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Greening the Haj: Environmental Challenges and Sustainability Options

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Introduction

Nearly three million Muslims perform the Haj every year. The Haj pilgrimage, during which Muslims from around the world travel to Makkah in Saudi Arabia to perform religious rites, is considered to be one of the largest gatherings of people in the world.

Allah says in the Quran: “Fulfill the pilgrimage and make the visitation for Allah. If you are prevented, then whatever offering that may be easy” (Surat Al-Baqarah, 196). Haj is one of the five pillars of Islam. It is a mandatory religious duty for Muslims, which must be carried out at least once in a lifetime by every adult Muslim who is physically and financially capable of undertaking the journey.

Haj is not just a form of worship, but also a way of understanding the meaning of life. It teaches Muslims equality by bringing together people from different cultures and races to Makkah to worship God.¹

It is well known that Haj is a spiritual and moral journey that helps Muslims to thank Allah for all the blessings. At the same time, protecting and conserving the

1. Husna Ahmad, Global One 2015, Eco Muslim, and UNDP, “The Green Guide for Hajj,” *Alliance of Religions and Conservation*, 2011, http://www.arcworld.org/downloads/Green_Guide_for_Hajj.pdf

environment and its natural resources is also a religious duty that all Muslims have to fulfill. However, very often during the Haj season, Muslims do not pay attention to the importance of protecting the environment and natural resources.²

This paper is structured in four sections: the first section addresses the environmental issues and concerns associated with the Haj; the second section looks at the Saudi efforts to overcome various environmental challenges associated with the Haj; the third section provides some insights into possible options and steps to deal with and alleviate some of the environmental stress associated with the Haj. The concluding section provides a short summary of the points raised earlier.

1. Environmental Issues Associated with Haj

Hosting the huge number of pilgrims who come for the Haj each year is a big challenge for the Saudi government as it has to make all the necessary arrangements for housing, transportation, sanitation, food and healthcare. One of the biggest environmental issues associated with the Haj is that during the pilgrimage season, a lot of waste, such as plastic bottles, used diapers, and food packaging, is generated. In addition, there is wastewater generation and air pollution caused by vehicles transporting the pilgrims.

Many of the pilgrims are poorly educated and lack an understanding of the proper use of environmental resources. Besides, a large number of pilgrims are not aware of the importance of protecting the environment, though it has been emphasized in Islamic teachings.

To achieve a green Haj and reduce the carbon footprint, pilgrims need to behave in a more environment-friendly manner.³ The main purpose of this religious journey is to develop the pilgrims' spiritual consciousness, improve their moral values and implement Islamic teachings. However, the Haj journey appears to contain a contradiction with its main purpose, in that during such a journey pilgrims should not cause any environmental harm or pollution, or harm others.⁴ Some of the environmental issues associated with the Haj are:

2. Ibid.

3. Rehan Ahmed, "Guide to Green Hajj," *Eco MENA, Echoing Sustainability*, April 11, 2016, <http://www.ecomena.org/green-hajj/>.

4. Shehroze Khan, "Towards a Green Hajj," *Eco MENA, Echoing Sustainability*, September 9, 2015, <http://www.ecomena.org/towards-a-green-hajj/>.

1.1 Food and Plastic Waste

One of the biggest challenges for Makkah during the pilgrimage season is dealing with the huge quantities of food and plastic waste. According to environmental expert Assad Akrami, waste generated during the pilgrimage season is one of the highest in the region, amounting to about 150,000 tons, or about 30,000 tons per day, plus 2.5 million boxes of water. Waste is usually thrown into specific landfills outside of the Makkah region without eco-friendly treatment, which causes air, water, and soil pollution. The issue of unsustainable treatment of waste is still a major concern for environmentalists.⁵

The General Administration of the Municipality of Makkah is aware of this problem. As such, they have started cooperating with recycling and re-manufacturing companies within the framework of the Saudi Vision 2030. Also, the municipality has commissioned research studies and plans in order to reduce waste. A report issued by the Scientific Forum for Research Haj and Umrah, which was held at Umm Al Qura University in May 2016, stated that recycling waste after the Haj and Umrah seasons would help in reducing the emissions of methane by 5.6 tons and that of carbon dioxide by 141,000 tons. In addition, recycling waste after the Haj season, by providing seasonal jobs, will reduce the unemployment numbers in the Makkah region and support the Saudi economy by providing work to waste recycling companies. Akrami points out that there is a demand to deepen environmental studies to find better and realistic solutions to reduce the food and plastic waste generated during the Haj season.⁶

1.2 Personal and Public Hygiene

Besides, there is also the need for pilgrims to take better care of their personal hygiene, especially in crowded areas, during the Haj season. A key reason for the spread of diseases during this season is the lack of awareness of personal and public hygiene.

Cleanliness is an important aspect of Islam. Worship is not complete without cleanliness. Many diseases such as diarrhea and dysentery and hepatitis are caused by lack of hygiene. Therefore, the pilgrims must use masks and change them on a daily basis in addition to ensuring that their accommodation is kept clean. Other aspects

5. Yaser Ba Amer, "Waste, the Largest Environmental Challenge in Hajj," Al Masar Online, September 1, 2016, <http://www.almasaronline.com/?p=207147>.

6. Ibid.

include washing hands thoroughly before eating.⁷ Table 1 summarizes the causes of the main environmental issues during Haj and their impact.

Table 1. Key environmental issues during Haj

Environmental Issues	Causes	Impact
Waste generated such as plastic bottles, used diapers, food packaging	Lack of awareness of the importance of protecting the environment and responsible consumption and disposal	Soil and air pollution; spread of diseases
Wastewater generation	Sheer number of pilgrims	Water and soil pollution; spread of diseases.
Air pollution	Use of vehicles, trains, and buses by pilgrims moving around	Increase in CO ₂ emissions which also impacts pilgrims' health
Spread of infectious diseases	Lack of awareness of personal and public hygiene	Disease outbreak including diarrhea and dysentery, hepatitis, and respiratory diseases

Source: Compiled by authors.

2. Saudi Efforts toward Bringing about a Green Haj

In fact, Saudi Arabia has spared no effort or money for the service of pilgrims each year and has done its best to facilitate their rituals. The Kingdom is spending tens of billions of dollars on projects to improve the area around the holy sites. In addition, it has harnessed human efforts for improving security, medical services, and roads so that pilgrims from all over the world can participate in the Haj in peace and comfort.

The Kingdom has initiated a number of policies to reduce the environmental footprint (waste, water and carbon) of the Haj. For instance, many environmental policies and standards have been introduced and police guardians appointed to conduct inspections and ensure compliance with environmental standards.

This paper will describe a number of specific initiatives and projects that aim at a green Haj but first it is important to describe the Saudi Vision 2030 that was launched on April 25, 2016 as this vision is an ambitious strategic plan to conduct all activities and projects in different sectors in a sustainable manner.

7. Ayisha Dagreri, "Cleanliness in Hajj," Ministry of Health, 2016, <http://www.moh.gov.sa/Hajj/InformationCenter/Articles/Pages/Artical-4.aspx>.

2.1 Saudi Vision 2030

The Saudi Vision 2030 is an ambitious plan that has three main themes: The first theme focuses on achieving a vibrant society with fulfilling lives. This theme targets the society at large by promoting physical, psychological and social well-being. Also, it aims to build a good quality of life and a healthy lifestyle and create an attractive living environment. This theme also has several other targets such as conserving the environment and natural resources.

The Saudi Vision 2030 seeks to preserve the environment by increasing waste management efficiency, establishing a number of comprehensive recycling projects, and, most importantly, reducing all kinds of pollution and combating desertification.⁸

Furthermore, it seeks to support water use efficiency through reducing water consumption and utilizing treated and renewable water. Also, it seeks to protect and rehabilitate beaches, natural reserves and islands, and make them accessible to everyone.⁹ The President of the General Authority for Meteorology and Environmental Protection Dr. Abdulaziz Al-Jasser has pointed out the importance of preserving the environment and said that sustainable development is essential for the country's development and for achieving the ambitious development plans.¹⁰

Another important target is to provide the best services to pilgrims. This includes projects such as the Makkah Metro project that will serve visitors to the Holy Mosques and holy sites. Such endeavors will certainly help pilgrims to perform their visits with greater ease and convenience.¹¹ These goals will be achieved through collaboration between the private and government sectors.¹² Additionally, the Vision places focus on moving the economy into new, high value-added activities and diversifying it.¹³

8. Vision 2030 Kingdom of Saudi Arabia, 2016. <http://vision2030.gov.sa/ar/node/259>. <http://vision2030.gov.sa/en/node/10>.

9. Ibid.

10. Saleh Al Ruwais, د. الجاسر: البيئة والتنمية المستدامة في أولويات: [Dr. Jasser: Environment and Sustainable Development in The Priorities of The Vision of The Kingdom in 2030] Al Riyadh, April 28, 2016, <http://www.alriyadh.com/1150844>.

11. *Al Arabiya*, "Full Text of Saudi Arabia's Vision 2030," April 26, 2016, <https://english.alarabiya.net/en/perspective/features/2016/04/26/Full-text-of-Saudi-Arabia-s-Vision-2030.html>.

12. Vision 2030 Kingdom of Saudi Arabia, 2016.

13. Alan Larson and Constance Anne Pence, "Saudi Arabia's Vision 2030 — Ambitions to Modernize and Diversify the Economy," Global Policy Watch, June 6, 2016, <https://www.globalpolicywatch.com/2016/06/saudi-arabias-vision-2030-ambitions-to-modernize-and-diversify-the-economy/>.

2.2 Awareness Guidelines for Pilgrims

The Ministry of Health has provided a number of awareness guidelines for pilgrims that will help them to perform Haj rituals easily and in a healthier environment. The guidelines relate to personal hygiene, food poisoning during Haj, and hygiene issues connected to shaving. The Ministry also sends a number of SMS messages that highlight the importance of washing hands and using clean tissues when sneezing or coughing in order to minimize the spread of diseases such as the Coronavirus. To ensure that its messages are understood by the pilgrims, in 2016, the Ministry provided 420 translators for more than 67 languages for 54 different nationalities, in a move that was also expected to help the medical staff provide the best services for the pilgrims.¹⁴

2.3 Eco-friendly Camps

The Coordinating Board of Institutions and Domestic Pilgrims Firms announced that, in 2016, environment-friendly camps would be set up. The well-equipped camps would accommodate about 200,000 pilgrims from 200 different pilgrimage campaigns.

According to the Secretary General of the Coordinating Board of Institutions and Domestic Pilgrims Firms Jamal Shagdar, a three-stage operational plan was put in place for the new season, including constructing the camps and providing services during the pilgrimage season. He added that the creation of environment-friendly green camps would help in the reduction of waste, aid recycling, and improve the sanitation in the camps.¹⁵

2.4 Waste Management

2.4.1 Hidden Containers

According to Dr. Iqbal bin Mohammed Ibrahim Ismail, faculty member at the Center of Excellence for Research in Environmental Studies at King Abdul Aziz University, waste recycling programs during the Haj season in Makkah could save about SR113 million per year. He added that the waste in the landfills does not go through a suitable waste management and treatment process, which causes emission of gases and water and soil pollution.¹⁶

14. Ministry of Health, "Desensitize Pilgrims via SMS: to Stop the Spread of Infection," September 10, 2016, <http://www.moh.gov.sa/Hajj/News/Pages/News-2016-09-10-003.aspx>.

15. Sameer Al Thibity, "Eco-friendly Camps in Mina," *Makkah Newspaper*, September 3, 2016, <http://makkahnewspaper.com/article/185129/Country/camps-friendly-environment-in-Mona>.

16. Saed Al Omary, "Academic: Recycling Hajj Waste Will Provide 113 Million SR Annually,"

The Municipality of Makkah has introduced a number of waste management technologies to help provide the best environment for the pilgrims. These new technologies will enable the temporary storage of waste in the sacred areas. Forty eight hidden containers with a 3,000 liter capacity each have been provided. These hidden containers do not require electrical or mechanical systems, and they prevent any fire in the stored waste.¹⁷

Figure 1 & 2: Hidden Containers



Source: Al Khaleej Online, “For Environmentally and Healthy Hajj: Hidden and Temporary Waste Containers in Makkah,” September 19, 2015.

1/ - سد يوف ر-ال حج- فلواتة دوير-إعادة أكادي مي/ <http://akthar.net>, May 26, 2016,

17. Al Khaleej Online, “For Environmentally and Healthy Hajj: Hidden and Temporary Waste Containers in Makkah,” September 19, 2015, <http://alkhaleejonline.net/articles/1442668698231256300/> بدينة/مكة في-يومؤة تسمدة ف يند فلوات-حاوية لت-صد ي-حج-ل

2.4.2 Electronic Application “Operating Management and Follow-up Cleaning”

In 2016, the Holy Makkah Municipality introduced an “Operating Management and Follow-up Cleaning” system, a modern electronic application that allowed the receipt of notifications from citizens, administrators or the cleaning management sub-system and municipalities to locate and monitor the places where waste accumulation occurs. This application also helps to involve citizens in the evaluation of the work and to prevent the accumulation of waste during the pilgrimage season in sacred areas. Furthermore, the Municipality has installed a tracer in all compressors and containers to monitor if the containers are full of waste. According to the director of the Operating Management and Follow-up, Engineer Atef Farhan, these steps have been taken with the support of the Mayor of Makkah Dr. Osama bin Fadl Bar and the Under-Secretary for Services Engineer Abdul Salam Mashat and are in line with the Saudi Vision 2030.

Cleaning in the holy sites area is a 24 hour job during the peak days and is supported with the necessary equipment such as vacuums and mechanized brooms. The Municipality has created a set of floor warehouses for temporary storage of waste. The collected waste is kept in storage in Mina temporarily, in compressors as well as the warehouse floor.¹⁸

2.4.3 Organic Bio-Spray

An issue that causes much concern during the Haj is the preponderance of flies. The presence of about four million people in an area of 463 square miles for almost a week is certain to stress any local waste disposal services. When garbage trucks are unable to access the overcrowded streets of Makkah, waste begins to pile up and rot in the heat. This, in turn, attracts hordes of flies raising health concerns. Saudi Arabia, in collaboration with the US biotechnology company BiOWiSH Technologies, has developed an organic bio spray solution to prevent waste-related odors. This solution is 100 percent natural and safe for human beings and the environment and helps to prevent flies from multiplying and spreading diseases. It was initially tested in 2014 and 2015 by the Haj operations management team, which reported a significant reduction in pesticide use as well as a drop in the distribution of medicines for coughs and other infections during the pilgrimage season.¹⁹

18. Khamis Al Zahrani, “Hajj Plan of Municipality of Mecca by Numbers,” *Al Arabiya*, August 26, 2016, <http://www.alarabiya.net/ar/saudi-today/2016/08/26/مكة-في-يومها-تتمدد-في-قيد-فلاي-التحارب-لت-صد-يتحج-ب-ي-نة/>

19. Aisha Abdelhamid, “Greening the Haj Pilgrimage to Mecca,” *Planet Save*, September 13, 2016, <http://planetsave.com/2016/09/13/greening-hajj-pilgrimage-mecca/>.
<http://www.alhijr.com/html/المكرمة-مسكة-أمان-تخطي-الأرق-ام/>

2.5 Transportation

2.5.1 The Sacred Areas Train

The Ministry of Municipal and Rural Affairs developed an integrated plan to operate the Sacred Areas Train during the Hajj beginning in 2015. The operation process of the train included identifying pilgrim camp sites and trails and providing access to the stations in Mina, Arafat, and Muzdalifah. A schedule plan was drawn up for the gathering point for pilgrims with the aim of reducing overcrowding at the train stations. The train project includes a package of awareness and guidance programs in different languages such as Arabic, English, and Urdu.²⁰ The Sacred Areas train, costing about SR6.7 billion, is about 300 meters long and can transport about 80,000 pilgrims an hour at a speed of 80-120 km/hour. Each holy site has three stations that come fully equipped with elevators and comfortable waiting areas that can accommodate more than 3,000 pilgrims.²¹

Figure 3: The Sacred Areas' Train



Source: Nouf Al Ghamdi, "The Sacred Areas' Train is Ready for the Hajj Season with Experimental Intensive Trips," *Al Riyadh*, August 28, 2015.

20. *Al Bayan*, "Saudi Arabia: The Sacred Areas' Train Transferred 370,000 Pilgrims," September 22, 2015, <http://www.albayan.ae/one-world/arabs/2015-09-22-1.2464555>.

21. Nouf Al Ghamdi, "The Sacred Areas' Train is Ready for the Hajj Season with Experimental Intensive Trips," *Al Riyadh*, August 28, 2015, <http://www.alriyadh.com/1077196>.

2.5.2. The Haramain High-Speed Railway

At the end of 2016, pilgrims will be able to use the Haramain High-Speed Railway from Makkah to Madinah to travel between the two holy cities in Saudi Arabia. Using public transportation helps reduce air pollution and traffic congestion. A total of 35 trains will be used in the Haj season to transport about two million pilgrims. The trains can transport about 166,000 passengers per day.²²

Figure 4: The Haramain High-Speed Railway



Source: Railway-technology, <http://www.raillynews.com/2012/saudi-arabias-haramain-high-speedrail-to-begin-operations-by-2014/>.

2.6 Water Conservation

The Haj and Umrah Gift Charity has collaborated with the National Water Company as well as a number of government and private sector firms to distribute innovative tools that help in saving 40 percent of water at the holy sites and do not require electrical energy. Some 3,000 metal devices that are easily installed in faucets in public places and pilgrim accommodation have been distributed. This will help to reduce water wastage and leakage in the pilgrim accommodation areas. These devices operate without electricity or battery.

The Director General of the Association, Mansour bin Amer Al Amer, pointed out that these metal devices are the first of its kind in Saudi Arabia. This innovation helps in saving water and protecting the environment and natural resources.²³

22. Abdul Aziz Ghazzawi, "Train for Pilgrims' Makkah-Madinah Travel by End of 2016," *Al Arabiya*, September 28, 2015, <http://english.alarabiya.net/en/business/aviation-and-transport/2015/09/28/Train-for-pilgrims-Makkah-Madinah-travel-by-end-of-2016.html>.

23. Twasul, "For the First Time in the Kingdom.. Haj Gift Distributed 3 Thousand Innovative Product to Save Water During Hajj," September 6, 2016, <http://twasul.info/529272>.

Figure 5: The Water conservation innovation



Source: Twasul, “For the First Time in the Kingdom, Haj Gift Distributed Three Thousand Innovative Product to Save Water during Hajj,” September 6, 2016, <http://twasul.info/529272/>.

Table 2: A summary of the Saudi efforts toward green Haj

Saudi Efforts Toward Green Haj		Addressed Issue
Eco friendly Camps	Eco-friendly camps help in the reduction of waste and improve the environmental sanitation within the camps	Waste reduction
Hidden containers	This new technology stores waste temporarily in the Haj sacred areas. There are 48 hidden containers with a 3,000 liter capacity each. They do not require electrical or mechanical systems, and they prevent any fire ignition in the waste storage area.	To store waste temporarily
Electronic Application “Operating Management and Follow-up Cleaning”	A modern electronic application that helps to receive notifications from citizens, administrators or cleaning management sub-system and municipalities to locate and monitor the place that has waste accumulation	To minimize waste accumulation
Organic Bio-Spray	Saudi Arabia collaborated with the US biotechnology company BiOWiSH Technologies and developed a bio spray to prevent waste-related odors. This organic solution is 100 percent natural and safe for the people and the environment	Preventing flies from multiplying and spreading diseases

The Sacred Areas Train	The Sacred Areas' Train can transfer about 370,000 pilgrims and costs about 6.7 billion Saudi Riyals. This train is about 300 meters long and can transport about 80,000 pilgrims an hour at a speed of 80-120 km/hour. The trip between the holy sites takes only a few minutes. Each holy site has three stations that come fully equipped with elevators and comfortable waiting areas enough for more than 3,000 pilgrims.	Reduce overcrowding at the train station
The Haramain High-Speed Railway	The Haramain High-Speed Railway between Makkah and Madinah connects the two holy cities in Saudi Arabia. A total of 35 trains will be used in the Haj season in 2017 to transport about two million pilgrims. The trains can transport about 166,000 passengers per day.	Reducing air pollution and traffic congestion
The Water Conservation Innovation	The Haj and Umrah Gift Charity has collaborated with the National Water Company, the government and private sectors to distribute around 3,000 metal devices that will help in saving 40 percent of water at the holy sites. The devices do not need electrical energy	Saving water and protecting the environment and natural resources

Source: Compiled by authors.

3. Possible Sustainability Options

In the past, lifestyle was more environment-friendly, transportation was more eco-friendly and the number of pilgrims was far less than today. Currently, the population of Makkah and Madinah almost doubles during Haj and the number of pilgrims has been rising annually, reflecting the growth in the global Muslim population. Thus, it is essential to use modern technological innovations in order to make sure the Haj is conducted in a sustainable way. In this section, a number of possible sustainable options that have been tried elsewhere and may be replicated in Saudi Arabia are presented.

3.1 First Solar Powered Village in India

The village of Dharnai in Bihar is the first solar powered village in India. The people of Dharnai did not have electricity until July 2014 and had used kerosene lamps and expensive diesel generators. In 2014, Greenpeace India installed a solar-powered micro grid with the assistance of two NGOs, BASIX and CEED. The Dharnai micro grid serves about 450 homes, hosting 2,400 residents, and also provides electricity to two schools, a health center, a farmer training center, 50 commercial shops, water pumps, and street lights.²⁴

24. Rumani Saikia Phukan, "India's Solar Powered Villages: Dharnai, Kannauj and Baripatha," *Maps of India*, October 14, 2015, <http://www.mapsofindia.com/my-india/government/indias-solar-powered-villages-dharnai-kannauj-and-baripatha>.

Figure 6: Solar power panels in Dharnai Village



Source: Angela Glieniceke, "In Pictures: Seeing Light after 33 Years of Darkness, First Fully Solar-powered Village in India," *Greenpeace*, July 24, 2014.

3.2 Green Innovations

Dr. Essam Bokhari, an expert in technology and innovation management, discusses in an article the importance of using the latest technologies to provide the most suitable and comfortable environment for the pilgrims. For instance, sterilization optical stimulation technique is a new method that helps in killing 99.9 percent of bacteria and viruses and, therefore, can be used in hospitals and public utilities. Another innovation that he describes focuses on generating energy from organic waste. About three tons of waste can generate energy that is equal to the energy generated from one ton of petroleum.²⁵

25. Essam Bokhari, "The Hajj with Technologies of Twenty First Century," *Al Riyadh*, October 3, 2014, <http://www.alriyadh.com/981903>.

3.3 Smart Umbrella

The smart umbrella is one of the innovations that help pilgrims to alleviate the hardship of the Hajj journey. It includes a solar system and a GPS system, a fan and lamp, and includes three USB outlets for various mobile phone chargers and computer tablets. This new innovation helps in protection from the heat and facilitating communication among pilgrims. Also, it allows pilgrims to track their family members through the GPS provided in the umbrella.²⁶

Figures 7 & 8: Smart Umbrella



Alwatan Newspaper, "Smart Umbrella Helps Pilgrims to Overcome the Difficulties of Hajj," August 21, 2016, <http://alwatannewspaper.ae/?p=60268>.



Alwatan Newspaper, "Smart Umbrella Helps Pilgrims to Overcome the Difficulties of Hajj," August 21, 2016, <http://alwatannewspaper.ae/?p=60268>.

26. *Alwatan Newspaper*, "Smart Umbrella Helps Pilgrims to Overcome the Difficulties of Hajj," August 21, 2016, <http://alwatannewspaper.ae/?p=60268>.

3.4 Solar Powered Train in India

It would be a good idea to use solar panels in the railway system in Makkah. Saudi Arabia depends mostly on fossil fuel; but it can use solar panels or a hybrid system (both solar and fossil fuel) and decrease the CO₂ emissions. India has implemented a project that provides a good example to follow.

In 2015, the Northern Railways in India had coaches fitted with rooftop solar panels. These coaches run on the Pathankot-Jogindernagar route in the Kangra Valley section and Kalka-Shimla section. Each solar panel generates 300 watts of electricity, which equals 3.6KW of power per coach. This is sufficient to generate electricity for lights and fans inside the coach although there is not enough power to run air-conditioners.²⁷ According to Indian Railway Minister Suresh Prabhu, Indian Railways are working towards fully solar-powered trains in the future. Using solar power will help in minimizing the carbon footprint of the railways.²⁸

Figure 9: India's first solar-powered train



Source: Smriti Jain, "India's 'First Solar-Powered Train': All You Want to Know about Indian Railways' Green Initiative," *Financial Express*, May 26, 2016.

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27. Smriti Jain, "India's 'First Solar-Powered Train': All You Want to Know about Indian Railways' Green Initiative," *Financial Express*, May 26, 2016, <http://www.financialexpress.com/economy/indias-first-solar-powered-train-all-you-want-to-know-about-indian-railways-green-initiative/264505/>.
28. Tech2 News, "Indian Railways Are Working on Fully Solar-Powered Trains, Says Union minister Suresh Prabhu," *Firstpost*, October 6, 2016, <http://tech.firstpost.com/news-analysis/indian-railways-are-working-on-fully-solar-powered-trains-says-union-minister-suresh-prabhu-339402.html>.

Conclusion and Recommendations

From the environmental point of view, there are many concerns associated with the Haj pilgrimage. Only through good governance can the Haj become a win-win situation for everyone, i.e., the pilgrims, the host country (Saudi Arabia), and the rest of the world. The environment is man's legacy. He must care for it and refrain from causing any damage for the simple reason that he is its main beneficiary. If he causes harm to one or more of the environment's components, he will be the one who suffers. This is evident during the Haj gathering when slight pollution can have a serious environmental impact and also affect the health of the pilgrims.

In Islam, one is responsible for one's actions and intentions. In fact, the protection, conservation, and sustainable development of the environment and natural resources should be a religious duty to which every Muslim is committed. The Haj can be a unique and pioneering example of sustainability if the pilgrims behave in an environment-friendly manner and avoid pollution and overconsumption. It is a great opportunity to reflect on one's moral values, respect the culture that includes the environment around us, and learn how to appreciate all the blessings that we have. Climate change and global warming result from human actions. Therefore, individuals, governments, and institutions can play an important role in tackling global warming and minimizing the carbon footprint.

Ideally, it would be wise to purchase environment-friendly products before and during the Haj journey and set a good example to your family and friends. Travel plans should give preference to hotels that have clear eco-friendly policies. Another point to be stressed is the need to avoid plastic bags or bottles that are not biodegradable and thus pollute the soil and water. Instead, people can bring their own water flasks. In 2010, around 100 million plastic bottles were left at the holy sites. In addition, people should consider purchasing organic food and be more conscious about what they eat while performing the Haj. In the tents in the holy sites like Mina, Muzdalefah and Arafah, solar panels for electricity, lighting, and air conditioning can be installed. Workshops that relate the importance of protecting and nurturing the environment to Islamic principles should be conducted. Moreover, the topic of environmental conservation, and the causes and effects of global warming, should be included in the school curriculum.²⁹

It is recommended that the Ministry of Haj and Umrah provide a "Green guide to an environment friendly Haj" that can be displayed at and distributed through Haj campaign offices; this may include clear and simple instructions from the beginning of the Haj journey until the pilgrims return to their homes. This guide should include

29. Ahmad, et al., "The Green Guide for Hajj."

eco-friendly options regarding purchasing organic food and energy consumption, and provide instructions for the use of the metro (instead of cars) to minimize the carbon footprint, as well as help in choosing eco-friendly accommodation. Furthermore, it is recommended that Haj campaign offices conduct an orientation program for pilgrims to inform them of the procedures of Haj and the green guide. Guidelines may specify how pilgrims should dispose of waste in a proper way, consume water wisely, and maintain personal hygiene and clean surroundings.

In addition, it is recommended that the Saudi government persuade hotels and travel agencies and Haj campaigns to improve their environmental performance in order to conserve natural resources and reduce their carbon footprint. The example of global hospitality company Hilton is worth noting. It is the first company to be certified ISO 50001 for Energy Management, ISO 14001 for Environmental Management, and 9001 for Quality Management across its entire hotel portfolio. Making hotels green would help in reducing water use, energy use, and waste generated.³⁰

During Haj, the holy sites require a large amount of energy for air conditioning, lighting, cooling, and so on. In recent years, electricity prices have gone up and they are expected to increase further due to the drop in oil prices. Therefore, to the extent possible, Saudi Arabia should shift to renewable energy from fossil fuel. Using solar power and renewable energy at the holy sites would save money in the long term and conserve the environment as well. A number of villages in India are now running entirely on solar power grids. The Saudi government should follow the Indian experience, which represents a good role model in solar energy and sustainability.

In short, if there is any place on the planet to which Muslims should offer environmental care and protection, surely it is their holiest sites of Makkah and Madinah. However, it is the joint responsibility of all actors (including the Saudi government, other countries from which pilgrims come, and the media). Haj is the best place to begin inculcating concern for the environment.

The Saudi government has initiated many green projects and enacted many environmental policies. Yet, there is still a pressing need for more sustainable solutions to tackle various environmental issues associated with the Haj mainly because of the growing number of pilgrims and their environmental footprint. Fortunately, green innovations that are rapidly emerging in various fields are of great help in this regard.

30. Hilton WorldWide, "Environments," <http://cr.hiltonworldwide.com/environments/>.

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