



# Climate Change Patterns in the UAE: A Qualitative Research and Review

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### ABSTRACT

Climate change is an inevitable challenge for the whole world these days. United Arab Emirates (UAE) is classified among the countries with highest rate of vulnerability to the potential impacts of climate change in the world. The purpose of this qualitative research is to study the patterns of climate change in the UAE and to predict the future patterns. The methods used in the study were reviews and interviews as the data collection method. The results obtained summarized that UAE is facing many challenges related to the climate change impacts such as, water resources, coastal areas and food security. UAE's efforts and future plans in dealing with climate change have been discussed. Climate change is hard to control because the emissions of green house gases (GHG) do not respect the boards, so countries should co-operate and take actions on global level to ensure save earth.

### INTRODUCTION

Climate change is one of the biggest challenges for the whole world these days. It is defined as any change in the weather caused by dynamic processes of the earth such as volcanoes, or because of human activities such as industrial activities and other activities that create greenhouse gases. (Simon-Lewis 2017).

The main cause of this phenomenon is the emissions produced from human activity; for example the green house gasses (GHG) emissions. The leading reasons of these emissions is burning of fossil fuels, cutting trees, waste incineration, and other activities that produce harmful gases which impact the level of the GHG and make it highly increased. This increase in the GHG levels will contribute directly to increase the climate change that has a lot of harmful effects such as natural disaster due to the increase in the sea level and the effect on crops (IPCC Fifth Assessment Report 2014).

The negative consequences of climate change could be mitigated by switching the dependence more on renewable energy instead of non-renewable energy. Since 1880, the statistics showed that global temperature has risen by 1.4F°. More dependency on renewable energy will reduce the harmful emissions which will prevent the global temperature from exceeding the normal (NASA 2018).

UAE is one of the pioneer countries in the Middle East that makes effort to control the phenomenon of climate change. UAE established a ministry specialized in climate change in particular and the environment, in general, under

the name of the Ministry of Climate Change and Environment. For that, UAE has future plans to depend on the renewable energy instead of fossil fuels by 2021. The ministry provides programs in order to mitigate and adapt with the effects of climate change (UAE Government 2018).

The objectives of this review are to study the patterns of climate change in the UAE's environment and their effects, to determine the effects of climate change in UAE's environment, to predict the future long term effects of the climate change especially on the UAE, and to raise awareness among UAE's population and provide them with the suitable ways to mitigate climate change.

### Causes and Effects of Climate Change

One of the most known causes of climate change is carbon dioxide emissions produced by burning of fossil fuels, transportation, and solid waste incineration. These emissions can stay in the atmosphere for a long time due to the slow transfer of carbon to ocean deposits. CO<sub>2</sub> has the ability to absorb infrared spectrum that leads to warming and affects the composition of the atmosphere. Methane produced through the process of producing or transporting fossil fuels (oil, coal, and natural gas) and from agricultural operations; usually remains in the atmosphere for 12.4 years. Nitrous oxide is formed by burning fossil fuels, solid waste, and agricultural or industrial activity with an average age of 121 years in the atmosphere (Simon Lewis 2017)

Greenhouse gases act as a glass barrier to the atmosphere. If the level of GHG continues to grow, more heat will

be trapped in the atmosphere, because it will be able to absorb more infrared radiation, which will increase the level of climate change globally. Trees absorb CO<sub>2</sub> for photosynthesis, burning trees and deforestation increase carbon in the atmosphere due to the disruption of the carbon cycle, which is based on the exchange of carbon between all natural components such as atmosphere, oceans and living things. The rapid increase in carbon is linked to human activity such as industrial activity, agricultural activity and production of electricity, which are the sources of greenhouse gases leading to climate change (Simon Lewis 2017).

If the level of greenhouse gases continues to grow, this will lead to many effects such as; ocean acidification due to increase in the level of CO<sub>2</sub> in oceans which will harm the marine life, melting of snow due to increase of temperature, drought and rising temperatures, frequent hurricanes, increased sea level, desertification leading to food insecurity and famine, and production of agricultural crops will be also be affected (Simon Lewis 2017).

According to a report written by the Stockholm Environment Institute's US Centre, the rising sea levels will cause the United Arab Emirates to lose up to 6 percent of its developed and populated coastline by 2100. The UAE has more than 1200 kilometers of coastline, and 85 percent of its population lives in the country's low-lying coastal areas located several meters below from the sea level (Al Ittihad 2017). Additionally, up to 90 percent of the country's infrastructure based in these regions. Rising sea level poses a significant threat to the country's population, especially the increased risk of tornadoes. The escalating high temperature of the sea level will consequence in thermal contraction, and aggregating sea level (Hamza et al. 2011). The communities living close to the sea level are likely to experience changes in the movement, intensity, and frequency of storms. These vicissitudes are also likely to unpleasantly affect aquatic species movement and reproduction owing to coral bleaching (Hamza et al. 2011).

Other reasons of environmental degradation in the UAE include oil-related activities and dredging which adversely affects the marine life in addition to upsetting the sea's ecological cycle. Some plant and animal species may become extinct, and the animals that do not will probably migrate to the northern mountains. They are unlikely to adapt to these irregular cycles of the climate. Agriculture will also be adversely affected owing to the reduction of freshwater, which is ideal for farming and the increased salt water which does not support farming. Additionally, the high temperatures will also make it difficult to farm all year round, and there may be food shortages shortly (Hamza et al. 2011).

Air pollution has also reached an all-time high at an

emission of 80 tonnes per capita. These emissions are mostly the result of vehicle exhaust fumes and factory emissions. At certain levels, they are toxic to the human health. Currently, the polluted air has been found to aggravate health conditions such as asthma, bronchitis and heart disease. Continued air pollution may cause breathing health adversities especially for children and the elderly.

The GHG emissions that come from human activities are leading to continuous rise of climate change as they are now at their maximum level. Without action, the average earth surface temperature will rise to over the 20th century and it is possible to exceed 3 degree Celsius this century, with expecting some areas of the world to become warmer (Climate Change - United Nations Sustainable Development n.d.).

A study conducted by the environmental agency in Abu Dhabi, about the possible harmful effects of the climate change on the coastline, found that global warming, which is connected with the climate change, is threatening the marine habitats such as coral reefs and mangrove trees, especially in the UAE and the other parts of the Arabian Gulf. In addition, some of the marine ecosystems such as the salt marshes, grasses, and the mangroves could turn down except if they moved to the land. Also, due to the rising sea level, the coastal freshwater will be mixed with the saltwater. Coral reefs damage, less biodiversity in the subtropical and tropical water, changing rain patterns and water availability are all expected.

One more important thing the study has highlighted is the lack or limited scientific information about the negative effects of climate change on the biodiversity, especially in Asia and globally (Todorova 2014).

### Climate Change in UAE

The United Arab Emirates (UAE) is identified as one of the most vulnerable countries to the impact of climate change. The stimulus of climate change is anticipated to significantly affect the country's infrastructure, the natural habitat, and the population's health. Analysts reported that social and economic vulnerabilities exacerbated by the interaction of climate change with political, economic and social variables (Hamza et al. 2011). For instance, the interaction of demographic growth and climate change will affect the quality as well as the availability of water resources in the Middle East and North African region. As the hydrological cycle accelerated, the area risks experiencing longer droughts and more intense and variable rainfall events, and these will result in increased probabilities of the extremities of desertification and flooding. As is, the country has come up with various policies under crisis management to ad-

dress the contamination and over-extraction of the land's groundwater aquifers, as well as the increasing shortage of urban water (Climate Change 2017).

According to the Gulf News report, the UAE is not safe from climate change and high carbon emissions. They predict that by 2050 a 2% increase in temperature level and 10% increase in humidity level may occur. The energy consumption will increase by 11%, construction costs will increase about \$834 million, the power required to meet the demand for additional electricity will equal 18 solar power plants, and the new demand for energy will produce CO<sub>2</sub> emission that is equivalent to one car making 17455 round trips to the moon, which will result in a heavy loss. As reported by the Emirates Wildlife and Wildlife Fund (EWS-WWF), climate change poses a threat to the business, economy, and society sector. The UAE certified its commitment to the United Nations Framework Convention on Climate Change (UNFCCC) to reduce the production of electricity from fossil fuel in the UAE and to start depending on the renewable energy by 2021 as 27%, as well as the commitment to the Paris Agreement that helps to keep the rise in global temperature to beneath 2 C° in the coming decades. In addition, the report stated that increasing of cooling in buildings would create a gap in energy supply, inhibit the energy security, increase the costs for consumers, and further greenhouse gas emission. Such as, the demand for air conditioning (cooling and fans) in a model of villas in the UAE might increase the greenhouse gas emissions between 10% and 35% by 2050 based on the CO<sub>2</sub> scenario in the future. In additional, the high temperature and humidity will reduce the productivity of workers, especially who work outside and it will increase the risk level, which is expected to cause losses of up to \$2 trillion, i.e. around Dh 7.3 trillion worldwide due to worker health effects. What might make them take longer breaks or turn their working shift to colder weather like evening and dawn. (Baldwin 2017)

Also, the coastline of the UAE is not only of commercial interest to the tourism sector, but also the Abu Dhabi Global Environment Data Initiative, that the comfort of the coastal and marine resources in Abu Dhabi is costed US \$141 million. It also mentioned the concern about the food security and the prediction in increasing the food price because of the weather events as in a previous report. UAE is one of the most important regions to export food resources which can cause increase in costs and less efficiency due to climate change leading to heat stress and flooding. Companies with a large number of the workers, who work outside, usually have special standards that workers need to follow, which have to be changed to acclimate the increasing temperature to avoid the possible risk to workers. They also stated the impacts of the climate change will not only slow down the

general sectors of the country, but will also have a huge impact on the citizen economy and enlarge the international market of commodity and services. Also, climate change will lead to drastic changes in the market and businesses in terms of costs, which increase the level of risk, especially in coastal areas and lead to reduction of the financial performance of the country (Shabeeh 2017).

In 2005, the UAE ratified the Kyoto Protocol to the UN Convention on Climate Change (UNFCCC). By 2021, UAE will generate 24% of the electricity used in the country from the clean energy instead of the current oil-electricity sources, which will make a huge positive difference on the environment and reduce the severity of many problems, especially climate change.

The Energy and Climate Change Report (2017) showed that by the end of this century, UAE might lose around 6% of its coastline because of the sea level increase. By 2050, as the raise of one meter of the sea level, 1155 square kilometres of the coast will be under water, so 9 meters raise of the sea level will make the emirate of Abu Dhabi and much of Dubai flooded. This shows us that how climate change is a serious threat on all life aspects (Energy and Climate Change 2017).

Food security is another source of concern in the UAE as 87 percent of the food supply in the UAE depends on the agricultural production. It is imported from outside the country and therefore vulnerable to the effects of climate change, which will influence the reliability and accuracy of international food market. That cause in increasing food prices, which results in depression of the households' income and making them vulnerable to food prices as a share of huge amount of their budget on food. Climate changes will affect the nation's agriculture which leads to inclusive turn down in agricultural production. According to Emirates Wildlife Society and World Wildlife Fund (EWS-WWF) report (2017), the increasing of global temperature by 2050 will lead to losses in many sectors in the UAE.

UAE was the first GCC country that accepts the Paris Convention in December 2015 which work to reduce the temperature rise of 1.5 C° by 2018 and to keep the temperature below 2 C°. As Daniel Mitchell and other researches at Oxford University confirmed that the difference between 1.5 and 2 degrees will be peripheral in the temperature rate every year, but will have a significant impact on reducing the possibility of devastating weather events such as floods, desiccation, and free wave. According to the EWS-WWF report, the changes in the air and sea temperature will lead to multiple secondary effects in different sectors of the economy. As the report stated, the direct effect of excessive weather events such as the increase in sea level will disrupt

human's daily activities. As Dubai Department of Tourism and Commerce Marketing stated, the UAE is one of the fastest growing tourism destinations in the world that welcomed more than 14.9 million passengers in 2016 and aims to reach 20 million tourists by 2020. While further research is needed to make changes in tourism due to climate as it is considered the third reason for choosing tourists a destination. If temperatures persist to be higher, the researchers expect a reduction in tourism level by 55% in the UAE by the end of the century. Many heritage and tourist resources such as coastal region attract tourists to the UAE that may be at an increased risk of flooding due to rising sea level (Shabeeh 2017).

### The Interviews

In this research, interviews were used as the primary source of information. The first interview was conducted in the Ministry of Climate Change and Environment. The interview was with Mr. Qais Bader Al-Suwaidi, leading the ministry's climate change adaptation project.

A discussion meeting was held with the Environment Agency of Abu Dhabi team, Mr. Rashed Ekaabi, Mr. Marco Vinaccia, Ms. Jane Claire, Ms. Mouza Al Zaabi and Ms. Ruqaya Mohamed. This meeting provided the needed statistics about the impacts of climate change on the UAE.

The interview results are summarized and discussed in the following section.

## RESULTS AND DISCUSSION

### The Climate Change Effects on the Water Resources in the UAE

There is an impact of climate change on the water resources. Managing the water resources is one of the challenges UAE is facing to achieve the long-term sustainable development. Water resource management became a challenge as the industrial and the agricultural consumption of water is increasing every year along with the population growth rate. The water consumption rates differ from one emirate to another considering the size, economic growth and the population size, but it is important and urgent to manage the water sources at the national level to achieve the water conservation, better water quality, and the restoration of the aquifer systems. In addition to all above factors, climate change is contributing in water-resource management. The water-energy nexus is a framework that views water as a part of integrated water and energy system, rather than as independent source (Flores et al. 2015). In addition to the other reasons of the water-resource management challenge, this framework is important as the climate change affected the

rainfall patterns and the temperature in the whole world and unfortunately UAE and this effect will increase year by year.

### Regional Atmospheric Modelling

A regional atmospheric modelling has been done by LNRCCP to evaluate the future climate changes in the UAE. Because of climate change, the average temperature in the winter and summer seasons will increase by 2°C to 3°C over the land areas. As a result of this increase in the temperature, there will be an additional demand for water in case of irrigation as the evaporation rates will be higher.

### Regional Ocean Modelling

Regarding oceans, the LNRCCP also did a modelling to evaluate the effects of the climate on the Arab gulf, which UAE depends on to desalination processes. As a result of climate change the Arab gulf will become highly stressed as the temperature will increase significantly in addition to the increase in the zones of the large salinity. Due to that increase in the temperature and the salinity zones, more energy needed for the desalination activities. With the consideration of the brine discharge to the gulf, the salinity zones will increase between 1.1 and 2.6 psu in the south area of the Arab gulf.

### Water System Modelling

Using the WEAP system, a water system model was built in the UAE. This model includes the surface and ground water, water demand, water quality, population growth, reuse of water, system losses and consumption. This system shows the water supply centres and the demand centres as the focus is on the flow of water abstraction to the consumption sites.

### The Water Demand Scenario

- Regarding agricultural use, due to climate change between 2015 to 2060 additional 4.4 BCM is consumed which is 3.9% higher without the climate change.
- Regarding indoor uses, opposite to the agricultural uses, by applying the conservation measures, total reduction in indoor demand is about 8.8% for the same period, in other words 0.19% annually.

That means that the main impact of climate change is on the Arab gulf as the salinity zones will increase, which means more energy is needed for the desalination activities and on the agricultural uses as the evaporation processes will increase due to the increase in the temperature. These results were expected as the climate change is a real threat on the water resources, and it is contributing to the water-resource management challenge in the UAE.

### **The Effects of Climate Change on Al Ain Water Resources, Most Green Area with Water Resources in the UAE**

All regions in UAE are affected by the climate change, but Al Ain region is the most climatically vulnerable region. As known, it is the only city in the UAE with renewable groundwater. The population of this small area increased dramatically, as in 2011 it reached 570,000. Along with this increase in the population, there was an economic development and agricultural development, the sectors which use most water with 78% consumption of the all water in the eastern region. The dependence of the irrigation in this area is on the Falaj system, which is the use of the surface water runoff from AL Hajar Mountains (Flores et al. 2016). Unfortunately, climate change is affecting the cycles and the patterns of the supplies of the water. So, how the climate change is doing that? Firstly the climate change has already affected the temperature and the rainfall patterns in the UAE including Al Ain city and the increase in the CO<sub>2</sub> concentration in the atmosphere could change the water and agricultural production patterns. This is in addition to the growing population demand for water. About the effect of the climate change on the water supply, the groundwater storage in Al Ain will increase slightly by 2060 because of the wetter conditions caused by the climate change, which will enhance the water recharge. Regarding the water consumption, climate change will increase the demand of water by 5% in 2060 because of the hotter conditions (Flores et al. 2016). The increase in the average groundwater storage will affect the infrastructure of Al Ain city, so there should more dependence of the groundwater than the desalinated water to keep the balance. Because of future wet conditions caused by climate change, there will be a strategic advantage to decrease the desalinated water in favour of local alluvial ground water (Flores et al. 2016). In this case there should be a huge effort to keep the balance between the water supply, the desalinated and the groundwater and the water consumption, to take the benefit of the increased groundwater storage, as an effect of climate change, and to avoid the infrastructure damage.

This impact of climate change was not predicted, but the UAE is taking huge efforts to keep the balance between the desalinated water and the increased level of the groundwater storage.

### **Effects of Climate Change on the Coastal and Geographic Area in the UAE**

The climate change effects are already observed in the UAE's coastal and geographical area. The sea level will rise as an impact of the climate change, which is a threat to the coastal areas of all emirates of UAE, especially areas near to the

beach within one kilometre and it is approximately a home for more than 17000 people. Moreover, Dubai and Ajman will be the most emirates that will be threatened from the related hazard of the rising sea level; for example, the expectation of 2050 shows that 75% of Ajman coastal area will be in the highly exposed area while Dubai ranked second with 36% of its coastal area. However, Abu Dhabi, Sharjah and Fujairah will be the least exposed Emirates to the related hazard.

To discuss, Dubai and Ajman come at the top of the list due to the continued dependency of their economy such as tourism projects and other activities on the coastal zones. On the other hand, the decline in Abu Dhabi, Sharjah and Fujairah compared to Dubai and Ajman is because of the towering of the coastal areas, less chance of storm surge, and less exposure from local and ocean-generated waves.

### **Effects of Climate Change on Sea Level**

New challenges will appear to the decision making on UAE due to the sea level rise. For example, more tides, waves and storms will reach inland more than before because of the rise in the sea level. This increase in the sea level will increase the chance of flooding, erosion and decay of groundwater quality. In addition, the UAE and GCC countries have a high chance to be affected more than any regions in the whole world.

To discuss globally, one of the results of the climate change is the increase in the sea level. This increase in the sea level is because of many factors such as thermal expansion when the water temperature increases so the water expands, melting glaciers and polar ice caps, and ice loss from Greenland and West Antarctica (National Geographic 2017). This rise in the sea level will have many influences as it was mentioned that more tides, waves and storms will reach inland more than before. Moreover, the chances of flooding, erosion and decay of groundwater quality will increase. However, the UAE and GCC counties are facing the risk of rising sea level more than any other region. Also, facing this high risk of rising sea level is because the Arabian Peninsula has a high concentration of population living near to the coastal zones, and the more dependency of economic activity and the tourism projects in coastal zones.

### **Effects of Climate Change on Food Security**

The global food crisis and food goods prices, with the climate change and unsuitable water suppliers, are associated to decrease crop produce and increase food insecurity globally. Most of the imported food to the UAE will be exposed to climate change, such as rice and wheat which are imported from Brazil, India or South Africa, are considered

as unsafe food. On the other hand, beef, mutton and maize, which are imported from Canada, Egypt, New Zealand and Spain are strongly safe and secure. To discuss, around 90% of the food suppliers in the UAE are international food due to UAE desert environment where local production is limited. UAE is also considered as a major region for re-export of food, especially to GCC countries. One of the most important concern regarding food supply is increase in the price of food. For example, cereals such as rice, wheat, maize and oats are imported from India, Australia, Canada and Thailand may show huge swings. Moreover, UAE's population has been increasing around 10.3% yearly. According to the international measure, UAE is a food secure country (Dougherty 2016).

### **UAE's Efforts and Future Plans Regarding the Climate Change**

Carbon ambassador program aims to assist UAE to achieve the economic diversification as well as increase of the awareness level. For that, the Ministry of Climate Change and environment (MOCCA) signed a Memorandum of Understanding (MOU) with Dubai Electricity and Water Authority (DEWA). Mr. Al-Suwaidi, the manager of the adaptation project in the Ministry of Climate Change and Environment, displayed the benefits of carbon ambassador program in raising awareness among the UAE population as the awareness level in UAE is still below half of the population. Also, he confirmed that UAE had a lot of efforts to control and reduce the effects of climate change by reaching the majority of the population. The carbon ambassadors program is administered by DEWA supported by the Dubai Carbon Centre of Excellence (Dubai Carbon), which aims to raise the awareness among university students and engage them in sustainable environment, low carbon growth and effective economy. There are challenges for applying the carbon ambassadors programs such as involving young people in the program and applying the program in different Emirates among the UAE. The program approach is to develop sustainable environment, reduce carbon emission, mitigation and adaptation (Carbon Ambassadors Program 2017). A Memorandum of Understanding (MOU) was signed between the MOCCA and DEWA to achieve the UAE 2021 vision as the MOCCA will be the sponsor of the program to provide training and experience for the carbon ambassador team (DEWA 2017). Carbon ambassadors program will help to raise the awareness level among UAE population and manage the greenhouse emission.

### **Challenges the UAE is Facing to Control the Effects of Climate Change**

The challenge of climate change that UAE face is how to

increase the people's awareness of the problem, how to reduce the greenhouse gases emission, and how to manage greenhouse gases emission from other countries around the world. The United Nation Framework Convention on Climate Change is an agreement among the countries to reduce emissions as Mr. Al-Suwaidi confirmed. Climate change is a big challenge in the 21<sup>st</sup> century. One of the challenges that UAE face due to climate change is food security as it is affecting the crops growth, availability and price (World Food Programme n.d.). Other challenges are the period of time for appropriate handling to the changes of greenhouse gases concentration as the oceans have the ability to store a huge amount of the heat and applying the renewable energy to manage the GHG emissions. Also, identifying costs to manage climate change is difficult because it includes natural assets where it has no prices (National Research Council 2011). Climate change is topic that has many challenges such as people's awareness of the problem, managing the GHG emissions, and expensive cost of solving this issue.

### **The Future Plans that the Ministry is Aiming to Achieve to Reduce the Effects of Climate Change**

Few countries around the world have a ministry under the name of The Ministry of Climate Change and Environment, which aims to achieve the government's goal and to create an Emirati society capable of dealing effectively with climate change. The National Plan for Climate Change aims to manage greenhouse gas emission, adaptation to climate change, and promote economic diversification. Also, the Energy Department's strategy aims by 2050 that 50 percent of energy production based on clean and renewable sources. In terms of sustainability, Emirates Authority for Standardization and Metrology (ESMA) stickers evaluate equipment efficiency to reduce the environment harmful impact, and the National Climate Adaptation Program aims to make the UAE one of the world's most adaptive to climate change. The Ministry of Climate Change and Environment have introduced the National Climate Adaptation Program (NCAP) and the UAE National Climate Change Plan for 2017 to the media. Engineer Fahad Al hammadi, the director of climate change department, said that UAE is mitigating the climate change phenomenon at an early stage. UAE is reducing the greenhouse gases emissions by setting and adopting a set of regulations and strategies to move to green ways of doing things including all life aspects such as energy, transportation, construction and the prevention of the environment (MOCCA 2017). Also, the UAE certified its commitment to the United Nations Framework Convention on Climate Change (UNFCCC) to reduce the production of electricity from fossil fuel in the UAE and to start to depend

on the renewable energy by 2021 as 27%. As well as, the commitment to the Paris Agreement that helps to rise the global temperature to beneath 2°C in the coming decades (Baldwin 2017). As Dr. Al Zeyoudi in the 23<sup>rd</sup> meeting of the Conference of the Parties confirmed that the UAE centennial plan objective is to depend on clean energy with 27% by 2021 and 50% by 2050. As well as build a photovoltaic station and being the first in waste to energy project (Abu Dhabi World 2017) UAE has signed an international agreement to mitigate climate change and they have national and local agreement to adapt and mitigate the climate change.

### **The Ministry's Advice on How Individuals can Contribute to Reduce the Climate Change Impact**

Climate change requires everyone's effort as individuals, organization, government and young people on the issue. As individual they need to reduce emission by using high efficiency equipment, follow the regulations, and drink local water to reduce carbon footprint. Sustainable schools in Abu Dhabi need to provide recycling awareness to others to build green environment. Also, they can use "I drink local water" application to provide information about the places that do not buy local water. Climate change is a global issue, but it can be minimized through daily life. For example, save energy by turning off unused devices, use LED or CFL lights, and check the machine labels before buying it. Also, use renewable energy, use public transportation, and use electrical vehicles that helps in reducing the GHG emissions. The most effective way that individuals can do is to being a vegetarian, buy local food, or eat organic food, which will minimize merchandise transportation and save the body from pesticides (Greenpeace International 2016). Climate change is an international problem, everyone around the world needs to participate to minimize its harm effects. Individuals will help in handling climate change problem as they are the biggest and the main factor to change.

### **Is it Too Late to do Anything About Climate Change?**

The Ministry of Climate Change and Environment in many countries is the first that provides a plan for climate change in terms of adaptation and mitigation. As adaptation, they consider the planning and understanding of the impact for 50 or 100 years of the climate change. As mitigation the UAE is advanced industrialized country in terms of renewable or clean energy and reduce emissions. There is no global goal for adaptation other than mitigation, which aims to not increase the temperature of more than two degrees. Mr. Al-Suwaidi said regarding the reaction of society that they need to understand the climate change term to know how to live with it. The awareness need to be increased through

schools visits, social media videos, and existing efforts with youth and agencies. The Ministry of Climate Change and Environment was established in 2016 to strengthen local efforts in all sectors related to climate change and to realize the sustainable development (United Arab Emirates Ministry of Climate Change and Environment). Climate change is one of the main objectives in the UAE to maintain sustainability growth. Globally, UAE with the US has started their first bilateral annual energy dialogue in 2014 to simplify new and current action of the global energy market. Also, government of UAE has organized awareness campaigns to raise the awareness level of the UAE population. As well as, our generation initiatives was established in November 2016 to increases the students awareness of climate change and encourage them how to reduce carbon footprint (The Office Portal of the UAE Government n.d.). UAE has signed to a global agreement to avoid the harmful impact of climate change. The UAE is not late in terms of climate change, they are the first in the world to find a radical solution of the problem.

### **CONCLUSION AND RECOMMENDATIONS**

To conclude, climate change is a wide field to look for its causes, effects and ways of adaptation. Climate change is hard to control because the emissions of Green House Gases (GHG) do not respect the borders, so countries should cooperate and take actions on global level to ensure save the earth. However, that does not mean that working at a local level will change nothing, it should start from a narrow area spreading to the whole world. Any adaptation plan provided by the government should take its place and be a behaviour for the whole public in this particular area. On the other hand, knowing the causes of something will help a lot in eliminating the impacts. As the cause of climate change almost known, starting to mitigate the impacts is a must.

One of the reasons behind the emissions of Green House Gases is the industry manufacturing, transportation emissions, burning fossil fuels, burning waste, and cutting trees. Being focus on each aspect alone will lead directly to changing the expected numbers for the future. For transportation, nowadays countries such as UAE concentrate in depending on the renewable energy for transportation, such as cars working with solar power instead of the fossil fuel, so this will reduce both the transportation emissions as well as the fossil fuel burning. On the other side, afforestation is one of the solutions to overcome the climate change but unfortunately, the wrong practices are still going on like cutting down the trees. The continuing of cutting the trees down will lead to increase in the concentration of the carbon dioxide which is one of the green house gases.

As we have discussed, awareness level plays a major role in applying the solutions provided to reduce the effects of the climate change. The awareness level of the UAE still does not reach half of the population after all the efforts that UAE has taken. Some of the steps that UAE has taken are applying many programs as the carbon ambassadors. The carbon ambassador program looks to increase the level of awareness among students to take actions regarding the carbon emission. In addition, the ministry of climate change is depending more on researching the current situation of the UAE regarding the climate change to develop solutions that will help in mitigating or create an adaptation plan with the effects of climate change.

Adaptation plans for mitigating the effects of the climate change and encouragement of public education by concentrating on sustainability at local level as well knowing the risks of this phenomenon are recommended.

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