Tourism and Climate Change – An Exploratory Study of the business opportunities

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Abstract:

The issue of environment and Greenhouse gas (GHG) emissions is being given its due importance by many countries, especially the ones which signed on Kyoto treaty in 1997, and agreed to reduce their collective green house gas emissions by 5.2% from the level that was in 1990. Evidently, most of these countries are popular tourism destinations contributing significantly to greenhouse gas (GHG) emissions through their tourism activities, the road transportation being the major one. Thus the drive to reduce emissions will affect decisions in many concerned businesses including tourism industry. Investment decisions taken today will have long-term impacts on emissions for decades to come. The present study aims at exploring some of the possible ways to reduce the greenhouse gas emissions from the environment and provides insight as to how the tourism sector can use them to improve functioning. Out of thirty emission abatement methods presented by McKinsey in its report, five are explored and evaluated on twelve business factors including Porter's five forces. This study provides reasonable findings to gauge business potential of selected emission abatement methods from the investment point of view and also paves way for future researches in this area.

Key words: Climate change, green house gas emission, emission abatement, Porter's five forces

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Background

Anthropogenic climate change is caused by greenhouse gasses emitted into the atmosphere, primarily through the burning of fossil fuels. Carbon dioxide (CO2) is the most important greenhouse gas, accounting for an estimated 60% of the warming caused by emissions of greenhouse gas emissions. "According to UNWTO-UNEP-WMO (2008), emissions from tourism, including transports, accommodation and activities (excluding the energy used for constructions and facilities for example) account for about 5% of global CO2 emissions. However, other greenhouse gases also make significant contributions to global warming. In the tourism sector, this is particularly relevant for emissions from aviation. In 2005, tourism's contribution to global warming was estimated to contribute between 5% and 14% to the overall warming caused by human emissions of greenhouse gases. Of the 5% of the global total of CO2 emissions contributed by tourism, transport generates around 75%, with air transport alone accounting for 54% to 75% of the total (UNWTO-UNEP-WMO 2008). The projections revealed by UNWTO indicate that in terms of the number of trips made, global tourism will grow by 179%, while guest nights will grow by 156%. Passenger kilometers traveled will rise by 222%, while CO2 emissions will increase at somewhat lower levels (152%) due to efficiency improvements. The share of aviation-related emissions will grow from 40% in 2005 to 52% by 2035. Tourism's contribution to global warming including all greenhouse gasses will be even larger, with an expected increase in radiative forcing of up to 188%, most of this once again caused by aviation." (Simpson, 2008)

International Efforts to adapt and mitigate the impacts

Apparently, the response of the tourism community to the challenge of climate change has visibly increased over the last few years. The World Tourism Organization (UNWTO), together with the World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP), and the United Nations Convention to Combat Desertification (UNCCD), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Government of Tunisia hosted the First International Conference on Climate Change and Tourism in Djerba, Tunisia in 2003. The conference aimed to develop awareness among government administrations, the tourism industry and other tourism stakeholders, highlighting both current, and anticipated climate change impacts affecting tourism destinations and the need to carefully consider the consequences of climate change mitigation policies on tourism as well as the responsibility of the tourism sector to be a part of the solution by reducing its greenhouse gas emissions.

Subsequent workshops supported by the European Science Foundation (ESF) (Milan 2003), the North Atlantic Treaty Organization (NATO) (Warsaw 2003), the European Forum on Integrated Environmental Assessment (EFIEA) (Genoa 2004), and the Experts on Climate Change and Tourism group (eCLAT) (Netherlands 2006, Paris 2007), further contributed to the development of collaborative research and practical case studies by a network of international tourism stakeholders and scientists. Following the first International Conference on Climate Change and Tourism in 2003, the WMO and UNWTO took steps to strengthen the working arrangement that had been in force between these agencies since 1992. In particular, WMO's Commission for Climatology, at its fourteenth session (Beijing, China, November 2005) established a new Expert Team on Climate and Tourism, which has contributed to the knowledge base and the partnerships to support sustainable development of the tourism industry. In March 2007, UNWTO, UNEP and WMO commissioned a review report on tourism and climate change, including impacts and adaptation, changes in tourism demand patterns, emissions from tourism, and mitigation policies and measures.

Business Opportunities

In striving to do no harm to the environment, there are potential cost savings which can be realized by big businesses in implementing the use of energy- efficient equipments which in turn ease strain on the national electricity utility and places less reliance on coal-generated power. Also, in showing a commitment to environmental concerns by leading from the top and becoming an agent for change, a positive reputation is built, which can do much to gain consumer trust and to advance the business. Apart from showing environmental responsibility, a company's corporate image can be significantly boosted, and a company implementing eco-sensitivity ahead of imposing policy and regulation could be rewarded by socially conscious shareholders and consumers. Last but not the least, the corporate in many countries are also bound to control the emissions due to Kyoto climate-change protocol which legally whereby all the participating nations commit themselves to tackling the issue of global warming and reduce greenhouse gas emissions. The target agreed upon at the summit is an average reduction of 5.2% from 1990 levels by the year 2012.

Objectives

The objective of this study is to identify and analyze the selected GHG abatement methods as presented by McKinsey in its global cost curve which is being used as major reference for this research. The selection of these abatement methods is done on the basis of their viability and potential in reducing the tourism environmental impacts. Subsequently, an effort is made to conduct a macro level strategic analysis of how these technologies could be translated into potential business. The analysis is done from both perspectives – an external view to establish a new venture in one of these areas as well as an internal view by considering new technologies that could positively reduce the GHG emissions by being more energy efficient than that of existing ones for an organization.

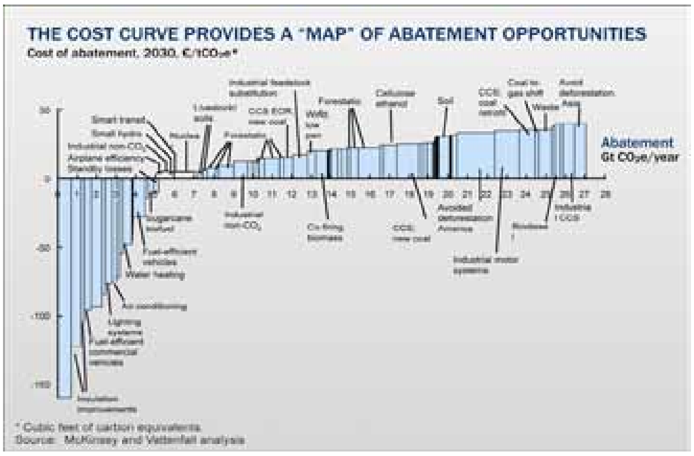
Research Methodology

McKinsey in its report recommended that certain measures to restrain costs be considered to ensure strict technical standards and rules for the energy efficiency of buildings and vehicles; to establish stable long-term incentives to encourage power producers and industrial companies to develop and deploy GHG efficient technologies; to provide incentives and support to improve the cost efficiency of selected key technologies, including carbon capture and storage (CCS), and finally, to ensure that the potential in forestry and agriculture is addressed effectively, primarily in developing countries (Mc Kinsey, 2007).

In the present study, an attempt is made to adopt a comprehensive and coherent approach for the analysis with a standard template that is used for all business opportunities. The template included basic twelve factors including Porter's five forces viz. geographical prominence, industry rivalry, barriers to entry, threat of substitutes, bargaining power of buyers, bargaining power of suppliers, government regulations, stage in life cycle, opportunities, and abatement potential (CO2 saved, costs), energy efficiency obtained from the technology, and government recognition & support.

Each of these 12 factors were deeply analyzed for every abatement technology and scaled on a range from "High", "Moderate" to "Low". For instance if "threat of substitutes" for sugarcane bio-fuel is "Moderate", it means that there are a few other available fuels that can easily take its place. Efforts are made to justify the scaling with facts and figures, nevertheless, in some cases the analyses could be perceived as subjective and be seen in relative terms. Furthermore, it has been taken care of that proper references are included for further investigation and details. The sources of information to conduct the analysis include intensive searches on Google and other search engines on internet.

Figure 1 The Cost Curve Provides a "MAP" of Abatement Opportunities



Findings and Inferences

Lighting systems – CFL lighting

In the hotel sector, there are some basic measures that can be taken to reduce energy needs for lighting. The most cost-effective measure is to use daylight to the largest extent possible, for instance by controlling vegetation growth and including aspects of illumination in the overall design of the hotel. Other low-cost measures include energy-saving lighting systems and motion detectors in floors and common areas. Energy efficient light bulbs have a far longer lifetime than conventional light bulbs (up to ten times longer). For instance, Compact fluorescent lamps (CFL) are four times more efficient and last up to 10 times longer than incandescent lamps. A 22 watt CFL produced similar light as a 100 watt incandescent lamp and uses 50 - 80% lesser energy (Eartheasy.com, 2009). Currently CFLs only account for 6% of the total lighting market and represent a minor share of light production in the residential sector but it is a fast growing industry with the rising demand for energy efficient lighting due to increasing awareness and legislative support (OECD, 2006). Due to the extensive experience with incandescent lamps, shifting away from this technology seems more difficult in OECD countries than in developing countries where such technological path dependency is more limited (ADB New Release 2008).
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Table 1 Business Factors for CFL Lighting

Geographical prominence	Global market for screw-based CFLs was around 1.6 billion lamps in 2006 of which four-fifths were made in China. CFL sales in 2003 in China are estimated at 355 million units, representing over 30% of the global market. Other big markets are Europe and US.
Industry Rivalry: Competitors	**High:** Concentrated in China with around 1000 manufacturers (1997). Voluntary agreement between key players like GE, Philips, Orpat, Osram and Halonix to produce higher quality products would create more differentiation (ADB New Release 2008). Growing innovation from Taiwanese suppliers with features like dimming capability, air purifying functions, adjustable base size.
Barriers to entry	**Moderate:** Purchase price are perceived high: even though it has decreased over the time, customer still do not have clear information about the product and fail to forecast benefits. Consumers who tried earlier version of CFLs do not trust the technology (Bertoldi, 2007). Reluctance from governments to create regulatory incentives. (Global environment Facility, 2007)
Threat of Substitutes	**Moderate:** Conventional Incandescent lights, light emitting diodes (LED market is still very small), Fluorescent tubes. Recent increase in the use of halogen lamps as low voltage lamps, reflector lamps, and double ended high wattage lamps (Bertoldi, 2007).
Bargaining Power of Buyers	**High:** Due to a large number of manufacturers in mainland china, globally buyers have higher bargaining power. But prices of higher quality CFLs may raise due to higher prices of raw materials but Chinese suppliers wouldn't rise beyond 5% to remain competitive. Utility subsidies would also cap the prices for end users by 40-50% (Global Sources 2007).
Bargaining Power Suppliers	**Low:** Prices of raw material are rising but there is large number of suppliers. Quality and RoHS compliances for raw materials have decreased their bargaining power.
Govt. Regulations	Lack of subsidized prices in Europe, while some rebates available in NA. Countries like brazil offer rebates and have policies to offer low interest loans for investment in energy saving project (OECD, 2006).
Stage in life cycle	In use with innovation and standardization in process
Opportunities	Awareness among utilities may create regulatory usage policies implying large demand.
Abatement potential (CO_2 saved, costs)	Average abatement cost(2030): -90 EUR/t CO_2e Total abatement opportunity (2030): 0.2 $GtCO_2e$ (Vatenfall, 2007).
Energy efficiency	**High:** CFL are four times more efficient and last up to 10 times longer than incandescent lamps. A 22 watt CFL produced similar light as a 100 watt incandescent lamp and uses 50 - 80% lesser

	energy. (Eartheasy.com, 2009)
Government Recognition & Support	**Moderate:** Regulations are not yet in place for use of CFL but are predicted to be mandated soon by several countries like US. There are already standards in place for building energy consumption and even there are existing incentives and rebates in few countries like brazil (OECD 2006, p.6). It is particularly recognized by some governments as a source of reducing GHG emissions.

Water heating – Solar water heating

A solar water heater captures sun's renewable energy to heat water which significantly reduces the amount of fuel used and also the emissions of harmful greenhouse gases (Solahart.com 2008). Globally, the industry started growing in early 1970s and went through different stages of innovation. The cumulative installed capacity of solar water heating systems grew 14% from 110 million m2 in 2004 (77 GWth) to 125 million m2 in 2005 (88 GWth) (E. Martinot, 2006). Usually Solar Water Heating Systems use solar energy as the primary source of heating water and uses electric, natural gas, propane as an auxiliary heating source.

Table 2 Business Factors for Solar water heating

Geographical prominence	Top 5 countries in solar water heating capacity: China, Germany , Turkey, India and Austria (Eric. Martinot, 2006).
Industry Rivalry: Competitors	**High**: China has the largest share in solar water heating industry with over 1000 manufacturers of which 100 can be considered competitive. The industry is quite fragmented and quality of products is a differentiator (Robert, 2007). Testing compliances and quality certifications like Gold star in china is becoming a differentiating factor (Z. Lou, 2007). Some of the global and Chinese key players are US Flying Hot Water, Changzhou Zhuohua, Solahart Australia, Shandong Huangming, Shandong Linuo, Beijing Tsinghua, Jiangsu Huayang, Jiangsu Sunshore and Tianpu.
Barriers to entry	**Moderate:** High upfront and transaction costs (information, procurement, installation works) implying long payback times. It is not yet perceived as a standard option for heating due to low awareness, especially among the decision makers which could mean more investments in marketing. There is also a lack of skilled installers.
Threat of Substitutes	**Low:** Latest water heating technologies such as pump water heaters, GeoExchange systems may pose threat. Decreasing threat from conventional technologies with rise of fuel prices.
Bargaining Power of Buyers	**Moderate:** As the demand is far higher than the capacity, the initial costs of installation are still high for end users, but rising competition is a balancing this.
Bargaining Power Suppliers	**Low**: Raw material supplier market is highly concentrated fragmented. *Limited information available on Chinese raw material market.*
Govt. Regulations	Initial subsidies, tax relief and low interest loans for installation offered in several countries. Countries like India, Korea, China and Spain have established regulations to increase the usage of solar hot water (E. Martinot, 2008). China has long-term goals for solar hot water (150 million m2 by 2010 and 300 million m2 by 2020 from 100 million m2 in 2006).
Stage in life cycle	Currently in use. Suitable for domestic and industrial use. Its recent growth in China and the rise in global power demand still make this industry a growing sector.
Opportunities	Costs can be driven less with economies of scale through investment in China and India. O&M costs are also lower when compared to conventional technologies.

Abatement potential (CO_2 saved, costs)	Abatement cost for commercial sector: -104Eur/TCO_2, residential: -62Eur/TCO_2. Potential: 0.1 GT CO_2 (commercial) 0.2 Gt CO_2 (residential) (Levine, 2007).
Energy efficiency	**Moderate:** Solar water heating can be used in commercial or industrial premises as an economic alternative to conventional furnace / electric heating. Thus it can reduce the operational costs.
Government Recognition & Support	**High:** Initial subsidies, tax relief and low interest loans for installation offered in several countries. Countries like India, Korea, China and Spain have established regulations to increase the usage of solar hot water (Eric Martinot, 2008).

Sugarcane Bio-fuel

Bio-fuels derived from the tropical crops such as sugar cane and palm oil are far more cost-effective than bio-fuels from other feed-stocks, including the target prices for cellulose ethanol. Profitability can be enhanced at the plant level by incorporating complementary products such as electricity cogeneration, yeast, and CO2. By comparison, U.S. corn-based ethanol costs from stand-alone ethanol plants is currently between $1.70 and $2.00 depending on the underlying cost of corn, which has recently exceeded $3.00 per bushel, or $1.10/gallon of ethanol. Similarly, the fully amortized cost per gallon to produce bio-diesel from vertically integrated Palm and Jathropa oil production and processing projects is estimated to be $1.25 per gallon. This is in contrast to the raw cost of the primary US bio-diesel feedstock, soybean oil, which is currently in the range of $2/gallon (Agland Investment Services, 2006).

Table 3 Business Factors for Sugarcane Bio-fuel

Geographical prominence (countries/continents)	About 30 countries currently either have active bio-fuel programs or will have soon. 1. US for domestic production and use. 2. Brazil for domestic and exports. Most FDI in bio-fuels in comes from the United States and Japan. 3. EU produces a lot but still looks for imports (due to ambitious targets) 4. India & China in addition to domestic production, are also investing in Africa, Philippines and other low cost locations (Phil, 2006).
Industry Competitors	**Low:** Monsanto, Syngenta, Ciba, Clariant and DuPont. Monsanto is working with Votorantim conglomerate which owns CanaVialis, world leader in the field of sugarcane genetics, and sugarcane genomics company Allelyx. Syngenta, Monsanto's major European competitor has access to inedible sugarcane strains wi ultra-high cellulose content developed by the Celunol biotechnology. In February 2008 Vereniu headquartered in Cambridge, Massachusetts, received a grant from the U.S. Department of Ener to develop cellulose ethanol (Carmelo, 2008).
Barriers to entry	**Moderate** due to high processing costs and unclear policies e.g. lack of agreed list of duty free tropical products. According to analysts even the new rules (e.g. Doha agreement) will not offer significant new trading opportunities (WTO, 2006).
Threat of Substitutes	**Moderate** : Bio-diesel from palm oil in Indonesia and Malaysia as well as from oil-rich, inedible plants such as jatropha and pongamia in India; and bio-ethanol from sugarcane in Mozambique and in several Latin American countries, such as Honduras, Nicaragua and Panama
Bargaining Power of Buyers	**Low** because of few available options and increasing pressure from government regulations.
Bargaining Power of Suppliers	**Moderate** because bio-fuel production is essentially labour intensive and fragmented industry. Low switching costs. (Keiser S., 2005)
Govt regulations	**High** as it touches four areas of policy: energy, environment, agriculture and rural development. These areas, in turn, are strongly shaped by international trade and investment rules, trade barriers, and tax policy, all of which generate significant policy distortions in both the agriculture

	and energy sectors.[1] Tax exemptions are common but not consistent across EU member states; some countries, such as Sweden and Spain, exempt bio-fuels from excise taxes altogether, while others (France, Ireland, the Netherlands and some others) grant only limited exemptions for bio-fuels. (Sophia Murpfy, 2007)
Stage in life cycle	Although assessments of the global economic potential of bio-fuels have just begun, current bio-fuel policies could, according to some estimates, lead to a fivefold increase of the share of bio-fuels in global transport energy consumption – from just over 1 percent today to 5 to 6 percent by 2020 (World Bank, 2008).
CO_2 saved	Sugarcane-based bio-ethanol saves between 80 and 90 percent of GHG emissions per mile while bio-diesel from soybeans can save 40 percent. (P. Hazell, 2007) In general, bio-fuels from grains have lower performance, reducing carbon emissions by 10 to 30 percent per mile or, in some cases, even producing higher emissions than fossil fuels.
Opportunities	Considering the raise in petroleum prices, bio-fuel is gaining acceptance in all countries. For instance the EU plan calls for bio-fuels to be used in at least 10 percent of fuels used in transport in the 27-nation bloc by 2020. However, the laws for bio-fuel export-import have to be taken care of. Sugarcane bio-fuel business opportunity could be thought for countries like India where the fuel consumption and price are increasing along with sugarcane supply exceeding demand.
Abatement potential (CO_2 saved, costs)	It estimated that sugarcane ethanol created up to 70 percent fewer greenhouse gases than fossil fuels, whereas maize -- most used in the United States -- permitted a reduction of only 13 percent (AFP 2008).
Energy efficiency	**High:** Producing sugarcane bio-fuel takes $1 in comparison to $3.08 for gasoline and $2.79 diesel.
Government Recognition & Support	**Depends on the country.** Brazil for domestic and exports. Most FDI in bio-fuels comes from the United States and Japan (Phil, 2006).

Fuel efficient Airplanes – Fiber optic based Sensor Technology

According to UNWTO 2008 report, after labour, fuel represents the largest cost component in airlines operations. Air transport accounts for an estimated 40 % of the tourism contribution of CO2 (and about two-thirds of the total GHG impact). Unfortunately, there are only few ways by which airplane fuel consumption can be reduced. International Air transportation Authority (IATA) is working with air navigation service providers (ANSPs), air traffic controllers (ATCs), airlines and other key stakeholders to improve the fuel efficiency. Its initiatives include "Save 1 Minute" per flight through

[1] U.S. spends an estimated US$ 39 billion per year on oil and gas subsidies, compared with US$ 8 billion on coal, US$ 9 billion on nuclear energy, US$ 6 billion on ethanol and US$ 6 billion on other forms of renewable energy.

better airspace design, procedures and management; Route Optimization by opening new more direct flight routes and re-aligning them; improvements to ground, departure & arrival traffic and refining the existing operating procedures (IATA, 2009). As far as business opportunity is concerned, it seems to be in the area of "Fiber optic based Sensor Technology", which is still in its infancy stage and being evaluated by NASA. (NASA, 2008) The weight reduction that fiber optic sensors would make possible could reduce operating costs and improve fuel efficiency. The development also opens up new opportunities and applications that would not be achievable with conventional technology. For example, the new sensors could enable adaptive wing-shape control. If the shape of the wing can be changed in flight, then the efficiency and performance of the aircraft can be improved, from takeoff and landing to cruising and maneuvering (Kate Greene, 2008).

Table 4 Business Factors for Fiber based Sensor Technology

Geographical prominence	Being an emerging area, a lot depends on publications & patents. Interestingly, the major publication work in the field has taken place in the United States and the United Kingdom. However, Japanese organizations accounted for less than 10% of technical publications; they accounted for about 31% of patents and are the largest contributors (WTECH, 1996).
Industry Rivalry: Competitors	**High**: *USA* - Agilent Technologies, Inc., Blue Road Research Inc., CompuDyne Corporation, Davidson Instruments Inc., Halliburton Company, Honeywell Sensing and Control, Intelligent Fiber Optics Systems, KVH Industries, Inc, Micron Optics, Inc., NxtPhase, T&D Corporation, Northrop Grumman Navigation Systems Division, Ocean Optics, Inc. Optrand, Inc. Photonics Laboratories, Inc.,Prime Photonics™, Schlumberger Limited Tubel Technologies, Inc. *The United Kingdom* - Sabeus Sensor Systems Sensornet Ltd. *The Netherlands* - Avantes B.V., Switzerland - Baumer Electric AG *Canada* - C-Chip Technologies Corporation, EXFO, Fiber Optic System, FISO Technologies, *France* - Highwave Optical Technologies *Japan* - Hitachi Cable Ltd.
Barriers to entry	**Moderate:** Patents, High costs in Research & Development.
Threat of Substitutes	**Low:** There is not any competitive technology except for other ways to save fuel such as better airspace design, procedures and management, route optimization, improvements to ground, departure & arrival traffic and refining the existing operating procedures.
Bargaining Power of Buyers	**Moderate:** Due to intense market competition in fiber optic companies.
Bargaining Power of Suppliers	Not much information available
Govt. Regulations	The technology is being testified by NASA. No specific regulations so far.
Stage in life cycle	**Nascent Stage -** The technology is not even launched and being tested on unmanned aircraft by NASA.
Opportunities	If approved, the new technology could not only substantially reduce the fuel consumption but also enable adaptive wing-shape control.
Abatement potential (CO_2 saved, costs)	According to a report – "Overall, the total annual distance covered by the global civil aircraft fleet was forecast to grow by 149% from 2002 to 2030, with the seat-kilometres forecast to grow by 229%. The case with the most technological advance (that with $100/tonne CO_2 cost) was forecast to produce 22% less CO_2 in 2030 than the case without the extra incentives. However, even this case was forecast to produce nearly twice as much CO_2 in 2030 as in 2002." (Gareth Horton, 2006).
Energy efficiency	**Moderate**: Cost 10cents kWh[1], no $C0_2$ is generated.
Government Recognition & Support	**Low**: The environmental incentives are large but it is regulatory constraints that are limiting small hydro's development making it unfeasible (European Commission 2009).

Wind power

Wind energy is a significant power source being safe, clean and abundant. Wind power is one of the few energy supply technologies that possess the maturity and a global potential to deliver deep cuts in fuel usage and GHG emissions. It is the fastest growing energy source in the world with an average annual growth rate of more than 26 % since 1990. World's wind energy generating capacity in 2005 stood at over 59 GW. GWEC estimates that the wind industry is capable of becoming a dynamic and innovative 80 billion euro (67 billion USD) annual business by 2020. Wind power installed worldwide could be increased from 59 GW in 2005 to 1,000 GW by 2020 and could supply 12 % of global electricity needs. (GWEC 2009)

Table 5 Business Factors for Wind Power Energy

Geographical prominence	Countries with the highest installed capacity: Germany, Spain, USA, India and Denmark. Other countries like Italy, UK, Netherlands, China, Japan and Portugal growing. Canada also is predicted to be among the fastest growing.
Industry Rivalry: Competitors	**Moderate:** Key players are Vestas, Enercon, GE, Gamesa, Clipper, Suzlon, Siemens, REpower Systems AG & Nordex. Globally the market is more on an oligopolistic framework although concentrated in some countries. With rising demand, competition has moved from project-driven, national agreements to multi-year frame agreements spanning several regions. There has been rising product size segmentation (Senosiain, 2001).
Barriers to entry	**High** Absence of proven technology, limited subsidies from government and dependence on governmental policies. Vertical integration of existing players. Rising steel costs (Efiong, 2007).
Threat of Substitutes	**Moderate** Threat from conventional power sources like coal, gas is less due to decreasing costs in wind power generation due to technology innovation and economies of scale. Rising threat from alternate sources like solar, hydro , biomass etc. (Alternate Energy 2008)
Bargaining Power of Buyers	**Low:** The key customers are large independent power producers and utilities who are ready for long term agreements with significant advance payments due to rising demand which signals a low buyer's power (Efiong, 2007).
Bargaining Power of Suppliers	**High:** With supply chain management becoming a competition driver, relationships between OEMs and suppliers is becoming crucial due to rising demand and bargaining power of these suppliers does seem high currently. There have been few entrants in supply chain and as there is large number of components used, few suppliers have been able to remain highly profitable (Efiong, 2007).
Govt. Regulations	In Europe Feed-in tariffs exist in most countries making utilities obliged to connect renewable energy plants to the electric grid and similar policies exist in countries like US and India. There are Green certificates in some countries which obliges consumers to buy a certain amount of energy produced by renewable sources. Federal government in Canada has in place Wind Power Production incentives, funding and tax benefits (Senosiain, 2001).
Stage in life cycle	Considered fairly mature with steady improvements in technology.
Opportunities	Rising demand and fast paced growth. Growing need to reduce GHG emissions.
Abatement potential (CO_2 saved, costs)	Estimated abatement cost(2030) : 22 EUR/tCO_2e Abatement potential(2030) : 485 Mt CO_2e (McKinsey, 2007)
Energy efficiency	**High:** Wind power is considered at par with coal power in terms of cost. Currently Coal power cost is estimated to be 4.8 - 5.5 Cents/kW-h while wind power cost is 4 - 6 Cents/kWh. Cost of producing wind power is predicted to become even lesser with low O&M costs. (Pure Energy

	Systems, 2009)
Government Recognition & Support	**High:** Feed-in tariffs exist in some European countries making utilities obliged to connect renewable energy plants to the electric grid and similar policies exist in countries like India and US (some US states have rebate programs for wind energy). Green certificates in some countries oblige consumers to buy a certain amount of energy produced by renewable sources. Canadian Federal government offers Wind Power Production incentives, funding & tax benefits (Senosiain, 2001).

Conclusion

The relevance of climate change to tourism is not inconceivable. Climate change is already influencing decision making within the tourism sector, including tourists, forward looking tourism businesses and investors, and international tourism organizations. The climate change mitigation potential is thought to be relatively high in the tourism sector because efforts to lower energy consumption and GHG emissions in the sector are still largely in their infancy (UNWTO, 2007). The usage of solar water heating, wind power energy and CFL lighting is presently observed in the hospitality industry whereas the application of fiber optical sensor technology and bio fuel in the transportation sector remains a widely unexplored area. The investors are advised to critically assess these potential technologies before making an effort to commercialize them. Also irrespective of the levels of maturity of these technologies, which may differ in various countries, profitability from any of such businesses cannot be expected without government support and assistance. Last but not the least, the business environment for these mitigation technologies is highly dynamic in nature hence, it is imperative that the investors keep a track of new developments in the market.

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