. California and Arizona use the most asphalt rubber in highway construction. Benefits of using asphalt rubber include:

- Longer lasting road surfaces,
- Reduced road maintenance,
- Cost effectiveness over the long term,
- Lower road noise,
- Shorter breaking distances.

As this technology proves itself and spreads to other countries around the world it is likely to prove a major boost for recycling scrap tyres.

Other innovative uses for **sized-reduced rubber** or '**crumb rubber**' include:

- Re-casting into rubber mats, highway noise barriers, carpet underlay, and flooring material (e.g. rubber tiles).
- As an alternative to rock in septic systems and landfill leachate collection systems.
- Ground cover under playground equipment (rubber matting possesses high impact attenuation/ ability to absorb falling children and objects).
- Running track material (the rubber compounds increase a track's flexibility and decrease stress on runners' legs).
- Sports and playing fields – as a soil additive it increases the resiliency of the field thereby decreasing injuries, improving drainage, and enabling better grass root structure.
- New tyre manufacturing (up to about 10%)
- Brake pads and brake shoes.
- Additive to injection moulded and extruded plastics.
- Agricultural and horticultural applications/soil amendments.
- In parts of Africa and Asia, used tyres have been cut up to make durable, hard-wearing sandals.

Whole tyres have been recycled for a wide variety of uses such as:

- Water retention rings around plants and trees;
- Raised flower and vegetable beds when laid flat on the ground and filled with soil;
- As 'swings' for children's playgrounds;

- As artificial reefs when tied together with heavy duty link chain and sunk off coastal areas;
- As 'bumpers' for boats on jetties;
- As soil retention devices where erosion is a problem; and
- When half sunk in the ground they may be used to make a low fence or barrier.
- Some processing plants which require fuel for heat, such as cement kilns and pulp and paper mills, may combust scrap tyres for waste-to-energy. But burning tyres is highly pollutant and requires strict atmospheric emission controls.

In tropical areas used tyres can be a particular hazard if allowed to fill with water because they become breeding habitats for the anopheles (malaria) and dengue mosquitoes.

Tourism may use some of the items produced from re-cycled rubber (such as floor mats, ground cover under children's play equipment) but the capacity for recycling activities will be limited because making ground rubber crumbs requires heavy machinery and producing finished products requires additional industrial machinery and know-how. Thus in most cases recycling must focus on what to do with whole tyres. The uses outlined above provide some ideas for recycling and re-use.

5.3. Battery recycling

Batteries of all kinds contain heavy metals and toxic materials. Inside a battery, heavy metals react with chemical electrolyte to produce the battery's power. Batteries contain heavy metals such as mercury, lead, cadmium, and nickel, which can contaminate the environment when batteries are improperly disposed of. When incinerated, certain metals might be released into the air or can concentrate in the ash produced by the combustion process. One way to reduce the number of batteries in the waste stream is to purchase rechargeable batteries. While much more expensive, over its useful life each rechargeable battery may substitute for hundreds of single-use batteries.

Recycling batteries keeps heavy metals out of landfills and the air. Recycling saves resources because recovered plastic and metals can be used to make new batteries. In many developing countries however there are inadequate facilities for recycling batteries and they can be a cause of major environmental pollution.

- **Lead-acid automobile batteries.** In western countries nearly 90% of all lead-acid batteries are recycled because their laws require that the retailer who sells the new batteries collects used batteries for recycling. Reclaimers crush batteries into nickel-sized pieces and separate the plastic components. They send the plastic to a re-processor for manufacture into new plastic products and deliver purified lead to battery manufacturers and other industries. A typical lead-acid battery in the United States contains 60% to 80% recycled lead and plastic.
- **Non-automotive lead-based batteries.** Gel cells and sealed lead-acid batteries, are commonly used to power industrial equipment, emergency lighting, and alarm systems. **Dry-cell batteries contain toxic cocktails of chemicals and heavy metals such as** alkaline and carbon zinc, mercuric-oxide, silver-oxide and zinc-air, and lithium. Types of such batteries are used to power small household and recreational equipment such as cameras, radios, etc. (9-volt, AA, AAA, button). **Alkaline and zinc-carbon batteries** are the everyday household batteries used in flashlights, remote controls, and other appliances. **Button-cell batteries** found in items such as watches and hearing aids contain mercury, silver, cadmium, lithium, or other heavy metals as their main component. Button cells are increasingly targeted for recycling because of the value of recoverable materials, their small size, and their easy handling relative to other battery types.

Tourism inevitably generate significant battery wastes, whether from various in hospitality or other operations, or tourists with the video camera recorders, digital cameras and other battery powered

equipment. All waste batteries should be stored in a safe dry place away from children and combustibles until they can either be passed on for recycling, or disposed of in approved manner.

5.4. Aluminium recycling

Aluminium is one of the best solid wastes for recycling because of a number of very real benefits, both economically and environmentally. By its very nature tourism generates a lot of aluminium waste – from beverage cans, aluminium foil, plate and pie moulds, window frames, vehicle parts, garden furniture, and so on.

Anything made of aluminium can be recycled repeatedly to make the very same product. Unlike many other metals aluminium retains its quality where-as other scrap metals are rarely re-used for the same application – they have to be downgraded to an application requiring lesser metallic properties. The recycling of aluminium eliminates waste. It saves energy, conserves natural resources, reduces use of landfills and provides income for recyclers. The aluminium can is therefore good news for the environment and good for the economy.

5.5. Recycling aluminium as a community business

In commercial terms aluminium waste is one of the few materials that covers more than the cost of its own collection and processing at recycling centres, even in western countries. Unlike other metals, scrap aluminium has significant value and commands good market prices. The London Metal Exchange quotes aluminium scrap prices: on the 1st of July 2004, crushed aluminium cans were priced at pounds sterling 650/ton, and aluminium foil at pounds sterling 450/ton.

Since used aluminium cans are worth six to 20 times more than any other used packaging material they can be profitably recycled by individuals and groups. Many countries have a national can recycling association which offers advice, support, and can put a community in touch with purchasing organizations. Since Inclusive Tourism aims to link communities into major tourist destinations the opportunities for engaging in such a business are far greater than if the community simply relied upon its own 'consumption' of aluminium based products.

For the tourism industry, the main aluminium waste will be old scrap in the form of cans and a range of foil from food packaging. It should be noted that a community venture will be restricted to collection and sale of wastes to a bulk buyer or a factory since re-processing aluminium is a very expensive business involving complex manufacturing and sophisticated machinery and equipment to make products from the recycled material.

The scrap aluminium has to be pre-treated and loaded into a furnace to melt the aluminium completely. This molten metal is then cast or processed – using the same techniques as primary processing.

All aluminium which is recycled is described as either 'new scrap' or 'old scrap'

New Scrap: is surplus aluminium that is left over during the manufacture and fabrication of aluminium up to the point where it is sold to the final consumer. Examples include the trimmings from the edges of sheet aluminium, turnings and millings from aluminium fabrication and surplus extrusion discards. Since such new scrap comes mainly from the manufacturing industry it tends to be of a known quality and composition and can be processed with very little preparation.

Old Scrap: is material which has been used by the consumer and subsequently discarded. This can include a wide range of items such as used beverage cans, car cylinder heads, window frames or electrical cabling.

Recycling aluminium

The World Aluminium Organization, based in the UK, has provided the following information about the recycling of aluminium (http://www.world-aluminium.org/production/recycling):

- Four tons of bauxite are needed to produce one ton of new or 'primary' aluminium.
- The recycling of aluminium requires only 5% of the energy to produce secondary metal as compared to primary metal
- Recycling generates only 5% of the green house gas emissions compared to the refining process for 'primary' aluminium
- Recycling one kilogram of aluminium can thus save about 8 kilograms of bauxite, four kilograms of chemical products and 14 kilowatt hours of electricity.
- In other words, recycling aluminium brings potential energy savings of 95%, reduction of emissions by 99% and reduction in the waste going to landfill.
- Anything made of aluminium can be recycled repeatedly: used aluminium cans can be recycled to make new aluminium cans, aluminium windows can be recycled to make new aluminium windows and old aluminium engine blocks to make new ones.
- Worldwide, the recycling rate for aluminium cans is higher than for any other used packaging material: globally, more than 50% of all aluminium cans are recycled.
- The recycling rate for aluminium cans is already above 70% in some countries. Sweden (92%) and Switzerland (88%) are the European can recycling champions.
- Aluminium companies have invested in dedicated state of the art secondary metal processing plants to recycle aluminium. In the case of beverage cans, the process uses gas collected from burning off the volatile substances in can coatings to provide heat for the process. Every last bit of energy is used.

The box below sets out the steps necessary for a Trainer to assist a community associated with an Inclusive Tourism project set up an aluminium waste recycling venture.

Setting up a community-based aluminium waste/recycling collection venture

Step 1. The trainer/consultant, after ascertaining tat a communitz wishes to set up an aluminium recycling venture, should contact thenational aluminium recycling association so that contact can be made with potential buyers.

Step 2. Following successful discussions with a potential purchaser, the community will need to organize a collection system for the aluminium waste. It could include not only waste generated by the many tourism businesses in and around tourist destination, but could include households as well.

Step 3. Obtain a very large collecting bin for cans, and a smaller one for foil and other aluminium waste. A can bin may be made from a wooden frame and chicken wire (the diameter of the mesh for pig wire may be too large so that crushed cans could slip out of the bin). Make the bin about 2 m long by 1.5 m wide by 1.5 m high. It will need the wire to form the base as well as the sides but a top is not needed. The bin for the foil will need solid sides and bottom because much foil waste is very small, e.g. milk bottle tops and cigarette packaging.

Step 4. Aluminium cans and foil must be separated because they are made of different alloys. Most recycled aluminium foil is used to make cast components for the automotive industry, such as cylinder heads and engine blocks.

Step 5. Foil wastes will often need to be washed clean of contaminants, e.g. foil milk bottle tops, tops of cartons, baking and freezing trays, kitchen foil. Cigarette and tobacco foil (without the backing paper) is suitable for collection. However, metal coated plastic film, which is often used for crisp and snack packets and looks like aluminium cannot be recycled. Use the scrunch test to check whether it is aluminium foil. If it springs back when scrunched in the hand it is not recyclable!

Step 6. Aluminium cans must be separated out from tin cans. This is easy because:

- They do stick to a magnet (so a small magnet is an essential piece of equipment)
- They are very light in weight
- They do not go rusty
- They have a very shiny silver base
- They sometimes have the 'ALU' sign on them (for aluminium).

Step 7. Set up a simple crushing system for cans. A large flat rock, cement paver or similar hard material could form the base, and a 4lb hammer used to flatten each can. The flattened cans are then stacked as tightly as possible in the appropriate bin.

Step 8. When the bins are full, or specific amounts of material as specified by the purchaser have been collected, the waste is transported to the buyer.

6. Organic recycling

The aim of this section is to introduce the topic of organic waste management. In particular, **food wastes, paper wastes and human faecal wastes** (sewage) generated by a CBT business will be described and different methods and procedures for recycling and re-use will be explained.

At the end of this section you will have an understanding of a range of different procedures such as composting, vermiculture (worm farming) sewage treatment and simple recycled paper making. You will also know how to apply them **for triple bottom line benefits** – that is, sustainable environmental management allied with social and economic returns for the community.

6.1. Composting for organic agriculture and market gardening

Any tourism venture which includes in its operations the provision of meals for its guests will produce food wastes and table scraps. Garden refuse (leaves, lawn clippings, tree and shrub prunings, weeds, straw, etc.) will also be available from many tourism businesses. All of these materials can be important ingredients in the making of compost, and compost is a very good soil additive. It will increase nutrients in sandy soils, help to break down hard clay soils and enrich all other soil types. It will help to retain water, especially in sandy soils. Compost replicates the humus found on forest floors, except that we can produce it in months rather than years.

Most compost is formed by decomposing carbon- and nitrogen-based materials using aerobic composting techniques. To understand how compost is formed we need to define these key words.

In simplified terms carbon- and nitrogen-based materials are anything that is or was living – plants and animal materials. Note that all plants have more carbon than nitrogen. Grass has a great deal more nitrogen than wood chips, thus it is called a 'green' material. Wood chips are very high in carbon, but low in nitrogen. Thus they are called a 'brown' material. A basic rule is that any green material like vegetable wastes, or grass and shrub clippings or weeds are nitrogen-rich. Dry or 'brown' material like autumn leaves or straw or sawdust is carbon-rich.

Humus

For those with a scientific bent, **humus** is the excreta of microorganisms which live in compost heaps. Dark and rich, humus is the key to improving the structure of all soils, and it has a remarkable ability to store and supply plant nutrients. When compost is spread on the soil it is being improved for many generations – indeed, studies have shown that humus lasts thousands of years.

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The processes at work

Decomposing these materials means that they need to be broken them down through a process of rotting.

Aerobic Composting means that enough heat needs to be produced in our waste materials for microorganisms to break them down.

Through its 'mainstreaming' process to link impoverished communities into mass tourism destinations to alleviate poverty through the power of the tourist dollar, the ITC has developed a series of projects some of which recycle organic wastes from hotels and resorts for organic fertiliser. One such project is its 'Poverty Reduction Programme Coconut Coast' project in Brazil.

ITC and inclusive tourism in Costa Dos Coqueiros (Coconut Coast), Bahia, North East Brazil

Objective of ITC's Poverty Reduction Programme

The Brazilian Inclusive Tourism (IT) project, launched late 2003, aims to improve the livelihood of communities of thousands of people by involving them in the tourism value chains of tourism resorts in Bahia.

In the Costa dos Coqueiros (Coconut Coast) region known both for natural beauty and low Human Development Index levels, large resorts attract international tourists in increasing numbers. The ITC has been working in this destination region for more than 6 years and through its Poverty Reduction Programme it has provided methodology (supply chain/value chain analysis), knowledge, and tools through technical cooperation to benefit local communities which were largely marginalized from the massive tourism development. In addition to hospitality training, technical training associated with hotel/resort management, and handicrafts cooperatives the 'Coconut Coast Inclusive Tourism Project' has provided some 500 farmers provided with training and assistance to help meet the tourist-driven demand for food and beverages.

A waste recycling plant was built in 2008 under ITC's Poverty Reduction tourism project and it collects 5 tons of organic waste per day from participating hotels which it transforms into organic fertilizer to the 500 local farmers, who sell their organic fruit and vegetables back into the tourist markets. This has improved production and reliability of supplies to the resorts. At the same time the recycling of the waste has had a significant environmental impact.

6.2. Composting guidelines

The following composting guidelines are courtesy of Florida's Online Composting Centre and the University of Florida.[7]

Rapid composting requires an environment in which microorganisms will thrive. To compost well, it is necessary to 'think like a microbe' and create the best environment to support microbial activity. Microbes have similar environmental needs as people: water, air, comfortable temperatures, and food. Thus to achieve rapid, efficient composting, we need to make sure we control the following elements:

- Moisture;
- Aeration;
- Heat (pile temperature);
- Particle size;
- Carbon to nitrogen ratio.

Moisture

Microbes need moisture to thrive. The ideal moisture level is between 40%-60%. A simple test is to take a handful of compost: it should feel wet, but water cannot be squeezed out of it. Some people compare this to the feeling of a damp sponge.

It may be necessary to add water to the compost pile to keep it moist. But do not let the pile get too wet or soggy. If the materials are too wet, they will compact and restrict the flow of air through the pile. This leads to anaerobic (no oxygen) conditions, which slow down the degradation process and causes foul odours. A pile which becomes too wet should be turned. Turning the compost will dry it out and add oxygen at the same time.

Aeration

Microbes need oxygen to survive. Aeration means adding oxygen to your compost system. Because microbes reproduce so rapidly under ideal conditions, they may quickly use up the available oxygen through their activities. Therefore, it is important to aerate the compost pile simply by turning it. This action directly incorporates oxygen into the pile.

The compost pile can also be aerated by adding bulky items which provide air channels so that oxygen can flow into and through the compost. Bulky items also keep the pile from settling and compacting, which could restrict oxygen flow. Bulky items include big leaves, pine needles, chipped twigs, and straw. Another way to aerate your compost pile is by probing it with a strong stick or a bar in several places. This will create passageways for air to enter the pile.

Heat (pile temperature)

Compost pile temperature is a function of the biological activity within the composting system, and, to some extent, its exposure to the sun. When microbes flourish, they will raise the pile temperature through their metabolism, reproduction, and conversion of composting materials to energy. The key elements in producing heat are carbons and nitrogens, and the ideal mix is a carbon to nitrogen ratio (C:N) of 30.

The main reason to be concerned about pile temperature is that maintaining a minimum pile temperature of 131°F for 3 days is desirable to destroy weed seeds or plant pathogens. To establish this highly efficient biological system requires the proper food balance (a mixture of nitrogen and carbon rich materials), sufficient pile size (approximately one cubic yard), oxygen and adequate moisture content (moist but not soggy). Your composting system may not reach higher temperatures during the composting process. If your pile does not heat up, don't worry: Composting Happens! – at all temperature levels.

[7] http://www.compostinfo.com/tutorial/ElementOfComposting.htm.

Particle size

Smaller materials have more surface area available for microbes to attack. Therefore, reducing the particle size of raw materials will increase the speed of the composting process. Size reduction also reduces the volume of the compost pile, thereby saving space. It is a good idea to chip or mulch small limbs and twigs to a size of 2-3 inches before composting. Particle size can be too small. For example, sawdust sized and wet materials can decrease aeration, reduce the rate of composting and perhaps cause anaerobic conditions leading to odour problems.

Carbon to nitrogen ratio

Scientists speak of an ideal ratio of Carbon to Nitrogen of 30 to 1 (30:1), as measured on a dry weight basis. This is known as the C:N ratio. But DON'T GET CAUGHT UP IN THE NUMBERS. What's important is to understand how greens and browns affect the compost process and to use them to manage the compost system. Animal manures which are very good additives for making compost are generally high in carbon. Chicken, horse, cow, sheep and goat manure can all be recycled for compost.

Harvesting

When the compost pile has broken down to rich humus it may be spread over the ground like a fertiliser. It is particularly useful for trees, when a spade full should be added to the bottom of the hole before planting the tree. Not only can you recycle compost for your own crops, you can put it into plastic bags and sell it, and you can thus develop a steady supplementary income from your organic waste.

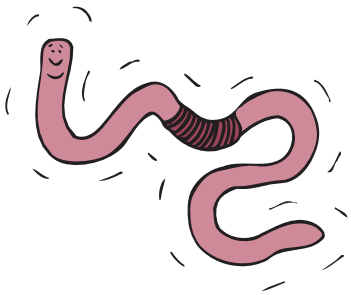
The C:N ratio of the materials can be calculated by using the chart below. For example, if you have two bags of grass clippings (C:N = 20:1) and one bag of leaves (C:N = 60:1) then combined you have a C:N ration of (20:1 + 20:1 + 60:1)/3 = (100:1)/3 = 33:1, which is pretty close to the ideal (C:N = 30:1)

Material C:N Ratio:

Coffee grounds	20:01
Corn stalks	60:01:00
Cow manure	20:01
Fruit wastes	35:01:00
Grass clippings	20:01
Horse manure w/ llitter	60:01:00
Leaves	60:01:00
Newspaper	50-200:1
Oak leaves (Green)	26:01:00
Peat moss	58:01:00
Pine needles	60-110:1
Rotted manure	20:01
Sawdust / wood	600:01:00
Sawdust weathered for two months	325:01:00
Straw	80-100:1
Table scraps	15:01
Vegetable trimmings	12-20:1

Source: www.compostinfo.com/tutorial/ElementOfComposting.htm.

6.3. Worm composting (vermiculture)[8]



Worm 'farms' are excellent for increasing the rate of composting of kitchen wastes and other suitable wastes. As worms eat the wastes they excrete worm castings. Castings contain more nutrients that simple composting and as an organic fertiliser their composition makes them even more readily available for take-up by plants.

One issue with composting that uses food wastes is the risk of providing a food source for vermin, especially mice and rats. Foul odours can also be generated if the compost pile is not aerated properly. One method that overcomes these problems is to make a 'worm farm' in a compost box or bin with a lid. Worm composting has been called 'organic garbage disposal'. Because worms eat the decaying food most smell is eliminated.

The worm bin

The three key points to get right in making a bin are to provide the right sort of environment, the materials from which to make the bin, and the size.

1. **Environment:** While making a bin, the following needs for a healthy colony of worms must be kept in mind:

    - Worms like a dark environment. They hate light.
    - Worms must have a moist environment. Dry conditions will kill them.
    - Worms need to breath.
    - Worms need to be protected from animals and birds which feed on worms.
    - Worms need to be protected from pests which would be attracted to rotting food left in the open.

2. **Materials:** A worm bin can be made from recycling bricks and timber left over from building construction. Sturdy wooden boxes could also be used or big opaque plastic containers or tubs. Clear plastic containers are not appropriate because worms need a dark environment. Plastic bins will need holes punched into them to allow air inside – a large nail can be used for this purpose. Punch 2/3 mm holes about 3 cm apart in rows all around the sides of the bin to provide air for the worms.

    Because rotting food releases quite a lot of moisture, holes will also need to be punched in the bottom of the bin regardless of the kind of material used. Bins made of bricks can be left without a bottom so that the soil forms the base and in hot dry weather the worms will retreat into the soil.

    Metal drums should be avoided: they could be difficult to clean completely from toxic materials they may have contained, they heat up easily, and they will rust after a while. A lid tight enough to prevent animals getting entry is necessary. Where monkeys are a problem (most of South and East Asia, some parts of Africa), the lid will need to be secured with a fastener or catch.

3. **Size:** Depending upon the amount of waste to be recycled each week, a bin about 60 cm length x 30 cm/40 cm wide x 15 cm/20 cm high (2 ft L x 1'6' W x 1'0' H) would be sufficient for a small operation. A bigger bin could be made for a larger operation, or a series of small bins could be used. Depth is not as important as surface area unless common earthworms (night crawlers) are used – see notes below. Much larger dimensions of length and width could be used, but depth does not need to be any greater for red worms and brown-nosed worms.

[8] Courtesy Master Composter, http://www.mastercomposter.com/worm/wormcomp.html.

Plate 22. A worm bin made of concrete blocks with a wooden lid

It has no bottom and the earth forms the base.

Source: http://www.mastercomposter.com/worm/wormcomp.html.

The worms

Red worms *(Eisenia foetida,* commonly called red wigglers in USA and Europe) or brown-nosed worms are best. They are excellent for composting kitchen wastes, and soil is not necessary.

Common earthworms can be used for composting food wastes, but they are difficult. If they are used it is essential that at least half the bedding material in the bin is soil. It will also be necessary to mix straw, leaves and other garden refuse with the food scraps.

Additionally a deep bin must be used because common earthworms are tunnellers. Common earthworms will die in the composting environment if there is insufficient soil and the bin is shallow.

If in doubt about the kind of worm that exists, always use lots of soil in the bedding material and use a deep bin without a bottom so that the earth forms the base.

To be an efficient system, about half a kilo of worms will be needed for each half kilo of kitchen waste per week to be composted.

In the right environment worms can double their populations every 90 days. Once a bin has a high population of worms that can manage the amount of waste deposited in the bin per week, after 90 days the worms can be divided and another bin constructed to put them to work. If there is insufficient kitchen waste, then straw, leaves, shredded paper and other material suitable for composting can be used.

Setting up house

The next step is to make the bin ready to receive the worms. Fill the bottom half with a layer of mixed soil, shredded paper and cardboard and leaves or straw. Make sure it is very moist. Place the worms in the middle of this layer. If you have red worms or brown-nosed worms only a few handfuls of soil will be needed and the main material can be shredded, fully moistened, paper and cardboard. Avoid **paper or cardboard that has coloured ink on it** because inks sometimes have metals in them that are toxic to worms.

Because worms do not have teeth, it is necessary to provide them with something gritty to start the process. Soil provides this, but fine sand, leaves, sawdust or ground eggshells would be equally as good. Once the process is under way, the castings themselves provide all the grit that is necessary.

After the worms are installed in the bin, leave them for one week to start eating the bedding before any food wastes are added. Add the food wastes in a layer about 3-4 cm thick, no thicker, on top of the bedding material and then cover the waste with either shredded paper or soil. Do not leave food wastes uncovered. Then close the lid.

The key to a good worm farm is to **start slowly!** The worms won't starve because of the bedding. But it takes time for bacteria to form and your bin can quickly become very smelly if you add too much food, too fast. The amount of food can be increased as the bin becomes established.

Not all wastes are acceptable for worms so some sorting may be needed. Acceptable foods are: fruit wastes (cores, peel, etc.), grains, all vegetable matter, egg shells, coffee grounds and filters, tea leaves and paper bags. Because they like materials high in cellulose, paper and cardboard (without coloured pictures or print), and sawdust are good. Leaves and straw can always be added. Chopping wastes before adding them will speed up the ability of the worms to eat them.

Unacceptable foods are: Oils, cat and dog faeces, meat, cheese, butter, animal products, fish, and as mentioned before, paper with coloured inks. Plastics are strictly inappropriate, as are any metallic objects like bottle tops. Fresh chicken, cow, horse, sheep or goat manure must also be avoided since they will heat up the bin and literally cook the worms.

Make sure that the material in the bin is always moist.

Temperature needs to be watched because worms do not like extreme heat or cold. In hot climates where day temperatures reach 35'C (90'F) or more keep the bins in a shady spot. In cold climates, place the bins under cover where they are protected from frosts. The composting material will retain significant heat sufficient for most worms to survive comfortably but as temperatures get colder in winter, they may retreat into the ground under the bin. They will be less active and so care must be taken not to put too much waste into the bin or it will rot without being eaten and it may begin to stink.

Wastes should only be put in the bin once per week unless it is being disposed of more quickly. The real test as to the correct amount of food is to check how much remains at the end of the week; ideally there should be none.

Harvesting

With the right environment, worms make compost faster than other methods. In a normal, productive bin, castings can be harvested three of four times a year because it will take only about 3-4 months for the bin to become full with rich, black fertiliser. Harvesting requires removing the fertiliser and leaving the worms in the bins to make more castings. To do this, the worms must be separated from the castings they currently inhabit without excessive handling. Take off the lid, expose the worms to light and they will retreat into the bottom of the bin. Slowly scrape of the first 5 or 6 cm, and the worms will retreat further down. Repeat this process until only a thin layer is left at the bottom which is mostly composed of the worms. As the layers are removed, carefully remove any worms or eggs – (small, opaque cocoons) and return them to the bin.

Add new bedding until the bin is one third to half full, and the process begins all over again.

The finished product

Castings are even richer in nutrients than compost and contain bacteria, calcium, iron, magnesium, and sulphur and up to 60 other trace minerals – so they must be used more sparingly. Compared to ordinary soil, the worm castings contain five times more nitrogen, seven times more phosphorus and eleven times more potassium. They are rich in humic acids and improve the structure of the soil.

Castings can be used to improve soil fertility, as mulch, and to grow healthier crops. However, castings are not suitable by themselves as a potting mix because they are too rich, and so should not be more than about a quarter of the mix, with soil making up the remaining three quarters.

If castings are not used by the community itself to improve its own farm outputs, it may be able to sell them to the resorts and/or other tourism businesses for their landscaping to generate a cash income. Alternatively, if there is an urban centre nearby, it may be possible to sell the castings as organic fertiliser to households and other businesses.

It may also be possible to sell worm 'farms' in starter kits: in western countries many people interested in increasing sustainable waste management set up farm worms both inside and outside of their homes to dispose of their household kitchen wastes. For inside worm farms however, only red worms or brown-nosed worms can be used.

Not all worm farms need to be small individual bins using the refuse from only one community or tourism business. A number of ventures could combine to run a large worm farm using all of the food wastes they generate as a commercial operation (e.g. the 30 or more lodges located in the village of Sauraha on the edge of the Chitwan National Park in Nepal). All of the refuse could be collected on a regular basis and delivered to a single site where the worm farm would be located.

6.4. Sewage

According to the World Health Organization, up to 90% of the developing world's raw sewage is dumped directly into the ocean, rivers and lakes. Many cities, towns and villages lack treatment facilities and the result is often a polluted environment and the spread of diarrhoeal illnesses, hepatitis and other diseases.

Conventional western sanitation is based on the perception that human faeces is waste that should be disposed of down pits or through sewers, and it requires huge volumes of water to flush toilets and transport the waste to treatment plants. But in many countries neither the finance nor the water is available in sufficient quantity to meet demand; today 10% of the world's population faces severe water shortages and by 2025 that figure is expected to rise to 35%.

In the circumstances water-intensive sanitation systems will be increasingly difficult to justify in the years ahead and there is a global need to focus on ways to re-examine how human faeces is disposed of.

Increasingly, **'ecological sanitation'** is seen as helping to provide a solution by recycling nutrients from human waste back into the environment and into 'productive systems,' such as farming. Ecological sanitation is based on three main principles:[9]

- It offers a safe sanitation solution that prevents disease and promotes health by successfully and hygienically removing pathogen-rich excreta from the immediate environment;
- It is environmentally sound as it doesn't contaminate groundwater or use scarce water resources;
- It creates a valuable resource that can be productively recycled back into the environment. Over time, through proper management and storage, excreta is transformed from a harmful product into a productive asset.

In one sense this is not new: In all countries, animal waste has been used for centuries to maintain soil fertility, and in rural farming communities in many countries using human faecal waste is just another animal fertiliser. In places like China, Viet Nam and Yemen, for example, agricultural recycling of human excrement has been practiced for centuries. In western countries chemical fertilisers are used to compensate for depleted soil fertility but serious environmental hazards are often associated with their use.

In industrialized countries, for example, indiscriminate use of these substances has polluted water supplies, and dangerously high levels of chemicals have been recorded in almost one quarter of Europe's groundwater supplies. According to the UNDP, applying properly treated human waste to cropland is safer than using chemical fertilisers, diverts raw sewage from rivers and other bodies of water, helps to raise agricultural production, saves scarce water, and costs only a fraction of conventional western sewage treatment facilities. Most importantly, human waste becomes part of a natural eco-system – recycled and returned to the land for food production and food security – rather than being dumped as a pollutant.

[9] **Source:** Sustainable Energy and Environment Division, UNDP.

In any recycling of human faeces for agricultural application, it must be remembered that human excrement contains dangerous pathogens that cause disease. These must be neutralized and destroyed, hence the emphasis of ecological sanitation is on proper treatment before it is used. The pathogens can be destroyed by dehydration, decomposition, or heating and forms of ecological sanitation rely on these methods.

However, in some societies the handling of human faecal waste is abhorrent and ecological sanitation methods will not work for cultural reasons.

Human urine, unlike faeces, is virtually sterile and contains no pathogens and can be a very useful supplementary liquid fertiliser especially when watered down. (Its astringent qualities have been known to many traditional societies for centuries and in some of them fresh urine is used as a traditional form of antiseptic, useful for cleansing wounds. The Maasai of East Africa have traditionally used fresh urine for clearing up eye infections, for example).

A standard ecological sanitation system uses two shallow pits which are excavated side by side (about 1.5 m (5 ft) deep is sufficient). One pit is covered to prevent use until the first pit is full, and a moveable latrine slab is placed over the hole to be used. After each use of the latrine, soil, ash or sawdust is sprinkled over the top to completely cover the contents. This helps to dry the pit contents, reduce odours, and reduce or eliminate flies since they are no longer attracted to the latrine.

More importantly, the regular addition of a significant amount of soil/ash/sawdust is essential for converting excreta to useable compost. Soil and ash also raise pH levels, which accelerates the destruction of pathogens. When the pit is full it is covered with a thick layer of soil, the latrine slab is moved to the empty pit, and the full pit is blocked off with a cover to prevent any child or animal falling into it or disturbing the contents. The contents are left to decompose and transform into compost, while the second pit is used for toileting.

When the second pit is full, the contents of the first pit are emptied out and used as compost; or, if not enough time has passed and decomposition is not complete, then the contents are moved to a safe storage place while further decomposition takes place. The latrine slab is placed back over the now-empty pit, and the process starts again.

Mozambique fruit tree cultivation

In a version of this recycling method in rural Lichinga in Mozambique, East Africa, the pits were located where fruit trees were to be grown. A lightweight moveable superstructure was erected around the first pit. When it was about two thirds full, it was topped up with soil, kitchen waste and compost and left to rot for several months, then a tree was planted over the spot. This removed the need to excavate the faecal waste. Where space is available and trees are desired, this is an excellent option for avoiding the cultural problem in those societies which strictly forbid handling human excrement.

6.5. Garden waste as horticulture

Many hotels and resorts will have extensive landscaping and gardens. Most often, all garden refuse is simply burnt, used as landfill or added to the compost heap. However an opportunity may exist for the community to develop a small plant nursery based on the clippings (‘cuttings’) from shrubs and trees when they are pruned. Many plants can easily be grown from cuttings if a few simple rules are followed.

Growing plants from cuttings

Step 1: Prepare soil which will encourage cuttings to grow roots. A sandy, well-drained soil should make up about one half to three-quarters of the mix. Compost can make up the remainder, with a sprinkling of worm castings if available. Avoid heavy clay soils, very acidic soils, and all fresh manure. Half-rotted compost will also be unsuitable.

Step 2: Use the mix to fill a number of pots. These can be recycled tins or plastic jars or bottles, but make sure that a large hole at least 1 cm in diameter has been punched in the bottom for drainage. They should be at least 20 cm deep.

Alternatively, a trench about 30 cm (1 ft deep) and 15 cm (6 inches) wide could be dug and filled with the potting mix. The trench should be positioned in a sheltered spot which gets filtered sunlight.

Step 3: Cuttings should be taken from trees and shrubs with a pair of sequateurs, scissors or a sharp knife. They should not be broken off with jagged ends. Different seasons will be best for different types of cuttings. For example, autumn in temperate climates is a good time to take cuttings from soft wooded plants. Winter is a good time to take cuttings from dormant grape vines. Often the first month of Spring is the best season for a range of other cuttings, and as this is the main growing season for most plants and the weather is warming up after winter, it is usually a good time to strike cuttings. Avoid taking cuttings when the plant is in flower as its energy is directed to the blooms, slowing growth away from the development of roots.

Most cuttings should include wood that is at least one year old: ‘green’ or ‘new wood’ shoots will often not strike but die. Choose long unbranched tips. Cut the stems between 12-30 cm long, about 3 mm below a node. Side twigs should be nipped off. Most leaves should also be stripped off to avoid loss of moisture through transpiration. Of ourse, if you have taken cuttings from dormant winter plants there will be no leaves!

Step 4: Give the potting mix a good soak to make sure it is moist.

Step 5: Soak the cuttings in a container of water mixed with a little honey if available, for 24 hours before planting. Honey has the same chemicals, naturally formed, that are found in artificial (and very expensive) hormone rooting powder. The honey will improve your strike rate.

Step 6: When you are ready to plant, dip the ends of the cuttings in honey if it is available.

Step 7: Use a thin stick or rod to make a hole about 20 cm deep in the trench or about two thirds of the depth of your pots. Push the cuttings into the holes (by making holes first more of the honey will stick to the end of each cutting), making sure that a bud is about 3-4 cm above ground level. Plant two or three cuttings in each pot, with their leaves just touching. Any closer and they risk fungal problems. Further apart and they tend to dry out.

Step 8: Water well after planting. To strike cuttings it is essential that the soil be kept moist and not allowed to dry out. Some cuttings may take eight to twelve weeks to strike so persevere. The appearance of roots growing out of the drainage holes, or new shoots and leaves, will signal a successful strike.

Step 9: After new shoots and leaves appear, do not disturb the cutting for another three months. This will allow the roots to develop well.

Step 10: Plants may then be lifted from the trench and transplanted into pots for sale. If more than one plant per pot has struck, remove the extra plants to pots of their own.

6.6. Waste paper

There are many forms of paper and many ways of re-using and recycling paper products.

Recycling paper makes sense because it does not require as much raw material to make the same amount of ‘virgin’ paper and thus reduces destruction of forests. Paper is also easy to recycle because it is made from wood, and it separates back into fibres when soaked in water.

Recycled paper

'One ton of recycled paper saves approximately 1.3 tons of logs and 109,000 litres (24,000 gallons) of water. One ton of recycled paper uses:

- 64% less energy
- 50% less water
- Causes 74% less air pollution
- Saves 17 trees, and
- Creates 5 times more jobs than one ton of paper products from virgin wood pulp.'

Source: http://www.recyclingit.com/recyfact2.htm.

Source: Clip art.

The basics steps in re-cycling after sorting are pulping, screening, de-inking and finally processing into new paper products. Different grades of paper are recycled and manufactured into new paper products. For example, the recycling process of mixed paper wastes produces a new paper or paperboard product out of materials that might otherwise have ended up in a landfill. Quality paper such as printing and writing papers used as office stationery, copy paper, and school homework (exercise sheets) are recycled into new printing and writing paper, tissues and paperboard. Yesterday's newspapers become today's news as most old newspapers are recycled into new newsprint. Recycling is one way to help manage the waste that is generated each year.

Not all paper can be recycled into new paper products. Some papers have too many contaminants to recycle. For example, pizza boxes and used paper plates cannot be re-cycled because food cannot be removed during processing. Other contaminants include carbon paper and plastic tape.

There is also a limit to the number of times a piece of paper, a corrugated box or other paper product can be recycled. This is because each time paper is re-processed; the wood fibres break down, getting smaller and smaller each time. Finally, they get so small that they slip through the screens during the screening process and become waste that goes to a landfill.

The simplest form of re-cycling is to collect all used paper and sell it to a paper recycling centre. The prices being paid for paper by the recycling centres are significant. In the United States, in June 2004, old newspapers were commanding US$ 50-US$ 60 per metric ton; used cardboard, US$ 112 per metric ton; and high-grade office paper as much as US$ 2,120 per metric ton.[10] These price levels are not repeated in developing countries, but nevertheless as the principles of sustainable development become more widely accepted and destruction of natural forests for paper attracts ever more criticism, recycling is an appropriate response and many countries now have multiple paper recycling plants. In countries like Indonesia, the Philippines, Viet Nam and India, many scrap paper collectors earn more money than the average income.

Instead of sending waste paper to a recycling depot, it is possible for community members to make paper themselves. It can then be used for a variety of products such as making postcards for sale to tourists. This is called value-adding.

[10] **Source:** http://www.recycle.net/exchange/index.html.

Making postcards from recycled newspaper

Resources:

- A Large square pan about 8-9 cm (3 inches) deep
- Three cups of warm water
- Enough water to fill one third of the pan
- One and a half sheets of newspaper
- Fine mesh wire screen (like a window insect screen) to fit into the pan
- A rolling pin
- A whole section of a newspaper (at least 8 sheets thick)
- An electric blender or a mortar and pestle

Procedure:

Step 1. Tear the one and half sheets of newspaper into tiny pieces.

Step 2. Put the shredded newspaper pieces and the three cups of water into the blender and turn it onto medium speed for about 5 seconds, to make paper pulp. If you do not have a blender, put the newspaper pieces and the cups of water into the mortar and pound with the pestle until the mixture is reduced to pulp.

Step 3. Place the wire mesh screen on the bottom of the pan and cover it with one inch of water.

Step 4. Pour about one cup of the pulp over the screen and spread it around evenly with your fingers.

Step 5. Lift the screen with the pulp on it and let the water drain.

Step 6. Open the section of newspaper in the middle so that there are 4 sheets on each side.

Step 7. Put the screen, pulp side up, on one side of the section of open newspaper.

Step 8. Close the newspaper and flip it over so that the pulp is now face down.

Step 9. Take the rolling pin and roll out the excess water.

Step 10. Open the newspaper and remove the screen, leaving the rolled pulp on the newspaper.

Step 11. Leave the newspaper open and let the pulp dry overnight.

Step 12. In the morning, peel the ‘recycled paper’ away from the newspaper. Hey presto! You have just recycled old newspaper into a new piece of paper!

Step 13: The new piece of paper will be ragged around the edges. You can leave it like this, or trim it with a pair of scissors.

Step 14: Now, to make a painting or postcard for sale to tourists, draw a picture on the paper, or print greetings in the local language.

Step 15: Make sure that the paper has a note on it to say that it is ‘Handmade, recycled paper.’ Tourists will value it more – and pay more!

Plate 23. Hand-painted postcards and paintings on hand-made paper, Vientiane, Lao People's Democractic Republic

Other forms of waste paper and recycling

We have already seen how waste paper can be shredded and used as an additive for the compost heap, or as a key ingredient in making a worm bin. Waste paper can be used in other ways in the farm and garden.

Surface mulch

Sheets of paper can be laid out on the ground as a form of mulch. Newspapers (including broadsheets with coloured print and pictures which can be used) should be laid in a layer at least 8 pages thick. This thickness will be sufficient to achieve two main objectives:

1. To prevent loss of moisture through evaporation from the soil beneath;
2. To act as an efficient barrier to suppress weed growth between rows of plants.

Keep the sheets moist while laying them on the ground to stop them from blowing around in the wind. Once laid, straw or other forms of mulch may be spread on top so they don't blow away, and over time the newspaper will break down and enrich the soil.

Moisture Retention Layer: Water percolates very quickly down through sandy soils and excess use of water often occurs as cultivators strive to keep their crops and plants healthy. In sandy soils, paper can form a layer to prevent moisture from escaping too quickly into the ground. Remove the topsoil to a depth of about one third of a metre (1 ft). Lay the paper at least 8-10 pages thick on the bottom. Then backfill with the topsoil.

The layer of paper, while not watertight, will nevertheless act as a sponge which will hold and retain water, slow its rate of downwards percolation, and allow the plants more time to obtain their moisture. Less water will be needed so saving on this scarce resource. Paper buried at this depth will decompose fairly quickly so the process will need to be repeated every two to three years.

Paper logs for fuel

Paper may be utilised as a fuel by making 'logs' which will help to reduce the quantity of wood fuel or coal. Newsprint is the better form of paper for this use.

Paper logs for fuel

Method 1: Open out a newspaper and start rolling it VERY tightly. When you get about halfway, add another paper, and keep rolling tightly. Then, when you get halfway with the second piece, add another newspaper, and then another. Depending upon the thickness of each newspaper, about six newspapers will give you a 'log' about 15 cm or 6 inches in diameter. The key is to roll it very tightly. Secure the 'log' with string at both ends. However a fire made completely out of paper 'logs' like these is not very good because as they burn they will lose their shape, flare up and burn quickly without generating prolonged heat. It is better to make a fire using both paper 'logs' and real wood (about half each). Stack the paper logs between the wood logs and they will retain their shape and burn more slowly.

Method 2: A better method is to soak the newspaper sheets in slightly soapy water until they are thoroughly wet, then roll them up on a smooth rod such as a length of bamboo or a stick. Squeeze out the excess water as you go. Stand the completed logs upright to drain and dry (they could take several days to dry, depending upon the weather). It is not necessary to remove the rod or stick but the logs will dry more quickly if it is removed; and the resultant hole will allow oxygen into the centre of the 'log' when burning.

Soaking the newspaper breaks down the fibres which causes fly ash, and the soap will hold the sheets together so that it will not be necessary to tie the ends of each completed log. Again, the trick is to roll each 'log' up as tightly as possible. The tighter they are rolled the more slowly they will burn. Newspaper logs prepared this way will burn steadily with about the same heat as a similar weight of wood. If no soap is available, simply soak the newspaper in water and a similar log will result but with less combustibility.

7. Monitoring and evaluation

If enterprises are to be sustainable, then monitoring and evaluating the implementation of environmental management in terms of both results and processes is very important. With Inclusive Tourism projects, members of the associated communities and other stakeholders need to know what they are doing well, and where there is room for improvement. It is thus essential that at regular intervals TSIs/consultants should organise a community/ stakeholder meeting to have participants:

- **Reflect** on what they have done so far;
- **Evaluate** results and outcomes;
- **Assess** the process(es) by which they are trying to achieve their objectives; and if need be
- **Re-direct** their efforts to achieve the desired results.

If the project is planned and working within a three to five year cycle, then after the first six months and at regular intervals of say 4-6 months thereafter, TSIs/consultants should engage in monitoring and evaluating achievements and progress with the community and other stakeholders. There is no fixed schedule; but regular meetings at relatively short internals should be carried out rather than waiting for a longer time before undertaking a review.

Such meetings are not only essential for the specific purpose of monitoring and evaluation but for maintaining stakeholder involvement and enthusiasm. At the beginning, TSIs will encounter a significant deal of enthusiasm and initial input for example when a community decides to embrace tourism development. But as time goes on, and as personal and family matters press down on individuals or when operational concerns occupy the central thoughts of a business partner it is not unusual for that early enthusiasm to wane. The organizing of regular stakeholder gatherings to reflect and review the work to date often provides the trigger to re-activate that initial enthusiasm.

The following key performance areas of sustainable environment management can be used a checklist against which progress can be evaluated. Not all points will apply to every Inclusive Tourism project, so TSIs/consultants will need to select those which are appropriate.

- Energy efficiency, conservation and management;
- Waste water management, drainage and pollution of streams or lakes or sea;
- Waste minimization, reuse and recycling;
- Storage and use of environmentally harmful substances;
- Management of freshwater resources;
- Tourism land use planning and development;
- Local socio-economic benefits of tourism;
- Reduction in greenhouse gas emissions, air quality protection and noise control;
- Ecosystem conservation and management;
- Management of social and cultural impacts of tourism;
- Cultural heritage conservation.

In convening a stakeholder monitoring and evaluation discussion, the following questions could form the basis for such a gathering. Again, not all questions will have the same relevance for different Inclusive Tourism projects or enterprises.

7.1. Reflect

- What has been accomplished so far?
- What are the stakeholders proud of?
- What have the stakeholders learnt?
- Have they benefited from new information?
- Have partners/members learnt new skills?
- Can this learning be incorporated into the Inclusive Tourism project or enterprise?

Source: Clip Art.

7.2. Evaluate

- What is working?
- What is not working?
- What do visitors value and are prepared to pay for?
- Are the stakeholders working together on environmental management in terms of energy usage, waste minimization, and waste recycling and re-use?

7.3. Assess

- Do the stakeholders, especially the community, still possess the same assets?
- Are its strengths for the project or enterprise the same as when it started, or have they changed in some way? (Grown stronger, now more varied; or are they weaker?)
- Are there still the same opportunities or are there more or less opportunities?
- In particular what are the benefits for the community in terms of poverty reduction?
- And how can the stakeholders build upon the strengths and opportunities for sustainable and marketable Inclusive tourism for poverty reduction?

7.4. Re-direct

- Following discussion of the questions raised above, is it appropriate for the project/enterprise(s) to continue in the same direction?
- Or should the original plans and processes be modified to improve things?
- The answer to these questions can be found by going back to the beginning.

What, **why**, **where**, **when**, **who**, and **how** will activities be undertaken to achieve the goals in sustainable environmental management for poverty reduction of participating communities?

As the stakeholders work through these questions, they will find that sometimes they lack indicators, or time frames, or ways to measure just what progress has actually been made. As part of the monitoring and evaluation process, TSIs may therefore wish to help them set baselines or benchmarks against which future developments can be measured.

For example, in terms of energy minimization, if a community is using wood for fuel they may decide to set a target to reduce fuel wood consumption by 10% a year for the next three years using alternative technologies – and perhaps plant 2-6 trees per family per month for 12 months if land is available for this purpose.

They may decide that waste should be minimized by 5% every month for six months and then see how much has been achieved. Setting targets becomes an important way to monitor progress against objectives to ensure year on year improvement.

TSIs/consultants should also teach stakeholders ways to maintain records of community consultations and communication so that each time a monitoring and evaluation gathering meets they can move forward from their last meeting.

Finally, as an integral part of monitoring and evaluation, TSIs/consultants should be proactive in raising stakeholder awareness of local and global environmental issues, since they would normally be more knowledgeable about advances and developments.

8. Implementing a programme of environmentally friendly production

This section consolidates many of the principles, lessons and examples of sustainable environmental management outlined in previous sections in order to suggest ways in which to implement environmentally friendly production related to Inclusive Tourism supply/value chain enterprises.

In approaching the issues of Inclusive Tourism for poverty alleviation the critical factor is to be clear about the objectives. In the context of this manual, poverty alleviation is linked strongly and clearly into economic development and income generation as the primary objective, but this objective can be obtained through different approaches such as a focus on conservation of natural resources available to a community; or development of various cultural resources such as handicraft production, or festivals, or built heritage and historic sites, or simply the socio-cultural 'landscape' of every-day living. Other avenues are through gender equity; or though linkages into other components of the tourism system such as backward linkages (e.g. market gardening) which will provide essential goods and services to frontline operators.

The need to confront climate change issues through adaptation and mitigation are fundamental to the future of the tourism industry globally. The principles of Sustainable Environmental Management follow the approach with a focus on contributing to increasing or improving conservation of natural and cultural resources in ways which in effect constitute the 'acting locally' component of 'thinking globally' while seeking to achieve local economic development through revenues from tourism. At the end of the day, all forms of tourism should provide a sustainable social and environmentally responsible product. However, benefits from tourism for poorer segments of populations cannot be planned in 'idealistic isolation', complete unto itself: it must be linked into the wider tourism industry, engaging other sectors and other stakeholders, hence the concepts of 'Inclusive Tourism' and 'mainstreaming' to bring impoverished communities into various forms of partnership with thriving established mass tourism destinations.

Tourism's capacity to achieve benefits for poor communities will also be affected by a wide range of other actors whose policies must be taken into account, such as a national parks and wildlife departments which will have legislative control over forests and other protected areas; or security bureaus which will determine whether visitors can or cannot access particular districts of a country; or departments responsible for agriculture, commerce, international treaties, visa entry conditions, currency; and so on.

Planning for inclusive tourism for poverty alleviation takes place in a complex environment and effective linkages across a range of actors and sectors will need to be constructed if it is to be sustainable. For these reasons it is often preferable to work with communities that are located within an existing tourism industry structure ('mainstreaming'), rather than attempting to introduce a new product in non-tourism environment. As an extension of an existing product into an existing market, this form of tourism carries the least risk and has the strongest chance of success, particularly when linked into existing marketing and promotion channels, and a capacity to utilise existing transport modes and channels. However, a new product in a new market for obvious reasons carries the highest risk. In general, it will be difficult for a community to undertake this kind of tourism enterprise (at least by itself without the support of an existing established player willing to assist) because it will be 'pioneering' both product development and market awareness. However, in terms of competitive advantage it may have an edge because it is something that has not been offered before. Inclusive tourism as defined and practiced by the ITC takes poverty alleviation in a much broader direction through the application of value chain analysis. This examines the tourism supply chain with a view to identifying new opportunities for poor communities to engage with tourism as a supplier of a particular product (labour, materials, food and beverages, handicrafts) without necessarily engaging in tourism through e.g. homestays, ecotourism, etc. In effect ITC's Poverty Reduction Programme is a pioneering approach with new forms of private sector/community/public sector partnerships, working with ccompanies operating in mainstream destinations and integrating local communities into their operations by direct, specifically targeted, pro-active interventions aimed at poverty alleviation, rather than through the passive so-called 'trickle down effect'. The ITC's Bahia Coconut Coast Project in Brazil is a sound example of the effectiveness of this approach.

Plate 24. Coconut Coast, Bahia, Brazil

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