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# 2<sup>nd</sup> White Paper Tourism and Water:

# From Challenges to Solutions

Providing the  
business case

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EarthCheck Research Institute



EARTHCHECK



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# From Challenges to Solutions

### Providing the business case

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EarthCheck Research Institute

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The EarthCheck Research Institute (ERI) is a not-for-profit company whose goal is to be a leading international centre for scientific excellence in sustainable tourism. The institute focuses on scientific research, education and capacity building to solve real-world challenges. The role of the ERI is to provide advice on the key sustainability and climate change issues now facing the world's travel and tourism industry and to provide advice and assistance to industry on the changing needs of new mandated reporting standards for climate change and sustainability. The ERI includes eight international centres of excellence with an established reputation for ground-breaking research.

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## Executive summary

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This second White Paper, From Challenges to Solutions, maps water stress and scarcity in the Asia Pacific region against tourism water use. The paper reviews new evidence to better understand the key drivers for water utilisation in hotels and where management action should be best focussed.

Primary data on hotels are sourced from a survey of hotel operators together with benchmarking data drawn from the international EarthCheck Certification database. In addition, a comparison of municipal and tourism water use per person per day is undertaken to gain some understanding of the key issues associated with water equity and responsible water management at a destination level.

At present, water is undervalued relative to its true environmental cost, but as this paper shows, this situation is changing in many countries. Water costs are increasing while expectations for more sustainable water use by the tourism industry are growing.

The paper identifies the need for tourism operators, destinations and managers to understand better the implications of increases in water prices alongside issues of availability and quality. There is no clear separation of these three dimensions. Water management initiatives and operational responses which offer multiple benefits are discussed through case studies and survey responses.

The case studies cover a diverse range of measures related to:

- Operations and water management
- Behaviour of staff and visitors
- Technology options
- Alternative water sources
- Destination stewardship

Finally the paper begins to sketch out future challenges and opportunities that the tourism industry must consider. The most important area of operational interest is the water-energy nexus. Water and energy consumption are highly interlinked and this nexus, if handled properly, can bring additional economic benefits which have thus far been neglected.

From Challenges to Solutions speaks directly to the need for the tourism industry to take more affirmative action on responsible water use.



# 1. Introduction

In March 2013, The EarthCheck Research Institute in partnership with Griffith University, EC3 Global and Ecolab, released its First White Paper on Tourism and Water (Becken et al. 2013). In this paper, the water challenges facing the Asia-Pacific region were discussed with a particular reference to tourism businesses and destinations. The focus on the Asia Pacific was, and still is, warranted as it is one of the fastest growing tourism destination regions on this planet, in turn demanding increasing amounts of quality water to cope with expanding resident and visitor populations.

Tourism visitation in the Asia Pacific is growing rapidly at a rate of around five percent per annum. It is estimated that by the end of 2014, the region will welcome close to 500 million international visitors annually. At the same time, quality water supply is increasingly constrained by industrialisation, pollution, and changing hydrological cycles in response to global climate change.

There is increasing concern about the equitable use of water, particularly in the Asia Pacific region. This is especially pressing in regions that are chronically water scarce, for example India and parts of China. Here, questions of both water availability and quality are critical for local communities. Tourism managers and operators need to engage in this debate.

The impacts of climate change are expected to result in more extreme weather conditions with increased risks of both droughts and floods (IPCC, 2013). An increase in weather variability makes the topic of water availability increasingly salient for the future. The responsible management of water by tourism businesses will assist resource governance beyond the tourism industry. This highlights the potential leadership role the tourism sector can – and already does – play in many destinations in the Asia Pacific.

The first White Paper proposed that understanding the importance of cost, availability and quality of water is essential for tourism businesses

as they inform important questions about operational management, design, planning, procurement, and development pathways. Businesses that are engaging proactively in water allocation and management discussions and are prepared to audit their water use will have a competitive advantage in a future world of water constraints and/or high costs.

At present, water is undervalued relative to its true environmental cost, but as this second paper will show, this is changing in many countries. Water costs are increasing.

The first White Paper presented an initial high level review of water use benchmarks in Asia Pacific hotels. This analysis revealed that the water consumption at hotels is substantial, but also varies considerably between businesses and regions with per-guest night usage ranging from around 200 to 900 litres. More detailed statistical analysis is presented in this second paper to help understand key drivers of water use in hotels.

This second White Paper, “From Challenges to Solutions“, presents key water measures that hotels should implement. Detailed case studies are provided to illustrate returns on investment from different water saving measures. At the same time this paper begins to outline future challenges and opportunities that the tourism industry will have to deal with.

We know that there are still questions about broader issues, for example how to manage the water footprint of the hotel’s supply chain. Other important questions relate to how to measure and manage outsourced activities such as laundry.

“From Challenges to Solutions” speaks directly to each of these areas; all of which require urgent action to ensure the tourism industry is well placed in this changing, and progressively more critical, water environment.

**While aiming to provide useful information to tourism managers, this White Paper is also a call to action.** It is no longer sufficient to simply address water use by ‘picking the low hanging fruit’ and making minor or incremental operational adjustments. The paper argues that greater change is needed. There are at least three good reasons for this. First, operational costs of water (and energy) are increasing and will continue to do so in the future. Second, increasing water scarcity at many destinations will put more pressure on tourism companies to perform responsibly while not compromising the development opportunities of the local population. And thirdly, the intrinsic relationship between water and energy makes the efficient use of both much more acute than previously thought.

**An intrinsically important area of operational interest is the water-energy nexus. It is increasingly understood that saving water improves energy efficiency, and vice versa. This water-energy nexus can bring additional economic benefits that have thus far been neglected.**

## 2. Methodology

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This White Paper draws on secondary literature from scientific papers, online case studies and business resource management reports to identify key issues and leading practice in water management in tourism. In addition, primary data from the EarthCheck database was used to gain more detailed insight into tourism water use patterns around the world. The analysis of water equity sought to develop a picture of tourism's water use relative to domestic water use by local populations. Estimates for local population water use were sourced from the United Nations Food and Agriculture Organisation's (FAO) (2013) AQUASTAT database. While tourism and non-tourism data are not completely compatible, a picture

of water discrepancy emerges and has important implications for tourism management.

A sub-sample of data from 210 hotels located in Asia Pacific who are members of the EarthCheck Benchmarking and Certification Programme were used for more detailed water modelling. Using these data, an econometric model was developed to test the influence of different factors (e.g. hotel room number, guest nights, hotel type, price, swimming pools, fitness facilities, restaurants, business facilities and day spas), on total and per guest night water use in hotels. A preliminary review of this research is enclosed in this White Paper.

Further insights will be provided in a Technical Paper which will be released at the end of 2014. Finally, a survey of EarthCheck members was undertaken in December 2013. The survey attracted a respondent list of some 181 participants. The respondents provide a truly global sample with 57 countries represented. The survey contained both closed and open-ended questions, with the data compiled for further analysis. A wide range of ideas, innovations, and examples of leading practice were collected through this member survey to complement secondary data sources described above. Where appropriate the survey findings are presented to provide greater richness to the analysis.



## 3. Tourism and Water Equity

An increasing number of destinations around the world are suffering from water stress or scarcity. This section reviews some of the key regions that suffer from water scarcity, and discusses the water use of hotels in these locations. Reputational risks for tourism are considered through the lens of equitable water distribution and use.

### 3.1 Water stress and scarcity

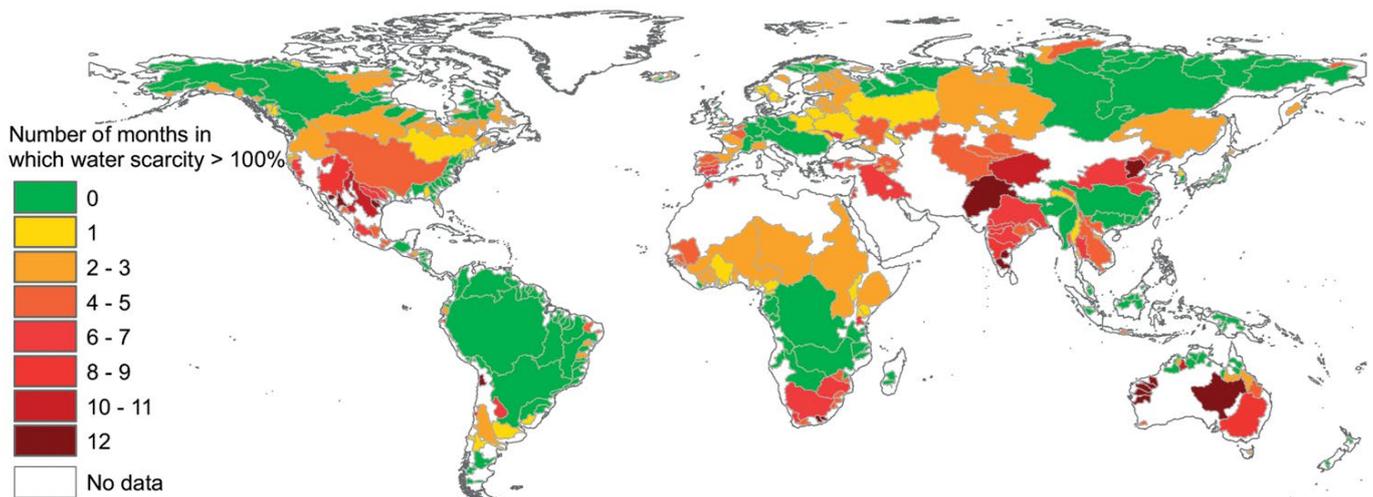
Water stress can be related to a threshold that is reached when annual freshwater supplies drop below 1,700 kilolitres per person (equating to 4,660 litres available per day); water scarcity means that fewer than 1,000 kilolitres per person (or 2,740 litres available per day) are available (United Nations

(UN) Water 2012). Moreover, in some circumstances water may be available, but heavily polluted or saline.

Tourism-related water use most likely competes with that of the local population, since both primarily draw on municipal water supply. In some destinations, this additional demand may lead to stress. In Bali, Indonesia, for example, tourism reportedly consumes 65 percent of local water resources, and conflict between the hotel industry and local communities is evident (Cole 2012). **Figure 1** visualises the urgency of addressing the water problem in Asia Pacific.

**Over 75% of the Asia-Pacific countries are experiencing serious water stress, with the region facing an imminent water crisis if immediate steps are not taken to improve water resource management (Becken et al. 2013). In some areas, we are literally running out of clean water – both for the local population and tourism. It is critical for tourism to be involved in addressing this challenge.**

**The key message for hotel operators is: your business may be located in one of these water stress areas. Make a point of understanding your region's current water status and the areas which form part of your supply chain. One simple tool is the AqueDuct mapping software available online through the World Resource Institute (Webb 2013)**



**Figure 1** The number of months in which water scarcity exceeds 100% in the 405 river basins studied (Hoekstra et al. 2012).

### 3.2 Tourism water equity

To investigate aspects of water equity two datasets were used to contrast tourism water consumption with that of the local community. The UN FAO (2013) AQUASTAT database is a global information system on water and agriculture which collects and analyses information on water resources and water uses. The indicator of ‘municipal water withdrawal per capita’ was used to provide a basis of comparison with per-guest night water use in hotels, provided through EC3’s EarthCheck database. Sufficient data was available for 21 countries, of which 12 are from the Asia Pacific region.

The highest per guest night water use was found in the Philippines (981 litres/guest-night), China (956 litres/guest-night) and Malaysia (914 litres/guest-night). While tourism’s share of municipal water use is typically quite small it can be as high as 7.2% as in the case of Fiji (Becken forthcoming). At the same time, countries such as Fiji and most Asian countries are characterised by very low municipal

water withdrawal per capita per day (less than 150 litres), indicating greater water constraints on domestic and tourism use in developing or emerging economies.

As can be seen in **Figure 2**, tourists’ per day water use in Fiji and Sri Lanka exceeds that of locals by a factor of over eight. China, India, Thailand, the Philippines and Indonesia also reflect substantial differences in water use between locals and tourists. Countries where water use by tourists is comparable with that of the local community, or even lower, are typically more developed high income countries.

The analysis of water equity issues in relation to tourism highlights a disparity that is particularly evident in developing countries, and those that already suffer water scarcity such as Egypt or India. Large disparities are likely to result from extensive use of water by accommodation providers for example in landscaping, pools and other water features within tourism establishments when compared with the very constrained domestic water use by locals. Such imbalances raise

serious concerns about water equity and the ethics surrounding water access. The analysis indicates that tourism businesses need to not only focus on their own operations and efficiencies, but to take a broader destination perspective that integrates business needs with those of the local community.

**Call to Action:**

If your business uses a lot of water you need to understand why and what can be done to reduce water use. The findings on water equity highlight the critical need for operators and hotels to get involved in destination stewardship initiatives that help provide clean water access to the local population. **If tourism operators ignore responding to the need for responsible water use they risk exposure to negative press and brand reputation** (CERES 2011). These risks can also include possible interruptions to water supply from disgruntled community members and other conflicts (Tourism Concern 2012).

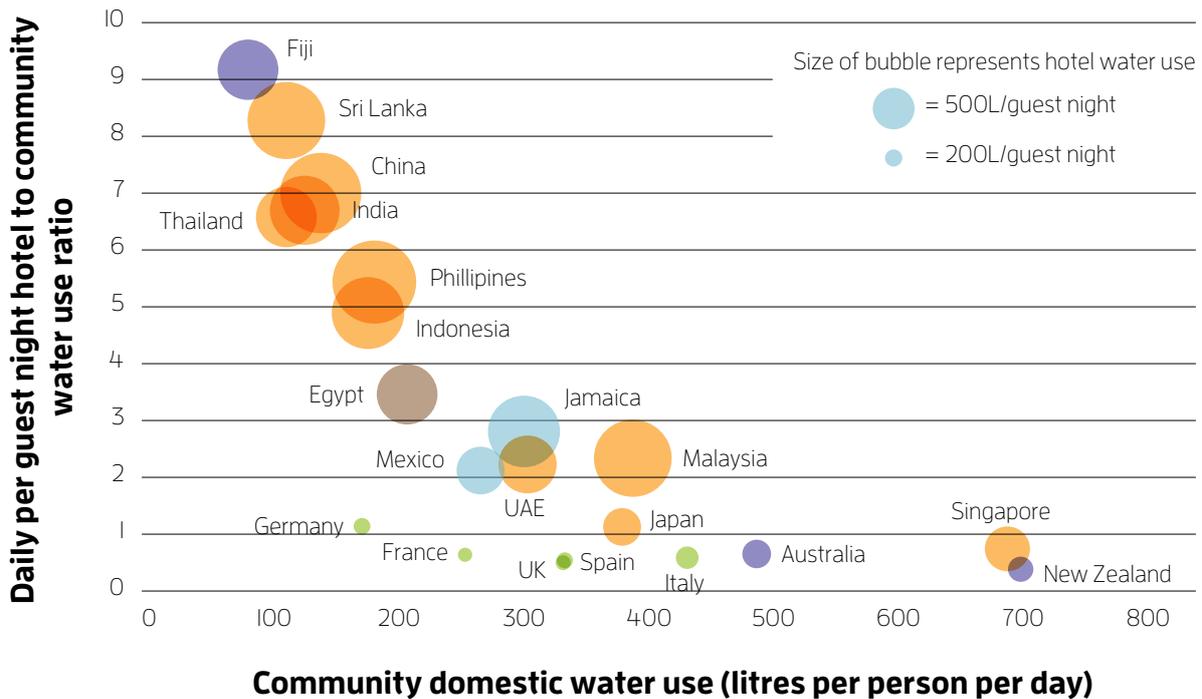
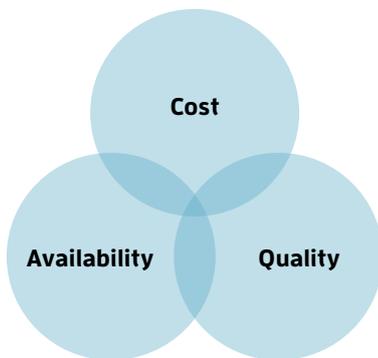


Figure 2 Comparison of municipal and tourism water use per person per day.

## 4. Bringing it Back to Business

### 4.1 Overview

In addition to potential water conflict, increases in water prices and operational costs are a business risk. For any tourism business it is essential to understand the importance of cost, alongside the issues of availability and quality of water (**Figure 3**).



**Figure 3** Three key dimensions of the water challenge: Cost, Availability and Quality.

The direct costs of water use by most hotels is relatively low as a percentage of revenue generated (less than 1 percent or 26 percent of hotel utility expenses).

In future, how water is priced and managed at a property and destination level will change as availability and quality concerns become more critical, and as the level of understanding of the nexus between water use and energy use increases.

In the following section, the rising cost of water will be discussed. Particular consideration will be given to the increase in water tariff rates in different Asia Pacific cities. This is followed by a section on water availability and quality. As visualised in **Figure 3** above, there is no clear separation of these three dimensions as they are highly inter-related. Investment into cost savings, for example, will usually also benefit aspects of water availability and quality, and vice versa. Measures with multiple benefits are clear win-win options for addressing water consumption.



## 4.2 The cost of water

Some accommodation providers can spend up to 30 percent of total utility expenses on water (Barberan et al. 2013). This is particularly evident in water scarce environments, such as small island destinations that often rely on desalination or water transported in by ship. Reducing water use is not only a sustainability measure, but it is increasingly important for the financial bottom line.

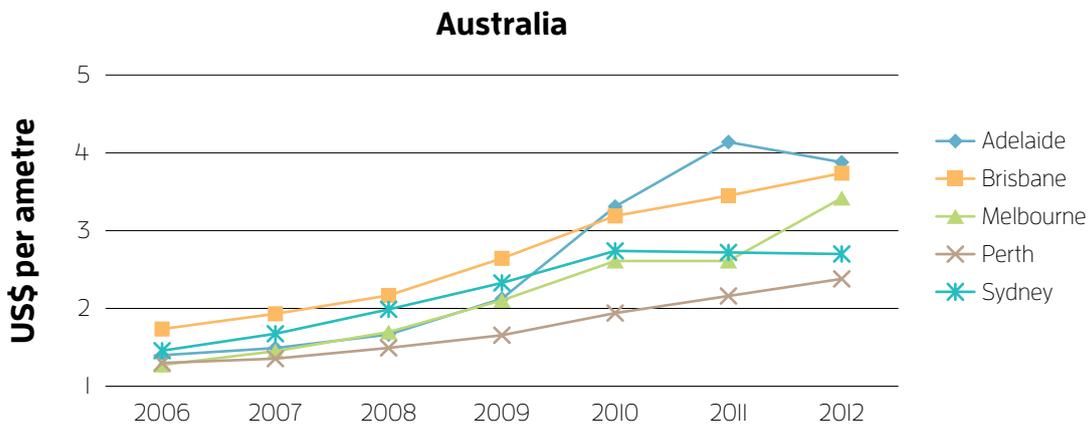
Differences in water costs across destinations are considerable. **Figure 4**

shows the rates of water in five different Australian cities, ranging from US\$ 2.40 per cubic metre (m<sup>3</sup>) in Perth to 3.88 US\$/m<sup>3</sup> in Adelaide. It can also be seen that water rates have climbed at an average of 14 percent per year in Australia’s cities between 2006 and 2012 (up from \$1.43/m<sup>3</sup> to \$3.22/m<sup>3</sup>).

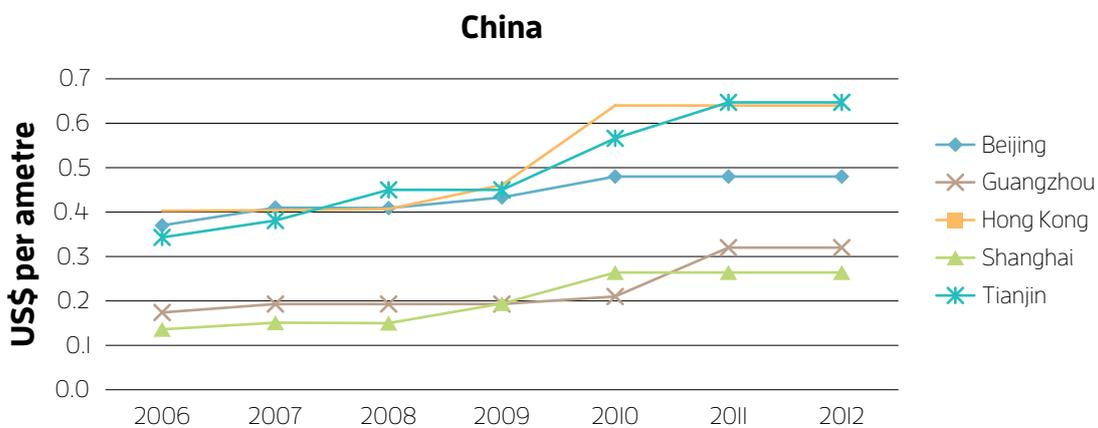
It should be noted that these costs are for municipal water supply based on a standard benchmark consumption rate of 15 cubic meters per day (which is relevant to commercial enterprises and not residences). The data are sourced from the most recent global

municipal water tariff survey of almost 360 utilities (Global Water Intelligence (GWI) 2013).

Public utility water rates in China are considerably lower than those in Australia. The most expensive cities are Hong Kong and Tianjin at about US\$0.65/m<sup>3</sup>. Rates have climbed at an average of 9% per year in China’s cities between 2006 and 2012 (up from \$0.29/m<sup>3</sup> to \$0.47/m<sup>3</sup>), but most of this increase occurred between 2008 and 2010. Since then, water rates have been flat (**Figure 5**).



**Figure 4** Municipal water tariff rates in selected Australian cities.



**Figure 5** Municipal water tariff rates in selected Chinese cities.

Water is a scarce resource in many parts of India; yet water rates are low by comparison and do not reflect the true cost of providing water (Figure 6). Average public utility water rates have dropped in India's cities between 2006 and 2012 (\$0.154/m<sup>3</sup> to \$0.152/m<sup>3</sup>), although the large cities of Delhi and Mumbai have had steady increases since 2008. The recently elected populist Chief Minister of New Delhi announced that he is going to drastically reduce power costs and supply free water for residents in India's capital (Dec 2013). The free

water (effective from Jan 1, 2014) will be limited to 667 litres per day per household and will be paid for by increasing rates by 10% per annum for those users who consume over this threshold of 20 m<sup>3</sup> per month (Mehrotra 2013). Practically, this surcharge would apply to all businesses, including hotels.

The water rates in most other Asia Pacific cities outside India and China have barely increased over the last six years. In most cities in this region, water rates are well below the global

average of US\$1/m<sup>3</sup> (GWI 2013). Manila in the Philippines is one of the few cities where rates have steadily increased in this period, at an average of 13% per year between 2006 and 2012, although 2012 rates were still less than US\$0.5/m<sup>3</sup>. However, regulators recently ordered that rates have to be cut by 29%, causing share prices of the privatized Manila Water Company to crash (Sep 2013) (Sayson 2013). Auckland, Tokyo and Singapore are exceptions with relatively higher water rates (Figure 7).

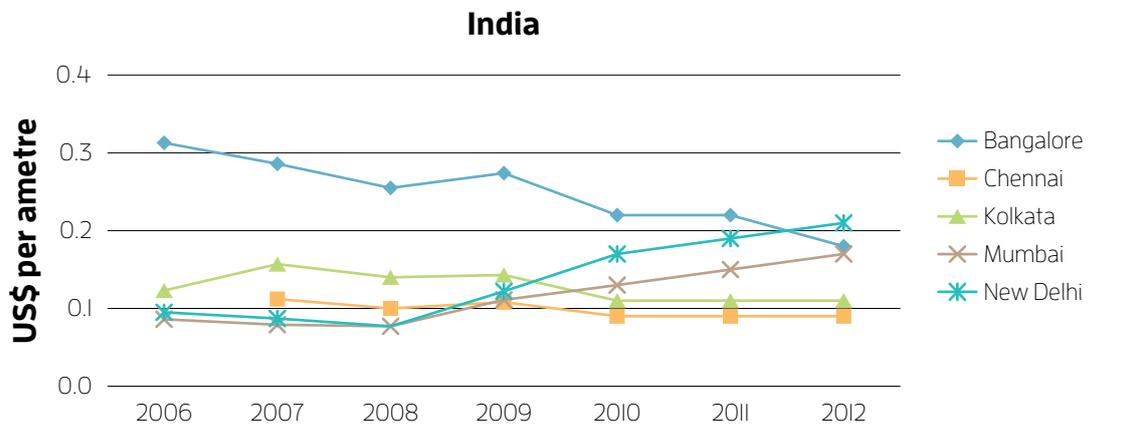


Figure 6 Municipal water tariff rates in selected Indian cities (Sources: Global Water Intelligence/ American Water Intelligence 2013).

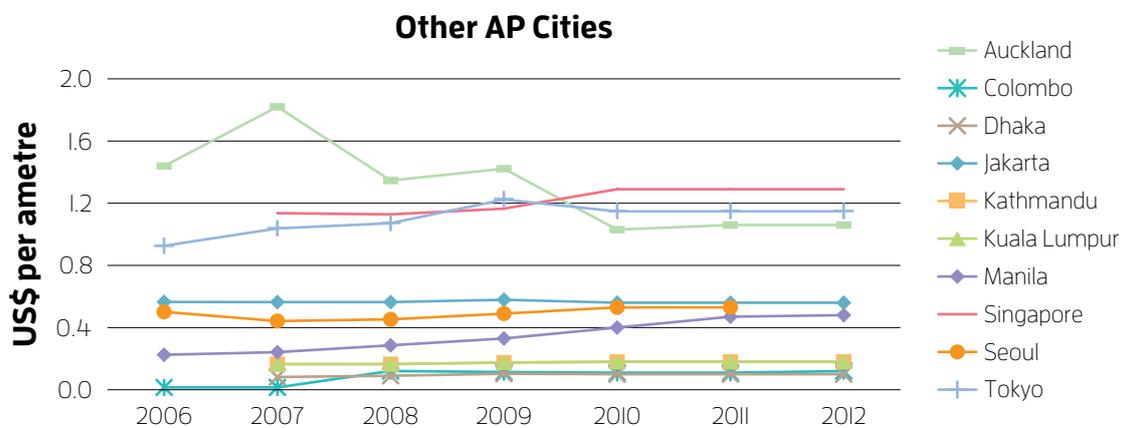


Figure 7 Municipal water tariff rates in selected Asia Pacific (AP) cities.

### 4.3 Availability and quality

Recent trends including the increasing intensity of agricultural production and rapid development and urbanisation have resulted in increased withdrawal of freshwater resources, with mounting risks of water stress. Globally, domestic water use alone has grown on average by 2.2% every year for the last 60 years (Flörke et al. 2013).

The fourth edition of the World Water Development Report recognises the urgent need to bring water challenges to the centre of societal and economic decision making. It argues that “robust governance mechanisms are required to protect water resources and ensure sustainable development and equitable distribution of water-derived benefits” (United Nations Educational, Scientific and Cultural Organisation (UNESCO) 2012, p. 2). The report further highlights the need to involve industry to reduce its potential for large scale unsustainable use of freshwater resources. Tourism is a major global industry that is known to be a substantial contributor to local water demand (Garcia & Servera 2003; Gössling 2001; Gössling et al. 2012).

The future availability and quality of water will also be strongly influenced by global climate change. Analyses of climatic trends in Asia Pacific reveal a complex picture. China, for example has experienced an overall decrease in precipitation in the last fifty years, although some areas in the West and the middle and lower reaches of the Yangtze River have seen an increase in rainfall. South East Asia and the Western parts of the South Pacific have recorded an increase in precipitation, whereas Fiji, the West of Australia and the East of New Zealand have received less precipitation (Dore 2005).

The above challenges and trends highlight that greater emphasis must be placed on the design of locally appropriate approaches to water reduction, conservation reuse, and recycling.

In addition, increasing attention needs to be paid to water quality

– both in terms of the quality of freshwater supplied and the treatment of waste water. Discerning tourists could potentially change their choice of destination if environmental degradation becomes increasingly evident (Fortuny et al. 2008).

Addressing water quantity and quality in the tourism business *and* at the destination needs to be achieved through a multi-dimensional portfolio of activities:

1. Installing well-established water saving technology to capture the ‘early gains;
2. Changing work practices and behaviours;
3. Installing advanced technology to maximise water savings;
4. Accessing alternative water sources; and
5. Supporting destination stewardship activities that focus on water.

The above activities are discussed in more detail in the following sections where water use (i.e. the quantity dimension) in the Asia Pacific region is explored in more detail (**Chapter 5**) followed by relevant business case studies (**Appendices**).

The EarthCheck Building and Precinct Planning and Design Standards have a set of guidelines which can be used to ensure that a project’s development’s design establishes a more efficient use of freshwater supply and stormwater collection. More discussion on the Design and Planning Standards is offered in **Section 6.4**.

**Water availability and its supply to the tourism industry, as part of a wider catchment management plan, must be ensured to enable the industry to trade effectively, year round.**

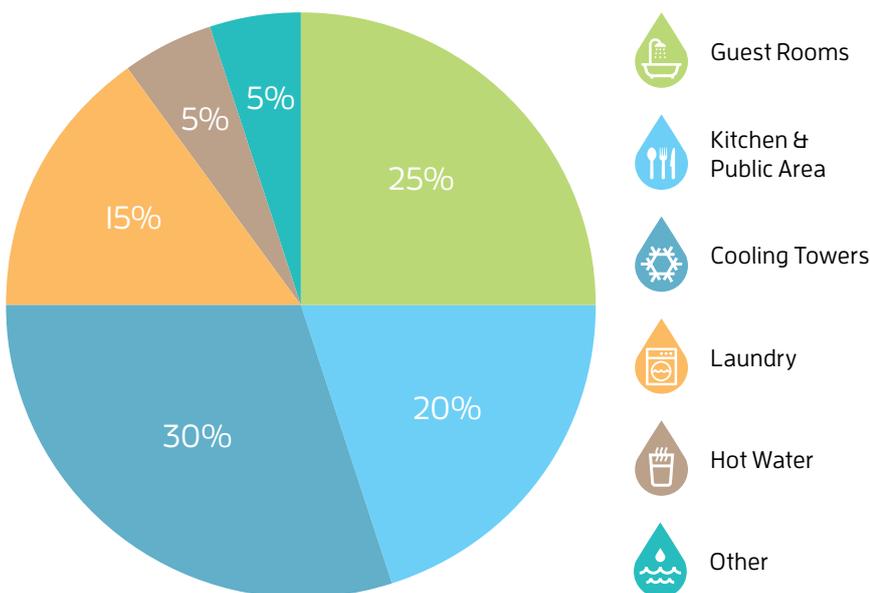
Of critical significance to this discussion is the need for hotel developers and operators to factor in water management considerations into future site selection and design.

## 5. Water Use In Hotels

### 5.1 Global water use profile

Water is required for a wide range of services at a hotel or resort. Water use profiles can significantly vary from one property to another. A study by Barberan et al. (2013) identifies several key factors in determining total water use in a property. These are noted as: 1) climate; 2) category of hotel; 3) number of rooms; 4) occupancy levels; and 5) visitor services within the hotels. Barberan et al. (2013) found that the average use per room per day in a four star hotel was 124.3 litres, of which 41.2 litres was for hot water. They further estimated that 50.7 percent of the water consumed by the hotel was used in public areas (e.g. reception, restaurant, kitchen, lounges, pools, gyms etc.), with the remainder being consumed by the guests in their room (see also **section 6.4** of this paper).

Different end uses of water in a large hotel are reflected in **Figure 8**. This analysis relates to a 500 room, upper scale hotel having 80% average occupancy which uses approximately 124 million litres of fresh water in a year - equivalent to the volume of water in fifty Olympic size swimming pools.



The EarthCheck Research shows that the breakdown into different end uses will vary widely subject to the size of hotel, climate zone and range of services and facilities. Additional considerations include the number of swimming pools and water features which can lead to as much as 30% increase in water use; and irrigation of landscaped gardens which can add as much as 5% of total water use.

**Figure 8** Average Water Use per Area - Upper Scale Resort (Ecolab 2012)

## 5.2 A lens on water use in Asia-Pacific hotels

### 5.2.1 Model development

The EarthCheck platform provides a comprehensive database where causal indicators can be used to understand better resource consumption. Based on water use data supplied by a sample of 210 member businesses located in the Asia-Pacific it was possible to develop a robust region specific water-use model (McLennan et al. forthcoming). The businesses used for the analysis below are located in Australia (n=88), New Zealand (n=27), Hong Kong (n=15), Singapore (n=9), Indonesia (n=32) and Thailand (n=39).

An econometric model was built to explain both total annual and per guest night water use in a hotel (**Figure 9**). The following variables were included in the analysis for each hotel:

- number of hotel rooms;
- total guest nights per annum;
- hotel type (business versus vacation);
- region (i.e. Asia versus Australia/ New Zealand);
- location (i.e. urban versus regional);
- climate zone;
- price (online rack rate as a proxy of ‘luxury’); and,
- hotel facilities (i.e. number of function rooms, business rooms, meeting rooms, spa facilities, swimming pools, fitness rooms and dining/bar facilities);
- an overall rating of water saving measures in place.

The results of the model are presented in the following sub-sections.

### 5.2.2 Asia Pacific water model results

For ease of discussion hotels in Asia were separated from those located in Australia/New Zealand to recognise the different operating conditions experienced (see **Box 1**). The EarthCheck Research Institute will follow this initial analysis with a set of country by country comparisons.

The EarthCheck Research Institute will continue to drill into the dataset collected to examine the key differences which exist in water use of hotels as a result of climate zone, number of pools and water features and size and variety of guest services.

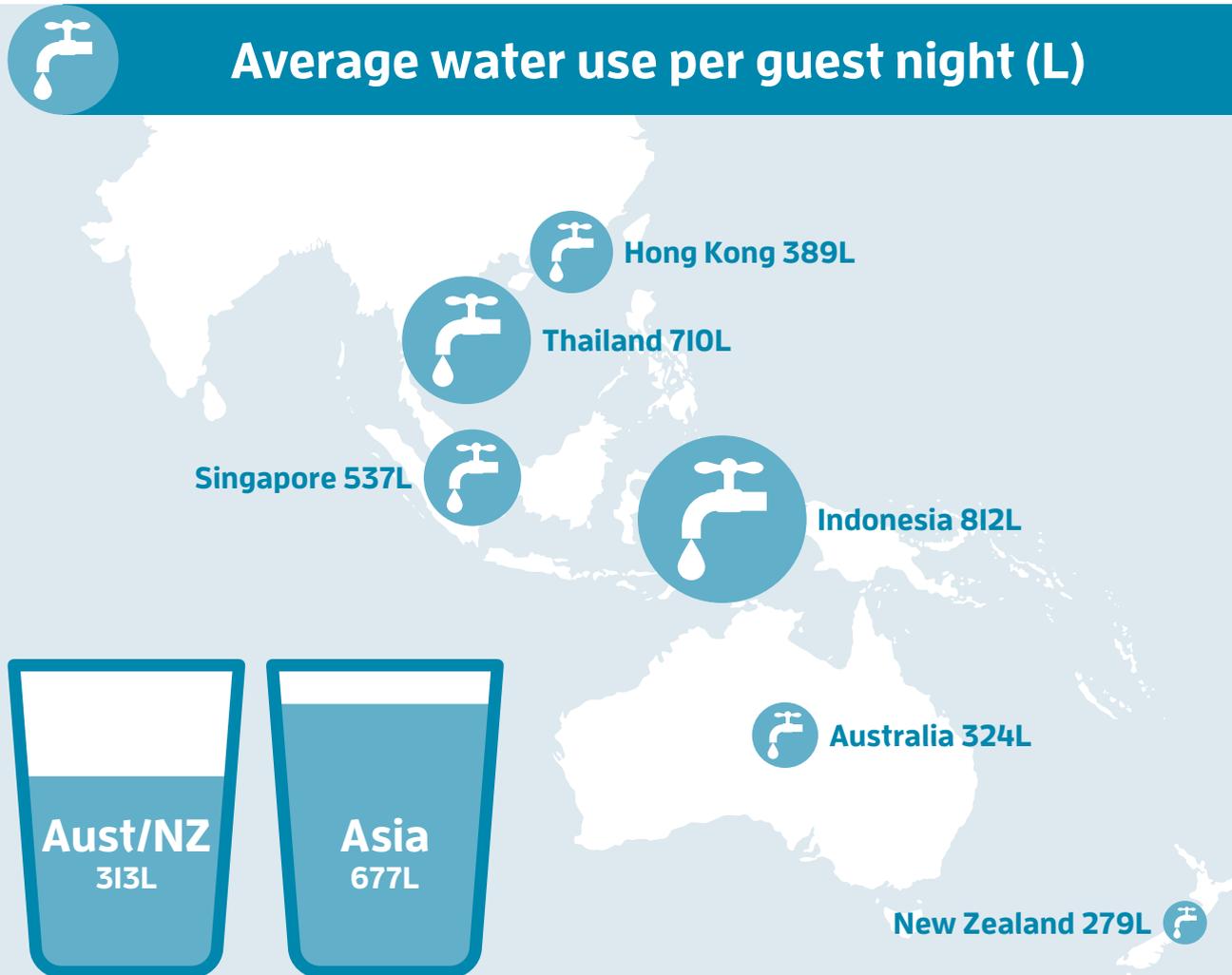
#### Asian Hotels

- **Water use:** 677 litres per guest night
- **Total average water use per property:** 118,500 kilolitres
- **Facilities:** Significantly more likely to have a fitness facility, a day spa, more pools, a business centre and more dining venues
- **Average guest nights:** 185,200 nights
- **Average hotel rooms:** 339 rooms
- **Price:** AS\$167 per night
- **Dining facilities:** median of 6

#### Australia/New Zealand Hotels

- **Water use:** 313 litres per guest night
- **Total average water use per property:** 31,440 kilolitres
- **Water savings:** Significantly higher “water savings” rating than Asian hotels. Aus/NZ hotels were far more likely to have low/dual flush toilets installed.
- **Average guest nights:** 101,250 nights
- **Average hotel rooms:** 229 rooms
- **Price:** AS\$189 per night
- **Dining facilities:** median of 3

**Box 1** Key Differences identified between hotels in the Asia Pacific



**Figure 9** Average water use per guest night in Asia Pacific hotels.

From the analysis of the current dataset, a key driver of water efficiency was shown as the percentage of all toilets installed being low/dual flush. Other key determining factors of water use were price per night, total number of hotel rooms, and dining/bar facilities. In particular, hotels located in Hong Kong had 43% lower water use compared with hotels in other Asia Pacific climate zones, while those in the Indonesian Climate Zone 2 (South) had 26% higher water use than hotels in other climate zones included in the model (e.g. 3 zones in Australia, 2 zones in New Zealand, etc.). The high water use in Indonesia is likely to reflect larger tourist resorts with extensive landscaping. Low water use in Hong Kong is likely to be achieved due to the use of salt water in toilet flushing (Leung et al. 2012).

Key insights from the model were:

- Water economies of scale begin to appear with an increase in guest nights. Once a property has reached a certain threshold in capacity for every 10% of additional guest nights water consumption increased by 6%.
- Having pool facilities has a substantial impact on water use per guest night and can raise water use as much as 30% per guest night subject to the number of pools. Having an extra dining or bar facility increases average per guest night water use by 6%.

Understanding high-level relationships between key drivers and water use is important for businesses. Solutions to achieve practical outcomes in terms of water efficiency are presented in the next chapter.

## 6. Taking Action



This chapter brings together management practices that are widely known, but not always implemented, with more novel ideas and practices around water saving that have yet to be explored. Where appropriate, case study material has been included in the Appendix.

### 6.1 Operations and water management

There are a wide range of initiatives which offer positive water management practices. In order to provide a useful baseline of actions, we have drawn from three core sources of information: Sustainable Tourism Online (2014), The Responsible Tourism Handbook (Global Nature Fund 2003), and The Green Hotelier (International Tourism Partnership (ITP) 2013). This information, combined with knowledge from the EarthCheck Benchmarking and Certification Program, can be used as a guide of minimum usage standard practice.

#### 6.1.1 You Can't Manage What You Don't Measure

In order to manage water, you must first measure its use. The first task is to complete a water audit. The key questions in this task include:

- i. Are water meters installed across your hotel?
- ii. How much water is used within each department or activity space?
- iii. Can you trace water use over time?
- iv. Can you map consumption and cost against industry averages to benchmark your performance?
- v. Can you calculate water used per guest night?

**From the Survey:**  
Monitoring is completed daily by 62% of survey respondents.

By maintaining a daily check of meters, early detection of leaks is possible thereby reducing your potential cost exposure.

How often do you monitor your water use?

#### 6.1.2 Water Management Planning

Once site specific data are available, a water management plan can be developed and put in place. Steps to develop a plan should comprise the following:

- i. Establish a Water Champion and a Green or Blue Team to manage water use and establish a water target.
- ii. Provide each department with a mini water audit checklist and a communication sheet to foster understanding by staff.
- iii. Measure departmental performance within the property and benchmark against similar hotels.
- iv. Investigate what rebates (Local, Regional, National) may be available to offset equipment or technology upgrades.
- v. Provide capacity building and training to all staff and suppliers.
- vi. Celebrate your success at regular intervals.
- vii. Look for community and commercial opportunities to collaborate on water management initiatives within your local area or region.

**From the Survey:**  
Sub-meters were used by 56% of survey respondents.

Respondents indicated swimming pools, guest rooms, restaurants and kitchens as the most common areas where sub-metering is installed. Also reflected was a high level of sub-metering in laundry operations.

Sub-meters are a large part of the water saving plan for Alila Ubud:

*"What it [sub-metering] allows is for me to track the loss of water or the misuse of water in different sections of the property. For the pool area alone, we have found weekly savings of 60kL thanks to the sub-meter."*

– Alasdair Davidson  
– General Manager Alila Ubud

### 6.1.3 Where to Look First

Fittings that save water use in guestrooms are well known. Examples include dual flush toilets, low flow shower heads, and low flow water taps for hand basins. For older hotels, improving on water efficiency often means retrofitting (see **Appendix 9.1**).

#### **Bathrooms**

EarthCheck data tells us that as much as 50% of water use is associated with guest rooms.

- Start with measuring your shower head flows. A bucket and a timer can be used for this. The suggested water flow is 9 litres per minute (SaveWater n.d.). Some hotels can go as high as 20 litres per minute. There is now aerator technology available which reduces water flow while maintaining guest comfort under the shower.
- The Asia-Pacific modelling results suggest low/dual flush toilets can significantly reduce water use (see **Appendix 9.1**).
- Review the flow of your bathroom taps. Good bathroom taps being used by some hotels deliver 7.5 litres per minute. The range of flow rates can be as low as 1.5 litres per minute up to 30 for the high users (WELS 2014)
- Check for leaking toilets in bathrooms – a leaking toilet can waste over 16,000 litres of water a year or 44 litres per day.

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#### **From the Survey:**

The 272 room Radisson Blu Portman Hotel, UK, estimates savings of some GBP 3,354 (around US\$ 5500) annually, thanks to the recent installation of low flow shower heads and bedroom sink tap aerators to each of their guest rooms.

The hotel estimates total water savings of 1,784 m<sup>3</sup> annually based on these installations.

#### **Laundries**

- Many hotels outsource their laundry operations. With the EarthCheck program, benchmarking for outsourced laundry services is provided as an option. At the very least, ask your service provider about their water and energy performance.
- Ensure machines are used with full loads where possible.
- Review the use of temporary holding tanks which can allow the reuse of water from previous rinse cycles.
- Minimise the length of the rinse cycle if possible. Ensure vigilance with leaks and general maintenance - water inlet valves and water level controls are two areas of potential focus.
- Smart technology options can be used to reduce heating and water use (see **Appendix 9.1**).

#### **Kitchens/Restaurants**

The EarthCheck Asia-Pacific modelling data suggests that kitchens/restaurants can use as much as 20 percent of water in a hotel. Considerations for improved water management include:

- Check the flow of kitchen taps and introduce low flow restrictors or aerators.
- Dishwashers should be used only with full loads.
- Pre-soaking of utensils can help to reduce the amount of water required for cleaning.
- Avoid thawing frozen food products with running water. Please refer to the **case study in 9.2**.
- Reduce the use of ice machines where possible.

#### **Swimming pools**

The EarthCheck Asia-Pacific modelling data indicates that swimming pools are a major user of water.

- Read water meters specific to the pool first thing in the morning and last thing at night to monitor levels of use and water leaks.
- Consider the backwashing schedule. Is backwashing required daily, or can this process be every second or third day?
- Ensure vigilance with leaks by implementing regular maintenance schedules.
- Consider the implementation of swimming pool blankets to save evaporation.
- Explore improving filtration systems (see **Appendix 9.1** for a case study of swimming pool blanket use and improved filtration).

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#### **From the Survey:**

**73% of survey respondents indicated they have one or more swimming pools on their property.**

36% said they have between two and seven pools.

The high rate of respondents with swimming pools highlights the importance of improving swimming pool management to reduce water use, and in turn reduce energy use.

#### **Landscaping and Gardens**

- Reduce watering during the heat of the day when evaporation is at its greatest.
- Develop a dedicated watering plan to reduce water use.
- Consider the selection of your landscaping and planting choices. Are there other more water tolerant plants which could be used?
- Consider the installation of rainwater collection tanks or the implementation of a greywater recycling system, where permitted, for irrigation use.

### 6.1.4 Implementation Rates of Key Water Initiatives in Asia/Pacific Properties

The EarthCheck database provides important information on the implementation rates of key water saving measures amongst the Asia-Pacific hotels.

The most significant finding is that even simple management practices are not being uniformly taken forward at this point in time.

- **62%** of Asia-Pacific hotels stated that they checked for leaks every week.
- **51%** of Asia-Pacific hotels stated that 100% of their shower fittings were low flow.
- **34%** of Asia-Pacific hotels stated that 100% of their tap fittings were low flow, with another 35% stating that **80-99%** of their tap fittings were low flow.
- **47%** of Asia-Pacific hotels stated that 100% of their toilets were low flow / dual flush, and **16%** stated that 80-99% of their toilets were low flow / dual flush.
- **30%** of Asia-Pacific hotels stated that use of recycled, grey or rain water was not relevant or not available. On the other hand, just **4%** stated that all of their water consumption came from recycled, grey or rain water. **31%** indicated that none of their water consumption came from these sources of water.
- **49%** of Asia-Pacific hotels stated that operating sprinklers after dark was not relevant or not available. While **19%** stated that all of their sprinklers were operated after dark, **23%** stated that less than 50% of their sprinklers operated after dark.

The measures identified in the EarthCheck database are a first step, but may not sufficiently reduce water use per guest night below the benchmark of about 200 litres as achieved by some European hotels. More water saving measures need to be considered and implemented to drive a decrease in per-guest night water use. It is evident that no single measure will offer a total solution. A diversified water saving approach is needed. This could include minimum standards as identified above, the installation of sub-meter devices (Chan et al. 2009), incorporating innovative building design and landscaping into new developments and renovations (EarthCheck 2013; Kelly & Williams 2007) and educating staff and consumers about water use and the impacts of tourism to modify current behaviour (Charara et al. 2011; Kelly & Williams 2007). The following sections discuss behavioural change, alternative water sources and stewardship in greater detail.

#### Call to Action:

If you are not already achieving minimum standards, it is time to review your water management plan. If you have only implemented some water saving techniques consider a more comprehensive management plan. The true value of water to your business, "lies in business continuity, in licence to operate and in brand value." - Marcus Norton, Head of Water and Investor Initiatives - Carbon Disclosure Water Project (Olin 2011). Implementation of minimum standards provides a basis for your water management plan and reduces your water risk.

## 6.2 Behaviour of staff and tourists

Limited research on the financial returns of changes in behaviour is available. However, the almost universally established practice of providing guests with information on water savings and towel replacement options highlights that accommodation establishments believe that behavioural change does make a difference. Staff training on these initiatives is essential to produce successful guest education outcomes. The case study on water use as a result of thawing seafood in Chinese restaurants highlights that a change in behaviour (and common practice) with support from different technology can result in significant savings (see **Appendix 9.2**).

#### From the Survey: Recommendations and Tips from Survey Respondents Include:

**Educating Consumers:** At the Dusit Thani Maldives, guests are offered educational tours of the property's desalination plant to increase awareness of the critical nature of water supply to the property.

**Educating staff:** Staff education, training and reminder signage ranked the highest in the survey of managerial and behavioural measures implemented. These measures attracted 76 comments from respondents to the survey.

#### Call to Action:

Developing a water plan *with* your staff rather than *for* your staff will improve the likelihood of changes to water practices being embraced. Create ownership of the plan with interested staff members. Where needed incentivise improved practices, which can be measured and monitored. Create awareness of the value of improved water practices to the hotel, and in turn to viability of their positions.

Similarly, by involving visitors in the development of your plan, your guests become active participants in the marketing of your property as one which takes their water impact seriously.

### 6.3 Alternative water sources

Businesses have a range of options to address the increasing cost of water. Apart from improving the efficiency of water use, tourism operators can make use of alternative water resources, rather than relying on potable water supplied to them. The three water resources most suitable for tourism are:

1. Rainwater;
2. Greywater; and
3. Salt water.

Case studies for each of these options are included in **Appendix 9.3**.

#### From the Survey:

Use of potable water to irrigate lawns and gardens is still standard practice for 38% of survey respondents.

Opportunities exist for increased use of rainwater, greywater and saltwater technologies for irrigation to reduce impacts to critical groundwater supplies, particularly in water stressed or water scarce areas.

#### Call to Action:

Although these technologies require up-front costs for design and installation, and potentially for annual maintenance, their long term benefits both for improved water use and reduction of short and long term costs is suggested in many instances. Furthermore, in some areas, the use of alternate water sources may well become the norm rather than the exception. In others, such as the Maldives, it already has.

### 6.4 Destination stewardship

For tourism, water stewardship considers how the tourism product or service can be delivered in the catchment by working with local community groups to ensure ethical approaches to the management of localised water supplies (see **Appendix 9.4**). Being a good steward involves a number of actions. Catchment planning by way of engaging with local stakeholders is suggested as a key method of managing water supplies, particularly where groundwater extraction is present. Importantly, catchment planning recognises the value of water to the health of not only the tourism industry and its operators, but to staff, community, country and beyond. Water as a natural and shared resource, and as a valuable ecosystem service, allows the tourism industry to exist. In the future, the scarcity of water will be reflected in its value.

#### Call to Action:

Engaging with your community is at the heart of destination stewardship. Being informed about the water issues affecting your local area and the regulations for extraction and waste water disposal provide the basic platform of knowledge required to move toward responsible water use. Further research on the existing policy environment within your catchment could reveal incentives, tax credits or other benefits to entice improved water risk management; with the benefits received by many.

### 6.5 Site Selection and Project Design

Perhaps the most significant call to action arising from this paper is the need to take forward water management considerations in the future design and site selection of new hotels and resorts.

There are a variety of building and precinct certification programs available including the EarthCheck Building and Precinct Planning and Design Standards, LEED, BREEAM, Green Star and Estidama. The EarthCheck program is the only platform which uses a range of performance KRAs and benchmarking indicators for design and construction.

If not correctly managed, the development and operation of precincts can place pressure on existing water supplies, reducing availability and affecting wildlife and habitats. Implementation of water conservation and management strategies should allow long-term sustainability to be achieved without compromising overall operation.

The key considerations that are recommended by EarthCheck in site selection and project design include the following:

- Has the developer included freshwater consumption minimisation and stormwater collection as a chief aim of the Sustainable Design and Construction Approach?
- Is there a commitment to the reduction of freshwater consumption and collection of stormwater evident in design?
- Are operational potable water consumption figures modelled during the design phase as per Benchmarking Indicator requirements?
- Have low/dual flush toilets, tap/faucet and shower fittings been included in the design?
- Does the design allow for rainwater collection and storage?
- Does the design allow for grey water or treated wastewater recycling?
- Does the design include native plant species (i.e. those that are adapted to the climate) to reduce irrigation requirements?
- Does the design include stormwater flows designed to maintain exiting drainage patterns as much as possible and ensure that there is limited or no erosion?

## 7. The Water-Energy Nexus

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*"The competition between water and energy needs represents a critical business, security, and environmental issue, but has not yet received the attention that it merits. Energy production consumes significant amounts of water; providing water, in turn, consumes energy. In a world where water scarcity is a major and growing challenge, meeting future energy needs depends on water availability –and meeting water needs depends on wise energy policy decisions."*

– Glassman et al for World Policy Institute (2011).



The dependent relationship of water and energy is known as the ‘water-energy nexus’. The two are inextricably linked (WBCSD 2009). As visualised in **Figure 10**, water forms part of the energy production process, as does energy in the processing, pumping and treating of water. Thus, businesses which have become accustomed to the idea of ‘carbon footprinting’ are now commonly engaging in ‘water footprinting’ and understand the interactions between the two.

The water-energy nexus is now recognised as a critical concept that highlights the interdependencies between water and energy production and consumption (Pittock et al. 2013; Scott 2013). Water is an essential input into the energy sector. Coal-fired electricity generation plants require 1.7 kilo-litres of water for every mega-watt hour generated (Retamal et al., 2008).

In the US, on average 7.6 litres of water are evaporated per kWh of electricity consumed (Torcellini et al., 2003). Similarly, research on global energy demand, for example, estimates that 7% of energy demand alone is for the delivery of water (James et al., 2002). A case study of a hotel in Singapore identified that 7 percent of its electricity use alone is for pumping water (Lu et al. 2013).

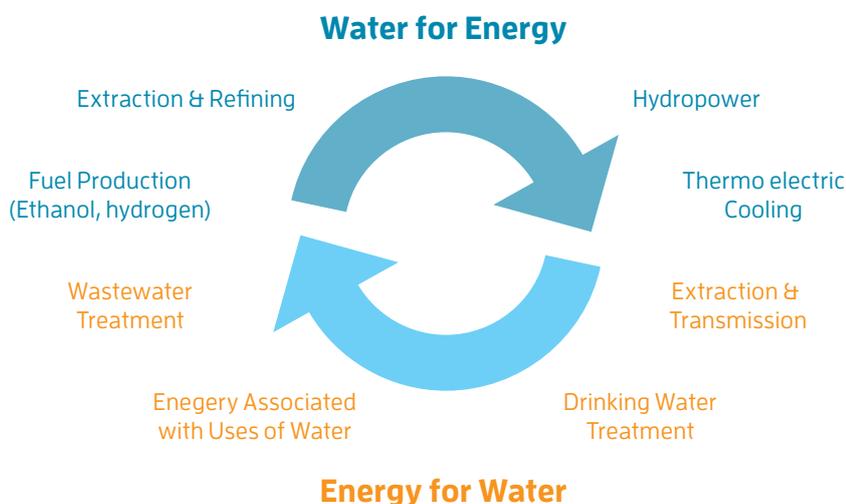
**What does the water-energy nexus mean for tourism businesses?** It increases the risk exposure for those companies that require access to water and energy. Already, investors are beginning to assess these risks. Last year, the Carbon Disclosure Project (CDP) sent its fourth annual Water Disclosure questionnaire to more than 300 of the top 500 companies globally. Of the CDP respondents 70% indicated water as a “substantive business risk”

(CDP 2013, p.6.). The World Economic Forum (2014) and the World Business Council for Sustainable Development have also recognised the water-energy nexus as not only the next challenge but also an opportunity for businesses (Vox Global 2011).

Resort islands located in the Maldives, epitomise tourism’s water-energy nexus. Here, resorts depend on desalinated water for cooking and bathing (Ibrahim et al. 2002). The process of desalination is extremely energy intensive. In other destinations, on-site well-water extraction (e.g. in Bali, Indonesia) and subsequent pumping to storage tanks also requires energy. Processing of most forms of waste water – for either on-site processing or for pumping to the local treatment plant – also requires energy. The nexus is present in perhaps every aspect of the tourism industry business.

In summary, water should no longer be considered as an individual cost, rather as a cost linked to energy. By choosing to focus solely on the costs of supply of each of these elements, a business risks missing the greater impacts of service interruptions, additional capital expense to reconnect supply and other potential water and energy related impacts (CERES 2011).

The water-energy nexus for tourism businesses is not well researched. It is important to examine the detailed data on hotels’ water and energy use patterns – and how they are inter-linked. Systematic testing of environmental management measures and their impacts on *both* water and energy use is recommended. Such information would inform the business case for future operational management and capital investment.



**Figure 10** Water for Energy and Energy for Water: the water-energy nexus (Source: Vox Global 2011).

## 8. Conclusion and Next Steps

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This White Paper was developed with the purpose of making available useful information to tourism managers. The trends are clear. Water is an increasingly precious resource, costs are increasing and the potential for conflict is an important business risk. Therefore, this White Paper is also a call to action.

Sustainable management in tourism has to go further than making incremental adjustments within the business scope or boundaries of tourism businesses. Major changes are required that involve leaps in the way we use water, how we deploy technology, and how tourism becomes involved in the local governance and stewardship of water resources.

This White Paper has demonstrated that the operational costs of water are increasing. At the same time, water scarcity is becoming more pressing at many destinations, putting pressure on tourism companies to perform responsibly. Finally, the highly interlinked use of water and energy requires a synergistic approach to resource management much more urgent than previously thought.

In this paper we highlighted that changes are of a managerial, behavioural and technological nature. Collectively they present an opportunity to address the water challenge, and also address reputational risks faced by the tourism sector.

Solving water management requires an holistic approach which incorporates many parties and many components. It is a complex issue, and will only become more complex. Should businesses do something now or wait? The more importance the tourism industry places on improving practices now, the greater the chance of survival in an increasingly water *and* energy constrained world.

You can get involved by implementing some of the practices discussed in this paper. Beyond this immediate action, it is important to share lessons learned and engage with other industry members and your supply chain to improve collective practice. It is also important to become involved in future cutting edge water-energy research that specifically targets the tourism industry. Specific understanding of the business costs associated with specific measures, the impacts these might have on tourist experiences, and broader destination perspectives will be invaluable for informed decision making towards responsible water and energy footprints.

The EarthCheck Research Institute offers one platform for collecting industry intelligence and engaging with tourism experts globally to continue to drive best practice and responsible tourism.

## 9. Appendix – Solutions in Practice

### 9.1 Operations and water management

#### Fact box: Smart metering

Generally speaking the installation of smart water meters includes four components: a probe, data logger, computer and relevant software (Hauber-Davidson 2008). Except in some older models normal water meters can be turned into smart meters by simply inserting or attaching an appropriate probe which records an electrical signal (or pulse) when a certain amount of water has passed through the meter. The probe is attached to a data logger which sends the recorded pulses to a computer. Relevant computer software will then display continuous, near real-time water consumption to an end-user; graphs are typically displayed as flow (litres/minute) over time. Specialised software can also be used to 'disaggregate' water data – this allows an end user to see the water consumption associated with particular water events (e.g. flushing a toilet, using a dishwasher). How smart water meters are installed and operational is dependent on organisational needs and is generally assessed by a relevant water consultant on a site by site basis.

Hauber-Davidson (2008) reports that smart water metering projects are close to A\$1000 per point in Australia. However due to some of the benefits listed below, smart metering can often pay for itself within two to three years even if the cost of monitoring a single stand-alone location is as high as A\$2500. Reported benefits associated with smart water meters include the following:

- Accurate, reliable, near real-time data is available to end-users/water managers who can then adjust their behaviour or any abnormal usage accordingly and receive feedback almost immediately instead of waiting for the next water bill;
- Visible daily water patterns help water users/managers understand their water consumption, especially daily and peak demand patterns; Seasonal variation in water consumption can be more accurately monitored and therefore managed;
- Smart water metering is an insurance against leaks – they can be identified immediately rather than months after they have happened. Obviously, this can save both money and water;
- Smart metering can provide socio-demographic information regarding work, lifestyle, and occupancy patterns. For example, monitoring water in one organisation helped to identify the inefficient operation of a cooling room such as since staff leaving doors open, and inefficient cooling tower operation;
- Data accumulated from smart water meters can be used in designing water efficiency and reuse systems (Butler, as cited in Australian Water Association, 2010) and assessing and evaluating the effectiveness of demand management programs and conservation initiatives (Australian Water Association, 2010); and
- Data from smart meters can be used as evidence when applying for environmental certification programs.

#### Case study findings: Water saving retrofit - Spain

Barberan et al. (2013) report on the water and cost savings of such a retrofit for a hotel in Zaragoza, Spain. The following investments were made:

- In guest rooms, old taps were replaced with water saving taps with aerators, ecological cartridges and a dual flow system that limit the flow to 6 litres per minute;
- Shower flow was limited to 9 litres per minute by installing discs;
- In the kitchen, pre-wash shower heads with limited flow were installed, and devices controlling the flow to the dishwashers were replaced;
- Hot and cold water meters were installed in two representative rooms.

The retrofits in the Zaragoza hotel guestrooms and public areas resulted in daily savings of 3,402 litres of cold water and 2,767 litres of hot water. The kitchen retrofit achieved an additional saving of 1,345 litres of cold water. In total the benefit of the retrofits was a water saving of 21.5%, with a greater impact on hot water savings (33.19%). The cost of investment amounted to a maximum of €14,126, or only €2,057 when one considers that the taps were due for replacement anyway. The financial savings as a result of reduced water bills as well as energy costs were €140,000 over the 12-year life-time of the retrofitted equipment. Thus, the profitability rate was over 1000%.

### Fact box: Switching to dual flush toilets can save kilolitres of water per year

When compared to a traditional single flush toilet, which uses an average of 9 litres per flush, the dual flush option requires only 4.5 litres for a full flush and 3.3 for a half flush.

If 100 people were to use the half flush, 4 times per day, instead of one single flush, 832,200 litres of water can be saved per year! And that is just by changing to dual flush toilets!

(Source: SA Water 2014)

### Case study findings: Laundries – Bangkok

The Dusit Bangkok contracted Ecolab to assist in reducing the water and energy use in the hotel's on-site laundry operations. Ecolab conducted an audit of equipment and found four large capacity washing machines and a traditional hot water laundry cleaning process. The water is heated using steam coming from a gas-fueled boiler.

The property implemented the Ecolab Ensure Laundry Program for six months to improve the operational efficiency and reduce the environmental impact of the department. Using technology and chemistry which delivers washing temperatures of 40 degrees celcius instead of 60 degrees, Ecolab was able to lower gas usage by reducing the amount of hot water used, lowering electricity use with cycle optimisation and reducing water consumption.

The use of the Ecolab Ensure Laundry Program saved an average of US\$ 1300 per month in energy and water costs, and some 390,000 litres of water just within the laundry operations. Furthermore, the improvements in process assisted the hotel in achieving their Silver Certification in the EarthCheck program (Ecolab 2013).

### Case study findings: Laundries – Turks and Caicos

Beaches Turks and Caicos Resort Villages and Spa, is an all-inclusive, 770 room resort situated on 75 acres beach front property. The facilities include a variety of water sports, 19 dining options, 14 bars, a full service waterpark and more than 15 swimming pools and jacuzzis. The property uses 1.5 million gallons of water to process over 500,000 pounds of laundry per month. The laundry facilities also use 10,600 gallons of LPG gas to heat the water (as 75% of water used in the laundry is hot water) and to dry the laundry through the dryers.

As a nation of islands where water shortages and restrictions are the norm, water management forms a large part of sustainability initiatives implemented by the hotel. These included the installation of innovative technologies such as AquaRecycle and ThermalRecycle in the onsite laundry facilities. The AquaRecycle Laundry Recycle System recycles laundry wastewater. The system employs a unique process using ground media filtration, an efficient and cost effective way of recycling water, while having the least impact on the environment. An additional solution is the ThermalRecycle system which is designed to reuse heat energy from the dryer's exhaust throughout the drying process. With the combined installation of both technologies, the resort has experienced significant savings in water and LPG usage over the entire project.

The initial financial investment on this project was US\$ 295,000 with US\$ 245,000 for the laundry wash water recycling system, installation and commissioning and US\$50,000 for the heat energy reuse system. By combining the heat savings from the water recycling with the energy saved capturing the heat from the dryer exhaust, Beaches Resort was able to save an average of US\$19,487 per month on water and energy costs. This investment generated over US\$300,000 in water and energy savings in the first twelve months of operation and almost US\$900,000 over the life of the project thus far.

Beaches Turks & Caicos Resort Villages and Spa project with AquaRecycle was an enormous success story. Over the thirty month period the system has performed efficiently, nearly 33 million gallons of water have been recycled and reused in the washing process, with a 69 percent reduction in water usage (Collymore 2014).

## Case study: Air Conditioning – India

The Renaissance Mumbai Convention Centre Hotel and Marriott Executive Apartments was experiencing significant condenser tube fouling, which was resulting in an increase in both the approach temperature and the energy requirements for its 1400-ton chiller system. In fact, the fouling was so bad that the approach temperature increased an average of 7.5 degrees Celsius. In addition, the kilowatt per ton had increased to an average of 0.74 due to the fouling.

Nalco – an Ecolab company – used its Optimizer software to analyze the operating data for the hotel makeup water used in the cooling system. This data led Nalco to recommend a trial of its state-of-the-art 3D TRASAR program. The program included PSO chemistry, non-oxidizing biocide, oxidizing biocide and an algaecide. The Nalco system cost the property US\$35,000 to install. The annual cost savings amounted to almost US\$110,000, calculated from both water and energy savings of US\$48,000 and US\$60,000 respectively. Return on investment was gained within approximately four months (Ecolab 2010).

## Case study findings: Swimming pools – Australia

A Perth based pool complex with two indoor pools and four outdoor pools installed pool blankets as a method of reducing heat loss and evaporation. With little staff training and maintenance required, the pool complex invested US\$70,954 on the blankets. The blankets are attributed to an annual saving of US\$60,507, just in reduced water costs. Additional benefits include a reduction of pool chemical use, and reduced corrosion, particularly in the indoor complexes. The return on investment for this technology is estimated at 18 months from installation.

Another smaller complex with 2 outdoor pools chose to invest in an ultra-fine filtration system. This complex already had a sand filtration system with one filter in place, so required only an upgrade to a triple filter system. With this improvement, annual maintenance charges are required, in addition to monitoring by staff. One of the greatest benefits is the reduced time in backwashing –from 45 minutes to 90 seconds. The upgrade cost for this system was about US\$40,000, however due to a reduction of water costs the system would be paid for in 3–4 years. One other key benefit is the reduction of chlorine required providing improved water quality for patrons (Hazell et al. 2006).

Other technologies for improved water management with swimming pools range from diagnostic water management systems and remote monitoring of water quality parameters (Australian Leisure Management 2013), to installation of shade sails to reduce evaporation (WaterWise QLD n.d.), to the use of ozone thereby reducing the required chemical load (SPASA 2013).

## 9.2 Behaviour of staff and tourists

### Case study findings: Food preparation – Hong Kong

Chinese restaurants were found to use more water than other types of restaurants due to a unique cold-water thawing process typical in commercial Chinese cooking. The traditional thawing method involves water being piped into a container with food at the bottom. Since water is injected from the bottom an upward flow is generated and water spills over the container from where it discharges into the sewage system. Water is pumped until all seafood is thawed.

Lo et al. (2011) found that two Hong Kong restaurants (for 600 and 370 patrons, respectively) consumed an average of 92.7 and 79.0 cubic meters of water per day. Thirty percent of this use was related to the thawing. The study also showed that a thawing machine could save about 20 percent of cold water and a microbubble machine would save 13 percent. The researchers also calculated the pay-back times. In the case of the thawing machine, the daily savings in water costs would be US\$ 5.55 (excluding additional requirements for electricity). The pay-back period is therefore 15.5 months. The microbubble machine would save US\$3.60 of water costs per day (a pay-back time of 10 months).

## 9.3 Alternative water sources

### Rainwater:

#### Case study findings: Rainwater harvesting and treatment – Thailand

In 2001, the Six Senses Resorts & Spas redeveloped the Phuket Island Resort into an environmentally friendly resort situated on 25.9 hectares of land. The Evason Phuket had extended its facilities and services but thanks to investment into water and energy efficiency, consumption has decreased and financial savings have been made. The main investment was a rainwater reservoir (WWF, Horwath HTL & HICAP 2010). The process to convert rain water into tap water involves several steps:

- Rainwater is captured in the reservoir as a result of natural run-off
- The water has to be pumped through a coagulation and filtration tank to eliminate sediment
- Carbon resin filters need to be in place to treat the water and soften it; in addition a small amount of chlorine peroxide is added to eradicate bacteria
- The clean water has to be pumped to an elevated holding tank
- From there the water can be distributed to the resort via gravity.

The installation cost was US\$ 36,000, and when operational it created an annual saving of US\$ 330,000 (WWF, Horwath HTL & HICAP 2010). The Evason Phuket has also invested into a wastewater treatment system (gravel filtration aerobic system) that provides water for irrigation purposes. The estimated savings for this system are about US\$ 150,000 per annum.

### Greywater:

#### Case study findings: Greywater system - Jordan

An example of the economical use of greywater comes from Jordan. Tourism in Jordan is an important economic activity; however its high demand for water is a challenge for the water scarce country – and it comes at a high cost to businesses. Dead Sea Spa Hotel became the first tourism business in the Arab world to install a greywater recycling plant for the reuse of greywater within a single building.

During an average peak season day, the Dead Sea Spa Hotel has to fill up its water tank up to ten times. Water is supplied at a high cost through a private water supplier. Public water supply is also available, but the quality is not sufficient for the standards of a four-star hotel. The majority of water use relates to the hotel's wellness and spa facility (Arab Forum for the Environment, 2010).

The investment into the Dead Sea Spa Hotel's greywater system was US\$80,000. The capital cost of the installation could be less if it was integrated earlier in the building design. The savings potential of the system is 17% of the hotel's water use. Guest room water use has been reduced from 120 litres on average to 80 litres (GIZ, no date). Wastewater is treated without chemical additives in a mechanical-biological process. It is subsequently used to flush toilets. The water quality is very good and meets the hygiene requirements of the European Union (EU) Bathing Water Directive. The installed system saves the Dead Sea Spa Hotel US\$25,000 per year (Grundlach 2012).

**Saltwater:****Case study findings: Saltwater cooling system – Tahiti**

Saltwater constitutes a plentiful resource and many resorts already use it as the basis for their production of drinking water via desalination. Other uses are possible. At the cutting edge of water efficiency is the use of cool seawater for air conditioning. The Bora Bora Resort & Thalasso Spa (managed by InterContinental Hotel Group) in French Polynesia has invested in a seawater cooling system (SWAC) to reduce its need to generate increasingly expensive electricity (WWF, Horwath HTL & HICAP 2010).

While the driver for this investment was energy costs, the impacts on water savings are also important. The SWAC uses seawater of around 5 degrees Celsius from a depth of 900 metres to cool a chilled-water air conditioning system. A separate and closed fresh water loop is cooled with the seawater in a cooling station, and then distributed to the various end uses in the resort (e.g. villas, kitchens, spas). The seawater, which has warmed to between 12 and 13 degrees, is pumped back into the ocean. Due to the innovative combination of a closed loop and the reuse of saltwater – an abundant resource – the freshwater consumption of this cooling system is minimal.

The Bora Bora Resort & Thalasso Spa, French Polynesia made what was a very high investment at about US\$ 7.9 million (a standard cooling system would cost about US\$1.5 million); however a tax credit of 35% was received, equivalent to US\$ 2.765 million. Annual savings amount to 2.5 million litres of fuel, equivalent to US\$ 720,000 per annum. Thus, the payback time is about 5 years. Payback times could be longer in other locations where energy costs are lower and the policy environment is less favourable (Intercontinental, n.d.).

**9.4 Destination stewardship****Case study findings: Community water conservation - China**

The “Nobility of Nature” program by Marriott International in partnership with Conservation International aims to protect the ‘Asia water tower’ that provides water for more than 2 billion people. The US\$500,000 program is based in Sichuan Province and supports the activities of the rural communities of Pingwu County. The project helps communities with the development of sustainable businesses, such as mushroom farming and honey production.

The outcomes of this program are projected to reduce the stress on the natural environment and reduce deforestation. High rates of deforestation are associated with increased sedimentation and pollution of water bodies; thus affecting water quality downstream in rural and urban areas (Marriott 2010). The project is a good example of how tourism companies can get involved in broader stewardship and Corporate Social Responsibility initiatives that improve water management beyond their own business. In addition, Marriott has agreed to reduce its own water consumption in China by 25%.

## 10. References

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