International Journal of Sustainable Built Environment (2014) 3, 167–178

Gulf Organisation for Research and Development

International Journal of Sustainable Built Environment

ScienceDirect
www.sciencedirect.com

Original Article/Research

Approaches to reducing carbon dioxide emissions in the built environment: Low carbon cities

Yousef Alhorr, Eiman Eliskandarani, Esam Elsarrag *

Gulf Organisation for Research and Development, Qatar Science and Technology Park (QSTP), Doha, Qatar

Received 4 July 2014; accepted 11 November 2014

Abstract

The interactions between water, energy, and food in terms of economic and environmental outcomes under conditions of a changing climate are something that all countries will need to understand if they intend to effectively manage the consequences. Qatar's measures to increase food security and diversification of the energy system and economy can provide valuable insights to other countries with similar climates but who have a lower capacity to respond. Through Qatari-based organisations, best practice reflecting local characteristics can be shared throughout the region and beyond.

The aim of this paper is to arrive at projections of CO_2 emissions in new cities in Qatar by 2020 using GSAS standards under a number of scenarios coupled with specific interventions that help them meet national and regional targets. The estimated CO_2 equivalent savings were calculated using GSAS energy calculator and based on the total area of the registered project and anticipated projects provided by different entities applying GSAS in Qatar. The projected annual savings of CO_2 emissions due to energy use reduction can be realised by 2020 when projects planned or under construction are completed. The projected CO_2 emission reduction is reported and compared with the international standards.

Keywords: CO_2 emissions; Urban development; Sustainable cities; Climate change; GSAS

1. Introduction

Climate change has received much attention at international forums amongst politicians and business leaders in the past decade. Scientists recognise the relationship between global warming and climate change. The carbon footprint arose out of the debate on climate change and became a tool to measure and estimate greenhouse gas (GHG) emissions related to human activities (Moss et al., 2008; Wiedmann, 2009; Wiedmann and Minx, 2007). It measures the emission of gases that contribute to heating the planet in carbon dioxide (CO_2) equivalents per unit of time or product.

Governments, policy makers and businesses are urgently required acquired to mitigate global warming and to seek ways to reduce GHG emissions in response to growing interests and concerns about climate change over the past two decades (Bo et al., 2008; Brenton et al., 2009; Courchene and Allan, 2008; Matthews et al., 2009). Awareness of global warming was raised by the Intergovernmental

* Corresponding author. Tel.: 00974 44049010.
E-mail addresses: e.elsarrag@gord.qa, elsarrag@hotmail.com (E. Elsarrag).

Peer review under responsibility of The Gulf Organisation for Research and Development.

http://dx.doi.org/10.1016/j.ijsbe.2014.11.003

Panel on Climate Change (IPCC) and provided scientific insights on climate change to governments.

The first IPCC assessment report played an important role in the establishment of the United Nations Framework Convention on Climate Change (UNFCCC), an international environmental treaty with the goal of stabilising GHG concentrations in the atmosphere at a level that prevents dangerous anthropogenic interference with the climate system (Ercin and Hoekstra, 2012). Efforts under the UNFCCC led to the Kyoto Protocol, an international agreement to cut GHG emissions, with specific reduction targets by country was signed in December 1997 and entered into force in 2005 (Ercin and Hoekstra, 2012).

Qatar is a Non-Annex I party and therefore it is not obliged to legally introduce binding emission reduction targets. However, since environmental protection is enshrined in the constitution and climate change is a cross cutting element for sustainable development, Qatar recognises the need to be integrated into all relevant social, economic and environmental policies.

Qatar has recently hosted the Conference of the Parties (COP18) of the UNFCCC where an agreement was signed to extend the life of Kyoto protocol till 2020, with an interim arrangement to achieve progress towards the accord terminate. Although achieving a consensus approval is extremely difficult taking into account the divergent views and interests of participating countries, the conference could be considered as a successful achievement for Qatar (UNFCCC, 2012). Nevertheless, Qatar has been criticised by the media for its lack in implementing plans regarding carbon emissions reduction, (UNEP, 2013). It is well known that Qatar resides at or close to the top of the global table of CO_2 emissions per capita and that its economy heavily relies on its fossil fuels. This provides a context which aims to create an understanding of emission pathways within Qatar cities and develops approaches for their reduction. Qatar is endeavouring to address its current and future emissions, and will need to embark on programmes that reduce emissions to appropriate levels for the whole country.

The 4th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) [IPCC, 2007], indicates that the climate for the Middle East and North Africa Region (MENA) region is likely to experience temperature increases of up to 2 degrees centigrade (°C) within the next 15–20 years, and over 4 °C by the end of this century.

The overall combined predicted effects are – water scarcity, reduced water quality, reduction in air quality – affecting public health and leading to more challenging living conditions especially in cities.

Furthermore, the rise in temperature coupled with current inefficient use of natural resources such as energy and water is likely to result in an increase in the cost of energy, impacting on livelihood and savings of the population and investments in these important sectors. It is therefore imperative that appropriate measures are put in place to transit Qatar to a lower GHG emissions pathway that could reduce emissions and open up low carbon economy options for the country.

Cities are major contributors to carbon emissions and hence are at the forefront of achieving tangible reductions. Tools that quantify emissions in cities are required not only to inform policy, but also to provide the baseline knowledge to allow coherent future planning targeted towards low carbon footprint. Hence in our aspiration to reduce carbon emissions and provide future projections for the expansion of cities, creating carbon accounting methodologies which are crucial to provide the necessary policy guidance to national and local governments as well as municipalities.

By 2030, Qatar aims to be an advanced society capable of sustaining its development and providing a high standard of living for its people. The Qatar National Vision 2030 (QNV 2030) embraces four main pillars including; economic, social, human and environment developments (GSDP, 2008). QNV 2030 defines the long-term outcomes that are sought for the country and provides a framework within which national strategies and implementation plans can be developed. The initial path for this vision was set out within the Qatar National Development Strategy (QNDS) 2011–2016, launched on February the 28th, 2011. It describes a strategy for sustainable development in Qatar and promotes energy efficiency in new buildings (GSDP, 2010). This substantiates Qatar's effort to develop a national policy to manage air pollution, greenhouse gas emissions and the broader challenges of climate change. Qatar needs forward looking, evidence-based policies to be backed by information systems that ensure both; informed decisions at the outset and continuous monitoring to guarantee compliance and, over time, to measure impact and enable learning and continuous improvement.

Through their consumption demands, between 60% and 80% of all global GHG emissions can be attributed to cities (Kamal and Robert, 2009). Direct emissions from buildings are expected to grow to 26% of all GHG emissions by 2030 (IPCC, 2007). Urban density and spatial organisation are the key factors that influence energy consumption in the built environment (OECD, 2010); yet, building design, construction and operation are also clearly significant. In the short-term, substantial reductions in energy use and carbon emissions from buildings can be achieved using energy efficiency technologies that are already well established and widely used – although the levels of investment and effort required would be far beyond current applications (IPCC, 2007). A large proportion of these reductions could be achieved in economically attractive ways that result in a net benefit rather than a cost with short pay-back periods (Gouldson et al., 2011). Such approaches also offer a range of co-benefits relating to employment generation and improved health and quality of life. However, despite their carbon-saving potential, cost-effectiveness and co-benefits, various barriers combine with the tendency for buildings to have long life spans to prevent many of the basic technologies being widely adopted (IPCC, 2007).