



MASTER IN INTERNATIONAL BUSINESS

SCHOOL OF BUSINESS ADMINISTRATION

**SUSTAINABLE HOSPITALITY IN THE SIERRA NEVADA DE
SANTA MARTA**

How to develop a sustainable hospitality industry in the Sierra Nevada de Santa Marta, Colombia, taking the case of Turtle Bay Resort in Hawai'i as a model.

By Enrique Montufar

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2014

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Abstract

This research attempts to provide necessary context in order to present recommendations and to evaluate the need for the development of the sustainable hospitality industry in the Sierra Nevada de Santa Marta. This research presents sustainable hospitality as an alternative for economic development, based on the analysis of data gathered at Turtle Bay Resort in Hawai'i and validated by a literature review. This analysis focuses mainly on the management of important resources: energy, water and waste, following sustainable principles like the ones presented by systems theories, such as Cradle to Cradle (Braungart, McDonough & Bollinger, 2006) and Blue Economy (Dijk, Tenpierik & Dobbelsteen, 2013). Sustainable hospitality¹ provides an eco-effective alternative, for the sustainable economic development of the Sierra Nevada de Santa Marta Region.

The world has changed. Today, we live in a world with highly competitive markets and volatile economic environments. No organization, especially those that rely on limited or declining natural resources, can operate the way they did a decade ago (COSO, 2013). The 20th century taught us that economic growth does not necessarily mean social development, and that unbounded growth is unsustainable. Growing energy demand and damaging greenhouse gas (GHG) emissions, such as CO₂ (Carbon dioxide) and CH₄ (Methane), reflect the cost and unsustainable requirements of the system that arose from the industrial revolution, powered initially by coal and later by oil (Peura, 2012). Economic development must be sustainable and alternatives to an ever growing economy must be explored (Jackson, 2009). The time framework presented in this research, from the industrial revolution to climate change (Jackson, 2009) presents arguments for dealing with high energy demand and negative environmental impact. In

¹ www.epa.gov/region4/p2/sustainablehospitality.html

particular considering the current context of growing inequality between (Müller-Steinhagen and Nitsch, 2005) and within countries, mainly in those with relatively recent economic growth, based in many cases on extractive industries and other unsustainable resource intensive activities (Fung, 2009). As is the case for Colombia in which sustainable hospitality principles are yet to be assimilated and implemented in its complex socio-economic context.

Sustainable hospitality focuses on reducing and when possible eliminating the negative environmental, social and economic impact resulting from the normal operation of the traditional hospitality sector (EPA, 2013). Society needs an economy that stimulates technologies that improve the system. The hospitality industry can benefit from the rising demand around the world for these technological and ecological solutions by providing clients a sustainable service, for the good of the company's bottom line, the guests, the employees, clients, suppliers and the surrounding community.

Keywords: sustainability, sustainable development, sustainable hospitality, environmental impact, energy efficiency, renewable energy sources, energy, water, waste, waste management, biosphere.

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LIST OF ABBREVIATIONS

QSSE: Quasi-steady state economy.

CO₂: Carbon dioxide

GHG: Greenhouse gas.

IPCC: Intergovernmental Panel on Climate Change.

GDP: Gross Domestic Product.

SDG: Sustainable De-growth.

SG: Sustainable Growth

WEF: World Economic Forum.

PV: Photovoltaics

a-Si: amorphous silicon.

CdTe: Cadmium telluride.

CuInSe₂ (CIS): Copper indium selenite.

IEA: International Energy Agency.

WEO: World Energy Outlook.

HECO: Hawaiian Electric Company.

UPME: Unidad de Planeación Minero Energética.

FAZNI: Fondo de Apoyo Financiero para la Energización de las Zonas No Interconectadas.

IPSE: Instituto para la Promoción de Soluciones Energéticas.

EUI: Energy use intensity.

EPA: Environmental Protection Agency

C2C: Cradle to Cradle

BE: Blue Economy

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How to develop a Sustainable Hospitality industry in the Sierra Nevada de Santa Marta, Colombia, taking the case of Turtle Bay resort in Hawai'i as a model.

1 INTRODUCTION

1.1 RATIONALE FOR THIS RESEARCH

This research presents recommendations and highlights current conditions for the sustainable development of the hospitality industry in the Sierra Nevada de Santa Marta region; in order to truly become sustainable hospitality, based on findings after analyzing the Turtle Bay resort case and validated through the analysis of literature review. While sustainable development and climate change mitigation strategies are at an early stage in Colombia (UPME, 2013), this research evaluates Sustainable Hospitality (EPA, 2013) as an alternative long term oriented economic development of the hospitality industry in the Sierra Nevada de Santa Marta.

Before analyzing the local case for sustainable hospitality in SNSM, time framework and the global context must be considered in order for true sustainability to be achieved. Energy is perhaps, the main variable for human development and the main focus of this research, especially regarding demand and production. Record high energy consumption and high levels of CO₂ and CH₄ emissions reflect the high cost and unsustainable requirements, resulting from the economic and productive systems that are our heritage from the industrial revolution and World War II era which were powered initially by coal and later by oil. Long term sustainability calls for an integral approach for the implementation of practices for sustainable management of resources, such as energy and water, complemented by control and proper management of waste resulting from every day

operations (Dijk et al., 2013). Sustainability is good for business (J.D. Power and Associates, 2009), the environment, and the community (Levy & Park, 2011).

This research also presents also sustainable hospitality as an alternative for long term economic development with a reduced negative impact, efficient use of resources (energy, water and waste), and a sustainable approach. Turtle Bay resort, located on the island of Oahu in Hawai'i, has taken measures to reduce its negative environmental impact and this research seeks to highlight key elements of the practices and improvements already implemented there. TBR's model can be taken into account for the sustainable development of the hospitality industry in the Sierra Nevada de Santa Marta, especially when considering their similarities regarding multicultural communities, a strong indigenous presence, prevalence of tourism and valuable natural resources. However there are also key differences, like Hawaii's advantage as part of the United States, mainly due to regulation and market instruments such as tax cuts and rebates, versus the limitations faced by sustainable initiatives in emerging economies like Colombia's.

Colombia and the Sierra Nevada de Santa Marta in particular, face diverse challenges for the sustainable development of local economies within a relatively uncertain global context. In order to improve the quality of life of the different communities in the region, while competing in a global economy, local communities need to develop their economy and social structures following sustainable principles to guarantee long-term success.

Although society and its important dynamics, like education and labor, are important variables for sustainable hospitality, the focus of this research will be mainly on the environmental dimension of the concept, in particular energy efficiency and its effective use. Also, due to the broad time framework analyzed, from the industrial revolution to climate

change, and the interdisciplinary scope of this research, detailed financial analysis is not included.

1.2 PROBLEM FORMULATION

As this research shows, high levels of greenhouse gas (GHG) emissions, extreme weather events, population growth and even greater levels of consumption and its resulting waste, present serious challenges for the socio-economic development of communities around the world, but in particular to those in emerging economies. People in rural areas struggle to make ends meet, as is the case for many people in the Sierra Nevada the Santa Marta. Tourism is an alternative for local communities, and presents a lesser impact than other industries, particularly extractive ones. Yet, as this research shows, the hospitality industry can be resource intensive, jeopardizing environmental resources and the sustainable livelihood of local communities including Tribes in the Sierra Nevada de Santa Marta requiring the decoupling of the development of the industry from the level of its material impact. The business cycle is not isolated and the nature of a business that grows without negative impact is a necessity for the long term sustainability of the system. The diagram below represents stakeholders' interacting in a closed loop running in parallel to the bidirectional interaction between sustainable hospitality and the surrounding environment (Nature), considering the effects of addressing environmental criteria such as: energy, water and waste.

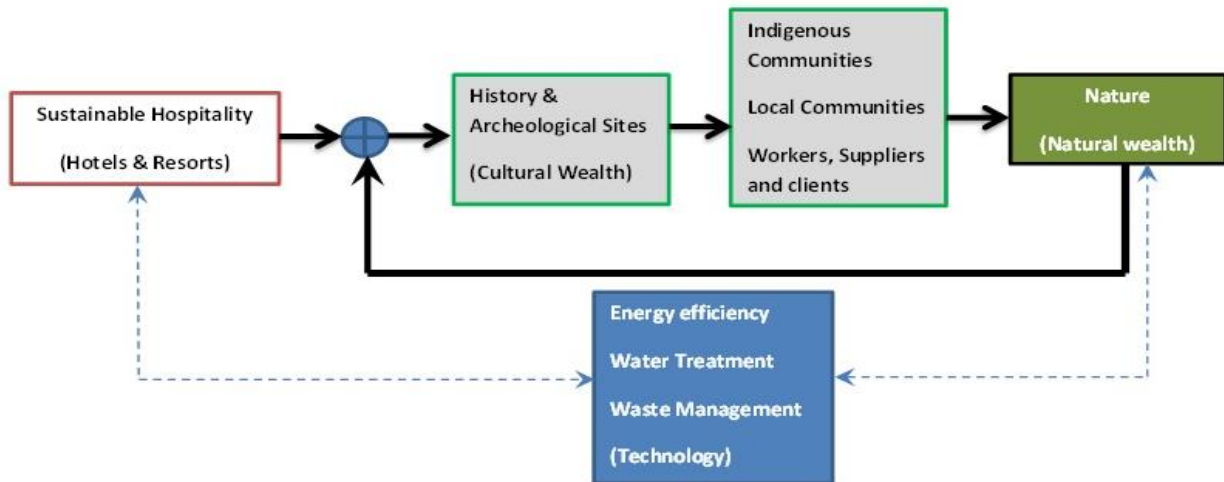


Figure 1. Problem diagram-Sustainable hospitality, stake holders and environmental criteria.

1.3 RESEARCH QUESTION

The underlying research question in this research is:

How to develop sustainable hospitality in the Sierra Nevada de Santa Marta?

Hence, several sub-questions have been defined:

- What is sustainability?
- What is sustainable development?
- Is sustainable development viable under current conditions?
- How to power sustainable development?
- Is there a working case for sustainable hospitality?
- Can sustainable hospitality in the Sierra Nevada de Santa Marta be

powered by Solar PV?

1.4 OBJECTIVES

- To establish that the global situation requires a change to sustainable practices. This research focuses on presenting and analyzing a time framework to complement, current, global, technical and economic conditions for the development of a sustainable hospitality industry in the Sierra Nevada de Santa Marta.
- The Sierra Nevada the Santa Marta needs alternative, low impact development. This research attempts to make the case that sustainable hospitality is a good low-impact industry that addresses the needs established by the current context.
- To present a case study of Turtle Bay Resort, in Hawai'i that has implemented some sustainable practices addressing energy efficiency, water use optimization and waste reduction. Reducing negative environmental impact from the Hospitality industry in areas with significant environmental and cultural wealth such us Hawai'i and the Sierra Nevada de Santa Marta.
- To present systems theories as a more comprehensive approach than the practices implemented at Turtle Bay Resort and to describe how these practices and theories, like Cradle to Cradle can be applied in the Sierra Nevada de Santa Marta and to present recommendations for their implementation.

2 LITERATURE REVIEW

2.1 SUSTAINABLE DEVELOPMENT

Planet Earth is an interconnected and interdependent system and our economy is a subsystem of the biosphere. Sustainable development models cannot ignore the environmental reality of a limited biosphere. Since the beginning of industrialization, the concentration of carbon dioxide (CO₂), among other greenhouse gas (GHG) emissions, in the atmosphere has increased 25%, causing the mean temperature near the ground to increase by 0.6+0.28C and an even greater increment in the mean temperature is expected, around 1.48C to 5.88C by the year 2100, as calculated in the scenarios of the Intergovernmental Panel on Climate Change (Müller-Steinhagen and Nitsch. 2005). Absolute decoupling of economic output and environmental pressure is necessary to remain within environmental limits (Jackson, 2009). Rampant economic growth increases environmental pressure on global systems. This section shows the one dimensional-growth oriented rationale to be unsustainable and insufficient to address current issues such as population growth, climate change, economic instability, and social unrest, among others.

Competition among firms has been mistakenly suggested to reflect the seemingly ruthless logic of Darwinian selection, the free market as a struggle for survival, in which the stronger survives, supporting three pillars of neoclassical economics (Johnson, Price, and Van Vugt, 2012): (1) economic actors are *self-interested*; (2) self-interest leads to *public goods* (Adam Smith's "invisible hand"); and (3) together these lead to *market optimization*. Both Charles Darwin and Alfred Russel Wallace arrived independently to similar theories of Natural Selection after reading Malthus, extending his logic even further by framing it in purely natural terms, both in outcome and ultimate reason, realizing that producing more offspring than can survive

provides a competitive environment among siblings, and that the variation among siblings would produce some individuals with a slightly greater chance of survival (Peura, 2012). But Malthus proposed and believed in human beings' capacity for reason and foresight to act as a preventive check, resulting in a controlled future instead of an ungovernable and chaotic world with active positive checks (Malthus, 1865). These four different *carrying capacity vs growth* scenarios portrayed in the next set of graphs, display different theoretic scenarios for economic growth:

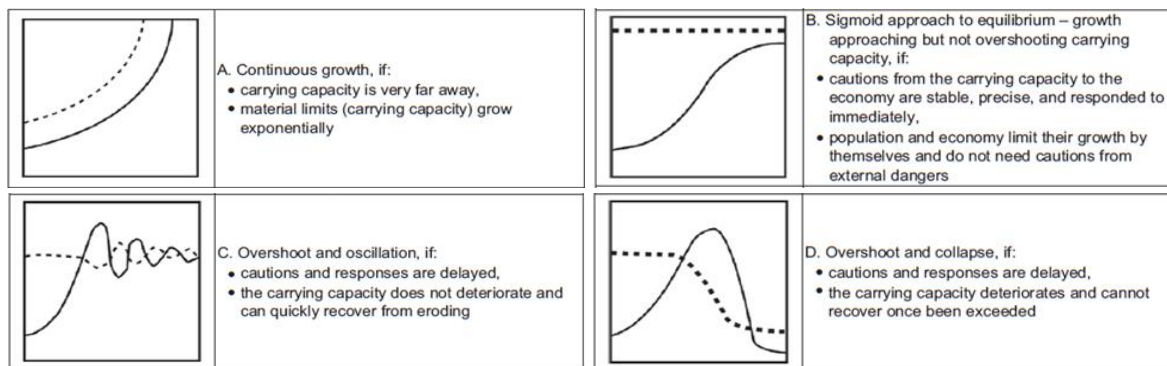


Figure 2. Schematic alternatives of population development (dotted line=carrying capacity, solid line=population and economy. *Source: Peura, 2012*).

Graph A represents a world in which carrying capacity grows as material limits grow exponentially, making unbounded economic growth possible. Graph B shows the effects of human beings' capacity for reason and foresight applied timely, before overshooting carrying capacity. Graph C shows a scenario reflecting a common behavior among physical systems (corrective response), where although measures to adjust to carrying capacity are taken after overshooting carrying capacity, this timely reaction may avoid irreversible carrying capacity deterioration, making recovery possible. Graph D is obviously the scenario to avoid. If cautions are not attended and responses not applied in a timely manner, growth could overshoot the carrying capacity beyond recovery causing the collapse of the system.

Thomas Malthus (1798) couldn't see past the age of fossil fuels, but he and other thinkers like Jevons (1865) and later Hotelling (1931) observed since the beginning of the industrial revolution, that limited resources were in conflict with the idea of a constantly growing resource based economy (Hepburn & Bowen, 2012). However the discovery of large amounts of oil, at the beginning of the 20th century, not only froze the discussion about bounded growth, but repowered risky industrialization processes that allowed for unmatched population growth and an even greater material demand, without knowing the real level of its negative environmental impact and its effect on future generations (Peura, 2012). Until very recently it appeared as if Malthus, Jevons and Hotelling had underestimated human inventiveness and adaptability to overcome this obstacle, yet now (with our current state of environmental decline) it seems that they understood the long-term effects of pushing the limits of production beyond the point of no return: the real cost of reaching planetary limits.

Colombia has been depending on oil exports for economic growth, this presents a clear challenge for new, sometimes disruptive technological solutions. This unsustainable path has been followed because "Most neoclassical and new-growth theory does not explicitly model environmental limitations, and hence never-ending growth is often possible" (Hepburn & Bowen, 2012. p 7). At least it appears possible, but population growth, dwindling resources, war and climate change, among other issues demand a new approach. The economic crisis of 2008 showed that the world has been following a short sighted set of goals: fast rewards in the short term for faster economic growth, in many cases regardless of the negative consequences for society and the environment. High levels of systemic inequality, as a result of this one-dimensional approach, has caused a lot of instability all over the world, in a wide range of societies, in places like Ukraine, Libya, Egypt, Turkey, U.S., England, Thailand, Chile, among

many others, showing that development must be integral, inclusive, local, long-term oriented, flexible, adaptable, distributed; in other words, sustainable. As social unrest in countries around the world increases, it is clear that population growth is a critical variable for sustainable development. “It was mainly the new oil reserves that created the illusion of limitlessness and technology optimism. The expansion of the world economies has nearly always increased parallel to an increase in the use of fossil energy, and when that energy has been withdrawn, the economies have shrunk accordingly” (Peura, 2012. p. 8). The extension of the impact of the perfect cocktail of industrial revolution with oil discoveries in the early 20th century has shaped the world we live in today.

In reality there clearly are limitations and it is necessary to learn to deal with them in order to achieve development while reducing impact. At least three main economic forces offset the limits imposed by natural resources (Stiglitz, 1974): technological change, the substitution of man-made factors of production (capital) for natural resources, and returns to scale (firm’s production function, the rate of increase in the output/production to the subsequent increase in the inputs). These only go so far to mitigate the use of resources. As shown in the graph below, in the 1960’s the world population was about 3 Billion people; 1B in the developed world and 2B in the developing. As shown by Hans Rosling (2010), today we are about 7.2 Billion people, approximately 1B in the developed world, 1B in emerging economies, 3B in soon to be emerging economies, and 2B still poor (low income segment of the population is where most of the population growth normally occurs)². It is expected that by 2050, the world will have 9 to 10 Billion people (Peura, 2012), a nightmare scenario without a sustainable development model to shape human activities and to preserve and equitably develop our limited natural resources.

²www.ted.com/talks/hans_rosling_on_global_population_growth

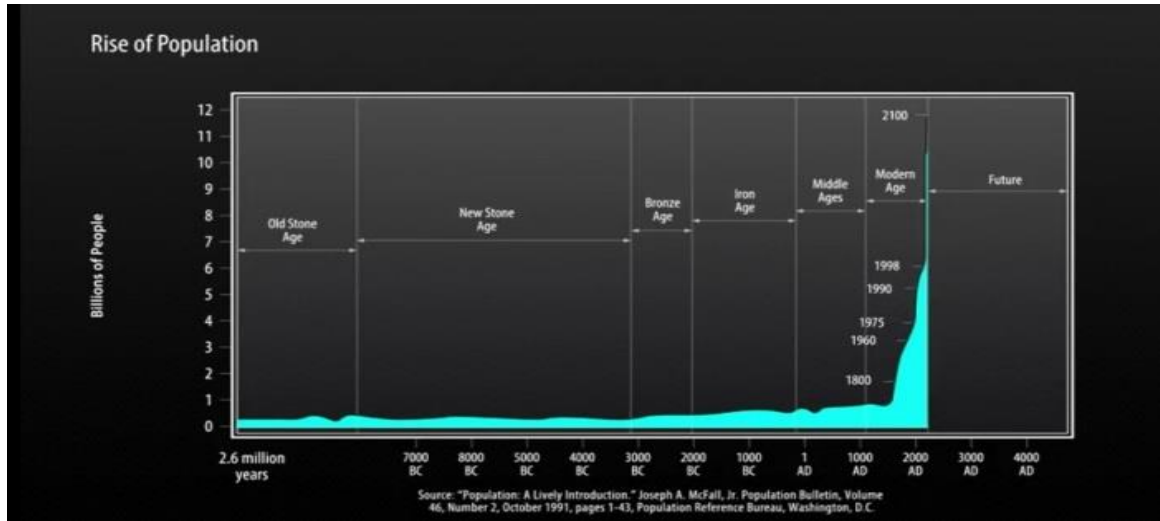


Figure 3. Population Growth (The age of sustainable development, Coursera 2014).

The planet's capacity to absorb waste products of the human economy (CO₂ in the atmosphere, nitrates in the water, heavy metals in the soil) has become more limiting than the available amount of potential natural resources itself (Kerschner, 2010). Impact can be estimated using the *IPAT* equation, where *I* represents total 'impact', measured in tons of CO₂, *P* is global population, *A* denotes affluence, measured by GDP (Gross Domestic Product) per capita, and *T* stands for 'technology' in the form of the CO₂ emissions intensity of GDP (Kerschner, 2010). For the analysis $I=PAT$, hence, $\ln I = \ln P + \ln A + \ln T$, differentiating all terms with respect to time gives the relationship between the growth rate of the variables: $\dot{I}/I = \dot{P}/P + \dot{A}/A + \dot{T}/T$. As shown by Hepburn & Bowen, in the past 20 years, annual population growth has been 1.3%, annual GDP per capita growth has been 1.4%, and emissions per unit of GDP have been falling by 0.75% p.a., and CO₂ emissions have been growing at 2% per annum: $\dot{I}/I = 1.3\% + 1.4\% - 0.7\% = 2\%$ (2010). In order for the emissions to fall, at the level required to achieve the 2°C change in global temperature, \dot{I}/I must be -4.9% (Hepburn & Bowen, 2010). This would require advances in technology to cause \dot{T}/T to fall at an even greater rate, posing the need for technologies and

economic models that take carbon out of the system while at the same time slowing down the increase of overall affluence. Another option would be reducing \dot{A}/A for the rich and increasing it for the poor, in a combination of de-growth (decroissance) for the rich with targeted-sustainable growth for the poor (Kerschner, 2010). The term decroissance as it is called in French can be used in order to show that it is necessary to take an integral approach, more than simply the opposite to the traditional one dimensional-growth oriented one. If an economy is to de-grow sustainably, it cannot reduce the quality of life of the people in developed nations, but rather their unsustainable consumption levels and waste, this is to become efficient and effective following a multidimensional approach.

The implementation of sustainable projects represent a significant short term investment with long term return, for which it is important to consider that cost must always be judged in relation to the environmental and social quality of the services provided, while also considering the external costs and damages that would result from a possible adherence to unsustainable energy systems (Müller-Steinhagen, Nitsch, 2005). The pursuit of fast economic growth, disregarding environmental impact, believing that wealthy societies will be inherently less damaging is reflected in the EKC (Environmental Kuznets Curve). The EKC attempts to show whether economic growth will ultimately lead to specific environmental improvements. However, even if environmental impact is reduced, it is important to understand how much drag will environmental limitations exert on economic development, and if it can bring the global economy to a halt (Hepburn & Bowen, 2012)³. A steady state economy in dynamic equilibrium

³ Empirical work done on the EKC shows that the hypothesis of less environmental impact as a result of income increase, is at best specific to local pollutants; there is no clear evidence that the EKC holds at the global and general level. Evidence shows estimated turning points at per capita incomes of between 1985 US\$3,280 to \$14,700 for a variety of local air and water pollutants, but for global pollutants such as CO₂, turning points are modeled to be well above incomes currently achieved by any nation, with an increasing pollution or with, at best, a small reduction. In some other cases pollution levels show a second turning point at higher incomes (Hepburn & Bowen, 2012).

is a necessity for a world with 9 billion people, dwindling resources and extreme weather due to climate change, among other century challenges.

One of the major indicators of environmental damage that has been largely accepted and documented is the levels of greenhouse gas emissions in the atmosphere. The table below shows the scale and intensity requirements to achieve Greenhouse Gas (GHG) reduction targets, as average annual GHG reduction rate in 40 years (Victor, 2011). For example an economy growing at 2% for 30 years would require a 4.36% reduction of GHG emission per year in order to cut 60% of GHG. Victor (2012) shows that at a basic level, any resource or environmental flow can be understood as the combination of the scale of the economic activity and the flow intensity (for example: $\text{GHG} \cdot \text{GHG}/\text{GDP}$ per year).

		Rate of economic growth					
		-1%	0%	1%	2%	3%	4%
Reduction after 40 years	50%	0.73%	1.75%	2.77%	3.78%	4.80%	5.82%
	60%	1.29%	2.32%	3.34%	4.36%	5.39%	6.41%
	70%	2.03%	3.06%	4.09%	5.12%	6.15%	7.18%
	80%	3.06%	4.11%	5.15%	6.19%	7.23%	8.27%
	90%	4.87%	5.93%	6.98%	8.04%	9.10%	10.16%

Table 1. Scale and intensity requirements to achieve Green House Gasses (GHG) reduction targets (Victor, 2011).

Industrialized and emerging economies require specific development strategies, according to their needs, responsibilities and challenges. The implementation of a Quasi Steady State Economy (QSSE) in dynamic equilibrium, as presented by Kerschner (2010), would require a global strategy beyond the reach of this research, yet necessary for the long term success of sustainable local strategies. Quasi Steady State Economy (QSSE), can be understood

as the combination of Sustainable De-growth (Decroissance⁴) for Industrialized Economies and Sustainable Growth for Emerging Economies (QSSE=SDG+SG) in order to bring the global economy to a state of dynamic equilibrium.

One can accept that, in some cases, economic growth improves environmental quality while also holding that environmental limits will nevertheless prevent unbounded growth. While total decoupling of economic growth from environmental impact is achieved, future growth must damage the environment at a lesser rate, and eventually it should actually preserve some stock level of natural capital altogether (Hepburn & Bowen, 2012). Given enough energy, a wasteful, ineffective, inefficient and therefore unsustainable technology, would deplete and then dissipate all concentrated deposits of minerals in the respective sinks of the lithosphere in a high entropy state (Kerschner, 2010). To prevent this possibility we need a sustainable system, but how should we define sustainability? The concept of ‘weak sustainability’ states that for economic growth to be considered sustainable the total aggregate stock of capital, both physical and natural, should not decline over time (Hepburn & Bowen, 2012). On the other hand, ‘strong sustainability’ requires the preservation of natural capital (or at least some minimum quantity), regardless of its substitutability. If long-term human welfare requires the preservation of stocks of natural capital, then no manufactured capital can compensate for the loss of that natural capital (Hepburn et al., 2012). The World Economic Forum (WEF) in its 2014 Global Risks report presents challenges that seriously challenge the long-term sustainability of any corporation invested in not harming others. Sustainable development is necessary to mitigate the effects of most of the risks identified in the list below by the WEF.

⁴ <http://www.ft.com/intl/cms/s/0/2c6a6306-f58c-11e0-94b1-00144feab49a.html#axzz32THpULzC>

No.	Global Risk
1	Fiscal crises in key economies
2	Structurally high unemployment/underemployment
3	Water crises
4	Severe income disparity
5	Failure of climate change mitigation and adaptation
6	Greater incidence of extreme weather events (e.g. floods, storms, fires)
7	Global governance failure
8	Food crises
9	Failure of a major financial mechanism/institution
10	Profound political and social instability

Source: Global Risks Perception Survey 2013-2014.

Note: From a list of 31 risks, survey respondents were asked to identify the five they are most concerned about.

Table 2. Global Risks (WEF Global Risks, 2014).

Sustainable development models provide an integral approach to long-term economic and social development, integrating environmental considerations, according to specific local needs. This research focuses primarily on energy as the main sustainability criteria, analyzing demand and power generation from traditional and renewable energy sources and their relevance for the sustainable development of the sustainable hospitality industry in the Sierra Nevada de Santa Marta. The next section presents an overview of the energy landscape and the alternatives to power sustainable development

2.1.1 RENEWABLE ENERGY SOURCES

Entropy production in energy conversion processes reduces exergy (energy consumption) and changes the composition of and the energy flows through the biosphere and when these changes are too fast, individuals and societies cannot adapt to them and they are perceived as

environmental pollution⁵. According to the second law of thermodynamics the entropy of a system approaches a constant value as the temperature approaches zero (Klimenko, 2012). The planet's temperature, as part of the solar system, will approach zero only when the energy from the sun stops reaching it. The earth is a closed system but it is not isolated, as it receives a huge amount of solar energy influx of which only about 3% or so is metabolized by plants, and although energy cannot be recycled (depleted stocks of coal; oil and gas are lost forever) entropy can increase in one system at the cost of another. The energy dissipated by the sun due to nuclear combustion of its mass, could sustain the entropic arrow until the end of the Sun's lifetime (Kerschner, 2010). Therefore, planetary entropy can be sustained, making solar powered economic and social development, and 100% recycling feasible since the law of conservation of mass states that matter is neither produced nor destroyed, therefore, in a sustainable system, energy from the sun can offset the 'waste' resulting from imperfect recycling. The key issue is that waste should always tend toward zero accounting for the entropic resistance of materials.

Powering development with renewable energy technologies requires upgrade and construction of infrastructure. The installations needed for the production of electricity from renewable energy sources, must be constructed, operated, and finally dismantled at the end of their useful life. Two parameters are used to quantify the effects from these processes on the environment, in particular the ones related to raw materials and energy required for the construction, and to compare it with the use of conventional energy sources (Müller-Steinhagen and Nitsch, 2005): first *the energetic amortization time*, which is the time needed by an energy system to provide the same amount of energy as required for its construction, operation, and disposal, complemented by *the cumulated greenhouse gas emissions*, which relates to the CO₂

⁵ www.aspo2012.at/wp-content/uploads/2012/06/K%C3%BCmmel_aspo2012.pdf. P22/26.

avoidance cost of renewable energy technologies. The table below presents amortization time for different power sources.

POWER SOURCE	ENERGETIC AMORTIZATION TIME
Wind	3 to 7 months
Hydroelectric	9 to 13 months
Solar Thermal	5 months
Solar PV- Polycrystalline silicon	3 to 5 years
Solar PV-Thin film	2 to 3 years
Gas	Never
Coal	Never
Nuclear	Never

Table 3. Energy amortization time of different electricity generation systems (adapted from Müller-Steinhagen and Nitsch. 2005).

According to Müller-Steinhagen and Nitsch, while the energy required for the construction of fossil fired or nuclear power plants is recovered within 2 to 3 months of operation, these plants never amortize in terms of their overall operation, because they require always more energy in the form of fuel than they produce in the form of electricity. Contrariwise, a multiple of the energy required for setting-up and operating renewable energy systems is produced within their operational lifetime, especially if the prices continue falling as is the current economic trend shown in the next graph (2005).

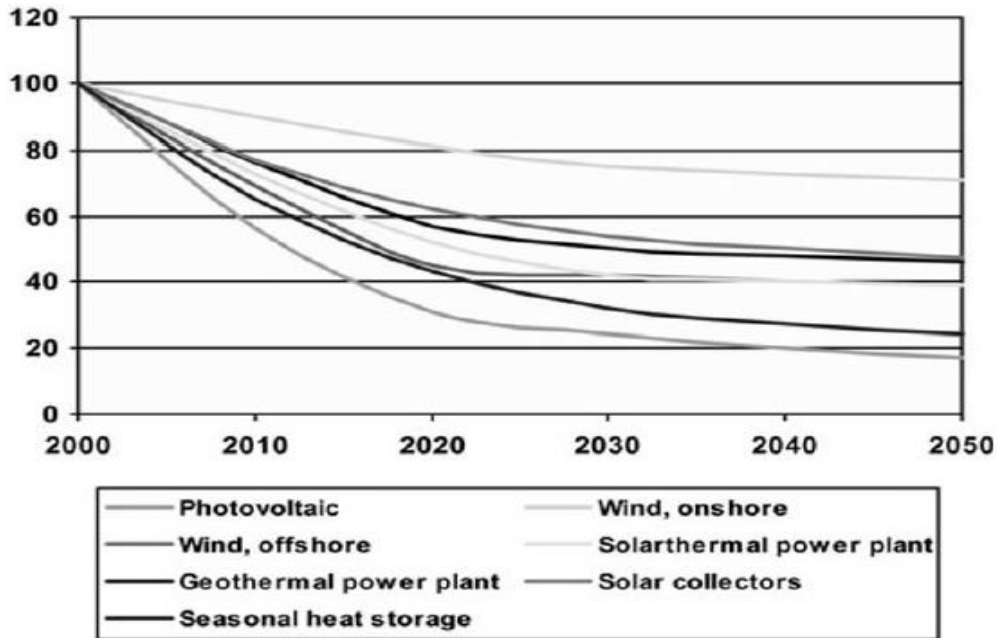


Figure 4. Future development of costs (current cost levels = 100%) for technologies for the use of renewables, derived from learning curves (Müller-Steinhagen and Nitsch. 2005).

During 2008 (*Figure 5, Below*), renewable energies accounted for 19% of the global primary energy; of which traditional biomass contributed with 13%, used for cooking and heating, with a very slow growth in the world regions where it is being replaced by modern energy technology. Large hydroelectric power represented about 3.2% with a growth reduction in the last decade, mainly due to the increasing difficulty of finding floodplain areas and environmental licensing. New renewables; represented by small hydroelectric power plants, modern biomass, biofuels and energies like solar, eolic, and geothermal contributed 2.7%, used mainly to generate electric power (0.7%), and produce sanitary hot water and heating (1.4%), and the last 0.3% are used as transportation biofuels (Hernandez, Velasco, Trujillo, 2011). Renewables are estimated to represent about half of the increase in global power generation through to 2035, with variable sources, wind and solar photovoltaics making up 45% of the

expansion in renewables (WEO, 2013). The energy forecast presents a positive trend for the clean renewable component of the primary world energy, which could power economic development without greenhouse gas emissions (GHG).

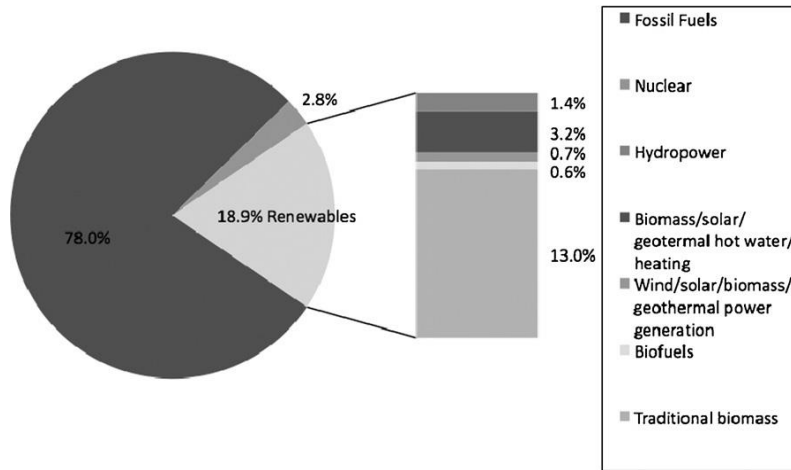


Figure 5. Participation of renewable energy within the framework of primary world energy (Hernandez, Velasco and Trujillo. 2011).

Growth of renewable energy sources from 2004 to 2009, for many renewable technologies such as wind power, sped up in 2009 in comparison with the previous four years. The graph below shows that grid-connected solar photovoltaic (PV) growth has been the fastest of all renewable technologies, with a 60% annual average growth rate for the five-year period. Biofuels also grew rapidly, at a 20% annual average rate for ethanol and a 5% annual average for biodiesel (reflecting its lower production levels), although growth rates began to decline later in the period (Hernandez, Velasco and Trujillo. 2011). These trends are important for emerging economies in order to design energy strategies oriented towards energy source with reduced or zero negative environmental impact as they begin to achieve more rapidly western lifestyles.

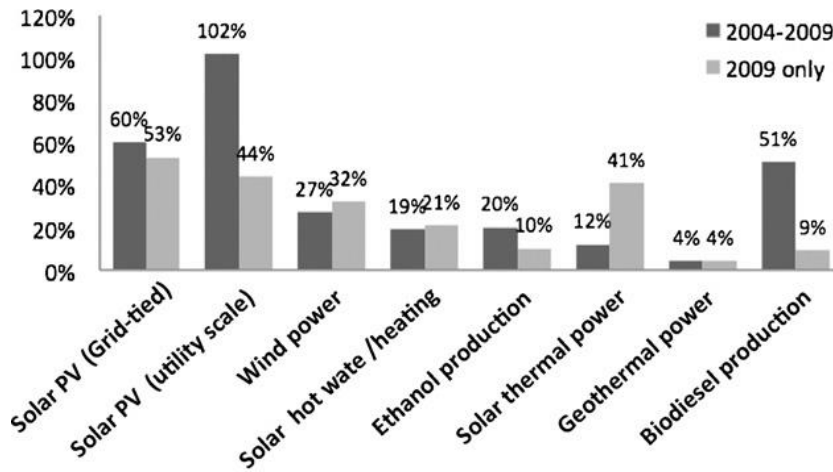


Figure 6. Growth of renewable technologies during the period: 2004–2009. Source: REN21. 2010 (as cited by Hernandez, Velasco and Trujillo. 2011).

As shown in the next graph, the cost of PV modules in the last four decades has come down significantly and in the last couple of years the market has also grown quite rapidly, hinting a near term market growth of bulk silicon and thin film solar cells that is encouraging for the industry (Hernandez, Velasco and Trujillo. 2011). These trends are very important when considering energy sources to power the sustainable development of the hospitality industry. Lower cost and higher efficiency will make investments in solar photovoltaic (PV) systems even more feasible.

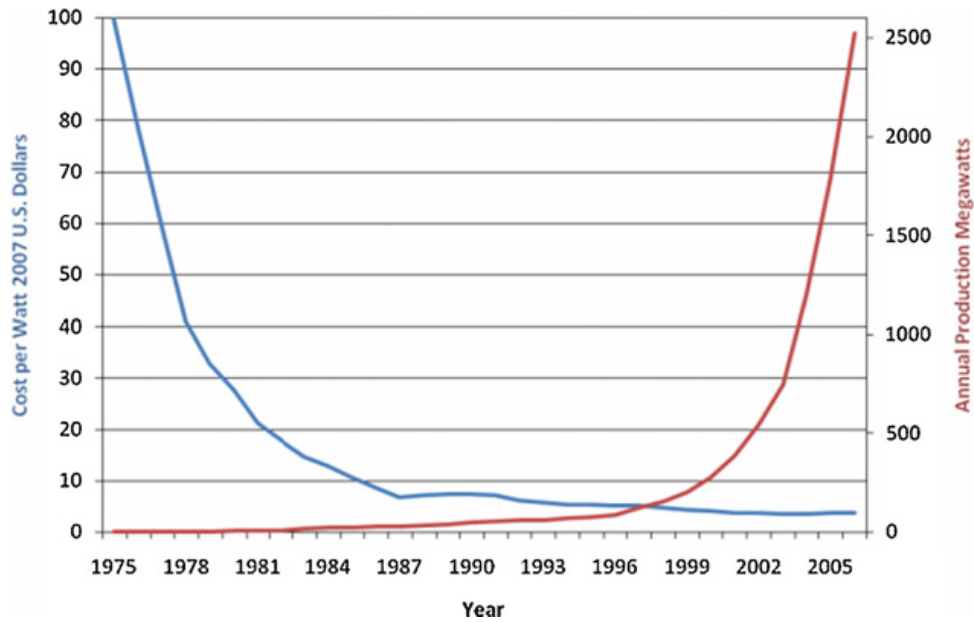


Figure 7, World PV production and cost per watt in the last about 30 years (Hernandez, Velasco and Trujillo. 2011).

Wadia (2009), Fthenakis, (2009) and Yoon, Song and Lee, (2009) all show an aggressive development of non-silicon-based PV materials, driven by fluctuating silicon prices. For example: iron sulphide (FeS₂) would produce 10,000 times more electricity than silicon-based PV (Hepburn & Bowen, 2012). To understand the future of renewables, photovoltaics in particular, it is important to notice that market failures associated with environmental pollution, interact with market failures associated with the innovation and diffusion of new technologies with the following two approaches (Jaffe, Newell and Stavins, 2004): the first is to foster the development and diffusion of new technology by designing environmental policies to increase the perceived market payoff and maximize flexibility in compliance. The second approach is to implement policies aimed directly at encouraging the development and diffusion of environmentally friendly technologies. Innovation and technology diffusion respond to the incentives of the market, and properly designed regulating framework can create such incentives.

Therefore the right legal framework is paramount for the long term success of sustainable hospitality projects.

Due to the change in the states' and economies' conception of photovoltaic systems and economies of scale, the installation of smaller power plants has been made possible, highlighting the importance of producing closely to the consumption centers. Hence, development and implementation of distributed, more adaptable systems is emerging as a viable alternative in the short and medium term (Hernandez, Velasco and Trujillo. 2011). *Figure 8* shows the main divisions of solar power technologies.

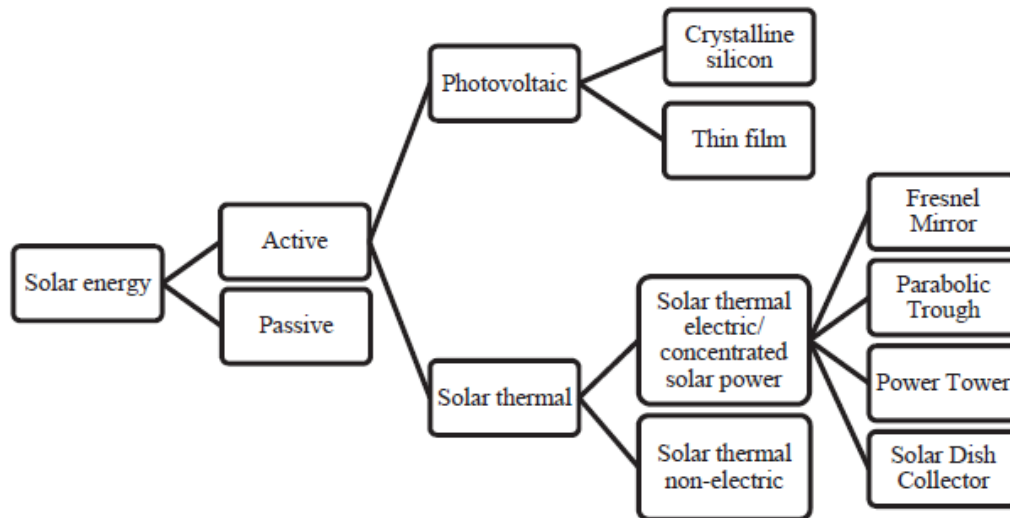


Figure 8. Assorted types of solar energy based on global market availability (Akikur, Saidur, Ping, Ullah, (2013).

The shift towards renewable solar energy is already happening globally. In 2009, about 7 GW of solar PV power capacity was installed world-wide (6.2 GW in the countries that report to IEA-PVPS), an impressive addition of 43.6% of new solar PV power capacity in 2009 and a

global shift toward grid-connected PV power world-wide is observed on the graphs below (Muneer, 2011).

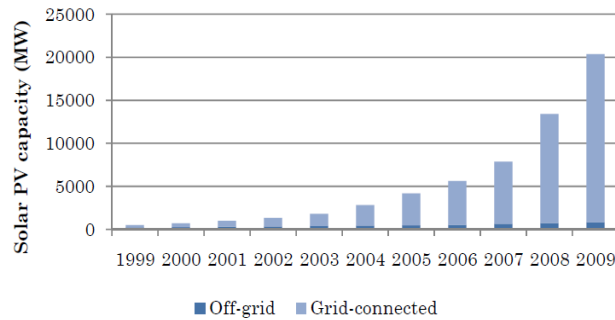


Figure 9. Cumulative installed solar PV power capacity as per the IEA-PVPS (Muneer, 2011).

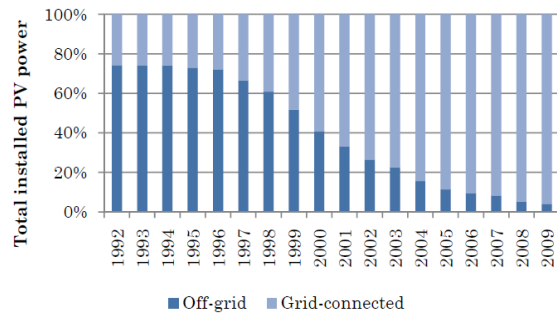


Figure 10. Percentages of grid-connected and off-grid PV power capacity as per IEA PVPS (Muneer, 2011).

More than 80% of PV modules in current global production use mono and polycrystalline silicon technology while thin film technology contributes to about 12%, with three photovoltaic materials currently allowed to manufacture solar cells industrially: amorphous silicon (a-Si), Cadmium telluride (CdTe) and Copper indium selenite (CuInSe₂ (CIS)). Currently efficiencies of 25% are achieved with the triple type junction panels (Hernandez, Velasco and Trujillo, 2011), which increases the financial viability of PV technologies. Yet, it is important to remember that the extraction of such minerals⁶ must be done in a sustainable way, avoiding unintended negative effects usually resulting from resource-intense extractive industries⁷.

⁶ www.mineralseducationcoalition.org/pdfs/Solar-Panel.pdf

⁷ www.bbc.com/news/magazine-16535620

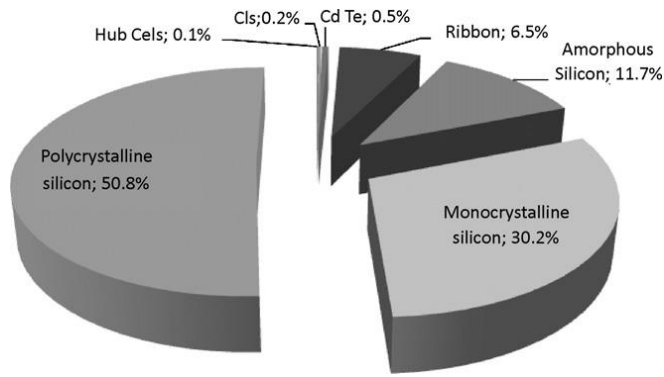


Figure 11. Contribution of several technologies of photovoltaic modules to the worldwide market (Hernandez, Velasco and Trujillo. 2011).

New technological milestones continue to be achieved, showing a positive trend for solar photovoltaics. On September 23th, 2013, The Fraunhofer Institute for Solar Energy Systems ISE, Soitec, CEA-Leti and the Helmholtz Center Berlin announced a new world record for the conversion of sunlight into electricity using a new solar cell structure with four solar sub-cells with an efficiency of 44.7%⁸. These developments although encouraging still have to face technical, financial, legal and cultural obstacles before reaching residential and commercial projects. Yet, with an ever-growing global energy demand, PV prices going down and considering the importance of the Energy criterion in human history; particularly since the industrial revolution, it is necessary to analyze different scenarios and consequences of the current levels of consumption. The following sections present a general overview required to understand the levels of consumption and the potential for renewable energy sources in the world, Hawai'i and the Sierra Nevada de Santa Marta.

⁸ www.ise.fraunhofer.de/en/press-and-media/press-releases/presseinformationen-2013/world-record-solar-cell-with-44.7-efficiency?set_language=en

2.1.2 GLOBAL ENERGY DEMAND

Since the beginning of the industrial revolution, energy consumption has increased far more rapidly than the number of people on the planet. World-wide energy consumption, hence the consumption of fossil resources in the form of coal, oil, and natural gas, has increased by a factor of 60 to the present level of 425×10^{18} J/y, the average person today uses fifteen times more energy than a person 130 years ago (Müller-Steinhagen and Nitsch, 2005). The current fast growth is relatively recent; energy demand started to ramp up around 1950, while energy consumption world-wide doubled between 1970 and 2000 and no fundamental change of this growth trend is expected in the near future, since this incremental trend has only been altered by temporary drops in the past, caused e.g., by the two world wars, the oil-price crises, or the serious decline of industrial production in the states of the U.S.S.R (Müller-Steinhagen and Nitsch, 2005).

According to the International Energy Agency (IEA), the energy sector is the source of two-thirds of global greenhouse-gas emissions, and will be pivotal in determining whether or not climate change goals are achieved. According to the World Energy Outlook (WEO) from 2013, accounting for the impact of measures announced by governments to improve energy efficiency, support renewables, and reduce fossil-fuel subsidies; and, in some cases, to put a price on carbon, energy-related CO₂ emissions will still rise by 20% to 2035. This leaves the world on a path consistent with a long-term average temperature increase of 3.6°C, far above the internationally agreed target of 2°C (WEO 2013, Executive summary, 2013). As presented in the WEO-2013, the center of gravity of energy demand is switching decisively to the emerging economies, particularly China, India and the Middle East (*Figure 12*), which drives global energy use one-third higher.

Renewable energy sources will grow the most, fossil fuels will also increase, and estimates show that both conventional and non-conventional oil reserves will meet the projected world demand only for some 50 years and gas reserves correspondingly for 80 years (Peura, 2012). As seen before, renewables account for nearly half of the increase in global power generation to 2035, with variable sources (wind and solar photovoltaics), making up 45% of the expansion in renewables (WOE-Executive summary, 2013).



Figure 12. Primary energy demand and share of global growth, International Energy Agency (*World Energy Outlook*, 2013)

It can be seen how unbounded growth in population (P) and its consumption (A), powered by a dirty technology (T), would cause huge negative environmental impact (I). The stress that our economies has been exerting on ecosystems since we have discovered and learned to utilize fossil fuels, is good evidence, especially when we see the huge environmental and social cost China is paying for its speedy growth. In order to reduce impact (I), T should be negative and A should be a function of the environmental limits (Kerschner, 2010). Development

of energy-related CO₂ emissions in different IPCC scenarios compared to the historical process and their impact on the atmospheric CO₂ concentration and temperature can be seen on *Figure 13*. (A1FI = meeting growing energy demand mainly by fossil energies; ‘450’ and ‘550’ = average values of scenarios which result in a stable concentration of CO₂ (ppm) in the atmosphere) (Müller-Steinhagen and Nitsch, 2005).

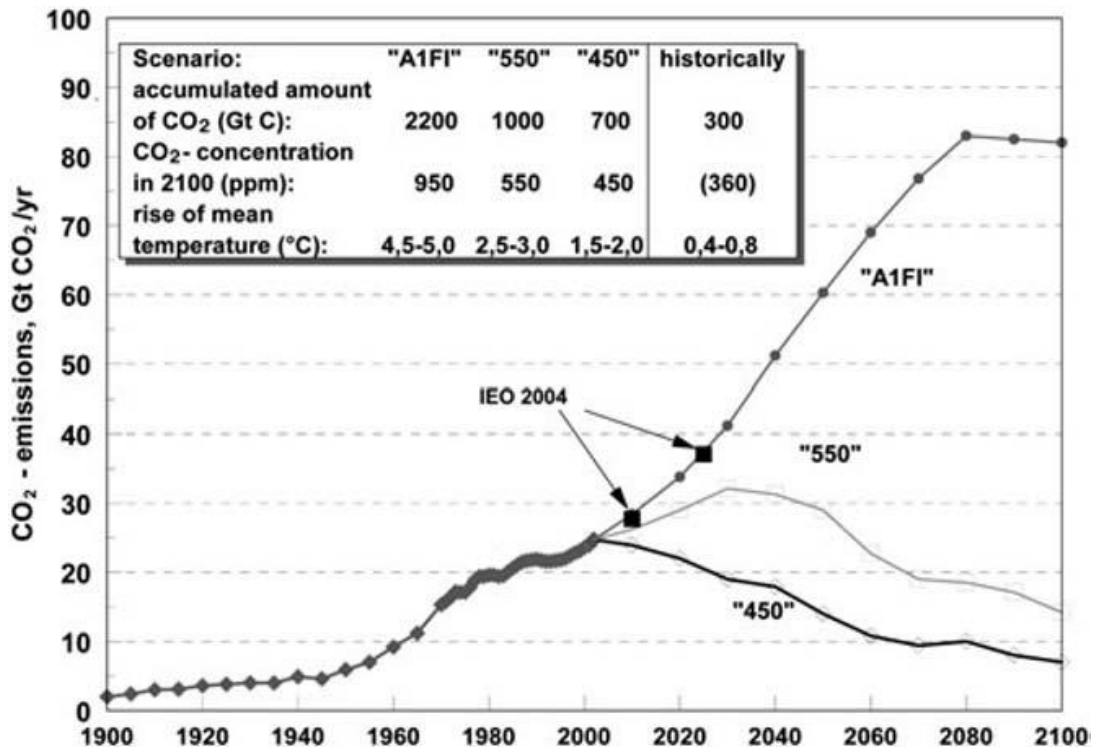


Figure 13. Development of energy-related CO₂ emissions in different IPCC scenarios compared to the historical process and their impact on the atmospheric CO₂ concentration and temperature (A1FI = meeting growing energy demand mainly by fossil energies; ‘450’ and ‘550’ = average values of scenarios which result in a stable concentration of CO₂ (ppm) in the atmosphere). Source: IPCC (2002)

The current increase of about 23.5 billion tons of CO₂/y, resulting from the steadily growing global energy consumption, has led to the emission of a total of 1000 billion tons of

additional CO₂ into the atmosphere since the beginning of industrialization, 80% of this amount was emitted in the last 50 years. To keep the temperature rise within reasonable limits, the current concentration of CO₂ in the atmosphere of around 360 ppm must not be allowed to rise above 500 ppm before the end of this century (Müller-Steinhagen and Nitsch, 2005). The figure below shows how the level of CO₂ in the atmosphere has spiked since the industrial revolution up to a point today that is almost off the chart on the far right side. It is important to understand the need for a dynamic and stable economy within environmental limits while addressing challenges from our current stage of development.

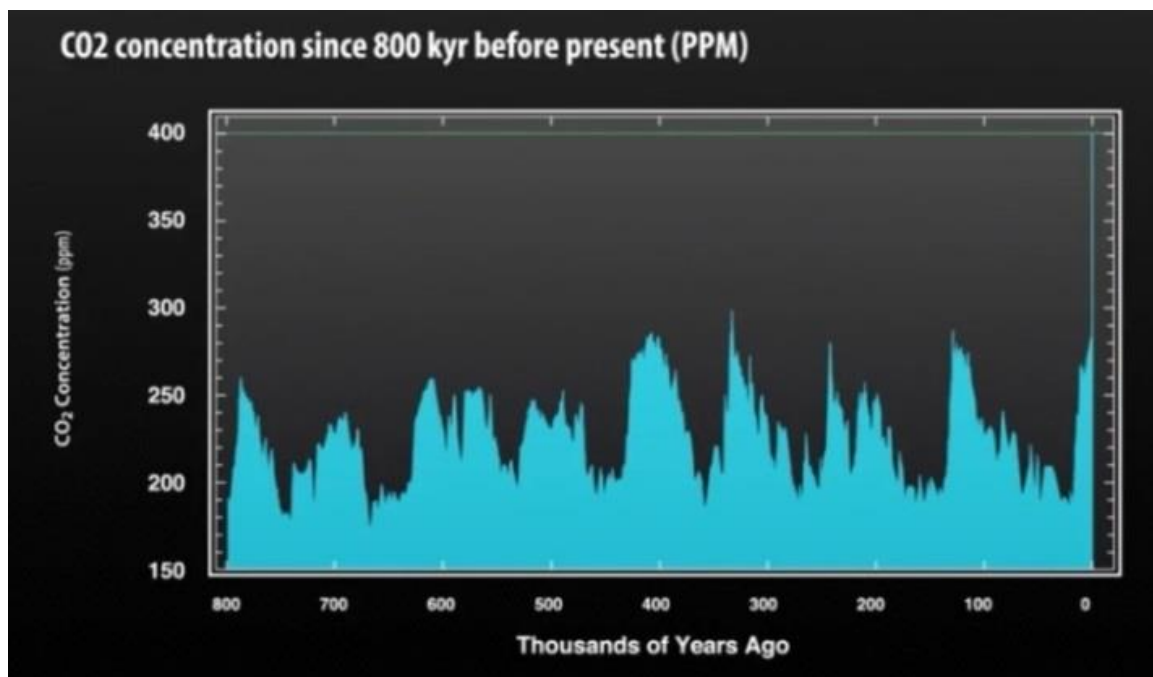


Figure 14. CO₂ concentrations (The age of sustainable development, Coursera 2014).

Another, perhaps greater sustainability problem is the huge disparity in energy consumption between industrialized and developing countries; which has increased rather than decreased in recent years, as shown in Figure 15. Today, 24% of the world's population; in the industrialized countries, consume 65% of the conventional energy carriers and 75% of the

electricity, and as mentioned before, a person in North America consumes 15 times more energy than one in Africa, and 30 times for commercial energy carriers, yet, the energy demand in Europe and Japan is about 50% that of the U.S. (2.5 times the world average), indicating that prosperity is not directly linked to high energy demand (Müller-Steinhagen and Nitsch. 2005). It is possible to use less energy and still be an affluent economy, especially with the advent of renewable energy sources with reasonable amortization rates.

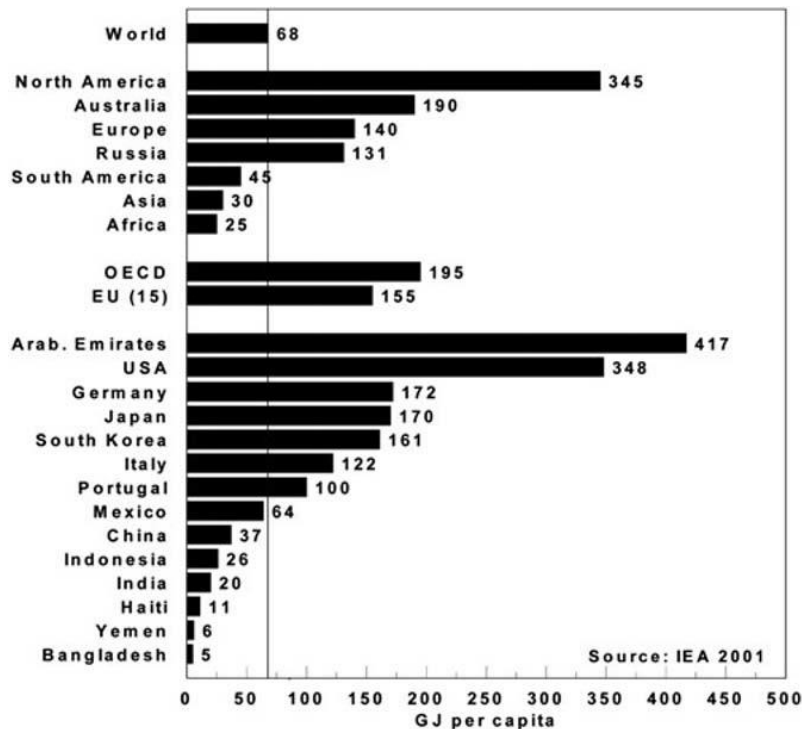


Figure 15. Comparison of the per-capita energy consumption (1999) by countries (including non-commercial energy) (Source: IEA (2001) system (as cited by Müller-Steinhagen and Nitsch. 2005)).

The unequal per capita energy consumption shown in the previous graph is yet another argument for sustainable development in an economy in dynamic equilibrium in which developed economies de-grow while emerging economies grow until reaching a quasi-steady

state. The economic development of the so called poor-countries is limited by several factors, including financial constraints that prevent them from fully taking advantage of technology transfers and cause them to diverge from the growth rate of the rest world (Fung, 2009). Financial and legal constrains created by under-developed financial markets, worsened by outdated or inappropriate legal frameworks and weak rule of law in general make it more difficult to motivate investment in R&D and baseline technologies, which are necessary inputs for successful technology transfer. As the next section shows an appropriate set of policies can make the difference, yet successful implementation of renewable energy systems will go just so far, presenting new challenges and revealing old limitations. Integral multidimensional strategies for sustainability reflected on long term sustainable policy can integrate and boost the massive technology transfer required to bring down GHG emissions.

2.1.3 ENERGY SOURCES AND ENERGY DEMAND IN HAWAII

Hawaii is an island chain lacking fossil fuels and must import relatively expensive petroleum for the generation of 70% of its electricity; therefore electricity generation cost in Hawaii is pegged to oil prices, making the residential electricity rate 3 times that of the rest of the United States. In addition each island must possess enough generating capacity to meet local demand and provide emergency reserves, since they can't be interconnected⁹. The electricity rate in Hawaii went up 50% between 2009 and 2012 (Blue Planet Foundation, 2014).

⁹ www.eia.gov/todayinenergy/detail.cfm?id=15091

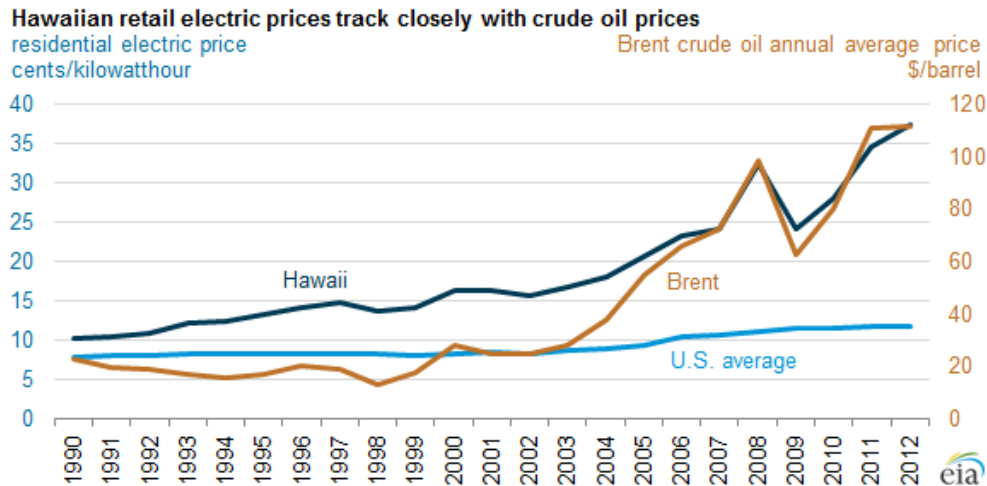


Figure 16. Hawaiian retail electric prices (U.S. Energy Information Administration and IntercontinentalExchange Inc, 2013).

As recently as 2008, oil and coal represented more than 90% of Hawaii's annual electric generation. The petroleum share of electric generation has been reduced, from 81% in 2002 to 72% in 2013 (through November). Meanwhile, generation from renewable sources has climbed from a 4% share in 2002 to more than 12% in 2013, in many regards as a result of the implementation of programs such as feed in tariff¹⁰ and net metering¹¹. Generation from coal comes from a single 180-megawatt (MW) facility on Oahu and has been relatively steady at 13%-15% of total generation each year¹². Recently HECO (Hawaiian Electric Company) has enraged the solar industry after an unfavorable media release about Rooftop PV¹³. Grid tied PV system represent a change in the way energy grids were designed. As shown in the graph below, from a presentation made by Dora Nakafuji, director of renewable energy planning for Hawaii

¹⁰

www.heco.com/portal/site/heco/menuitem.508576f78baa14340b4c0610c510b1ca/?vgnnextoid=0b0a8618ce4f7210VgnVCM1000005c011bacRCD&vgnnextfmt=default&cpsexcurrchannel=1

¹¹ www.hawaiianelectric.com/heco/Clean-Energy/Clean-Energy-Generation/Net-Energy-Metering-in-Hawaii

¹² www.eia.gov/todayinenergy/detail.cfm?id=15091

¹³ www.hawaiinewsnow.com/story/24544422/rooftop-pv-enjoys-another-strong-year-in-hawaii

Electric Co. (HECO), at the DistribuTECH conference in San Antonio, Texas¹⁴. Oahu shows a Loch Ness profile for energy demand during its daily cycle, causing unforeseen effects on the energy grid. Energy demand drops when rooftop solar PV energy supply exceeds the energy demand on those circuits around midday. Then when the sun fades away, in late afternoon, the energy demand goes back up, only to diminish once again late at night, giving the name to the profile. This presents a truly challenging situation in terms of turning down oil-fired generators when solar is at its peak, then ramping them up much faster than it is used to when solar power availability declines¹⁵. This is to show some of the challenges renewable energy must face to power sustainable development. The need for a smart grid able to handle distributed generation from diverse renewable energy sources in changing scenarios like the one shown on the graph below.

Trending Hi-Pen Circuits (12kV) – Loch Ness Profile

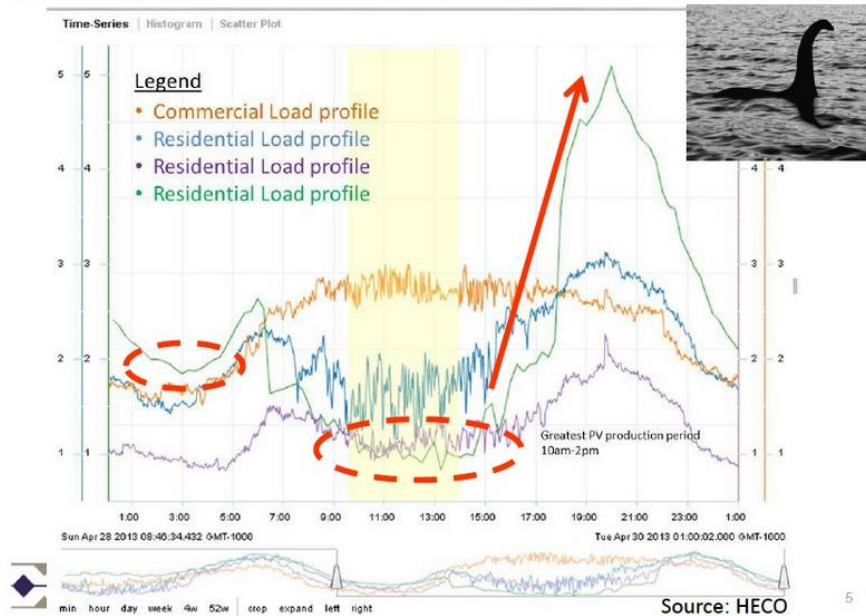


Figure 17, Energy load profile (HECO, 2014).

¹⁴ www.theenergycollective.com/jeffstjohn/339451/hawaiis-solar-grid-landscape-and-nessie-curve

¹⁵ www.theenergycollective.com/jeffstjohn/339451/hawaiis-solar-grid-landscape-and-nessie-curve

2.1.4 ENERGY SOURCES AND ENERGY DEMAND IN COLOMBIA

Negative environmental impact due to energy generation is a critical sustainability factor in the US, since today everybody is looking at the CO₂ emissions caused by oil and coal boilers. In Colombia energy is generated through hydroelectric plants with much lower levels of CO₂ emissions resulting from energy generation, but there are other impacts which are usually ignored. The negative social and environmental impact from hydroelectric projects is usually out of sight, making the transition to renewable energy sources, apparently less pressing for many industries.

Between 2002 and 2012 the Colombian economy grew at an annual average rate of 4.6%, population grew at about 1.2%. The country's energy demand grew by 2.9%, slowed down by the effects of the 2008 crisis felt throughout 2009, and it is projected to average 3.9% between 2012 and 2020 (UPME, 2013). According to the demand projections from the UPME (Unidad de Planeacion Minero Energetica), unit from the Energy and Mines Ministry of Colombia, in 2012 Colombia's energy demand was 1000PetaJoules¹⁶, 67% from fossil fuels, 13% from biomass and 20% from electricity (about 20% of electricity comes from fossil fuels, and 7% of the gasoline and diesel is biofuel) (2013). As shown in the graph below solar and wind are not part of the energy landscape of the country.

¹⁶ 1PetaJoule = 10¹⁸ Joules

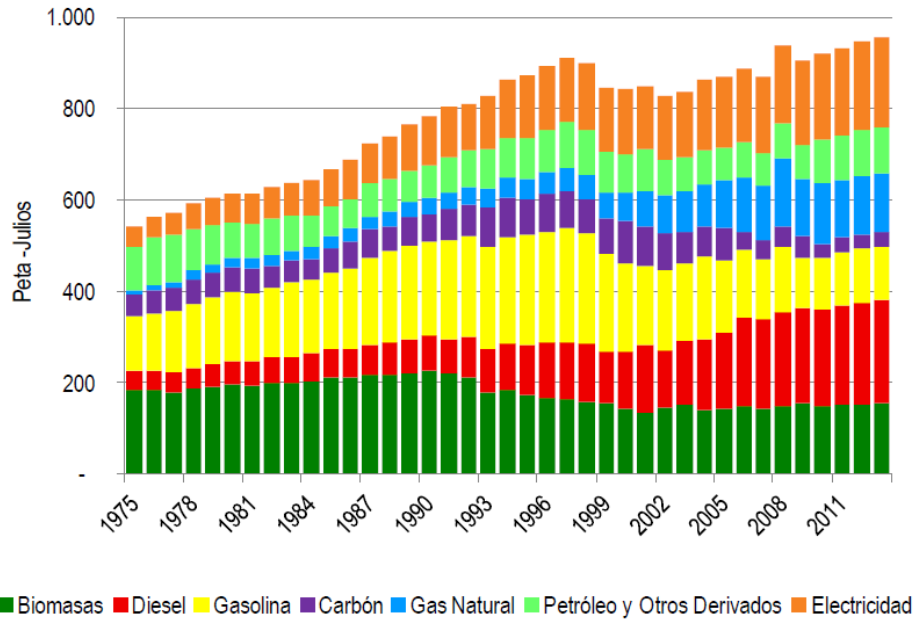


Figure 18. Final energy demand in Colombia (UPME, March report 2013).

The Colombian constitution in its article 80 establishes that the Colombian State will plan the use and management of natural resources for their sustainable development. However, Colombia's strategy regarding renewable energy is still at a very basic stage. The trend of energy policies in Colombia, regarding renewable energy sources, can be summarized in the Law 697 of 2001¹⁷, also called Law URE (Rational Use of Energy), Decree 3683 of 2003¹⁸. The law 697 of October 3, 2001, declared URE (Rational Use of Energy) a matter of public and national interest. Its main objective is to guarantee timely and sufficient energy supply, improve competition and to protect the consumer. In this law sustainable development is defined as the development that boosts economic growth, improves quality of life and social wellbeing, without depleting natural resources and the environment in general, and respecting the right for future generation to use it for their own needs.

¹⁷ www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=4449

¹⁸ www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=11032

As a result of its secondary role, the development of photovoltaic systems in Colombia has been focused mainly on the rural sector in electrification programs (small systems of 50–70Wh, US\$1200-1500, for lighting, radio and TV, and other basic needs of the peasants), with strong state funding, currently using resources like FAZNI (Fondo de Apoyo Financiero para la Energización de las Zonas No Interconectadas) and the IPSE (Instituto para la Promoción de Soluciones Energéticas); currently leading the State’s actions in the Colombian countryside (Hernandez, Velasco and Trujillo. 2011). This is to show that Colombia’s energy strategy regarding renewable energy sources, solar and wind in particular is insufficient to provide a competent regulatory framework and market mechanisms for up-front cost financing of residential and non-residential projects. As shown on *Figure 19* and *20* Colombia’s coverage has been matching increasing demand, providing coverage for 94.4% of the national territories.

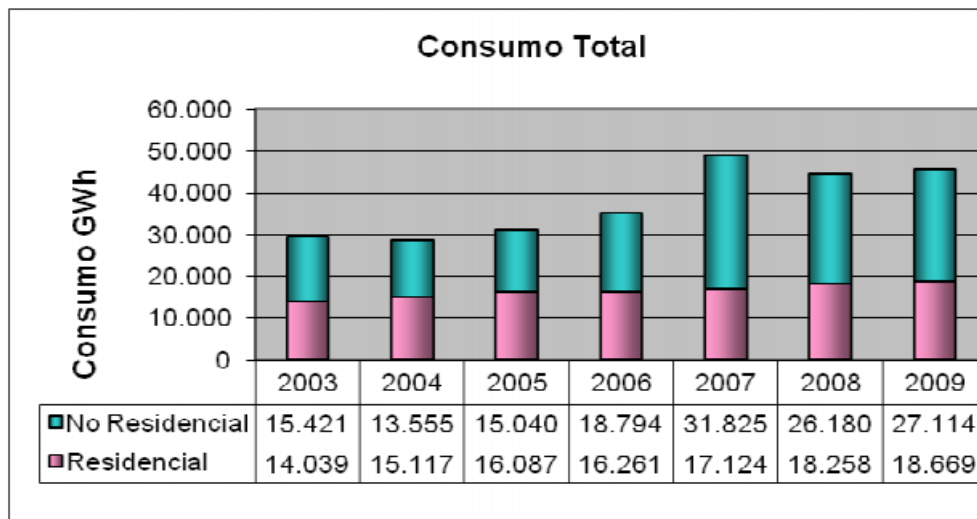


Figure 19. Total energy demand residential and non-residential (UPME, 2010)¹⁹.

¹⁹ www.upme.gov.co/Docs/PEN/PEN%202010%20VERSION%20FINAL.pdf

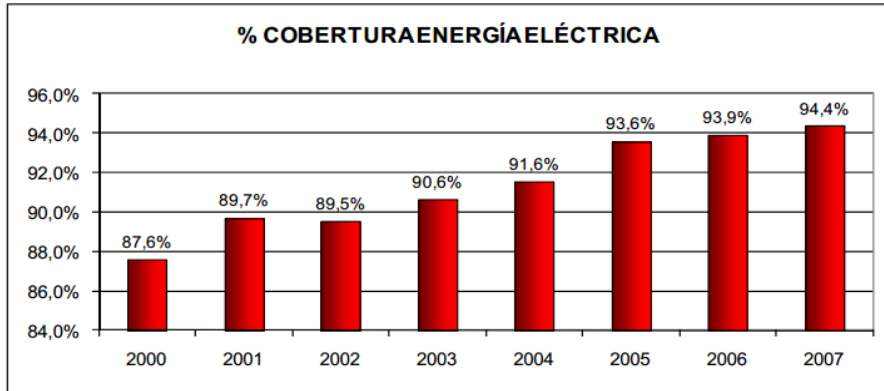


Figure 20. Percentage of electricity service coverage in Colombia. Period 2000-2008 (UPME, 2010).

The graph below (*Figure 21*) shows energy prices in Colombia decreasing between 2009 and 2010, yet the trend from the previous years could suggest a high probability for energy prices to present an overall upward tendency.

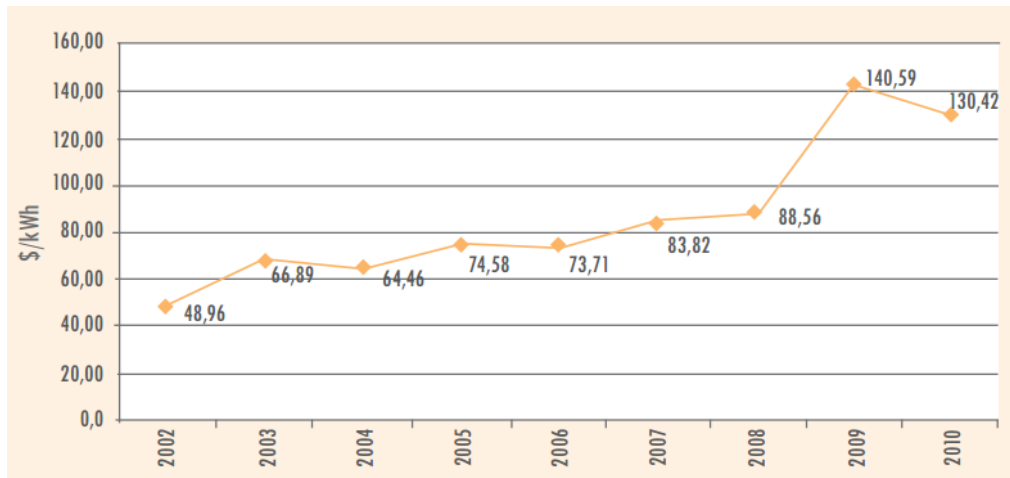


Figure 21. Energy price trend 2002-2010 \$/kWh (UPME, 2011)²⁰

Electricity prices in Colombia could increase especially as a result of extreme weather events, such as the El Niño effect presented in the chart below (*Figure 22*). As shown previously

²⁰ www.upme.gov.co/Docs/PEN/PEN%202010%20VERSION%20FINAL.pdf

renewable energy sources do not represent extra cost in order to operate and produce electricity. This stable, almost fixed kWh price, given by renewable energy sources is yet another reason to increase the likelihood for renewable energy sources to become relevant in Colombia's energy policy and key for the implementation of sustainable strategies.

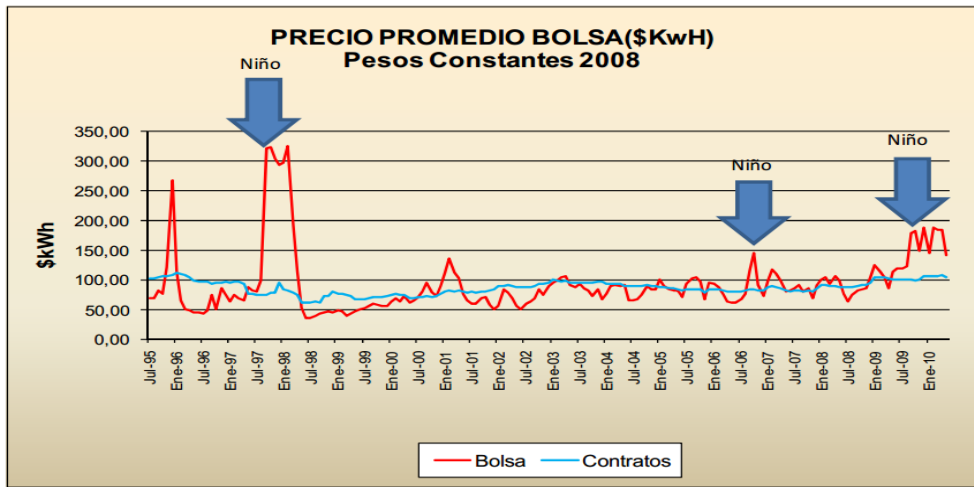


Figure 22. Average price evolution in \$Kwh at 2008 constant prices de 2008 (UPME, 2010)²¹.

The implementation of renewable energy technologies in Colombia besides requiring an appropriate policy framework also needs greater environmental corporate awareness, beyond whitewash, CSR and CER (Corporate Environmental Responsibility) imbedded in the corporate DNA so industries can exert pressure for the development of comprehensive sustainable strategies. Analyzing CSR activities in the Lodging Industry, Levy and Park present the results of a survey of the US-based hotel executives showing that the most important and highest performing initiatives had a tendency towards popular environmental practices focused on energy, waste and water management (2011). The next section shows how the development of

²¹ www.upme.gov.co/Docs/PEN/PEN%202010%20VERSION%20FINAL.pdf

industries with reduced or zero negative impact has become a priority for corporations in developed economies, particularly in the US and the Eurozone. Due to the global nature of critical issues previously discussed, global convergence towards sustainable practices can be expected, especially in regions that have abundant natural resources where low impact industries like sustainable hospitality can be developed instead of extractive resource intensive industries presenting short term profit but long term environmental losses.

2.1.5 SUSTAINABLE HOSPITALITY

Negative environmental and social impacts reduce revenues and increase operating costs, and employee costs. Adopting sustainable hospitality procedures and technologies can provide a significant competitive advantage to businesses in the hospitality sector. According to the EPA (Environmental Protection Agency), sustainable hospitality focuses on reducing the environmental, social and economic impact of the hospitality sector, which covers: lodging, restaurants, food and beverage operations, venues, events and meetings, and sporting events (2013). According to Ernst & Young, the role and the need for sustainability have not been front and center of the business strategy, yet it has been lingering in the background. Although companies may not talk about climate change per se, many are being affected by indirectly due to deforestation and shrinking biodiversity, that are affecting the availability of agricultural products, resulting in the hospitality industry increasingly connecting the dots between risk management and corporate sustainability (2013).

To what degree is sustainability embedded in your corporate strategy and governance?



Figure 23. Sustainability in Corporate strategy (Ernst & Young, 2013. p7).

The graph above shows the result from a survey of 283 executives and leader in 17 industries from companies generating US\$1 billion in renews (Approximately 85% from the U.S.). It shows how more and more companies are taking care to address the issue of sustainability at the core of their business strategies. Sustainable hospitality development focuses on how to manage the natural, man-made and socio cultural resources of host communities in order to meet the following fundamental criteria: promoting the company's economic well-being and self-sufficiency, protecting natural and socio-cultural capital, achieving intra and intergenerational equity in the distribution of costs and benefits, and satisfying the needs of tourists (Briassoulis, 2002). The hospitality industry's connection with almost all sectors of the host economy has a multiplying effect for the promotion of sustainable practices, especially since traditional hospitality has a significant environmental footprint through energy and water

consumption, use of consumable products, and solid and hazardous waste generation (EPA, 2013).

Hospitality is an industry in need of a sustainable approach to mitigate intensive use of resources in everyday operations. Energy use intensity (EUI) ranges from less than 100 to more than 800 kBtu/ft² across all hotel buildings in the US, with those at the 95th percentile using about 4 times the energy of those at the 5th percentile. The distribution has a negative skew, which means the most energy intensive buildings are much further away from the median than the most efficient (Energy Star, 2012), as shown on the figure below.

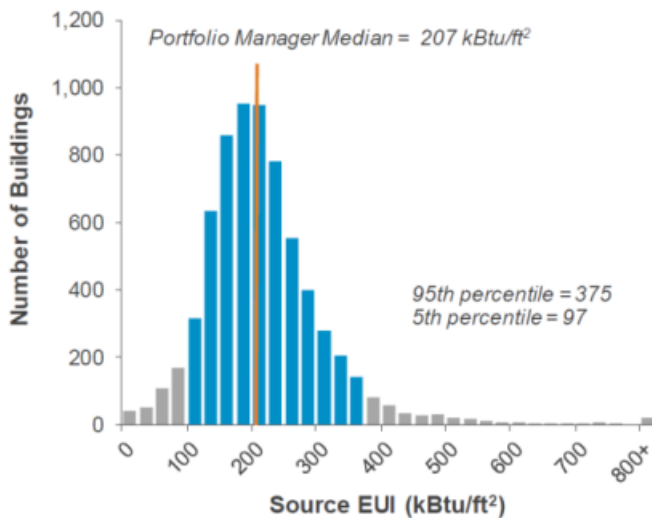


Figure 24. Energy Use Intensity (Energy Star, 2012).

Energy production, as well as its efficient use, is paramount for the long-term sustainability of any organism. Buildings and organizations are no exception. A buildings energy use can vary for many reasons, including variable equipment efficiency and energy management practices, as well as variations in climate and business activities. As shown in figure below (Hepburn and Bowen, 2012) sustainable hospitality should base its growth on the intellectual

economy, in which economic growth and development is decoupled from environmental impact, applying sustainable practices for the eco-effective use of resources (Braungart, McDonough, Bollinger, 2006).

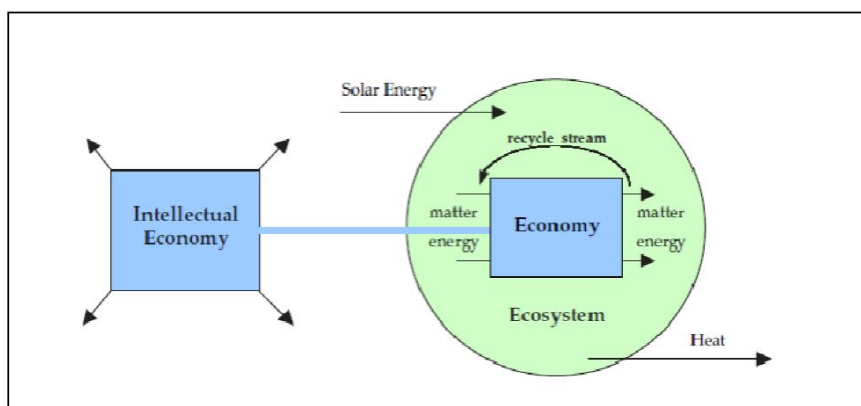


Figure 25. The material economy is bounded by the ecosystem; the intellectual economy is not (Hepburn and Bowen, 2012).

Lack of methods to enforce and promote sustainable management and regulate green messages in tourism has led to an increasing number of voluntary initiatives in the form of codes of conduct, manuals, awards and ecolabels (Font, 2002). The sustainable and harmonic development of the hospitality industry, in tune with local communities and with clear positive impact on the environment and local processes is highly relevant. Standards and certifications are being implemented as shown by Green Globe certification's worldwide expansion and the proposals for a European label and the Sustainable Tourism Stewardship Council seem to be the framework in which the current ecolabels need to wrestle to maintain their identity, ensure exposure and credibility, and gain more positioning with people being more exposed to the effects and information regarding environmental challenges, like extreme weather and climate change (Font, 2002). Eco-labels and certifications are the result of complex processes of

evaluation and adaptation that address environmental impact but not necessary sustainability. As it is shown in following sections the hospitality industry must go beyond green-wash, and truly implement integral approaches that could yield long term benefits at different levels of the company from addressing important environmental criteria such as energy, water and waste.

2.1.5.1 LIFE CYCLE ENERGY ANALYSIS (LCEA)

Achieving energy efficiency is a key issue for sustainable hospitality. One of the energy use assessment tools hotels can use is the Life Cycle Energy Analysis (LCEA), which is based on the original four-step LCA (Life Cycle Analysis) methodology, however it focuses only on energy and concomitant carbon emissions as the only measure of environmental impacts as shown in the figure 26 below (Filimonau, Dickinson, Robbins and Huijbregts. 2011).

Achieving effective energy benchmarking for hotels is integral in fostering the sustainable development of the lodging sector. Energy is needed for all everyday duties of a hotel such as food and materials processing, heating and cooling, illumination, and transport. In Greece and Spain, hotels are the principal energy consumers among commercial buildings, being responsible for about 1/3 of their country's total energy demand; in France, the UK and USA the share of hotels is lower, nevertheless significant: 18%, 16% and 14% of the energy demand respectively (Filimonau, Dickinson, Robbins and Huijbregts, 2011). Benchmarking based on facilities should be the first priority for hotel management or owners (Chan 2012). Since most commercial buildings haven't been built to be sustainable, too much energy is wasted in hotels and buildings in general, thus presenting opportunities for the implementation of energy conservation, energy efficiency and energy effectiveness practices. Although LCEA will get the industry closer to energy efficiency, sustainable hospitality requires a broader and more integral approach than the one offered in the LCEA graph below which tracks the complete life cycle of a

building, yet it lacks the integrality and interconnectedness needed for long term sustainability. Life cycle analysis is only an aspect of multidimensional sustainability analysis, as this research shows in following sections.

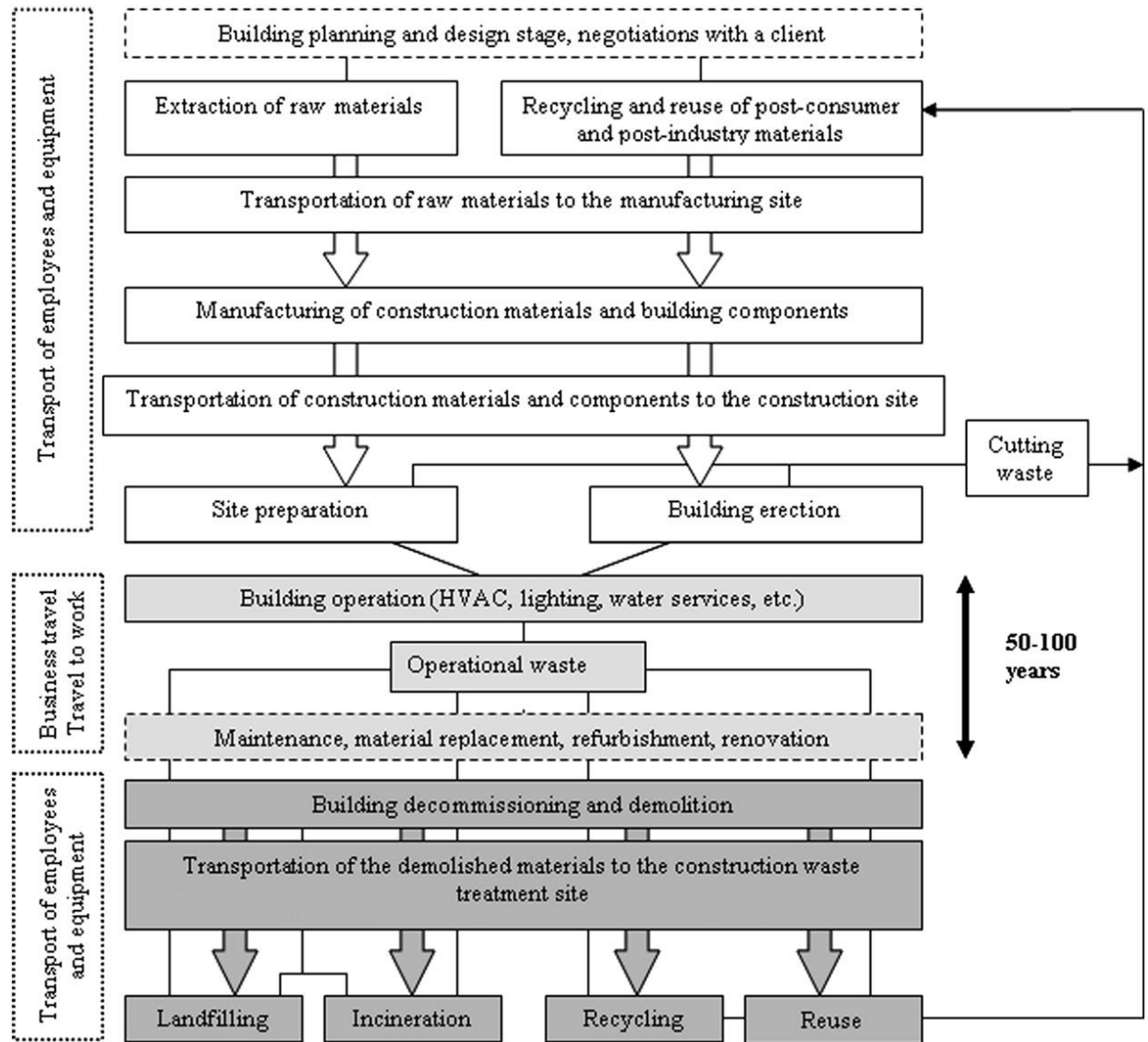


Figure 26. Simplified lifecycle diagram of a building. Modified from Kellenberger and Althaus (2009); Scheuer et al. (2003). The white color represents the pre-operational phases of the building lifecycle (so-called preparation and material placement). The light gray color

corresponds to the building's operations. The dark gray color indicates the end-of-life stages of the building life frame (Filimonau, Dickinson, Robbins and Huijbregts. 2011).

2.1.5.2 SYSTEMS THEORIES

Although LCEA is a good attempt to become more efficient, it is not enough. As previously shown in the IPAT equation, in order for the emissions to fall, at the level required to achieve the 2°C change in global temperature, \dot{I}/I must be at least -4.9% (Hepburn & Bowen, 2010). This would require \dot{T}/T to fall at a high rate, requiring technologies and economic models that take carbon out of the system and at the same time increasing the overall affluence at a lesser rate. There are 7 systems theories: Laws of Ecology, Looped (later known as Performance) Economy, Regenerative Design, Biomimicry, Industrial Ecology, Cradle to Cradle and Blue Economy.

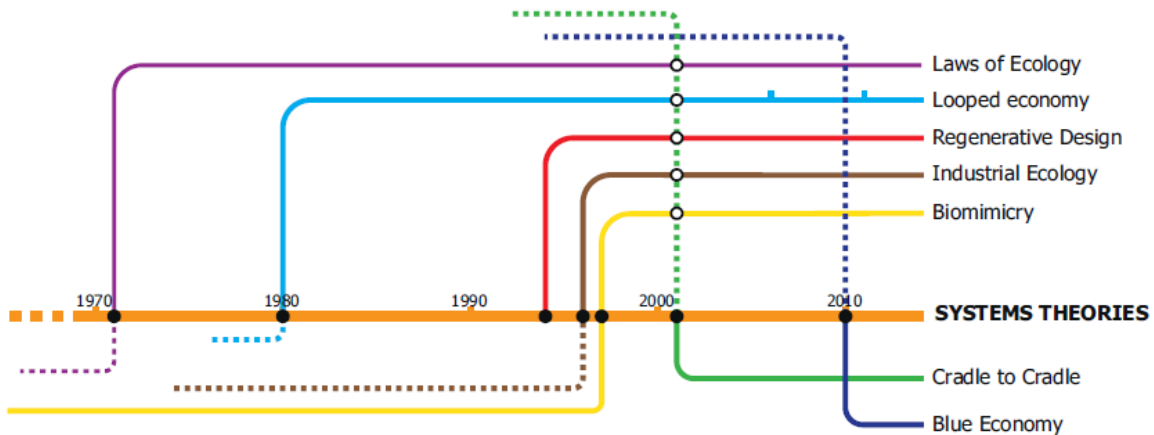


Figure 27. The seven systems theories set up in a time line and their relation to Cradle to Cradle (Dijk, Tenpierik and Dobbelsteen, 2013).

These theories try to consider 5 “Kingdoms of Nature” (bacteria, algae, fungi, animals and plants), 5 design principles and 12 axioms of economics (purpose, growth, productivity, cash

flow, price, quality, competitiveness, place, innovation, diversification, management and thermodynamics). BE theory focuses on implementing feasible innovations to help fundamentally change the contemporary economy to a more sustainable one through the added value they produce (Dijk, Tenpierik, Dobbelsteen, 2013). Next section presents elements of C2C and BE that jointly provide the approach this research has found highly relevant for long term sustainability.

2.1.5.3 TAKING SUSTAINABLE HOSPITALITY TO THE NEXT LEVEL

The term Blue Economy stands for a new way of designing business models focusing on eco-effective use of available resources in cascading systems, where waste from one process becomes the input of the next process to create a new cash flow; where jobs are created, social capital is built and income increases while the Biosphere that provides the basis for our lives is no longer depleted and polluted (Dijk, Tenpierik & Dobbelsteen, 2013). Achieving eco-effectiveness following systems theories such as Blue Economy or cradle-to-cradle presents an alternative for design and production of goods and services that incorporate social, economic, and environmental benefit; enabling triple top line growth and the creation of wholly beneficial industrial systems driven by the synergistic pursuit of positive economic, environmental and social goals (Braungart, McDonough, Bollinger, 2006).

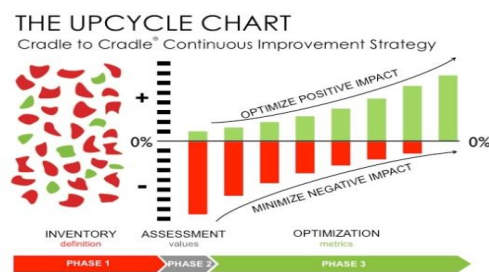


Figure 28. The upcycle chart (MBDC, 2014).

The goal of eco-effectiveness as presented by C2C theory is a concept for the production and consumption of goods and services that goes beyond the reduction of negative consequences implied in having eco-efficiency and zero emissions as the goal. Eco-effectiveness positively defines the beneficial environmental, social and, economic traits of goods and services, eliminating the fundamental problems (material flow quality limitations, antagonism to economic growth and innovation, and toxicity) resulting from eco-efficiency strategies (Braungart, McDonough, Bollinger, 2006). According to C2C principals, sustainable hospitality would have to redefine itself with a more holistic approach.

The Cradle to Cradle framework is fundamentally focused on improving models from simply being less-bad to becoming more-good. Since conventional eco-efficient demand side approaches often simply seek to reduce damage and minimize negative footprint (Efficiency is simply good business), by adding the eco-effective supply side approaches and articulating positively defined goals based on Cradle to Cradle values and principles, the hospitality industry would be able to direct innovation and leadership towards a positive footprint (MBDC, 2014).

Cradle to Cradle Principles (MBDC, 2014):
Material Health: Value materials as nutrients for safe, continuous cycling
Material Reutilization: Maintain continuous flows of biological and technical nutrients
Renewable Energy: Power all operations with 100% renewable energy
Water Stewardship: Regard water as a precious resource
Social Fairness: Celebrate all people and natural systems

Cradle to Cradle tenants (Dijk, S., Tenpierik, M., Dobbelsteen, A., 2013):

- Waste equals food
- Use current solar income
- Celebrate diversity

The figure below presents the relation between the 7 theories and cradle to cradle, showing how they can complement each other. There is no silver bullet and as shown at Turtle Bay Resort (TBR) Case the main obstacles lay on the implementation of the theory. Using these principles any industry, in this case the hospitality industry, can develop sustainable business models. Long term sustainability goes beyond efficiency and having reduction to zero negative

impact as a goal, C2C (Cradle to Cradle) aims for eco-effective management and performance, seeing processes as part of a closed system in which the concept of waste just doesn't exist. As figure 29 shows C2C integrates criteria and principles from the evolution of systems theories offering a comprehensive theoretical framework, complemented by thorough certification process²².

²² <http://www.c2ccertified.org/>

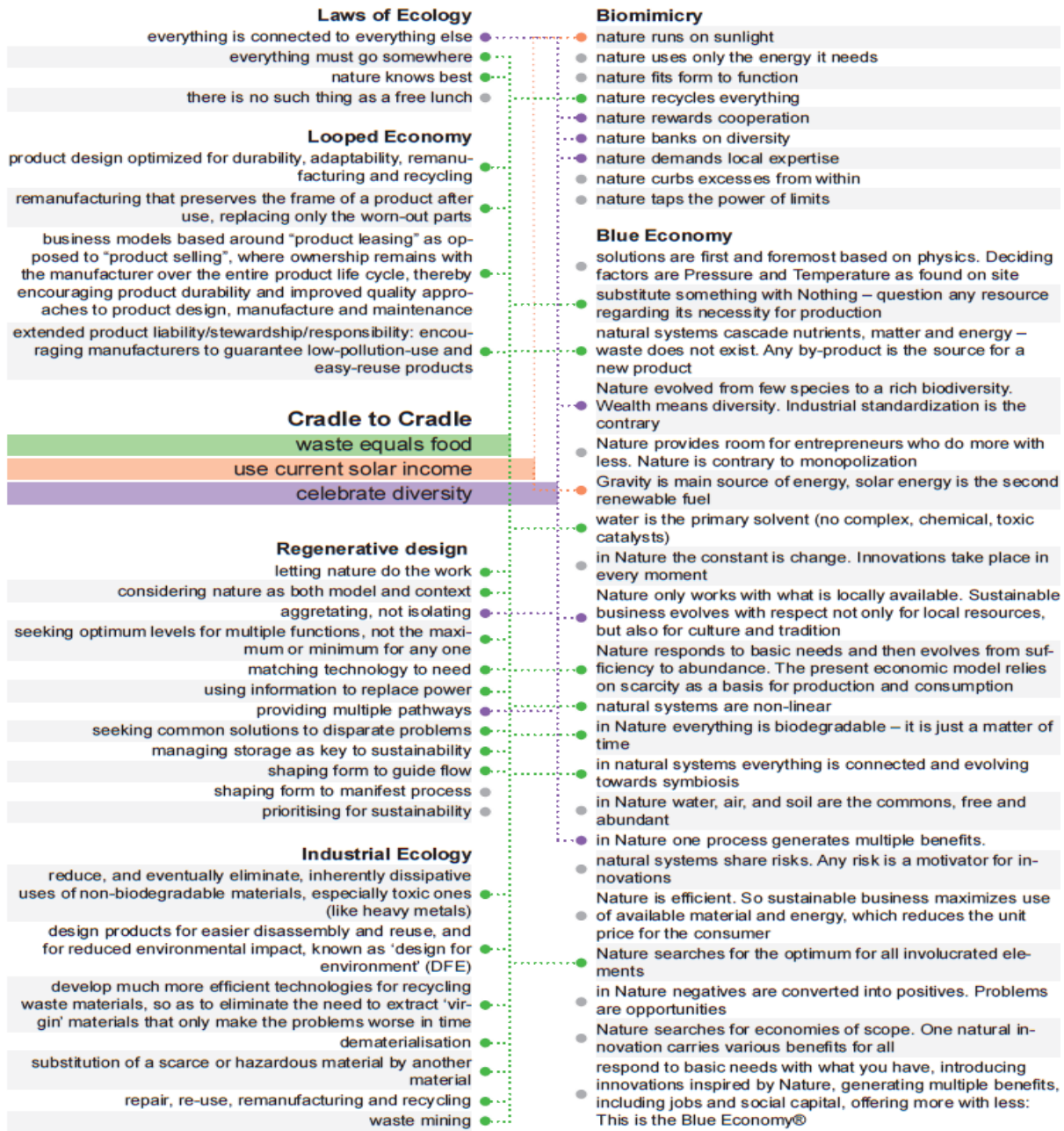


Figure 29. Principles of the seven systems theories discussed and related to Cradle to Cradle (Dijk, Tenpierik & Dobbelsteen, 2013).

Sustainable hospitality follows fundamental principles already tested by nature. For example, plants are living systems that grow, using free energy (powered by the sun) and with an

open metabolism (Chemicals operating for the benefit of the organism). As stated by C2C literature, an eco-effective design turns waste into food (Biological and technical), uses current solar income and celebrates diversity. C2C evaluation is based on the following criteria²³:



A hotel or resort designed or improved following C2C principles could aim for a C2C certification. Yet, based on observations and interviews with hotel owners from Taganga and El Rodadero in Santa Marta, and Oahu island in Hawai'i, it is clear that for the Colombian context the initial investment required to achieve a C2C certification is still too high and, as this research shows in following sections, it is even more difficult when accounting for an outdated framework focused only on growth disregarding long term impact, without appropriate market financing mechanisms such tax breaks and stimulus . As next section shows there are certifications in the hospitality industry which although not as far reaching as C2C, advocate for green practices that can be consider steps in the rights direction.

2.1.5.4 SUSTAINABLE HOSPITALTY CERTIFICATIONS

The 2009 North America Hotel Guest Satisfaction Index Study showed that guest awareness of property-initiated “green” programs has increased in 2009, with 66% of the guests answering that they were aware of their hotel’s conservation efforts, compared with 57 percent in

²³ www.c2ccertified.org/product_certification

2008, and among these guests, 72 percent say they participated in their hotel's conservation programs (J.D. Power and Associates, 2009). The Colombian tourism industry would do well to consider these factors in both existing and new developments, especially as tourism increases, in order to attract a population increasingly aware and concerned with environmental initiatives. Not to mention the current and primary environmental necessity for conservation.

Turtle Bay Resort has been focusing on sustainability since 2009, being a proud member of the Hawaii Green Business Program (HGBP) and awarded Green Eco-Leaf Rating²⁴. Turtle Bay Resort has earned a 4 Green Eco-Leaf rating by completing a 70 point comprehensive eco-audit survey administered by the online social network of environmentally friendly travel iStayGreen.org²⁵. Trip Advisor CEO and Co-Founder Stephen Kaufer also awarded TBR with the Silver Green Leaders Award 2013 for Turtle Bay's green practices and commitment to enhancing those practices²⁶. These awards are particular to the US economy; however there are now more and more "green" certifications and standards in various countries, with some starting to be recognized worldwide. Among these are a few I will describe here as possible guidelines for Colombian companies.

Green Globe: This certification is a structured assessment (337 compliance indicators applied to 41 individual sustainability criteria) of sustainable performance of travel and tourism businesses and their supply chain partners²⁷.

Green Key Global: The Green Key Eco-Rating Program and Green Key Meetings Program are graduated rating systems designed to recognize green lodging efforts looking at nine

²⁴ www.turtlebayresort.com/resort/green_practices/

²⁵ www.istaygreen.org/

²⁶ www.turtlebayresort.com/resort/green_practices/

²⁷ www.greenglobe.com/standard/

major areas of sustainable hotel operations, including: energy conservation, water conservation, solid waste management, hazardous waste management, indoor air quality, community outreach, building infrastructure, and land use²⁸.

Energy Star: Established in 1992, under the authority of the Clean Air Act Section 103(g), ENERGY STAR is a U.S. Environmental Protection Agency (EPA) voluntary program helping businesses and individuals to save money and protect the climate through superior energy efficiency²⁹.

LEED (Leadership in Energy & Environmental Design) is a comprehensive and flexible program that provides third-party verification of green buildings, analyzing the entire building life cycle recognizing best-in-class building strategies³⁰.

Green Tourism Business Scheme: This certification is recognized by UK national and regional government, as a crucial part of its drive towards sustainability, independently validated by the International Centre for Responsible Tourism (ICRT) on behalf of VisitEngland, VisitWales and the Northern Ireland Tourist Board and endorsed by VisitScotland and Failte Ireland³¹.

3 METHODOLOGY

A qualitative approach has been chosen here over the quantitative due to the need to abstract from immediate/short term criteria to give priority to sustainable long term ones.

Qualitative research could be defined as “any kind of research that produces findings not arrived

²⁸ greenkeyglobal.com/

²⁹ www.energystar.gov/about/

³⁰ www.usgbc.org/leed

³¹ www.green-tourism.com/consumer/about-us/

by means of statistical procedures or other means of quantification” (Strauss and Corbin 1990:17). This descriptive study offers a comprehensive summary and presents a qualitative description and analysis of literature related to economic development, sustainable development, population growth, energy demand, CO₂ emissions, renewable energy sources and sustainable hospitality, seeking descriptive validity through the combination of sampling, data collection and analysis (Sandelowski, 2000). This qualitative inquiry focuses in depth on a single case (n = 1), Turtle Bay Resort selected purposefully to validate previous literature review.

According to Phillip Mayring, single case analyses are not speaking for themselves; a reflective, theory-guided selection of cases and a stepwise broadening of the case basis are central procedures for generalization of single cases (2007). This research applies the following set of steps, taken from Stake’s “The art of case study research” (1995): 1) anticipation, 2) first visit, 3) further preparation for observation, 4) further development of conceptualization, 5) gather data, 6) validate data, 7) analysis of data, and 8) providing audience opportunity for understanding. This research follows an inductive process of generalization from a single case study that has been derived initially, from analyzing the context of Turtle Bay Resort Case, and to validate and apply results from the generalization process to the specific conditions in the Sierra Nevada de Santa Marta, Colombia. Hawai’i and the Sierra Nevada de Santa Marta present a similar multicultural market, with an economy highly dependent on tourism, and with abundant natural resources, that need to be protected and developed in a sustainable way. TBR’s model presents a model to be further validated by literature review, observation and analysis of the particular challenges for adapting and implementing a concept like sustainable hospitality in the context of an emerging economy in the middle of the war on drugs and terrorism. TBR is a representative case for how the hospitality industry could evolve in order to assure long term

sustainability by improving eco-efficiency, following C2C and BE, systems theories presented in section 2.6.

This inductive research attempts to help the reader develop an understanding of what the concept of sustainability, and sustainable hospitality in particular mean based on a significant literature review.

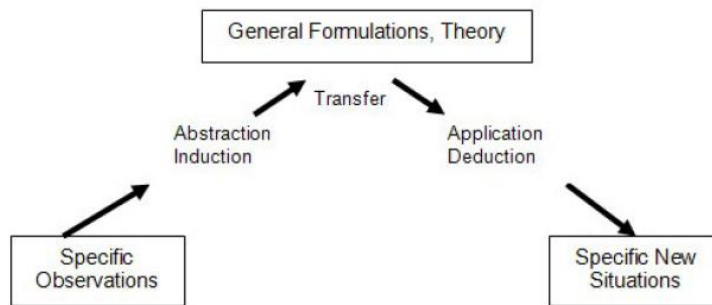


Figure 30. The process of generalization (Mayring, 2007)

Using literature maps to navigate a sea of information, this research validates sustainability criteria such as energy, water and waste necessary for the implementation of sustainable hospitality in the Sierra Nevada de Santa Marta (Creswell, 2013). Through the analysis of TBR's case, this research has identified energy as a critical variable, specifically energy demand growth at current unsustainable levels, which is related to population growth and CO₂ emissions, as a result of technological development and the abundance of apparently cheap energy (underestimating the cost of negative social and environmental impact). Water and waste management have been also identified as relevant criteria to be address for the success of sustainable hospitality strategies.

The figure below represents Mayring's step model of inductive category development, in which the main idea of the procedure is, to formulate energy as the sustainability criterion of

definition, derived from theoretical background and research question, which determines the aspects of the textual material taken into account. Following this criterion the material has been worked through and revised several times in respect to their reliability.

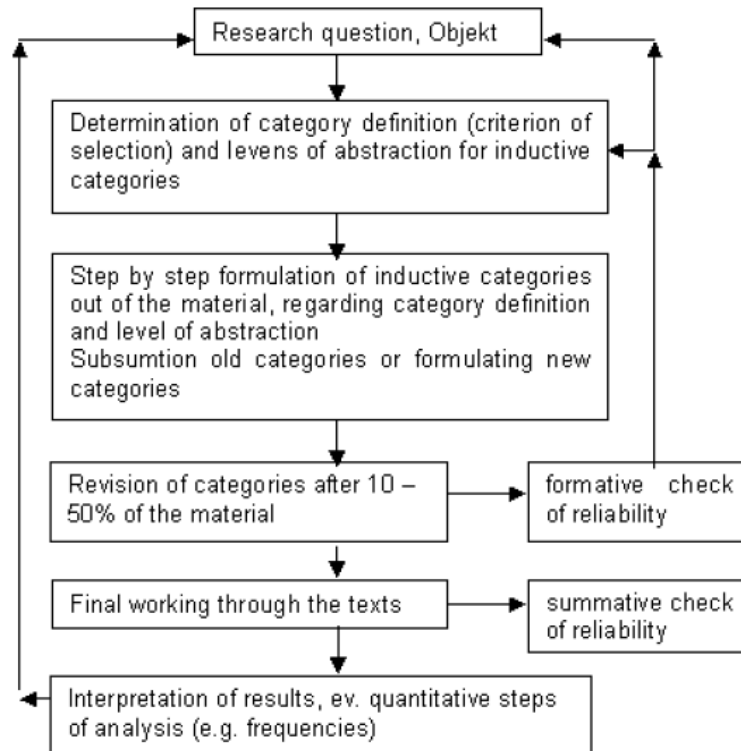


Figure 31 Step model of inductive category development (MAYRING 2000)

3.1 TURTLE BAY RESORT CASE

Turtle Bay Resort (TBR), a part of Benchmark resorts and hotels³², is the only destination on Oahu’s North Shore (*Figure 32*), with renovated accommodations³³ seeking to reduce, and if possible eliminate, any negative impact on the environment and the community. TBR has taken measures to reduce its environmental impact and to further solidify its positioning in the Hawaiian community, focusing mainly on energy, water and waste.

³² www.benchmarkresortsandhotels.com/about/

³³ www.turtlebayresort.com/resort/



Figure 32. Benchmark property listing (Benchmark, 2014)³⁴

A major focus of TBR’s enhancement project is to identify ways for conserving Oahu’s natural resources³⁵. The path to sustainability at TBR started by identifying the Resort’s responsibility to become sustainable and reducing its carbon footprint and with the creation in 2009, of the Hui-Malama (People who care) committee, comprised of members from each of the different company teams: Facilities, Rooms, Culinary, Human Resources, Spa, Purchasing and Executive teams. This committee has implemented changes cohesively for a greener Turtle Bay resort, such us green practices³⁶ and improvements³⁷. The set of sustainable measures implemented at TBR is reviewed in the next section.

3.2 TURTLE BAY RESORT-SUTAINABLE PRACTICES

TBR’s sustainable practices have been classified based on three criteria: energy, water and waste. Although as shown in previous sections, energy generation and management is the main focus of this research. TBR’s results reducing and managing solid waste shows a clear path to reduce impact with relatively low investment. The importance of water as the source of life

³⁴ www.benchmarkresortsandhotels.com/weddings/

³⁵ www.turtlebayresort.com/resort/improvements/

³⁶ www.turtlebayresort.com/resort/green_practices/

³⁷ www.turtlebayresort.com/resort/improvements/

along with air, vital non-renewable resources, must also be taken into account when formulating sustainable strategies, as reflected in TBR sustainable practices.

3.2.1 ENERGY

In December 2013 Turtle Bay installed a Solar PV (Photovoltaic) system of 400 kWh, equivalent to preventing the release of 4.3 million pounds of CO₂ emissions over the next ten years (Equivalent to planting 350 acres of forest). TBR's green roof³⁸ also saves 1,000 barrels of oil annually, otherwise needed for electricity production. 70% of the resort's lighting retrofit has been converted, using Compact Florescent Light Bulbs (CFL's) resulting in reduced power consumption by 12% during the first year³⁹. The use of solar power, as we will see in the next section, is a good alternative for the Sierra Nevada de Santa Marta region, complemented with green roofs for cooling and lighting retrofit as a good practice for any building, anywhere in the world, especially in warm weather. TBR has also installed clean condenser coil HVAC (Heating, Ventilation and Air Conditioning) systems to reduce operating cost by 25% and Xlerator hand drying systems which are 80% more efficient than previous systems in the public bathrooms⁴⁰.

To maximize the effective use of resources TBR has installed an Energy Management System for the automated operation of chillers and air conditioning systems in rooms and areas not in use. Each room has a special system that allows for room temperature control upon check-in or before the start of a function/event, limiting energy demand.

Another interesting energy initiative is the resort's partnership with Brigham Young University, Hawai'i in donating hundreds of gallons of used oil from the TBR kitchens to the

³⁸ <http://usa.sarnafil.sika.com/en/group/roofing-sustainability/sustainable-product-solutions/vegetated-green-roofs.html>

³⁹ www.turtlebayresort.com/resort/green_practices/

⁴⁰ Hui Malama Meeting. August 20, 2013

University to be converted into bio-diesel to fuel its fleet of vehicles⁴¹. This presents an interesting approach to waste management and community cooperation, turning waste vegetable oil into fuel; turning waste from one process into food for another according to C2C principles.

3.2.2 WATER

Compared to previous years water usage has decreased at TBR, yet the results presented by the Hui Malama committee shows there is still work to be done in this regard. At TBR restrooms and showers in both guest rooms and public areas have been upgraded to reduce water usage in toilets, urinals, and showers. The linen program, the practice of changing bed linens every third day of guests' stays, has reduced the amount of water and detergent use⁴². These kinds of practices should be easily implemented in the Sierra Nevada de Santa Marta context, complemented with some gray water treatment and reuse as well as waste water treatment needed due to the lack of infrastructure in many areas along the coast.

3.2.3 WASTE

TBR is seriously reducing its negative footprint⁴³: recycling has increased to an average of 1.8 tons of recycling over the last two years; complemented by 0.4 tons of trash reduction each month. Recycling collection centers have been placed in designated areas around the resort for both guests and employees. TBR also supports local social groups and organizations through food donations to prevent waste of food goods. TBR is today less reliant on plastic and Styrofoam based products; all cups (usual bulk of restaurant waste) in TBR's restaurants and outlets are either washable/reusable or made from corn-based or post-consumer materials, which break down quicker. TBR is currently analyzing changing the remaining plastic based items

⁴¹ www.turtlebayresort.com/resort/green_practices/

⁴² www.turtlebayresort.com/resort/green_practices/

⁴³ www.turtlebayresort.com/resort/green_practices/

(cutlery) to corn-based materials. All these initiative are reinforced by the Turtle Bay Values which provide a corporate culture suitable for long term sustainability (appendix A).

From the results presented at the Hui Malama Meeting in August 20, 2013. It is clear that the effect of sustainability measures will gradually show eco-effectiveness improvements in the overall performance of the resort. Pursuing realistic goals of about 5% annual reduction in energy and water demand, and waste reduction, TBR has achieved good results mainly on energy demand and waste reduction, while water has been a more challenging variable since its demand is affected by many external factors making it harder to control. TBR can and will continue improving in the sustainability path, yet appropriate policy following principles such as those proposed by C2C is required for financing of green projects required to achieve long term sustainability.

3.3 SIERRA NEVADA DE SANTA MARTA

The Tayrona Park was legally established in 1964 and in 1982; the UNESCO declared the combined area of the Sierra Nevada de Santa Marta and the Tayrona Park a Biosphere resource. This combined bio-diverse area integrates the territories of the native Arahuaico, Kan Kuamo, Koguis and Wiwa tribes and it is home to about 30,000 of their members (Ojeda, 2011). According to Ojeda, between 1998 and 2008, about 4 million people were forcefully displaced from 5.3 million hectares of land in different regions of Colombia (2011). This counter agrarian reform posed even greater challenges for the region, already struggling with the aftermath from the Marijuana and Coca booms of the 1970's and 1980's, respectively, and the Caribbean is no exception⁴⁴⁴⁵.

⁴⁴ www.verdadabierta.com/nunca-mas/38-desplazados/210-desplazamiento-y-despojo-de-tierras-estrategia-paramilitar-

Tourism and sustainable hospitality practices in particular, if not implemented properly could create conflict with the regular activities of many locals, displacing them, making them less viable. Yet, if the socio-economic context is analyzed through a multidimensional prism of Economy, Environment and Society, considering stakeholders and not only shareholders, sustainable hospitality would contribute to economic diversification and forge positive link with existing forms of production. It is unlikely for tourism to be the sole user of resources, so long-term sustainability should be sought between tourism and other existing and potential activities (Tao and Wall. 2008). Sustainable hospitality is an alternative for the economic development of the region presenting an alternative to other more damaging industries⁴⁶⁴⁷. In 2005, Aviatur, the chamber of commerce and the travel agency Alnuva, with Aviatur as its main stakeholder, signed an agreement that gives Aviatur control over eco-tourism operations in the Tayrona Park (Ojeda, 2011)⁴⁸. This kind of agreement has the potential to create a sustainability benchmark in the region that addresses some critical environmental and social variables, and not just as another form of concentration of land and power⁴⁹.

The Sierra Nevada de Santa Marta region needs sustainable development to satisfy its social needs without destroying environmental and cultural wealth, and what's more it has the potential due to historic sites, natural beauty and cultural richness to be a successful tourist destination and increase the common wealth of the region. One of the contributing factors for the region's potential for sustainable economic development, is the abundant sunlight available all

⁴⁵ www.verdadabierta.com/justicia-y-paz/juicios/5243-hernan-giraldo-maquina-de-guerra-en-la-sierra-nevada-de-santa-marta

⁴⁶ www.verdadabierta.com/negocios-ilegales/narcotrafico/3383-asi-trafico-el-tuso-sierra-para-los-castano-y-mancuso

⁴⁷ www.drummondco.com/drummond-ltd-responds-with-facts-and-asks-why-2/

⁴⁸ www.verdadabierta.com/tierras/despojo-de-tierras/3182-concesion-del-parque-tayrona-bajo-sospecha

⁴⁹ <http://lasillavacia.com/historia/de-los-ambientalistas-para-santos-no-mas-el-modelo-de-aviatur-para-parques-nacionales-29831>

year around. Addressing energy demand is perhaps the most important variables for long term sustainability, particularly for sustainable hospitality. The map below shows the solar radiance in the Caribbean region of Colombia, it goes from violet to red, and as presented in the table, this region has a solar radiance between 4.5 and 6.5 kWh/m² all year around, presenting a good potential in the Caribbean coast for solar powered economic development⁵⁰. Therefore, this alternative power source should be implemented by Sustainable Hospitality projects in the area. Yet, the current framework in Colombia doesn't address the issue of sustainable development powered by clean renewable energy sources, such as wind, solar or even geothermal. Instead the Colombian government has decided, so far, to bet on natural gas and biofuels from palm oil, according to the framework set by the Law 697 of 2001⁵¹ (Law URE (Rational Use of Energy)) and the Decree 3683 of 2003⁵², as shown in section 2.1.4.

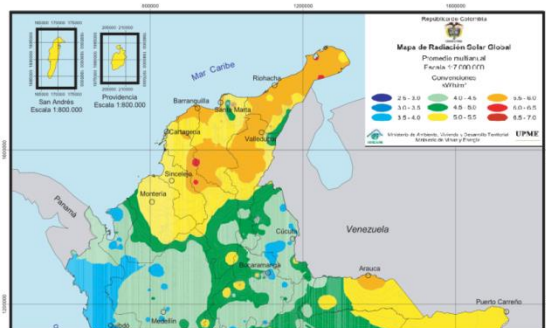


Figure 33. Santa Marta's solar radiance (adapted from Atlas de Radiación del INEA-HIMAT/1993)

Month	kWh/m ²	Month	kWh/m ²
January	5.0-5.5	July	6.0-6.5
February	5.5-6.0	August	5.5-6.0
March	6.0-6.5	September	5.0-5.5
April	5.5-6.0	October	5.0-5.5
May	5.5-6.0	November	5.0-5.5
June	5.5-6.0	December	4.5-5.0

⁵⁰ www.upme.gov.co/Docs/Atlas_Radiacion_Solar/2-Mapas_Radiacion_Solar.pdf

⁵¹ www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=4449

⁵² www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=11032

Sustainable hospitality can only provide economic incentives to preserve natural habitats only if the revenues are large enough and accessible to the communities in the region. This requires delinking indigenous and local livelihoods from the wasteful and destructive, use of flora and fauna in forests, oceans, and jungles, and reducing rates of habitat conversion and poaching (Coria and Calfucura, 2011). The implementation of ecotourism ventures by indigenous communities does not automatically imply conservation or economic development for these groups (Coria and Calfucura, 2011). Yet, indigenous cultures often have integrated many sustainable principles already. Sustainable hospitality could be a solution to concerns raised recently by local tribes in April 2014⁵³, implementing sustainable practices in a joint effort of local and outsiders following local guidelines and global standards.

4 CONCLUSIONS

When one begins to answer the question of how to develop a sustainable hospitality industry in the Sierra Nevada de Santa Marta, it is clear that answering why to do it and identifying the context in which sustainable measures could take place becomes a pre-requisite, as shown in section 2.1. Over-population and high levels of consumption resulting from abundant and apparently cheap energy (from coal and oil) present a significant threat for long term global economic development all around the world. Biosphere saturation due to human waste would mean changing the human friendly environment humans have enjoyed for millennia, taking us into a collapse scenario, as shown in Graph D, section 2.1.

⁵³ www.caracol.com.co/noticias/actualidad/indigenas-quieren-prohibir-el-turismo-en-la-sierra-nevada-de-santa-marta/20140412/nota/2174718.aspx

Solar powered economic and social development and 100% recycling are physically feasible as a result of tapping into the entropic arrow of the solar system. As shown in section 2.1.1, Solar PV is one of the most promising alternatives for long term solutions, especially as price of the technology decreases and efficiency increases. Yet, a change towards energy policy that stimulates growth of the solar PV market through: incentives such as tax cuts and government subsidized initial investment. As shown in section 2.1 the implementation of programs such as Feed in Tariff and Net Metering in Hawai'i, could boost the implementation of new technology.

An appropriate legal framework is paramount for the long term success of sustainable hospitality projects. Achieving effective and objective energy benchmarking for hotels is integral in fostering the sustainable development of the lodging sector in Colombia. Hence, it is necessary to address grid limitations from the design stage to assure long-term sustainability. For solutions in the most distant parts of the Sierra, despite its harmful gas emissions, diesel generators must be used along with solar energy due to its well proven technology and as an intermediate stage for rural applications, especially when powered by biodiesel.

The hospitality industry in the Sierra Nevada de Santa Marta should follow TBR's green practices and improvements model by reducing waste and implementing practices for efficient use of energy and water before moving on to equipment retrofit and more expensive full revamping of a hotel. Systems theories present a model for sustainable development encouraging: equipment retrofit, energy management systems, and energy generation from renewable sources. Although there are social and technical challenges, the main obstacle for sustainable hospitality to overcome is the lack of a clear global, legal framework that accounts for long term sustainability following planetary guidelines, allowing sustainable hospitality to

contribute to economic diversification and to forge positive links with existing forms of production.

5 RECOMMENDATIONS

Greenhouse gas (GHG) emissions' effect on the biosphere can and must be reduced. It requires a technological solution yet it's lacking an appropriate economic and political framework to achieve a development model that respects the rights of future generations, our future selves. The pursuit of economic growth can't break the material link to the future-self (future generations), it is necessary to understand that no economic interest can be above the respect for life and that development should include Prosperity, Happiness, Health, Security, Community, Peace and Culture. Although this paper does not analyse the social dimension of sustainable development, it recommends two principles of justice, given by John Rawls (1971), as key elements for the appropriate social framework required for sustainable development. "First: each person is to have an equal right to the most extensive scheme of equal basic liberties compatible with a similar scheme of liberties for others. Second: social and economic inequalities are to be arranged so that they are both (a) reasonably expected to be to everyone's advantage, and (b) attached to positions and offices open to all" (Rawls, 1971. p. 53).

The Sun is the best nuclear reactor, already how we need it and where we need it: wireless and far away. To power the development of the sustainable hospitality industry, the industry can use renewable energy sources. As shown in previous sections, these technologies will become even more price competitive in the near future, especially if new technologies hop on the trend of exponential increase in technological development marked by Moore's Law, as seems to be happening with PV Thin Film, and other revolutionary technologies. Energy

production from renewable sources and ideally 100% independence pose an interesting backdrop to long-term sustainable projects, in particular in regions such as Hawai'i and the Sierra Nevada de Santa Marta, where many people depend directly or indirectly on income derived from the hospitality industry. An energy source that produces free electricity (after amortization time, section 2.1.1) fits Rawl's requirements for society to encourage equal access to the resource needed to guarantee a sustainable livelihood for the communities in the region.

Water is life, one of the most basic elements in our biosphere. The efficient use of water is a financial and an environmental priority. The implementation of sustainable practices and upgrading hydraulic equipment can reduce dramatically the volume of water use in any facility. Yet, as shown in Turtle Bay, goals for the efficient use of water use can be harder to reach. Water use can be affected by weather patterns; extreme weather events demand more complex strategies. This result is relevant considering that as of May 2014, Santa Marta is experiencing its fourth month without rain, and NOAA (National Oceanic and Atmospheric administration) reports a 50% probability for El Niño in the second half of 2014⁵⁴ which is a weather pattern that results in drought in that area of the world.

TBR's energy initiatives aim for a 50% energy demand reduction, added to waste reduction and water usage optimization, and further complemented with the Turtle Bay values rooted in the Hawaiian culture, present a harmonious alternative to further analyzed as a model for the implementation of sustainable initiatives in the Sierra Nevada de Santa Marta, and regions with similar characteristics.

⁵⁴ www.portafolio.co/economia/fenomeno-del-nino-2014-0

This research seeks to offer some guidance for local policy in Sierra Nevada de Santa Marta, NYC's sustainability Indicators are shown in Appendix B⁵⁵, and an in depth review of successful sustainability policies and practices from other countries is recommended in order to guide policy design, containing regulation and stimulus that allow for shorter amortization times for clean renewable energy projects. In order to begin the implementation, the hospitality industry should implement the following ECO-EFFECTIVENES CHECK LIST, based on TBR's model and the C2C principles, as a guideline for sustainable development management of relevant criteria: energy, water and waste.

ECO-EFFECTIVENES CHECK LIST:

1. Energy production from renewable energy sources
2. Energy efficiency: Lights and equipment retrofitting, automated energy management systems
3. Water use optimization: plumbing and equipment retrofitting
4. Water treatment, recycling and reuse
5. Waste reduction
6. Waste recycling, reuse and upcycling

The conservation and protection of cultural and environmental wealth added to optimal management of resources (energy, water and waste) would significantly reduce the negative impact and the overall footprint of any operation, in particular the tourism business. Therefore, sustainable hospitality presents attractive financial, cultural and environmental incentives and

⁵⁵ nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc_2011_sustainability_indicators.pdf

very positive technological expectations for the economic development of the Sierra Nevada de Santa Marta.

Global summits on climate change⁵⁶ in previous occasions have failed to deliver global guidelines for sustainable development. Yet, the high cost of doing nothing is perhaps the most pressing element for significant developments on global sustainability guidelines, energy strategies in particular, in this year's summit in the Philippines⁵⁷. It is necessary to abstract one to see the big picture, to realize the inspiring need for sustainable development, an attractive potential for those businesses that choose eco-effectiveness methods to shape the natural and economic landscape of the future, to improve our legacy to future generations.

⁵⁶ unfccc.int/meetings/warsaw_nov_2013/meeting/7649.php

⁵⁷ www.un.org/climatechange/summit2014/

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APPENDIX A: TURTLE BAY VALUES

Petroglyphs, or rock engravings, are found worldwide and are often associated with ancient peoples. They are also found in all the major Hawaiian Islands and depict Hawai'i's rich history and culture. However this petroglyph is unique to Turtle Bay designed with six elements representing six values (TBR-Values Guide, 2014).



Turtle Bay Values (TBR Values guide, 2013)

MANAWA (time, season, period of me): At Turtle Bay we value time. Employees' and guests' time

It is important for TBR that guests and employees enjoy the time they spend at Turtle bay. We adapt to change as the seasons change and turtle bay continues to evolve. Here we also value the present, reflect on our past and time yet to come



PONO (goodness, proper, moral, righteous): At Turtle Bay we value doing the right thing at all times through trust, honesty, integrity, fairness, openness and transparency. We strive to treat others with compassion dignity and respect.



HANAI (taking care of our own and treating our guests and co-workers as family): At TBR we value nurturing and strive to bring our guests and co-workers into the Turtle Bay family. We do this through teamwork, communication, community spirit and fun with the objective of being welcoming and inclusive.



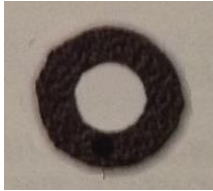
MALAMA (to care for): We value our unique location, our assets and our resources we accept the responsibility of being stewards of the land and ocean for generations to come. We employ environmentally sensitive land use practices and strive to share this important value with our employees, our guests and community.



KAMA'AINA (of the land, being authentically local, a host, acquainted with, familiar): A TBR we value and embrace those people and things from the North Shore. We love to share and explain our diverse cultural and local traditions, our food our activities our language our music and our history. We treat our customers as locals and welcome locals as guests.



ALOHA (affection, compassion, kindness, to love, friendship, greeting): Aloha is pure – the circle of life, the center of our being, the infinite energy of the universe and the inclusivity of our culture.



APPENDIX B: NYC’s sustainability Indicators (PlaNYC 2030, 2013)

CATEGORY	METRIC	2030 TARGET	FIGURE FOR MOST RECENT YEAR	TREND SINCE BASE YEAR
WATERWAYS	Improve the quality of our waterways to increase opportunities for recreation and restore coastal ecosystems			
	Fecal coliform rates in New York Harbor (Cells/100mL) (5 yr rolling avg)	DECREASE	21.1 ₂	↘
	Dissolved oxygen rates New York Harbor (mg/L) (5 yr rolling avg)	INCREASE	6.71 ₂	↗
WATER SUPPLY	Ensure the high quality and reliability of our water supply system			
	Number of drinking water analyses below maximum contaminant level	INCREASE	99.995% ₂	NEUTRAL
	Water usage per capita (gallons per day) (3 yr rolling avg)	DECREASE	124.67 ₂	↘
TRANSPORTATION	Expand sustainable transportation choices and ensure the reliability and high quality of our transportation network			
	Sustainable transportation mode share (Manhattan CBD bound commute)	INCREASE	73.5% ₃	NEUTRAL
	Change in transit volume minus change in auto traffic volume	POSITIVE	-2.8% ₃	↗
	Vehicle revenue miles (Miles transit vehicles travel in revenue service)	INCREASE	945,912,801 ₃	↗
	% of bridges meeting a state of good repair (FY)	100%	41% ₃	NEUTRAL
	% of roads meeting a state of good repair (FY)	100%	72% ₂	↗
	% of transit station components meeting a state of good repair	100%	72% ₂	NEUTRAL
ENERGY	Reduce energy consumption and make our energy systems cleaner and more reliable			
	GHG emissions per unit of electrical power (lbs CO ₂ e/MWh)	DECREASE	692.25 ₃	↘
	System reliability SAIFI (System Average Interruption Frequency Index)	DECREASE	69.72 ₃	↘
	Energy use per capita (MMBTU) (3 yr rolling avg)	DECREASE	102.55 ₃	NEUTRAL
AIR QUALITY	Achieve the cleanest air quality of any big U.S. city			
	City ranking in average PM 2.5 (3 yr rolling avg)	#1 (LEAST)	7 ₃	↘
	Change in average PM 2.5 (3 yr rolling avg)	DECREASE	-3.5% ₃	↘
SOLID WASTE	Divert 75% of our solid waste from landfills			
	Percentage of waste diverted from landfills	75%	51% ₂	NEUTRAL
CLIMATE CHANGE	Reduce greenhouse gas emissions by more than 30%			
	Increase the resilience of our communities, natural systems, and infrastructure to climate risks			
	Greenhouse gas emissions (MTCO ₂ e)	DECREASE 30%	49,301,948 ₃	↘
	Greenhouse gas emissions, (100% = 2005 GHG emissions)	70%	87.06% ₃	↘
	Greenhouse gas emissions (MTCO ₂ e) per GCP (\$M)	DECREASE	91.07 ₃	↘
Greenhouse gas emissions (MTCO ₂ e) per capita	DECREASE 30%	5.87 ₃	↘	

- 1 Results are a snapshot taken in March 2011
- 2 Results are for FY or CY 2010
- 3 Results are for FY or CY 2009, data is only available with a lag
- 4 Results are for CY 2008, data comes from HVS a triennial survey