

Climate Change Policies and the Potential for Energy Efficiency in the Gulf Cooperation Council (GCC) Economy

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Abstract

Climate change is a problem that many municipalities in the world are facing today. Due to the fragile ecosystem, and harsh climates that are experienced by the Gulf Cooperation Council (GCC) countries, the region has become vulnerable to a wide variety of ecosystem and climate change issues. Aside from the climate affecting the area severely, its dependence on hydrocarbons, also makes it vulnerable to climate changes. There are climate change policies adopted by the GCC region for prosperous future and sustainability. These include, policies to affect impacts of energy and carbon intensities, response measures being adopted for climate change, the mitigation potentials of the region, along with the suitability of the markets to harness potentials.

This analysis focuses on utilizing Marginal Abatement Cost curves, along with econometric techniques that will assess the emissions of Green House Gases (GHGs), the potential for mitigation in the GCC region, and computable general equilibriums that invest the impacts of measures, exploring suitability of instruments that can help to harness the potential mitigation measures for the region. Main policy insights that can be concluded based on the analysis is the role that incentives play to help promote energy efficient mechanics, while reducing emissions of carbon emissions within the region, contributions made to climate policies for air quality, along with the roles that green tax reforms play to help improve the economics of welfare, while pursuing carbon policies for the domestic areas in the region.

Globally, there are a lot of energy efficiency policies. The GCC has been witnessing a phenomenal amount of growth when it comes to meeting the needs of domestic households. The region is facing extreme demographic pressure, and as a result has decided to accelerate energy intensive drives. The requirements that the GCC has to meet is causing trade-offs and challenging implications regarding allocation and development of hydrocarbon resources to adhere to domestic and export demands.

In conclusion, four issues that have arisen within the GCC in relations to climate change policies have been addressed in this paper. These issues include the rising amounts of energy and carbon intensities, the impacts that the response measures that are being implemented by developed countries have on developing countries, as well as the mitigation potentials that exist within the region, as a method to harness the potentials that are available. Energy efficiency is believed to be a primary candidate to deal with the challenges the GCC is facing. Detailed assessments regarding energy efficiency for the GCC economies is addressed, along with how these intensities relate to outside world economies.

Keywords: energy, climate, fragile ecosystem, carbon emissions

1. Introduction

Changes in climate, are adversely affecting the entire world. Economies all around the world are being forced to deal with the devastating blows that changing climates have caused. These unchecked increases that are occurring on earth, are going to have devastating impacts on the ecological balance of the planet. The Gulf Cooperation Council (GCC) region is extremely vulnerable to the impacts that climate change is having. With its low coastal lands, fragile ecosystem and harsh environments, are only exemplified by the wide spread landscape of desertification and additional water stress issues (Michel, 2008).

Regulations and policies relating to climate changes have gone through multiple negotiation stages,

implementation stages, and adoption stages. Despite the controversies that have arisen regarding climate changes being a result of man-made inventions and natural phenomenon's, the issues that the world is experiencing due to these changes has moved to the top of the agenda of many nations throughout the world (Coccia et al., 2012).

The increased amount of concern that nations have regarding climate changes, has led to the creation of a new union and called United Nations Framework Convention on Climate Change, or UNFCCC. This union was formed in 1992. The main focus of this group is to stabilize greenhouse gases that are being released into the earth's atmosphere at an alarming rate. The group believes that by stabilizing these gases that this will help prevent further anthropogenic interference to the climate system, without affecting the aspirations that developing countries have, or affecting economic growth for sustainability.

Up until 2012, countries within the GCC and other surrounding developing nations, were exempt from the measures that the group was taking to mitigate the release of greenhouse gases (Hill et al., 2008). The region was at a standstill, they were experiencing the negative impacts that climate change had on the area (Hill et al., 2008), and spillover impacts were being experienced due to the mitigation policies that other countries were involved in. Economies within the GCC are vulnerable to climate change, and they also have vulnerabilities when it comes to the response measures that are being made to control the changing climates. The latter vulnerabilities that the region possesses is due in part by the high amount of dependence the region has for one of its greatest exports, hydrocarbon. Therefore, it is important that an adaptation approach that addresses both of the vulnerabilities that the region has, is taken into consideration when mitigation responses are being deployed. An adaptation approach that is taken within the GCC will need to address domestic efforts, as well as parallel the international efforts that are being taken to help minimize the impacts of the response measures and strengthen the resilience of ecology, enabling these economies to be able to cope with climate changes and the related policies that are being implemented as a result. The good news is that the response measures that are being taken, have revealed through literature, that the negative spillover impacts the GCC region is experiencing may be reduced, if Annex I countries implement mitigation measures that are efficiently market-based.

Due to their growing GHG gas footprints, a lot of GCC countries may be considered probable candidates for binding emission targets. Therefore, it is important that the policymakers within the GCC investigate their countries greenhouse gas mitigation potential, and decide on what mitigation commitments they will be able to adhere to in the future, screening out any opportunities that award for voluntary abatement actions. In order to apply mitigation tactics, policy makers will need to identify the spillover impacts that countries that are already developed are having on the GCC region, and how these impacts can be mediated through utilizing policy instruments that are efficient. Further studies need to be made to determine the mitigation potential that the GCC countries have in regards to GHG emissions, and the utilization of market based instruments need to be used in order to harness the potential that the region encompasses (Michel et al., 2013).

Modernization and industrialization have been expanding in too many undeveloped countries for the past three decades. Albeit, the expansion is happening at differing paces, and is causing differing consequences as a result. One of the negative consequences that this rapid expansion is causing is it is forcing domestic and municipalities to have increased demand for energy, and drives for energy efficient mechanisms are needing to be adopted to adhere to the demand. The strongest stimulus to augment energy efficiency policies and measures within the world have emerged as an environmental concern, especially during the latter half of the twentieth century, as strong calls for sustainable development as it relates to global warming have been adopted, following a publication made by the United Nations (UN, 2000). However, contrary to popular belief, energy efficient measures are not only limited to energy-poor areas, it is also taking shape in countries that are energy-rich, to help decrease pressures being put on budgets and resources, ensuring that the growing demands for domestic energy needs are met.

Along the GCC levels, domestic energy requirements are growing at higher rates, than were ever anticipated, and they are expected to continue to grow over the near future. The primary drivers for energy utilization, are economic growth, population growth, industrialization, harsh climatic conditions, and modernization. With these increasing demands, demands for power generation, industry feedstock, and transport fuels is causing implications for trade-offs on allocating hydrocarbon resources between exporting and the demand of domestics.

On the other hand, when comparing the advantages that the GCC region has regarding their hydrocarbon resources, increased growth and demand on a domestic level for energy, may not pose any major concerns, if the demand is supported by sound economic practices. But, there is fear that with very low domestic energy prices, that encouragement for wastage and inefficiencies is being given. Also, just like in various other countries, there is an increased awareness within the GCC to conserve resources that can be depleted, and to take steps that

enable optimizing energy for clear environmental, economic, as well as social reasons. This increased awareness results in measures and efforts being taken in order to rationalize energy, while achieving a sustainable economy. Energy intensities within GCC economies as they relate to other world economies, and quantifying saving potentials that exist in the GCC based on assessing energy intensities are assessed (Babiker, 2010).

Gulf Cooperation Council (GCC) countries which is the core of GCC council are made up of the six countries in the Arabian Peninsula. The region is made up to cover three million km², the southeastern area of the peninsula is the Rub'al-Khali, the Empty Quarter, which is the world's largest expanse of continuous sand. Politically, the Arabian Peninsula consists of Saudi Arabia, Kuwait, Bahrain, Qatar, the United Arab Emirates, the Sultanate of Oman, and lately accepted to add the Republic of Yemen. Together, these countries (excluding the Republic of Yemen) constitute the Gulf Cooperation Council (GCC). The aim of this collective is to promote coordination between member states in all fields in order to achieve unity. The energy security became of the most prominent subject that raising the alarm for saving and policy of sustainability.

2. Facing the Challenge: CO₂ and Energy Intensities in the GCC

The term energy intensity is used to describe the amounts of energy that are consumed by an area per unit of their economic activities. Along the aggregate levels, energy intensity is expressed as Gross Domestic Product, or GDP units. The acronym of British Thermal Unit of energy BTU is used to represent real monies, of GDP, when other countries are brought in for comparison, PPP an acronym for purchasing power parity is used. Table 1 shows the primary energy intensity (BTU/\$ PPP) calculated for year 2010 as Purchasing Power Parity.

Table 1. Primary energy intensity (BTU/\$PPP) (Mario, 2012)

Country	Calculated Primary Energy Intensity (BTU/\$ PPP), 2010
Morocco	6000
Tunisia	6000
UK	8000
Japan	7000
India	7300
OECD	8400
World	9800
US	9900
Egypt	10000
Jordan	11300
Middle East	12300
Oman	15600
Saudi Arabia	18400
Bahrain	19300
UAE	19800
Kuwait	20600
Qatar	21400

It is apparent that the GCC region has extremely high energy intensity patterns, when compared to world average numbers. The GCC is more than twice higher than other economies within the area. Investigations of the high energy intensities within the GCC, looking at the consumer and producer sides, points out that there is a presence of large inefficiencies within the GCC economies, especially given to the effects of the low energy prices, along with the absence of regulations for energy efficiency. According to statistics, the GCC region has experienced an excess of 100%, over a period spanning from 1980-2010 (UN, 2011; UNDP, 2012). According to the Table 2

supported by literatures over a wide range of time that the highest primary energy intensity in terms of BTU/\$PPP has scored for GCC countries as Bahrain 622 thousands, UAE 670 thousands, Saudi Arabia as 300 thousands (UN, 2011).

Table 2. Per capita primary energy consumption (BTU/\$PPP) (Mario, 2012)

Country	Per Capita Primary Energy Consumption (BTU/\$ PPP), 2010
Morocco	71000
Tunisia	69000
UK	170000
Japan	170000
India	73000
OECD	84000
World	123000
US	312000
Egypt	100000
Jordan	76000
Middle East	127000
Oman	290500
Saudi Arabia	300000
Bahrain	622000
UAE	670000
Kuwait	730000
Qatar	1000000

This suggests that energy intensities within GCC countries are off-track from a time-wise as well as a cross-section perspective. Before this can be characterized as inefficiency, further analyses need to be taken for all of the factors involved that explain the various within cross-countries for energy intensity. However, in contrast, energy efficiency is a fairly narrow concept. When speaking about energy intensity from an economic standpoint, it relates to an increase in the productivity of energy, which is brought about by increasing cost-effectiveness of the input of energy, within production processes. Therefore, it is important to note that energy intensity is not the same thing as energy efficiency. When energy intensity declines, this does not mean that there is an improvement in energy efficiency, due to the fact that the decline that is experienced could be a result of the economic structure changing, which in particular, has to do with the process of production, without an involvement of explicit energy efficiency actions being taken.

There is another issue that arises whenever energy intensities are being calculating. These relate to primary as well as secondary forms of energy. Intensities can be computed from two different sides. They can be computed from a primary energy supply side, which are the fuels that directly affect the economy, and then there are intensities that affect the final energy side, which is the indirect and direct final utilization of energy within the company, with the differences between these two measures being the losses of transmission. The conventional way to compute the information, is through the primary intensities aggregate levels, with the final intensities being the sectoral or end-utilization of the source. Table 3 Averaged Normalized Primary Energy Intensity Trends has been taken as a duration of 5 years to show that the GCC countries has an average higher motivation towards primary energy intensity trends (Babiker, 2012).

Table 3. Averaged normalized primary energy intensity trends (Michel et al., 2013)

	1980-1985	1985-1990	1990-1995	1995-2000	2000-2005	2005-2010
US	80	70	65	55	45	43
UK	75	66	56	53	48	45
GCC	130	158	180	197	199	223
Middle East	122	176	184	197	205	220
OECD	70	63	55	52	48	45

Consistent with the increased amounts of energy intensities within the GCC region, CO₂ intensities are also uniformly high, posing the same percentage in comparison to energy intensities. The CO₂ emissions within the GCC region are twice the amount as other regions. Something that is even more striking regarding CO₂ emissions, is the fact that other countries have seen a decrease in emissions, while the GCC region has seen a gradual increase between the time frame of 1990s and 2010. In contrast, the GCC region is emitting far more CO₂ emissions, than any other region per capita. The CO₂ emissions showcase that the GCC is placing large carbon footprints on the world that cannot be erased. Looking at the Table 4 Averaged Normalized Primary Energy Intensity Trends to conclude that the normalized energy intensity trends for GCC countries has a higher than Organization for Economic Cooperation and Development (OECD) countries.

Table 4. Averaged normalized primary energy intensity trends (Michel et al, 2013) modified by author

	1980-1985	1985-1990	1990-1995	1995-2000	2000-2005	2005-2010
GCC	0.70	0.80	0.84	0.85	0.87	0.86
OECD	0.6	0.55	0.51	0.48	0.42	0.38

The large carbon footprints that the GCC is placing on the world, is raising a lot of concerns for environmental policies and reasons for international mitigation techniques to need to be made within the region to help assist with future climate change regimes. However, despite the carbon footprints being made, this represents opportunities for cheaply priced mitigation potentials to be made, when they are combined with inefficient energy systems within various countries of the region.

3. Variations Regarding Energy Intensities: Econometric Approaches

Just like any other commodity that is used, demands for energy, are usually drive by price, and income. However, given the climate-sensitivity of this commodity, the demand for energy is also dependent greatly upon the conditions of climate. Furthermore, variations regarding energy demands across countries, can also be linked to several structural factors as well. Factors such as demographic structure, economic structure, and the development stage of the country. Given the differences that exist when discussing energy intensity and energy efficiency, the latter of thought may also equally be determined by these two factors as well.

There are two different approaches that are shown in literary works, when it comes to econometric modeling of the intensity of energies. One approach, which is referred to as the Divisia Decomposition approach, breaks the intensities index, into structural components and socioeconomic parts, utilizing rations and then assessing the contributions of different drivers econometrically (Sun, 1998), Cornillie and Fankhauser (2004). The other type of approach applies to the economic theories of households and the firm behaviors that are used to identify energy intensity driver's that can guide specifications of econometric estimations. Hang and Tu (2007), do analyzes of energy intensities as they relate to household levels, deriving their functional relations from a utility style maximization framework model. The primary determinants when it comes to intensities within these frameworks are identified by household incomes and the prices the households are being charged for their consumption of energy products.

Sue Wing (2008), takes a different approach when analyzing energy intensities. The approach taken by Wing, is measuring energy intensities at firm levels, coming up with a derivative of relations from a cost minimization standpoint. From this frameworks standpoint, the primary drivers of energy intensities are prices, output, technology, and structural barriers. The specifications utilized in these models, are consistent with the scale ups that are utilized at the household levels, and the firm variables within the theoretical approach is at the national

levels.

The two different approaches that are employed are used to investigate and qualify the magnitude of the mitigation potential within the GCC region. The initial approach, which is the Divisia Decomposition, is considered to be an accounting approach that takes into account cross-country comparisons as they relate to energy intensities, discerning whether there are excessive amounts of use regarding energies within the region, and the potential for saving energy, and mitigating carbon. The second approach is more analytical, it involves constructing as well as computing greenhouse gas abatement from a cost standpoint (Cornillie & Fankhauser, 2004; Douglas et al., 2012).

4. The Top-Down Energy Saving Assessment Potentials for the GCC Region

Two approaches can be used to assess energy efficiency potential in economies. These approaches are referred to as a Bottom-Up technological approach, and a Top-Down macroeconomic approach. The way that the Top-Down approach is conducted, is usually on sectoral or national levels. This approach involves doing a comparison of indices that relate to the intensity of energy for specific economies or sectors of benchmark countries or groups of countries, after a few controlling factors that may explain variations relating to performance indexes within benchmark groups is performed. During a study, Babiker (2010) used the Top-Down approach when assessing energy savings or the energy efficiency potential within the economies in the GCC, utilizing a set of IEA datasets of 140 different countries. Babiker utilized an estimates model that was consistent with literature done by Wing (2008) and Hand and Tu (2007). The model is equated to determined Intensity of Energy that follows ($I_i = \beta' x_i + \mu_i$); where, x determined to be a vector of explanatory variables, μ is considered to be a type of stochastic term for an error, and the N was the size of the sample that was assessed.

When it comes to ranking, the price of energy is the factor that has the biggest impact on the intensity of energy. Followed closely by climatic conditions, economic development stages, the structure of the economy, and the income earned per household. Something that is even more surprising is the fact that Kuznets hypotheses regarding the negative effects of coefficients within the second order income terms are strongly supported. According to this hypothesis, the intensity of energy increased whenever income increases at early developmental stages. However the intensity of energy begins to decline with the growth of income, during latter stages of economic development.

Taking the benchmark sample into consideration, and following the algorithm precisely, when the coefficients are applied to GCC data, the results from doing these two steps indicate that the primary intensity of energy is the actual intensity of energy that the GCC encompasses. The implied excess intensities along with the implied excess energy use, showcase the potential savings for energy within GCC countries.

Results of utilizing this algorithm to come to this conclusion, state a huge presence for energy saving potentials within GCC countries. In fact, during 2005, the savings ended up amounting to twenty percent of the total amount of energy consumption within the GCC region. In terms of the countries within the GCC, these potentials considerably differ. The GCC states that shown minimum potentials are Oman, however larger potentials show for UAE as well as Bahrain.

Looking at these results from an efficiency standpoint, it suggests that there are large inefficiencies in energy and waste, within all of the countries located in the GCC, with the exception of one, which is Oman. In order to discourage the waste of energy within the GCC, and harness the savings potentials, GCC countries will need to adopt explicit policies, programs, and measures that will enable them to promote energy efficiency as well as conserve the amount of hydrocarbon resources that they naturally possess, as their largest export.

5. Implications and Spillovers of Policy Choices Made by Annex I

Developing countries have been raising a lot of concerns in relations to the climate change policies that are being implemented by developed countries, in an attempt to mitigate the emissions being given off by greenhouse gases. Implementing certain climate change policies as they relate to energy, in an attempt to mitigate the emissions of these gases by industrialized countries, is going to have an adverse effect on the economies that are dependent upon exports and production of oil products, this is true for a wide variety of GCC economies. The policies are including measures to decrease emissions of carbon dioxide into the air, which would translate into reducing the demands for fossil fuels. Which, when it comes to fossil fuels, petroleum is one of the larger contributors to this market.

There are two specific channels in which climate change related actions taken by Annex I countries, typically, the countries that are advanced industrially, have adverse effects on economies that do not fit into this category. These channels are demands for fossil fuels, which is direct, and the terms of trade for the fuels, which is indirect.

The mitigation of greenhouse emissions taken by Annex I parties, will reduce the demands for fossil fuels, as well as depress the international costs for those fuels. This will result in a direct loss in revenue for exporters, such as the GCC, that export hydrocarbons. Implementing specific response measures due by Annex I, can also increase the chances of spillover effects, taking place throughout international trade channels. Restrictions on the utilization of fossil energies within Annex I countries, regardless if they are through taxes or prices, will increase the costs associated with production, and the prices of exportable services and goods. Provided that a larger amount of developing countries that receive imports are Annex I markets, the mitigation actions that are being taken in these regions, will translate into adverse movements, when it comes to trades for companies that are energy-exporting, and still in the developmental stages. Due to the fact that GCC countries are heavy exporters of oil, and their economies are extremely open, there will be a plethora of economies within the GCC that are going to be impacted, when it comes to both of these channels.

However, according to a document filed by the UNFCCC, all Annex I countries will have obligations to minimize the impacts that any of their climate response measures may have on countries that are still in the development stages (Babiker et al., 2003). The first step that will need be taken, in order to ensure that this obligation is being met, is to select policy measures that will have the least amount of negative impacts on countries that are still developing. This literature regarding climate change policy designs, should suggest that any policies being implemented, are market-based, comprehensive, and encourage flexibility throughout sources, location, and time, including Kyoto-style flexibility solutions.

6. Measures and Policies that Promote Energy Efficiency

There is a great extent that documents that international experience as it relates to energy efficiency measures and policies that is provided within a report by the Expert Group of the United Nations Foundation (2007), which represents G8 countries. This report identifies that there are price as well as non-price options that incorporate sector-specific policy levels, along with economy-wide levels.

Economy-wide measures and policies include crosscutting measures and policies that will help to improve the efficiency of energy overall: (a) incentives for private investments to be made in sectors for energy efficiency, which include creating funding arrangements that can help support investments made in energy efficiency by medium and small sized enterprise, as well as their customers, (b) promoting energy service companies and provisions for fiscal incentives (c) government procurements for energy efficient products, and (d) promoting effective utilize of energy-efficient technologies through educating the public.

7. Utilizing Market-Based Instruments to Harness Mitigation Potentials in the GCC

There are various market-based policy approaches that can be used to harness greenhouse gas mitigation potentials within the GCC region. This analysis is designed to simulate a variety of mitigation scenarios and cases, utilizing the EPPA models that will focus on environmental impacts, cost-effectiveness, as well as welfare implications of the considered policies.

7.1 Taxes vs. Prices

Carbon tax and Cap and Trade are two ways to put a price on the amount of carbon emissions within the GCC. In comparison to other regulatory options that exist, Carbon Tax as well as Cap and Trade are characterized by being cost-effective, market-based, and efficient. However, even though both of these instruments are market-based, they do differ on the various ways they can be utilized on the markets. With the cap and trade systems, regulators are used to determine the quantity that is emitted and the market then determines the price. However, when it comes to the carbon tax system, regulators are what specify the price, while the market is used to determine the quantity of emissions that allowed to be emitted.

7.2 The Makeup of The Cap and Trade System

The primary design variables within cap and trade systems include point of regulation, scope, revenue use, as well as allocation. Scope is what defines what types of greenhouse gases should be included within the trading and what sectors are going to be covered by the scheme. Point of regulation is what refers to the people and the companies that hold permits for emissions, a point of upstream versus downstream regulation points come into play. Allocation is what covers how decisions relating to permits are distributed, and determines if the permits should be given away complimentary or auctioned off. Revenue use is used to define various options with regards of use of the generated revenues that are permitted from the sale. The options typically including limping recycling, tax reductions, and subsidization of renewable energy sources together, into one.

7.3 The Pros and Cons: Carbon Tax vs. Cap and Trade

When considering cap and trade systems versus carbon tax, there are some pros and cons that need to be considered, as they relate to equity, efficiency, technology, uncertainty, administration, and political acceptance.

(a) Efficiency: With perfect information, these two systems are equal when it comes to the effects that they have on the economy, prices, costs, and employment. Emissions targets can be achieved equally with utilizing either the carbon tax or the cap and trade system. Additional efficiency gains may be obtained by implementing either of the systems, as well as utilizing revenue recycling as a means to reduce distorting taxes within the economy, such as capital taxes or labor.

(b) Equity: This refers to distributional implications, basically a matter of who will gain, who will lose, and what will be the costs. Equity differs between the two systems, and depends greatly upon the way that the two systems are implemented. Tax revenues accrue directly to the government, however, proceeds from the sale of carbon permits, may not apply in this manner, based on how the government decides they should be implemented.

(c) Uncertainty: Depending on if the regulator is uncertain regarding the level of emissions or the costs that will be associated with abatement may affect the choices made between price systems and taxes. The Cap and Trade system will assure that the regulator of the meeting regarding the emissions reduction target is met, but will not take costs into consideration; while the carbon tax system will assure that the regulator relating to cost put on the economy per ton is of the amount of carbon emitted is taken into consideration, but the emissions targeted as not addressed.

Table 5. Marginal GHG abatement Cost Curves (2020) (Kesicki, 2011) modified by author

% of the cutback		5	10	15	20	25	30	35	40
\$/ton CO _{2eq}	USA	0	15	19	25	50	62	95	120
	JPN	0	9	22	29	32	85	130	180
	EUR	5	22	32	45	62	72	82	120
	MES	2	9	19	35	46	58	68	75

(d) Technology: There are some that argue that giving additional attention to costs, carbon taxes are superior in comparison to Cap and Trade systems, when it comes to developing emissions mitigation processes. Companies involved in international emissions trading within developed countries, will be able to purchase their way out of having to obtain cheap reduction units from countries that are still in the development stages, instead of having to invest in costly abatement technologies from home.

(e) Administration: Arguments are being made that the carbon tax systems are simpler to initiate, and they are easier to administer through utilizing existing fiscal structures, whereas implementing cap and trade systems will require the establishments of new markets.

(f) Politically Appealing: Cap and trade system are seen as being accepted more on a political standpoint, than the carbon taxes are.

From a practice perspective, there is a thought that perhaps a hybrid or intermediate systems could possibly emerge instead of utilizing a pure cap and trade system or a pure carbon tax system. Economy-wide cap and trade or a uniform style carbon tax system throughout all sources would be an ideal scenario. In practice, there are some intermediate regulatory schemes that may be possible, such as utilizing a partial cap and trade system, where some of the sectors are capped, and others are directly controlled, and the system of utilizing cap and trade with safety valves. In this type of scenario, there are cap and trade system coverage's along with a regime for carbon price passes that will be administered to pre-determined thresholds.

8. Sector-Specific Demand Management Measures

Building and Equipment Sectors- The building and equipment sectors possess large potentials when it comes to untapped energy efficiency improvements that can be made worldwide. According to Urge-Vorsatz (2006), the potential amount of energy savings for this sector, could result in thirty four percent, regarding the projected consumption levels for the sector by the year 2020. The potentials for efficiency include energy savings for changing the designs of buildings as well as upgrading appliances and the different pieces of equipment used.

Different measures and policies that may be adopted in order to improve the energy efficiencies of buildings will

include: (a) adopting minimal energy performance standards for new infrastructures being constructed; (b) Encouraging renovations for buildings that presently exist, utilizing energy performance contracting methods that utilize fiscal incentives; (c) Establishing procedures and guidelines for audits and inspections to help verify the compliance of standards; as well as (d) Establishing programs for energy efficiency, that will give buildings and occupants that are within the buildings the ability to identify the energy efficiency of a building, based on certificates awarded to the infrastructure.

The Industrial Sector – The conditions that are necessary for achieving substantial improvements as they relate to the industrial energy efficiency sectors include: improved processes for decisions, access to information, access to technology, access to financing, as well as the ability to verify and measure the achieved savings for energy. Measures and policies that help to create these conditions along with reducing improvements in industrial efficiencies for energy include: (a) energy management standards that relate to large industrial users of energy; (b) Establishing binding targets that reduce the consumption of industrial energy that is done over a specific period of time, and accomplished through negotiating long term agreements that take place between industry and government; as well as (c) minimal energy efficiency standards that are used for crosscutting technologies, along with other large systems that utilize massive amounts of energy.

Transportation Sectors – Measures and policies that can be taken in order to improve the fuel efficiencies within the transportation sector includes: (a) Fleet efficiency standards; (b) Incentives for consumers that purchase vehicles that are fuel efficient; (c) Accelerated retirement plans for vehicles that are geared towards recycling/scraping older vehicles that are inefficient and replacing them with newer vehicles that have greater efficiency (Alberini et al., 1996). (d) Procurement for the public that exercises amongst its highest efficiency standards as they relate to transport fleets; (e) creating funding mechanisms that are able to operate and build public transit systems that are efficient; (f) putting incentives in place that increase vehicle occupancies and encourage the utilization of public transport systems; and (g) technical support incentives that are aimed to improve logistics and technology of the ways that freight is transported, thus optimizing the fuel that is being used.

Utility Sectors – A few policy options that can be adopted when it comes to making improvements to energy efficiency within the power supply sectors are: (a) Restructuring rates in order to provide attractive incentives regarding utilities to invest in end-use energy efficiencies; (b) Implementing mandatory efficiency obligations and targets for power supply companies along with effective systems for monitoring, auditing, and reporting; (c) minimal generation efficiency standards as they relate to the implementation of new power plants; (d) Institution and policy capacities to reduce losses for transmissions and distribution lines; along with (e) promoting combined cooling, heating, as well as power technologies through regulation standards and with the assistance of government support.

9. Recommendations for Measures and Policies in the GCC

The analysis regarding the trends of energy intensities along with energy-saving potentials helps to prove strong support to the concerns of excessive consumption of energy within the GCC. International experiences seem to suggest that pricing as well as non-pricing policies that deal with wasteful patterns of consumption and promote the efficiency and conservation of energy.

Even though the low energy prices are primary drivers of excessive use of energy within the GCC, the pricing measures along can provide effective cures for two different reasons. First, the successful experiences that some countries that are developed have been able to implement when it comes to pricing measures, may be able to be replicated for developing economies given the large differences that exist with respects to marketing structures, marketing incentives, and marketing institutions. Secondly, given the evaluation of the extremely low GCC price elasticity's, increased for the end-use prices are required in order to discourage energy being used in excess. These large increases as they relate to energy prices within the GCC are not politically feasible.

The non-pricing policy options include capability building measures for Demand Side Management(DSM), and public awareness. To promote awareness for energy conservation within the GCC, efforts need to be done to engage various organizations, such as the government, religious organizations, large corporation, as well as civic society operations. Capacity-building measures should be used in order to target creating an enabling institutional setup as it relates to improving the efficiency of energy, including implementing conservation laws and regulations, research institutions, testing labs, as well as Energy Service Company (ESCO).

Renewable and alternative energy can also be tapped into in remote locations to help reduce distribution losses and large transportation losses within the power grids of the GCC. There are wide ranges of technologies that may be introduced into household sectors that could reduce the demands that this sector has for electricity that is

emitted from the power grids. Some of the technologies that have a lot of potential if employed within the GCC are solar power, solar for heating water, wind turbines, and solar for air conditioning reasons, just to name a few of these alternatives.

DSM measures are being used widely, and have been able to reproduce great results for a wide array of countries. Based on the results that these measures have had in China, which was once a developing country, as well as India, the potential amount of energy savings along with the applicability within the GCC, following the specific DSM measures is recommended as candidates for promotion energy efficiency within a vast amount of sectors.

10. Conclusions and Recommendations

Four issues that have arisen within the GCC in relations to climate change policies have been addressed in this paper. These issues include the rising amounts of energy and carbon intensities, the impacts that the response measures that are being implemented by developed countries have on developing countries, as well as the mitigation potentials that exist within the region, as a method to harness the potentials that are available.

Increased carbon emissions pose a challenge when it comes to sustainable developments within the region, and these increase the likeliness that the GCC region is going to be assigned mitigation measurements in the future. With this in mind, there have been some analyses performed as they relate to energy intensities relating to emissions trends throughout the last three decades, confirming legitimacy of the worries that carbon emissions present a challenge for the GCC area.

Relating the impacts that the response measures have on the region, relevant literature was used to discuss the impacts of strength that the Annex I response measures have on the GCC hydrocarbon exporters and the mechanisms that are available to mitigate the negative impacts. Important messages to take away from the literature, is that the mitigation processes being practiced by Annex I parties may have great costs on the welfare of hydrocarbon exporters, and the use of broad policies, which include all of the greenhouse gas related emissions, and are allowing training amongst constrained parties, reducing the welfare impacts.

Details regarding market-based options and different candidate mechanisms that may be employed to harness the mitigation of greenhouse gases in the region has been made. With setting the benchmark, there have been a certain degree of pledges made that indicate the impacts on welfare that the regions that are lowest have when developed countries, are able to efficiently apply market-based instruments in order to carry on with their pledges. There are a lot of lessons that should be taken away from the analyses made. The primary lessons that should be learned, include the importance of carefully monitoring the regions carbon footprint, the roles that incentives and demand management policies play, in order to promote energy efficiency and reduce carbon emissions within the GCC region, the potential gains that can be made from actively participating in international carbon markets, through the utilization of CDM, the utilization of market-based and efficient policy instruments in order to help pursue the objectives outlined for climate changes, the contribution of climate policies to the quality of air, and the roles that green tax reforms along with other sweeteners to improve the welfare of economic of domestic carbon policies play.

Within the GCC region, energy intensities are extremely high. What is even more alarming is the fact that these intensities within the region, are expected to accelerate, with the growing pressures that are being put on the region, to move towards being an industrialized energy-intensive area. Apart from the vast amount of environmental issues that it causes, increasing the use of hydrocarbon in order to adhere to the domestic needs of the GCC will require the need for costly capital investments to be made, which will eventually end up compromising the future of the hydrocarbon targets that the GCC has set forth. Therefore, a quest for energy savings and efficiency within the GCC countries will prove to be an endeavor that is a win-win scenario for all parties involved.

Energy intensity trends and the scopes where potential energy savings exist within the GCC have been explored. Surprisingly enough, there is a large presence where savings potentials can be realized within the region. Being able to harness these potentials is going to require some programs along with active policy efforts to be implemented. The international experience, as it relates to measures and policies to promote the efficiency of energy and additional recommendations have been made.

Given the fact that there are energy saving models that can be followed, and the increased sense of urgency within the GCC, for states to act upon this now, these recommendations help to prove essential ingredients that need to be employed for designing the nations region-wide efficiency programs for energy.

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