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A New Approach to Climate Change and Development: The Future of the Green Climate Fund

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A New Approach to Climate Change and Development: The Future of the Green
Climate Fund

By

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Abstract

This report proposes that the climate crisis can be looked at as an opportunity at this time to not only curb the occurrence and effects of climate change, but to additionally address the problem of underdevelopment. The deep connections between these two problems are explored, and it is suggested that by aiming to achieve widespread clean energy access in the developing world, both adaptation and mitigation projects and the Millennium Development Goals can be pursued using the same resources. The Green Climate Fund, a financial board of the United Nations Framework Convention on Climate Change, is proposed as the mechanism through which clean energy access can be realized, utilizing a combination of technology transfer and research and development efforts.

Ultimately, this proposal serves a double purpose, and does not only seek to offer a comprehensive policy approach, but to additionally reframe the debate taking place in the international arena. The report concludes by calling for a change in the way that climate change policy is configured, using the imbedded proposal as an example of where innovation in this field might move the discussion amongst international leaders.

Preface

This thesis is a reflection of my amazing experience interacting with the top faculty at the University of Colorado, Boulder. I have had the opportunity to learn from such a diverse range of academic minds, leaving me inspired to offer up my own contribution. I am especially grateful to my thesis advisors, each of whom inspired and equipped me throughout this process. Maxwell Boykoff provided me with the background knowledge and analytical skills necessary to engage with the topic of international climate change policy. I am deeply grateful for the support he has provided me with in this endeavor, as well as my other academic pursuits. Lakshman Guruswamy also played a key role in my research by inspiring me to look outside the bounds of strict environmentalism, and providing me the framework in which I was able to connect climate change with development issues. Finally, I am very grateful to Dale Miller, who has shared with me his considerable wisdom on the thesis process and ensured that this project was as enjoyable as possible.

It should also be mentioned here that my work was made possible via the generous support of the Undergraduate Research Opportunity Program (UROP). I would like to thank the people behind the UROP grant for providing me with the means to continue my research over the summer of 2012, allowing me to develop my topic to its fullest.

It is my hope that throughout this report my passion for the global community comes through, both from an environmental and a social perspective. It has been very rewarding piecing together these two topics, and I look forward to continuing my work in the future.

Introduction

“A good crisis should not be wasted” – this was the mentality of the authors of *The Hartwell Paper* as they wrote about the opportunity to alter the face of climate change policy following the disappointing results of international negotiations in 2009 (Prins et al., 2010). The global climate system is certainly at immense risk, with elevated levels of green house gases in the atmosphere working to raise the overall temperature of the Earth and resulting in extreme harm to many natural ecosystems and the human populations that rely on them. Agricultural productivity is expected to decrease in many areas, sea levels are on the rise, natural disasters are occurring with increased frequency and fatality, and the spread of vector borne diseases is steadily swelling. People all over the world have been working to find a solution, collaboratively and individually, and there is virtually no doubt that climate change poses a serious threat.

Unfortunately, it is not the only problem our planet is faced with, one of the biggest being the inequality that exists between the so-called developed and developing countries. There are countless publications that explore the origins of this inequality, yet regardless of why it exists the fact remains that an incredible number of people are living in poverty, without proper access to many of the accouterments required for a full and healthy life. The incidence of human suffering is immense, and this inequality must also be addressed on a global scale as soon as possible; yet, in this time of extended recession across the world, able countries have been reticent to generate the capital necessary for tackling all of these issues.

Clearly, there is a detrimental gap between the necessities of the global community and the ability of that community to respond to the problems at hand. The issues of climate change and development have been known to the world for quite some time, and the many approaches taken to solve them have taught us valuable lessons about the failures and successes of policy

work undertaken to address these. It is important now, in looking forward, to explore alternate methods of framing these problems and consider new discourses regarding the diagnoses of the problems and the solutions inherent therein. It is only by pushing the conceptual boundaries of current efforts that new and innovative approaches may be developed.

This report serves as a proposal for how the climate change crisis can be used as a springboard to not only curb the occurrence and effects of global climate change, but to likewise tackle the problem of underdevelopment using the same techniques and the same financial resources – namely, the Green Climate Fund (GCF). I looked at how the resources of this fund could be applied, at this point in time, to both combat the effects of climate change as well as work toward the achievement of the Millennium Development Goals (MDG). In so doing I have addressed the flaws in the current policy model of the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, and analyzed the intended purpose of the GCF coupled with an examination of the complex relationship between climate change and the MDG. My research has led me to propose that the GCF could be used to increase access to sustainable energy in developing countries, and in so doing move closer to solving both issues. Climate change should be thought of as an opportunity in disguise to bring about some much-needed change in this world, and it is my intention to move forward international discussions on this topic.

Background

Literature Review on GCF

Now more than ever the concept of global climate change has become a central issue in the eyes of virtually all nations as the notion of real and serious harm for human populations

becomes more accepted. The Conference of the Parties – abbreviated COP – is an annual collaboration of nations on the topic of global climate change hosted under the United Nations Framework Convention on Climate Change (UNFCCC). The Convention acknowledges that change in the Earth’s climate and its adverse effects are a common concern of humankind, and that thereby the Convention’s objectives, as stated in Article 2, are to achieve “stabilization of greenhouse gas concentration in the atmosphere at a level that will prevent dangerous anthropogenic interference with the climate system” and that “such a level should be achieved within a time frame sufficient to allow ecosystems to adjust naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner” (UNFCCC – Article 2, 2012). Article 3 continues to set out five specific principles to guide the Convention’s actions in achieving these objectives:

- 1) Common but differentiated responsibility (CDR).
- 2) Specific needs of developing countries should be given full consideration, especially vulnerable ones.
- 3) Employing the precautionary principle (it is better to take the risk of acting even if the threat is shown, in the future, to be minor).
- 4) Actions be consistent with sustainable development.
- 5) That parties should cooperate in promoting an open international economic system that would lead to sustainable economic growth (UNFCCC – Article 3, 2012).

The Conference of the Parties first met in 1995 in Berlin, Germany, and have been meeting every year since. COP18 recently concluded in Doha, Qatar, continuing the search for an appropriate solution to the global warming phenomena.

Many nations stand to be impacted by the effects of climate change, but it is primarily the least developed countries that are predicted to be those most adversely affected, despite their relatively minor contribution to anthropogenic climate change overall. The International Monetary Fund and the World Bank, as well as many other organizations, have established several mechanisms to provide funds to these countries, but it was at the Copenhagen Accord in 2009 that the idea of a Green Climate Fund (GCF) was raised, with a proposed budget of US\$100 billion annually beginning in 2020, to be provided by developed countries and climate-focused organizations and industries (Bredenkamp & Pattillo, 2010). It will consist of a board of 24 members, split equally between developing and developed Parties, with the World Bank serving as an interim trustee (United Nations, 2012). Ultimately the GCF will be an operating entity of the Financial Mechanisms of the Convention and will be required to engage in collaboration with and function under the guidance of COP in order to carry out programs, policies, and projects directed at adaptation and mitigation efforts in the developing world (UNFCCC, 2010).

Summary of Research

In order to consider the literature currently available on my topic, I considered each of the following questions: Why is there a need for the GCF; how is the GCF developing; how will the GCF be funded; and what critiques are being made? The concept of the GCF itself is relatively new, coming into being a short four years ago, and therefore there is virtually no mention of this mechanism prior to the year 2009. Although the GCF is in its infancy, the idea of climate finance as a whole has been circulating in academic spheres for approximately fifteen years and in many cases this is apparent in the literature.

Why is there a need for the Green Climate Fund?

The necessity of having a Green Climate Fund is a complicated topic, as it is engaged with the issues of sustainable development, shared responsibility, prior success of other financial mechanisms, and global climate change itself. To begin with, the United Nations Committee for Development Policy (2009) has compiled a strong report regarding the achievement of sustainable development amidst the challenges of climate change. This has really set the stage for why action must be taken in the developing world, and explores the impact of climate change on achieving the Millennium Development Goals that are so crucial to these nations. By highlighting the connection between economic development and the use of natural resources, this source emphasizes the detrimental effects of making the use of carbon fuels more expensive, as it will halt much of the progress underway and leave 32 percent of the developing world without access to electricity (UN, 2009).

Having clearly established the need of financial aid, it is not as clear as to why the array of past and present financial mechanisms of the UNFCCC have not been successful in addressing this issue. Stewart et al. (2009) provides an overview of these initial funds and programs, making clear the breadth of attempts to supply the developing world with financial support. However, it is with de Gouvello et al. (2010) that an explanation is offered as to the need for a new, and much larger, fund targeted at climate change in the developing world. This report takes a slightly different approach, and instead of proponenting the need of financial aid to support developing countries, the issue of the world's ability to meet necessary greenhouse gas (GHG) emissions reductions is addressed. It is argued that without reductions in the developing world, the scientifically-based target for reductions cannot be met, and that therefore the application of funds in these nations is crucial to the health and safety of the global community (de Gouvello et al., 2010). Many low-carbon investment projects already exist in the developing world under the

support of mechanisms such as the Clean Development Mechanism (CDM), however, these authors argue that because these projects have limited access to financing they are never realized in full. A new mechanism, the Low-Carbon Development Facility (LCDF) is proposed under the operation of the GCF as a way to mobilize much larger sums and support ongoing and future projects in the nations most in need (de Gouvello et al., 2010).

Caperton (2011) expands on this idea in that the diversity of a country's sustainable development portfolio is dependent on the breadth of the fund backing it. In this report he explains the importance of pooling both the risk of investment as well as the capital gained, and that this method would enable countries to fund more adaptation and mitigation projects than they are now able to. By diversifying these projects, Caperton (2011) claims that each individual country will be better able to manage their risk in regard to climate change. An operation such as the GCF would theoretically meet the requirements for achieving this.

What will the structure of the GCF be?

Having officially adopted the GCF as a mechanism to be implemented by the UNFCCC at COP16 in 2010, it has since been under the responsibility of the COP to move the project forward. At this point in time there is a notable lack of analytical material regarding the evolution of the structure of the GCF, leading to a surplus of information provided by the UNFCCC in the form of official reports and summaries. One such summary by the UNFCCC (2012a) describes the current plan of action for governing the creation of the GCF for the first few years, moving towards operationalization. This source reviews the structure of the Green Climate Board, consisting of 24 members split between developing and developed countries, and a trustee who will administer the fund itself. A "Transitional Committee" is referenced as being

responsible for the development of the fund, with recommendations subject to approval by the COP17 (UNFCCC, 2012a).

Looking at the recommendations put forth by the Transitional Committee at COP17 in Durban, it is apparent that the focus of the committee was on moving forward with the creation of an actual governing board for the GCF. Several requests are made to the COP for country recommendations for board members as well as inviting Parties to submit expressions of interest to host the GCF itself permanently within their borders (UNFCCC, 2011a). Also under request from the Transitional Committee is the establishment of a date for the first Board meeting, as well as the appointment of an interim secretariat immediately following COP17 and the consideration of a fair and accurate process for the selection of the trustee of the GCF (UNFCCC, 2011a).

These requests made by the Transitional Committee are expanded upon in their composed draft of the governing instruments proposed for the GCF. The authors of this report provide a very thorough consideration of the structural mechanisms of the GCF, including selection process for members, terms of service, and responsibilities inherent in the position. While there is considerable information on the role of the board itself, little details are provided in terms of the implementation of the fund. Financial inputs to the fund are summarized as coming from developed nations and a variety of other sources, to take the form of grants and concessional lending to eligible developing nations (UNFCCC, 2011b). Brief mention is given to monitoring and evaluation standards, but as of yet the governing instruments remain a draft.

Financial Instruments of the Fund

There has been much speculation as to the appropriate way of providing funds to the GCF in the most efficient and reliable manner, and it would appear that it is an issue of

considerable complexity. Much literature exists on the topic of climate financing in the broadest sense, looking at the needs of developing countries and the global community as a whole. With the application of the GCF specifically aimed at developing nations it is most useful for the purposes of this review to consider only those sources targeted at these same nations. Despite climate change being a relatively new concern on a global scale, previous financial instruments aimed at this problem have provided a base to consider the best approach to financing low emissions projects in developing countries. It is proposed by Dubash (2009) that a top-down approach, for the immediate future, is inferior to the application of bottom-up approaches in terms of having a positive effect on environmental systems. The emphasis on local-level governments is due to the fear of contradicting incentives if emissions reductions were implemented on a higher level, such that sustainable development in vulnerable communities might be sacrificed in the interest of meeting targets and collecting monetary rewards. This idea is supported by Rao (2010), albeit much more broadly as it is related to all green economic policies throughout the globe, not only those directed at developing nations and climate change.

Apart from these general conclusions, there are a number of research reports that directly address the GCF itself and possible ways forward. There are significant disagreements when it comes to climate financing and who should be responsible for making a contribution. Many accusations have been made over the past decade as to the United States' participation, however the focus of the debate has now turned towards public versus private financing. Over the past decade many countries have attempted to implement market-based mechanisms to curb carbon dioxide emissions (e.g., cap and trade, carbon tax). As a private sector investment these mechanisms are recognized as important to the overall lowering of greenhouse gas emissions, but some researchers speculate that this will not be enough to meet global challenges for

emissions reductions. Lattanzio and Leggett (2011) postulate that it is the public sector that will have the greatest effect on climate financing efforts, suggesting that it will be able to enact the necessary economic changes at a much quicker pace.

The opinion that market-based mechanisms are inadequate on their own is shared by Romani & Stern (2011) as they break down the current international finance flows going towards climate change. It is estimated that out of the US\$97 billion per annum supporting low-carbon development in the developing world, carbon markets account for only US\$2 billion, a small percentage of the total. A point of divergence, however, is that these authors do not list carbon markets as a subsection under private investment sources, and instead consider it to be a completely separate section. Over half of current investments now come from private sources, and it is predicted that if global trends persist and private investments continue to increase by ten percent annually, then over the next ten years this sector will be able to provide well over US\$200 billion to adaptation and mitigation activities in the developing world (Romani & Stern, 2011; Chaum et al., 2011).

The Secretary General of the United Nations' High-Level Advisory Group on Climate Change (AGF), which was tasked with identifying potential sources of funding for the GCF to be presented to the COP, brings further disagreement to the debate by emphasizing the role of carbon pricing on meeting the US\$100 billion annually for the GCF. The claim is that without a carbon price of US\$20-US\$25, the rise in available revenues for climate financing will not be sufficient to meet global demand (AGF, 2010). This is a very contentious claim as many have pointed out that a steep rise in carbon pricing would be detrimental to sustainable development in developing nations, without considerable technology transfer from developed countries. Overall,

however, the AGF posits that the amount of US\$100 billion annually is an achievable, if challenging, sum (AGF, 2010).

As mentioned previously, de Gouvello et al. (2010) go beyond simple speculation as to the best approach to financing the GCF, and propose their own system called the Low-Carbon Development Fund (LCDF), which is based on a refined model of the Clean Development Mechanism (CDM), a current financial mechanism supporting mitigation projects in developing countries. This paper represents the next phase in the discussion of financing the GCF and it is expected that many similar proposals will be emerging over the next few years.

Concerns Regarding the Green Climate Fund

As it is still in its initial phases, several critics have commented on the challenges still facing the GCF, which are considerable considering the scope of the fund and the complexity of its nature. Bird et al. (2011) have written a report focusing on the design challenges faced by the GCF, addressing the tenuous relationship between developed and developing countries that exists in the climate change arena. These authors bring up the point that many observers of the COP proceedings are concerned that the GCF will in actuality amount to a failed financial mechanism, serving only to entice developing nations into a binding agreement on carbon emissions. This concern has manifested in negotiations as a debate between having the GCF be accountable and guided by the COP, or having it also be under this group's authority. The role of the World Bank as interim trustee is also explored by these authors, as many question the motives of the World Bank given that this institution operates a portfolio of Climate Investment Funds, and therefore may have conflicting interests (Bird et al., 2011).

Critiques have also been made as to how the GCF will interact with existing financing mechanisms targeted at climate change. While some propose that a new niche for the fund must

be created for it to succeed (Bird et al., 2011), others claim that it will in fact replace or subsume existing programs that have less mobilization power (Lattanzio, 2011). With many financial mechanisms already in existence, it is crucial to create the right incentives to garner support for the GCF, and as of yet it is still unclear what those may be (Bird et al., 2011).

Negotiators on behalf of the United States have also raised concerns in regard to the governing board of the GCF, making clear their opposition to including climate negotiators in decision-making processes, in lieu of a board containing only finance experts (Caperton & Light, 2011). Still, there are other organizations expressing concern at the elimination of climate negotiators from the process (Bird et al., 2011). Overall, a main concern expressed by many politicians and academics alike, is that not much progress has been made with the conclusion of COP17 this past year (Padma et al., 2011; Podest, 2012). There is still a considerable amount of work to be done on the refinement of the GCF, and with such a contentious and complex issue it is understandable that some question its ability to progress in a timely manner.

Furthering the Discussion

After reviewing the current research, it is clear that the intent of the GCF is to address mitigation and adaptation measures in the developing world in order to act on global climate change. While many aspects surrounding the creation of the fund have been explored, there has not yet been significant research done to determine what the impact of these actions will be on the developing world in terms of sustainable development. Many clear goals have been established globally in terms of achieving sustainable development, and as a guiding principal of the UNFCCC it is critical to incorporate these goals within the climate change solution and not allow global warming to affect the developing world in a negative way. There has been some theoretical research that proposes that by allowing nations to develop they will be better

equipped overall to deal with global warming both in terms of adaptation and mitigation. Moving forward from the existing collection of research on the GCF, I have created a proposal as to how this financial mechanism can be applied in a way that address both climate change adaptation and mitigation, as well as underdevelopment. However, before the topic of underdevelopment can adequately be explored, a certain amount of background is required.

Underdevelopment as Seen Through the MDG

The Millennium Development Goals (MDG) consist of eight targets signed into being as part of the Millennium Declaration at the 2000 UN Millennium Summit. This meeting was a collaboration between leaders from both the global North and South, as 189 nations gathered to discuss how to improve the lives of the billions living in developing nations. In order to achieve this, eight separate goals were established to target different facets of what the leaders saw to be the core causes of underdevelopment. For each goal, a shorthand tag line was concocted, but each was additionally given more specific objectives – all eight are listed below.

- 1) Eradicate extreme poverty and hunger
 - a. Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day
 - b. Achieve full and productive employment and decent work for all, including women and young people
 - c. Halve, between 1990 and 2015, the proportion of people who suffer from hunger
- 2) Achieve universal primary education
 - a. Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling
- 3) Promote gender equality and empower women
 - a. Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015
- 4) Reduce child mortality
 - a. Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate
- 5) Improve maternal health

- a. Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio
 - b. Achieve, by 2015, universal access to reproductive health
- 6) Combat HIV/AIDS, malaria and other diseases
- a. Have halted by 2015 and begun to reverse the spread of HIV/AIDS
 - b. Achieve, by 2010, universal access to treatment for HIV/AIDS for all those who need it
 - c. Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases
- 7) Ensure environmental sustainability
- a. Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources
 - b. Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss
 - c. Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation
 - d. By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers
- 8) Develop a global partnership for development
- a. Develop further an open, rule-based, predictable, non-discriminatory trading and financial system – includes a commitment to good governance, development and poverty reduction – both naturally and internationally
 - b. Address the special needs of the least developed countries
 - c. Address the special needs of landlocked developing countries and small island developing States
 - d. Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term
 - e. In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries
 - f. In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

It is clear that each of the goals is slightly different, some calling for complete eradication of a condition, while others simply call for a reduction. Most of the goals have a targeted completion set at 2015, but there is slight variation to this. For the purposes of this paper, I will be focusing on the shorthand goals set out by the United Nations.

The MDG have come under a measure of scrutiny in recent years, with critics such as William Easterly calling into question the effectiveness of such broad goals. There are many

programs aimed at achieving the MDG, and many of these involve the giving of aid. Easterly is very critical of aid giving, as he argues that without specific, narrowly defined goals, it is harder to generate momentum and make actual progress (2006). For example, the goal to halt the spread of HIV/AIDS across the entirety of the developing world is very broad, and there is clear way to begin going about it. What is more, with the MDG there are numerous international actors, entire nations even, who are committed to achieving them. The problem here is that too many people are involved in too broad of goals, and it becomes easy for people to assume that others will act for them. The levels of accountability are incredibly low with this international effort, and it is important to consider the flaws inherent in the MDG model (Easterly, 2006).

This report will not argue against these flaws, but instead uses the MDG as a framework around which to discuss development in general. This concludes the background portion of this proposal, and we will now transition to a discussion of the current state of policy in the UNFCCC, followed by a look at the role for clean energy access to address these issues.

The Importance of Timing and the GCF

The intention of this report is to propose a change in the policy direction taken by the UNFCCC in their efforts to curb global climate change; however, before discussing the specifics of such a proposal it is important to understand the circumstances under which a change is necessary, and more importantly, possible. An examination of the current policy model and the timeline of the UNFCCC reveals that the climate of international negotiations is perfectly poised to consider an alternate approach to mitigation and adaptation measures, and combined with the planned deployment of the GCF the timing has never been better.

Current Policy Model

Currently, the international community has come together, for the most part, under the banner of the Kyoto Protocol. This policy was developed at COP3 in 1997 in Kyoto, Japan, and is a legally binding agreement for countries to reduce their greenhouse gas emissions. 37 countries eventually signed on and ratified the treaty, with the commitment to reduce their emissions by an average of 5% relative to their emissions for the year 1990, over the period 2008-2012 (UN, 1998; UNFCCC, 2012d). It is based on the idea of common but differentiated responsibility, thus targeting the industrialized countries that are most historically responsible for the current levels of greenhouse gases in the Earth's atmosphere. This agreement was set to expire in 2012, but this term was recently extended until 2020 as agreed upon by nations attending the most recent Conference of the Parties (COP18) held in Doha, Qatar in November, 2012. The Kyoto Protocol encourages its members to take national measures in order to meet the objectives for reduction, but it did include three major mechanisms through which countries could approach this difficult task – emissions trading (or the “carbon market”), the Clean Development Mechanism (CDM), and Joint Implementation (JI) (UNFCCC, 2012d). This policy has been a central component to climate change negotiations since its creation in 1998, and while many have applauded its accomplishments and still fight for its continuance, the flaws of the Kyoto Protocol, both in theory and in practice, are immense.

Flaws in the Current Model

Beginning from a logistical standpoint, the Kyoto Protocol has been unable, as of yet, to include the world's largest emitters within its framework. The treaty was designed to target only Annex I countries, that is industrialized or developed countries, as part of its initiative to uphold “common but differentiated responsibility”, and to have all treaty members account for at least

55% of total global emissions (UN, 2012). This important benchmark was finally reached in 2004 and allowed the treaty to go into force, yet it did so without including the United States. The United States makes up a large proportion of global greenhouse gas emissions, and has signed but not ratified the treaty. Faith in the Kyoto Protocol has decreased dramatically, and after the latest COP gathering Japan, Canada, Russia and New Zealand have all pulled out of the treaty, leaving it to now cover only 15% of total global emissions (Ritter & Casey, 2012). Many have used this information to argue that the effectiveness of the Kyoto Protocol is dwindling and that a new treaty must be found, and while I agree with this statement I would argue that even greater issues have plagued the treaty from its conception.

The Kyoto Protocol is a universal intergovernmental treaty based off of previous models such as the International Stratospheric Ozone Regime, the US EPA Acid Rain Program, and the Strategic Arms Reduction Strategy, all of which target problems that are incomparable to the issue of global climate change (Prins & Rayner, 2007b). Prins and Rayner have defined climate change as a “wicked problem”, or in other words a problem that “can be considered as a symptom of another problem” (2007b; Prins et al., 2010). The essence of this is that climate change is not a problem that is cut and dry, with one input and one output. The occurrence of global warming combines political, economic, and social factors at a myriad of levels, resulting in a problem that is so multi-faceted that no simple solution can be had in order to ward off its effects – the problem will not be solved by merely asking developed nations to reduce their greenhouse gas emissions.

This leads to the point that it is essential to accurately identify the problem that needs addressing. Climate change is a complex problem, and if this complexity is not taken into account when diagnosing the problem, any resulting solution will lack effectiveness

(Guruswamy, 2007). Because the Kyoto Protocol was based on existing treaty models, it failed to account for the unique nuances inherent in the climate problem, and was disadvantaged from its conception. Following a correct diagnosis of the problem, it is important that an international treaty embody a prescriptive answer that deals directly with the cause of the problem, not its symptoms (Guruswamy, 2007). In this regard, Kyoto again falls short.

A critical flaw in the treaty model is its creation of flawed incentives for all signees, as well as for those member nations whose livelihoods rely so heavily on the success of Kyoto. The way Kyoto is designed requires participating nations to go against their nature and not pursue altruistic motives – a strategy that rarely works. The nations most responsible for greenhouse gas emissions are also those that are least effected by the changes taking place across the globe, therefore their involvement in the treaty is centered around moral obligation and international diplomacy. While these can be motivating factors, it is more natural for nations to pursue actions that benefit their populace in a very direct and immediate way, and historically this policy model has not had sustainable, long-term outcomes (Prins & Rayner, 2007b). Kyoto is further flawed in that it has created a system where a number of countries, such as Russia, Ukraine, and Germany, are able to claim free money as a consequence of tearing down their highly inefficient industries, remnants from the communist era. In this way the Kyoto Protocol is rewarding a lack of economic growth and punishing those that are economically successful, once again demonstrating skewed incentives (Prins & Rayner, 2007b; Easterly, 2001).

This becomes an even greater problem when the question of involving developing nations is raised, a critical component that is becoming increasingly demanded amongst UNFCCC member nations, particularly the United States. By stifling development the treaty will only contribute to the extreme inequality currently experienced across the globe, decreasing the

incentives of treaty participants even further. What is more, although it is clear that the Kyoto Protocol seeks to uphold the notion of “common but differentiated responsibility”, it is harmful to exclude developing nations from an issue that they are both impacted by and increasingly responsible for. It is predicted that by 2015, developing countries will have outpaced developed ones in terms of energy consumption, much of this coming from fossil fuel sources (Guruswamy, 2007). As it currently stands, the treaty does not take into account this significant contribution to greenhouse gas emissions, and therefore it is again avoiding addressing the heart of the problem. This is not to say that developing countries should be held accountable for the same actions required of developed nations, new solutions must be devised to that incorporate the entirety of the problem.

Ultimately, many claim that the Kyoto Protocol holds only symbolic importance, and even so creates more harm than good. It has been argued that with the existence of this treaty the international community has fallen into a state of complacency, content not to push for more hardline action as the illusion of a solution blocks further political treaties from manifesting (Prins & Rayner, 2007b; Prins & Rayner, 2007a; Verweij, 2006). Fortunately, the time to move in a new policy direction has never been so perfect.

The Perfect Time to Act

With the recent renewal of the Kyoto Protocol through 2020, many have been disheartened at the lack of progress made by the UNFCCC in tackling the issue of climate change, a feeling that is perfectly justified. Despite this continuance, it must also be noted that the opportunity to refocus international efforts on this issue has never been greater, as the UNFCCC is in the process of developing a new, comprehensive legal agreement, working under a deadline of 2015 (C2ES, 2012). It is becoming more and more clear that the basic structure of

the Kyoto Protocol is ineffective, as seen by the recent withdrawal of Japan, Canada, Russia, and New Zealand, and with the continued insistence by the United States that developing nations be included in the agreement before they will commit to any reductions. The upcoming deadline, coupled with growing criticism of this treaty, combines to create the perfect atmosphere under which national leaders may be willing to expand their preconceived notions on how to tackle the issue of climate change and be open to considering a significant change in the policy model.

Even more fortuitous is the correspondence of the end of the second commitment period of the Kyoto Protocol with the launch date of the GCF. Whatever agreement is made in 2015 by the UNFCCC will most likely go into effect in 2020 as the second commitment period of the Kyoto Protocol comes to an end, allowing the new treaty to coordinate its efforts with the ample financial resources of the GCF. It is not yet clear in what form the new agreement will manifest, but it is my proposal that the alignment of the end of the Kyoto Protocol and the beginning of the GCF be taken advantage of to move climate change adaptation and mitigation to a new level, one where the situation is looked at as an opportunity and not as an insurmountable problem. The following section will provide details on my proposal for one way this opportunity might be realized, and how the issue of climate change can be used to achieve the Millennium Development Goals.

Clean Energy Access, Climate Change, and the Millennium

Development Goals

The Kyoto Protocol has been in place for sixteen years and has long stood as a symbol for international cooperation, leadership, and action in the face of daunting climatic changes, and

yet it is clear that the time has come for a shift in policy. It can be hard to admit that an action taken in the past has been wrong for a given situation, particularly when this action was made under immense international scrutiny. Nonetheless it is the case that the theory behind and application of the Kyoto Protocol is flawed. The leadership required to recognize this error is immense, almost as great as that required to move the discussion forward and begin considering new possibilities for the management of climate change on a global scale. This process will undoubtedly be a difficult one, but it will be impossible unless the international community as a whole engages in a discussion as to how this new era in climate change policy might take shape. The mistakes of the past must be analyzed along with the necessities of present and future peoples in order to move forward in the best direction possible. In this section I will offer my own contribution to this conversation, in an attempt to further the dialogue surrounding the best mechanisms of climate change policy.

The GCF, as a burgeoning financial mechanism of the UNFCCC, is an institution of immense potential as its boundaries are still flexible enough to render it a tool in any new climate agreement that is made. It is set to allocate US\$100 billion annually towards adaptation and mitigation efforts in the developing world, but I will argue that climate change is a very narrow lens through which to view the possible application of this fund. Underdevelopment is another serious problem faced by many of the world's nations, and it would be a mistake to extricate these two issues, as I will argue that they are inexorably linked.

The Hartwell Paper is a leading publication on this topic, where authors highlight the opportunities presented by the looming demise of the Kyoto Protocol to shift the policy approach towards climate change. The authors argue that if greenhouse gas emissions are reduced to the targeted parts per million, but people are still left without access to energy, then this would be an

affront to human dignity and an ultimate failure rather than a success (Prins et al., 2010). With the international community pressed to come up with a solution to climate change, a holistic approach should be taken in order to take advantage of the crisis and use it to raise up the state of the human race. Haines et al. echo this sentiment, in their call for a “no regrets” solution, that is, a solution that will be beneficial on the widest scale possible even if climate change turns out to be a false prophecy (2007). Ultimately Prins et al. (2010) outline three objectives that they deem the most important to pursue in terms of future climate policy:

- 1) Energy access for all
- 2) Ensure that we develop in a manner that does not undermine the essential functioning of the earth system
- 3) Ensure that societies are adequately equipped to deal with climate change

In the following pages I will use these points as a basis for my argument that sustainable energy access in the developing world is an appropriate and highly desirable policy objective to both combat the effects of climate change and bring about development through the MDG, under the guidance and resources of the GCF. First, however, I will present the deep connection that exists between climate change and development.

Climate Change and Development

The concept of development is not one that is easy to define or even to recognize, as it has many connotations and has been used in many different ways throughout the course of civilized society. Lawson discusses development in terms of three separate meanings: Big “D” development being government action taken with the intention to develop, little “d” development as the natural unfolding of “economic and social processes within capitalist societies”, and finally development as a discourse, as a way of examining the histories and power relations

inherent within the concept (2007). This can be a very complex and nuanced way of approaching development as a discipline, and many scholars have simplified discussions on the topic by relating development directly to a measure of GDP per capita, or income. Though, this approach can be very dangerous as it may overlook many improvements in the lives of billions that have been achieved despite a notable lack of increase in GDP per capita overall (Kenny, 2011). Focusing on income alone ignores the improvements in education, health, and gender equality that have been made in recent years, to name but a few. It is for this reason that, for purposes of this report, I will be examining development through the lens of the MDG, as they highlight many of the areas that might otherwise be overlooked and they provide a holistic view of the most important factors of development in today's day and age.

As evidenced by the respective institutions dealing with both climate change and the MDG, the two are often treated as distinct issues with distinct solutions; however, it is not practical to separate them when they have become so intermeshed. The relationship between climate change and the MDG flows in both directions, with each one impacting and influencing the other as the global community seeks to halt one and promote the other (Orellana, 2010). The effects of climate change could have a serious, negative impact on the achievement of the MDG, and yet many people have blamed development, in a very capitalist sense, for bringing about the elevated levels of greenhouse gases in the atmosphere. It is a cycle of inequality where nations who developed first created the circumstances under which the world's poorer nations are most vulnerable to shifts in the global climate, and are unable to develop to a point where they are able to combat the dangerous effects of these shifts.

People residing in underdeveloped conditions are most vulnerable to the effects of climate change. Some of this is due to the geographic location, as some scholars posit that

geography is a key determinant of wealth, and therefore of development (Fig. 1) (Sachs et al., 2001).

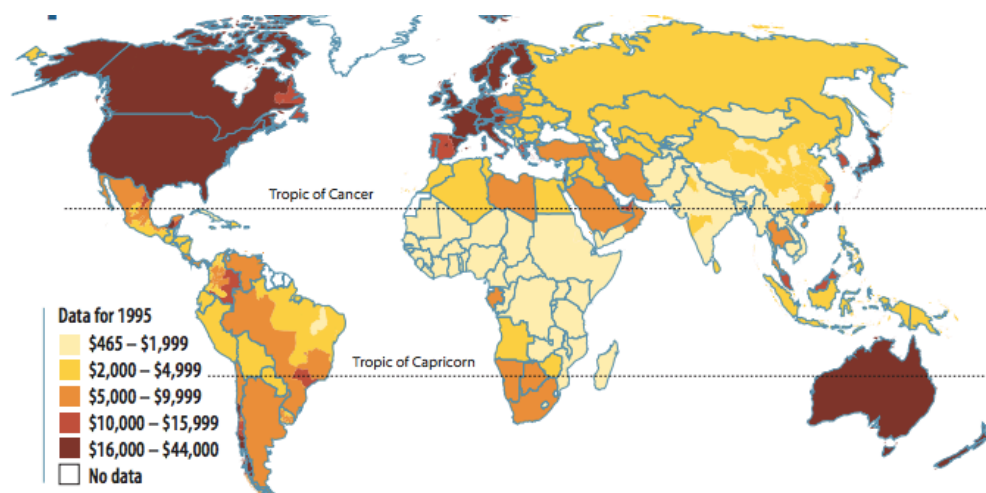


Fig. 1 Shows a map of the United States with areas colored according to the amount of GNP per capita derived from them (Sachs et al., 2001).

Sachs et al. use this visual representation of the world's wealth to demonstrate that nations that fall between the Tropic of Cancer and the Tropic of Capricorn are generally poorer than nations in temperate zones, and with that poverty comes underdevelopment (2001). Unfortunately it is also the tropics, as well as small island nations, that will be hit hardest by climate change.

Climate change is already causing global temperatures to rise, changes in patterns of precipitation, rising sea levels, a spread of disease, and more frequent weather-related disasters (World Bank, 2012). These factors combine to severely threaten agricultural productivity in developing nations, which in turn serves to undermine progress made in achieving the MDG of alleviating poverty, hunger, and health concerns. Looking at Fig. 2 it can be seen that the areas that will see the largest decrease in agricultural productivity match up closely with the world's poorest regions, as shown in Fig. 1.

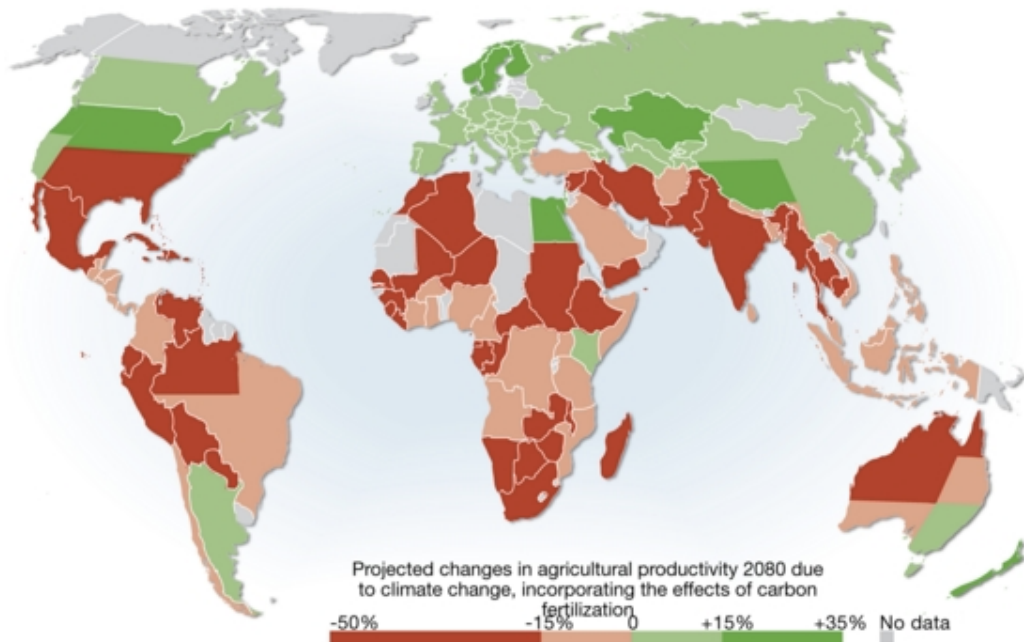


Fig 2. Changes in agricultural productivity projected for the year 2080 based on the effects of climate change (Ahlenius, 2008)

Beyond agricultural concerns, the threat from increased occurrence of natural hazards is detrimental to the billions of people in underdeveloped nations. People living in poverty have higher sensitivity and vulnerability to natural hazards, as it is typical that they are greatly reliant on natural resources for their livelihoods. This is especially true of those living in rural areas, where the possibility of diversifying their living is quite minimal. Poverty also brings with it a lack of access to resources, which are critical for rebuilding purposes in the wake of a natural disaster, and widespread lack of institutional support only exacerbates this issue (Smith, 2006).

Of course, the relationship goes both ways, and if the developing world were to continue along a path of development similar to Western countries, that is, a carbon-intensive development path, then the consequences for climate change would be overwhelming. Currently, 86% of the expected increase in carbon emissions is predicted to come from developing countries as they move towards a more energy-intensive economy (Guruswamy, 2012).

Development is typically squared off against protection of the climate, resulting in a game of “either/or” when it should be one of mutual progress (Baer et al., 2008). A large sum has thus far been expended on development initiatives to achieve the MDG, both private and public, yet all of the progress that has been made could be undone by climate change (UN 2007; World Bank, 2010). The UN’s development goals cannot be achieved if climate change is left unmitigated, and it would likewise be morally repugnant to abate climate change by repressing the billions living in the developing world (Prins et al., 2010). It is clear that both issues need to be addressed simultaneously, and that these strong connections need to be taken advantage of. As the Secretary General of the UN, Ban Ki-moon, stated in a general address to the press: “This is our opportunity to advance sustainable development; encourage new kinds of cleaner technologies, industries and jobs; and integrate climate change risks into national policies and practices” (UN, 2007).

Of course, it is one thing to claim that development cannot be had without accounting for climate change and vice versa, but for the purposes of this proposal it is equally important to demonstrate why the approaches should be combined into one. A basic reason for arguing for a joint approach is that there are limited global financial resources, particularly during times of economic depression, and channeling money towards an initiative that addresses two large-scale issues is naturally more efficient than addressing them separately. Also, the expenses generated by monitoring and regulating these programs is reduced by streamlining projects into a single approach.

Beyond the simple benefit of saving money, combining approaches towards climate change and global development also serves to inspire people to take action where they might otherwise not be willing. Climate change continues to be a contentious issue in many Western

nations, and with governments greatly divided on this topic it becomes more difficult to generate the funds necessary to address the problem. There remain those who do not adhere to a belief in climate change, and while they might be very opposed to diverting national resources towards adaptation and mitigation efforts, they may instead be very passionate about global poverty and underdevelopment. Some have called for a “no regrets” solution to climate change, that is to say one that is beneficial to people on a global scale even if predictions of disaster turn out to be wrong (Haines et al., 2007). From an inverse perspective, McDonald argues that climate justice could be used as a philosophy through which to promote development projects, and involve environmentalists more strongly in the issue (McDonald, 2010). Ultimately, combining the approach towards climate change and global development takes advantage of limited world resources and rallies more people to the cause; I will argue that this can be done through the spread of clean, sustainable energy access.

How Energy Access Addresses Climate Change

Energy and Mitigation Efforts

The purpose of the GCF is very clear, in that it specifies that funds are to be used for both adaptation and mitigation projects in the developing world (UNFCCC, 2011c), so any action plan that is designed must take both of these into consideration. With the proposal to increase clean energy access, mitigation is very direct in this case in that sustainable energy sources prevent the further addition of greenhouse gases to the atmosphere. As developing nations continue following a carbon-intensive development path, it is predicted that 86% of the expected increase in greenhouse gas emissions will come from developing countries (Guruswamy, 2012). Greenhouse gases do come from many sources, but it is fuel combustion associated with human energy demands that account for the largest percentage of these emissions, and as Smith and

Haigler state, “serious global mitigation will require major changes in energy production and use” (2008). If an alternative path to development could be negotiated, such as replacing fossil fuels with clean energy sources as this paper proposes, then a sizeable portion of this increase might be prevented, and greenhouse gas levels might have a better chance at being held within a steady range.

Black carbon emissions are another component of global climate change that can be addressed via the promotion of clean energy access in the developing world. Black carbon is described as being a carbonaceous aerosol, defined as carbon-rich substances suspended in a gas either in a solid particle or liquid droplet form, with some well known examples being smoke, haze, and air pollution (C2ES, 2010). Beyond being a serious health hazard, it ranks as the second leading cause of climate change, right behind carbon dioxide emissions, with the majority of emissions coming from the developing world, 25-35% from China and India alone (Ramanathan & Carmichael, 2008; C2ES, 2010). Black carbon affects the climate in two ways, the first being that the suspended particles trap heat in the air, which leads to warming, and the presence of the particles affects regional cloud formation and patterns of precipitation. Secondly, particles can become attached to snow and ice, decreasing the albedo and leading to the absorption of more heat, which causes snow and ice to melt faster (C2ES, 2010).

Black carbon is largely regional in its effect, and is predicted to be responsible for a significant portion of observed warming in the Arctic and the Himalayans. Unlike carbon dioxide, its residence time in the atmosphere is only one to four weeks, meaning that if the sources of black carbon could be targeted then notable improvements could be achieved relatively rapidly (Ramanathan & Carmichael, 2008). Currently, traditional cook stoves are seen to be one of the main culprits of black carbon emissions (C2ES, 2010), so a focus on delivering

clean alternatives to regions most in need via a clean energy initiative would go a long way in mitigating this major contributor to climate change.

Clean energy access would not only achieve significant mitigation goals in developing nations, but it has the potential to go beyond even this and impact emissions in the developed world as well. In order for sources of clean energy to reach developing nations, the appropriate technologies would first have to be produced by developed nations. The combination of the expenditure of time and resources and the mass distribution of these technologies should go a long way in making them viable options for developed countries, and perhaps facilitate a shift to cleaner energy sources in those nations as well.

Energy and Adaptation Efforts

While it would be ideal to simply employ mitigation tactics and eliminate the problem of climate change entirely, adaptation measures are equally needed as vulnerable populations are already being impacted by the shifting climate. Carbon dioxide in the atmosphere is the leading cause of climate change, and due to its unique nature it has the ability to remain in residence in the atmosphere for nearly 100 years, indicating that even if greenhouse gas emissions were to cease immediately, warming of the climate would still occur based on existing levels of carbon dioxide (World Bank, 2010). With this knowledge, international efforts to address climate change have shifted in recent years from direct efforts to reduce greenhouse gas emissions, to increasing countries' adaptive capacity to handle the higher temperatures, lower water availability, rising sea levels, and much more. Having already discussed how clean energy access will work towards mitigation efforts in the context of climate change, it is important to also consider how this tactic will increase adaptive capacity.

Right now, the majority of countries most impacted by climate change are developing ones, and due to this underdevelopment they are for the most part unable to take adaptive action. Many of these countries are now relying on aid programs from developed countries when disasters occur, and this system of reaction is ultimately undesirable. Instead of focusing on relief and disaster efforts after tragedy has struck, energy access will work to build up the resilience of the people most affected, so that these events do not strike them so strongly. Access to energy creates an increase in adaptive capacity that comes from many places, most of them tied to the increase in development that energy access brings, details for which can be found in the following section. Adaptive capacity is increased when a country's infrastructure and institutions are enhanced, all of which comes from long-term human and social development (Haines et al., 2007; Smit & Pilifosova, 2001).

One specific way that energy access ties in to adaptation techniques is the increased use of information and communication devices that is facilitated by sustainable energy, allowing people to be better prepared and organized in case of a disaster, and for everyday coping with a warming climate. Energy access also brings more reliability to agricultural practices, such as how an electric water pump allows farmers to be less reliant on rainfall to grow their crops, particularly when many regions are experiencing a severe drop in precipitation (Johnson & Lambe, 2009).

Ultimately, adaptive capacity comes through the resilience of a nation's people, and this resilience can be largely strengthened via development. Therefore, to truly understand how clean energy access can create adaptation in a country one must first examine how clean energy access builds development. This topic will be discussed at length in the following section, through an examination of clean energy and the MDG.

How Energy Access Address the MDG

As discussed previously, there are many different ways that development can be understood, and as an alternative to engaging with such a complex topic the Millennium Development Goals (MDG) will be used as a means to discuss the topic as it relates to energy access, and additionally to climate change. The MDG are not an exhaustive account of problems facing developing nations, but taken together they do touch on many of the primary impediments blocking the path to development. To review, the MDG are as follows: (1) Eradicate extreme poverty and hunger, (2) Achieve universal primary education, (3) Promote gender equality and empower women, (4) Reduce child mortality, (5) Improve maternal health, (6) Combat HIV/AIDS, malaria, and other diseases, (7) Ensure environmental sustainability, (8) Develop a global partnership for development. Access to clean energy addresses each of these goals, some more than others and in varying degrees of directness, and the following will briefly explore this relationship.

Eradicate Extreme Poverty and Hunger (MDG 1)

The first MDG focuses on reducing poverty and hunger among developing nations, and one way that energy access addresses this is through the agricultural sector. Agriculture is still a primary means of employment for many people residing in developing nations, and income generated from this practice directly relates to a family's overall poverty and their ability to keep food on the table. Energy technologies can assist in making farmers more productive, for example an electric water pump can serve to make farmers less reliant on natural precipitation or the manual transport of water to irrigate their fields. This leads to less vulnerability to seasonal variation and allows them to better handle periods of drought that are becoming more and more frequent (Modi et al., 2005). Another role for energy in the agricultural sector is in the form of

information and communication devices, such as internet and telephone services. These devices can serve to better connect rural laborers to urban markets, and allow them to stay better informed on crop prices so they can ensure they are receiving fair prices for their goods, and so that they can make informed decisions on what crops are the most appropriate to plant given current market conditions (Johnson & Lambe, 2009).

While agriculture is an important part of the economy in developing nations, it is important to also look at how energy might allow individuals to expand their sources of income, and therefore achieve better economic security. By implementing energy products in the physical maintenance of crops, less manual labor is required by farmers and their children, and more time becomes available to them to engage in other pursuits. For children, this might mean that they are more frequently able to attend school, and in many cases higher levels of education can lead to higher income earning potential later in life. For adults this could mean participating in alternative forms of income generation, and additionally having access to lighting at night allows for the pursuance of commercial activity well into the evening hours (Modi et al., 2005; Johnson & Lambe, 2009).

Achieve Universal Primary Education (MDG 2)

The role of energy access as it relates to universal primary education has been briefly discussed, but will again be examined here. A primary reason for keeping children out of school is that in the short term they are more valuable working at home than they are sitting in a classroom, and it can be difficult to take the long-term advantages of education into account when a family may be going hungry in the present. As discussed in the above section, energy products could have the effect of reducing the need for manual labor in the fields, and technologies such as electric water pumps and clean cook stoves reduce the need for children to

be fetching water and biofuels (Modi et al., 2005). By reducing the need for children to contribute to these activities at home, they are better able to consistently attend school and receive an education.

Illumination, or lighting, again plays a role in this MDG. An important part to any education is the ability to study the material and complete homework assignments outside of the classroom, and without proper access to lighting the ability of children to engage with their education is lessened. Clean energy access brings reliable lighting to individual homes, allowing children to study after dark without having to travel many miles to find lighting, or forgo studying all together (Johnson & Lambe, 2009). What is more, the most common source of illumination for poor households in the developing world is the use of kerosene lamps, which brings with it a number of problems. Kerosene, as a fuel source, has low efficiency for a high cost, and studies have found that up to \$36 billion is spent on this fuel source every year (The Economist, 2012). For households, this could mean spending between 10-25% of their income on lighting, and this is money that could instead be spent in a number of other ways that could benefit children's education. It could be used to pay school fees to send more children to school, or send them to better schools, or it could be used on medications or basic calories to improve a child's health and keep them more engaged in class material. The widespread use of kerosene has additional negative implications, and will be discussed throughout the sections that follow.

Promote Gender Equality and Empower Women (MDG 3)

An examination of the relationship between the empowerment of women and energy access is quite astounding, and unfortunately can only briefly be explored here. To begin with, it is important to note the increased stress placed on women in many developing countries that is brought on by climate change, as in many cases it is the women that are heavily responsible for

resource management and with these becoming scarcer and more prone to natural disasters, the burden placed on females is growing. This can lead to gender inequality as female children are more often pulled away from school in order to handle the growing scarcity of resources (Kammila et al., 2010), so it is important to look at how energy mitigates this effect.

Clean energy services can improve women's lives by addressing their practical, productive, and strategic needs at all levels of society. A large part of these benefits comes in the form of improved female health, most of which will be discussed in the following section, but it bears mentioning here, as poor health conditions are at the heart of gender inequality. As mentioned previously, technologies such as electric water pumps and clean cook stoves can act to greatly reduce the need for women to travel and carry heavy containers of water and wood over long distances, negatively impacting their bodies and their time. When less time is spent on laborious work, women are able to retain more energy to look after themselves, their children, and the elderly, which serves to increase the health of these populations. Also, in this way energy services work to remove the burden of resource gathering, and instead allow women to pursue activities that promote their independence and empowerment. With proper lighting brought by reliable, clean energy sources, women are able to engage in income-generating activities at night, and refrigeration technologies can assist them in preserving food products for local sale (Etuati, 2008). These activities are very important for female empowerment, as it allows women to earn their own income either for themselves or for the household, and this can bring them a sense of pride and economic power that they are not completely reliant on the men in their household (IFAD, 2010).

Another role for energy in female empowerment is the safety created by street lighting at night, which allows women to meet as a group with more security. This improves their mental

state, as it reduces feelings of isolation that women have been observed to experience, and anxiety is reduced via the sharing of information on reproductive and preventative health issues. This is a form of empowerment as well as an improvement in health, as it better prepares women to deal with many common afflictions native to developing countries that target them as well as their children (Etuati, 2008). Energy also brings the potential for communication devices, including mobile phones, internet access, radios and television. Some studies have shown that local television programs can be used as a medium to deliver messages of female equality, encouraging women to send their female children to school and to have less children overall (Kenny, 2011). This is only a small look at how clean energy can contribute to the achievement of the third MDG, and certainly there are many more ways this relationship is realized across the developing world.

Reduce Child Mortality and Improve Maternal Health (MDG 4 & 5)

Because clean energy access addresses these two MDG in very similar ways, I have chosen to discuss them as a single factor for the purposes of this paper. It was estimated that in 2000 there were 2.4 million premature deaths directly associated with the energy sector in developing nations, specifically, indoor and outdoor air pollution (Smith & Haigler, 2008). Approximately 76% of all global particulate matter air pollution comes from the developing world in the form of indoor burning of biomass fuel, and in many countries this accounts for up to 95% of domestic energy use (Fullerton et al., 2008). The widespread usage of biomass fuel is of extreme concern as there are numerous toxic products in the smoke, including particulate matter, hydrocarbons, free radicals, carbon monoxide, oxygenated organics, and chlorinated organics. This in turn leads to a high prevalence of disease amongst family members, particularly women and children who are most often indoors where cooking primarily takes place (Fullerton

et al., 2008; Campbell-Lendrum & Corvalan, 2007). By replacing traditional cook stoves with alternative forms that run on clean energy, a huge burden on women and children's health can be lifted and their quality of life improved.

Illumination also has a role to play in the health of women and children. As discussed previously, kerosene lamps are often used as a light source during the evening hours, and many health risks are associated with these objects. Kerosene-based devices have been documented to cause fires and explosions in many households, leaving people with severe burns, or even decimating entire complexes (Lam et al., 2012; Peck, 2011). Similar to biofuels, these lamps also emit pollutants that degrade indoor air quality, such as fine particulates, carbon monoxide, nitric oxides and other damaging substances. As mentioned when discussing biofuels, women and children are at greater risk from these poor conditions as they typically spend more time working in the household (Lam et al., 2012). Finding a cleaner alternative to kerosene would go a long way in improving indoor air quality and incidences of burns for women and children in many parts of the developing world.

Clean energy access can also contribute to improving health conditions in women and children through many of the ways mentioned in the previous section. Increased safety achieved via streetlamps allow women to gather and share health information, and access to reliable lighting and refrigeration technologies can contribute to women engaging in independent income-generating activities, giving them more money to spend on their children's and their own health. Many studies have shown that women are more likely than men to spend money feeding children and seeking medical care for them, so if more women are able to earn their own income it stands to reason that more money will go towards family healthcare (Todaro & Smith, 2008). There is also a role for information and communication devices, previously mentioned as

promoting female empowerment, but which can also be used to share health-related information (Kenny, 2011).

Combat HIV/AIDS, Malaria, and Other Diseases (MDG 6)

Looking beyond child mortality and maternal health, there are other serious health concerns facing the majority of the population in developing countries. In recent years, notable progress has been made in terms of diseases such as HIV/AIDS and malaria, and a lot of this has been done without energy services, such as distributing mosquito nets and condoms. Still, there is room for clean energy access to contribute to the fight against these diseases, and improve upon the progress that has already been made.

One way for this to occur is again through the information sharing devices that energy access provides. Knowledge on preventative actions can be spread via radios, televisions, and the internet, and practices can be made more socially acceptable through local television programs (Modi et al., 2005). Along the same lines, energy access has an indirect role in combating these diseases in that it makes it easier for children to attend school, where many health practices are communicated and implemented. Another direct connection is that energy access brings the potential for more widespread access to refrigeration technologies, allowing for medicines to be better stored and transported to areas where they are most in need. Ultimately, energy access provides the means to improve upon techniques already being used to combat HIV/AIDS, malaria, and other diseases.

Ensure Environmental Sustainability (MDG 7)

Environmental sustainability and clean energy access connect in multiple ways, most of these understood through the lens of climate change mitigation as described above. Right now, environmental systems around the world are under extreme duress as the climate shifts, and

much of the cause has been shown to have anthropogenic origins. The entirety of the developed world has for years pursued a carbon-intensive development path, relying on fossil fuel sources as a means of energy production and industrial strength, and the environment is paying the price. If developing nations are able to adopt clean energy sources early on in the development process, they could prevent the addition of countless tons of greenhouse gases to the atmosphere and in that way move towards environmental sustainability by mitigating climate change.

A switch from traditional biofuels to cleaner sources also facilitates environmental sustainability in that it halts massive deforestation in developing countries. Wood is a primary source of biofuel, and if alternative sources could lower demand, then this would greatly contribute to global efforts to curb deforestation.

Develop a Global Partnership for Development (MDG 8)

With the eighth MDG, the connection between energy access and a global partnership is made very clear through the proposal presented in this paper – that developed countries utilize the GCF to deliver clean energy technologies to the developing world. A clearer overview on how this might take place will be delivered following this section, however the take away point is that clean energy access cannot be realized in the developing world without extensive collaboration and partnership across the globe and between all nations.

Overview

Ultimately, a lot of good is predicted to come from increasing access to clean energy sources in the developing world, but not all predictions are good and some studies call into question the feasibility of achieving such widespread distribution of reliable and renewable sources. As with any discussion on development, it is questionable whether the imposition of foreign technology will be appreciated and utilized in the manner that it is intended, and if the

technology will truly be effective or if in fact it requires an institutional framework that is still lacking in many of the regions most in need. The problem is truly complex and the answers not at all clear at this point in time, but the following section will work to outline the potential role of the GCF in realizing the connections between clean energy access, the MDG, and mitigation and adaptation of climate change.

The Application of the GCF to Address Clean Energy Access

The role of clean energy access as it relates to both climate change and development has been thoroughly explored, and now the question remains as to how this can be accomplished. It is here that the GCF has the potential to play a major role. The fund was created in 2009 in Copenhagen, and although many logistical decisions have been made regarding its functioning, there remains considerable room to define the exact use of the proposed US\$100 billion annually. The official writing states that “the Board must balance the provision of the Green Climate Fund between adaptation and mitigation proposals”, so the opportunity to focus the fund towards a project such as clean energy is still technically, if not practically, a possibility (UNFCCC, 2011c).

When it comes to climate change, one noted failing of financial mechanisms in the past has been their tendency to spread insufficient money across too wide a range of projects, resulting in limited success. Others have noted the same occurrence in terms of development-oriented aid projects, where focusing on a project with broad objectives leads to minimal impact (Birdsall et al., 2005; Easterly, 2006). Because the proposal to target clean energy access addresses both climate change and development, it becomes increasingly important to narrowly define how this might be brought about. Aid of any type can prove ineffective if there are too

many donors spreading money across a number of projects, so the benefit of utilizing the GCF for this project is in attempting to narrow the field of focus and implementation. A review of the literature on the GCF reveals that many experts are concerned that the fund will be unable to find a unique enough niche to avoid supplanting other programs already in existence, so by defining the fund to a narrow target will additionally help to alleviate concerns of this nature (Bird et al., 2011).

How exactly will the money of the GCF be spent in order to bring about clean energy access in the developing world? One way to answer this is simply via technology transfer from developed nations to the developing ones. Many investors supporting existing energy technologies are not willing to engage in projects with high up-front costs that require long payback periods, as there is significant risk involved in renewable energy and energy efficiency projects (Beg et al., 2002). Many communities most in need of clean energy access are located in remote areas in developing nations, and they become reliant on non-governmental organizations (NGOs) for any sort of energy services, as they do not prove to be an attractive investment. The GCF could provide the necessary funds that would allow developing regions to undertake these projects.

Pedersen talks about the “tipping point” required for energy access projects, described as the point at which a project becomes ambitious enough to “provide a critical mass sufficient to support all of the foundational applications of an energy ecosystem” (2009). As has been explored in the previous section, there are numerous benefits that can be derived from energy access, such as increased agricultural productivity and health improvements; however, these benefits cannot be realized if the energy project is not extensive enough to provide a multitude of services in all of the necessary areas. This raises the question as to what types of technology

would be most effective to transfer. Some efforts have already focused on de-centralized renewable energy technologies, such as solar stoves and treadle pumps, and a number of NGOs have engaged in efforts to bring these technologies directly to people most in need (Johnson & Lambe, 2009). Many of these initiatives have proved effective in addressing very specific targets, but fail to power communities to the point of complete access to sustainable energy.

This leads to a secondary, though equally important, role for the GCF in achieving clean energy access in developing nations – research and development initiatives. Research efforts must be increased in order to find answers to many of the questions surrounding clean energy access; such as, do underdeveloped communities need to be included into an energy grid in order to realize full benefits, and if so, how will this be achieved? A lot of dedicated people and organizations across the globe have been engaged in answering these questions, and while admirable, their efforts could be capitalized upon via increased funding. Many nations have already developed renewable energy technologies, such as solar photovoltaic and thermal energy, wind energy, tidal energy, and biofuels, and these technologies could go a long way in benefiting urban areas in developing nations that already have an energy grid in place (Kammen, 2010). For the more rural areas, significant research and development is necessary.

Using the GCF to increase research and development efforts has an additional benefit, which is lending support to similar projects in developing countries. For years there have been movements in countries such as the United States to embrace renewable energy technologies, yet lobbying and subsidies for carbon-intensive sources has proven to be a formidable barrier preventing the serious funding of research and development projects. By utilizing the GCF as a platform from which to mobilize the necessary resources required for such projects, renewable technologies could become more highly refined and economically competitive in developed, as

well as developing, markets. Of course, some technologies would be specific to the needs of developing nations, but with more and more countries revealing emergent industrialized centers, it is expected that an arsenal of technologies will be needed.

To summarize, the GCF can be used to mobilize a transfer of existing clean energy technologies, as well as provide funding for research and development efforts targeted at the developing world. Program development, maintenance, and monitoring must also be considered as part of the financial outputs of the fund, but this is expected to occur in conjunction with the other functions of the fund. This overview of fund application has been purposefully brief, and there are admittedly many unexplored facets of this proposal. While it is a useful exercise to explore potential avenues for the evolution of policy within the UNFCCC, it would be remiss to ignore the very real conditions under which this proposal would be taking place. It is by no means an exhaustive prescription of policy, simply an exploration meant to broaden the range of possibilities under consideration by international governing bodies. That being said, it is important to acknowledge and discuss the flaws in this proposal.

Problems with this Model

The policy model that has been presented in this paper is only a basic outline of how to bring clean, renewable energy to the developing world, and yet even this theoretical proposal contains a number of potential flaws that are worth mentioning here.

An initial concern is that many of the countries most in need of clean energy technologies suffer from corrupt governments, typically in combination with ailing institutions, which can make it difficult to ensure that money is being used appropriately and effectively (Easterly, 2001). This presents an additional challenge of having to divert a portion of resources away from

research and development initiatives and implementation programs, and instead utilize time and money to investigate country-specific conditions and develop unique avenues for delivery in each instance. Of course, a degree of bottom-up design is desirable in this situation, as it is proposed that energy services be delivered to a number of nations with differing environmental and geographical conditions, governing bodies, and cultural practices – and yet such an undertaking is monumental and intimidating if it is to fall under a single governing entity, namely the governing board of the GCF. There are of course existing models on which to base new programs, for example *Elephant Energy* working to deliver energy services in Namibia, but the scale of the project might appear to many as unapproachable.

The issue of time with this proposal is a major one, as it can be difficult to predict the timescale over which significant results might be seen from this model, begging the question as to if it will be soon enough to effectively address the ill effects of climate change. Already scientists are abandoning the possibility of holding the world to a 2⁰C increase in temperature, while in the same breath they are declaring that a 1.5⁰C increase is the only amount that the Earth could sustain without major consequences for human kind (World Bank, 2010). The time required to develop a range of clean energy technologies that can be employed across countries with varying requirements and infrastructure could take any number of years to achieve, as there are many conditions to take into account and a high output of innovation required (Pedersen, 2009). In addition to this, the time frame required for largely redirecting the policy agenda of the UNFCCC must be considered, as the institution has many members and many interests that must be reconciled before any new treaty can be agreed to and implemented – all of this preceding the required process of research and development.

Unfortunately, while time may be a serious factor to overcome in dealing with the UNFCCC there is an even bigger issue at the heart of this proposal, that is the question of whether UNFCCC representatives will still agree to the terms of the GCF if the overarching goal is adjusted to reflect a focus on clean energy access. As discussed in the previous section, there is still considerable room to define the objectives of the GCF, and yet the process of solidification is moving forward every day, closing the gap available to redirect the policy model of the UNFCCC and incorporate this into the purpose of the GCF. This creates the problem as to how a revised goal for the fund can be moved forward in the arena of international climate change politics, and this is not a question that can be easily answered, as at the heart of it rests the issue of inequality.

It would be impractical to consider any proposal on climate change adaptation and mitigation without at least in part addressing the inequality inherent in the issue. This idea has been briefly touched on in the concept of “common but differentiated responsibility”, and yet the problem runs much deeper than that. Inequality has always been a large contributing factor in why the world cannot come to an agreement on climate change, as nations have differing responsibility for the problem, differing vulnerability, and uneven participation in global efforts to solve the problem. This inequality is apparent in both environmental and economic regimes, and yet a nation’s economic influence holds great weight in the power it wields to influence decision making at institutions such as the UNFCCC. Even when nations can agree that there is a problem, there remains the concern of how to bring about solutions to ‘general fairness’ issues, and states holding this increased economic power must resist the attraction of pursuing solutions with short-term payoff that might take advantage of weaker states (Parks & Roberts, 2010). By acknowledging this inequality, it must also be acknowledged the difficulty of introducing and

adopting such radical approaches as clean energy access as a policy model. The probability of agreement is unclear and highly debatable.

Conclusion

The issue of climate change has been widely recognized now for many years and the effects felt all around the world, yet the global community is still seeking appropriate and effective solutions to the problem. Nearly fifteen years of the Kyoto Protocol has not led to any significant results, and in many ways the problem continues to grow rather than abate. Now is the time to be searching for new and innovative ways of approaching the issue and developing solutions that will have real and lasting impacts for the environment and for human kind.

The proposal to use the money in the GCF as a means of bringing clean energy access to the developing world is certainly a radical one, and as previously discussed it is accompanied by a myriad of complications that rightfully call into question the viability of this plan. Looking at it very broadly, the spread of clean energy access could contribute to mitigation and adaptation efforts, as well as working toward the MDG, but without more nuance it is easy to see where such a plan might go wrong. To add to this list of potential roadblocks is the very real possibility the US\$100 billion promised annually will not be realized, and the GCF will simply turn out to be another empty effort and failed tactic on the road to climate change mitigation and adaptation. This might very well come to pass, but ultimately the realization of this proposal is less important than what it represents.

This paper has sought to conjure a basic outline of the potential benefits of bringing clean energy access to the developing world, along with the many barriers standing in the way of its achievement - but its purpose does not lie solely in providing the right answer. Instead, this work

is a call to action for scholars, policy makers, and national leaders alike, urging them to take advantage of this crisis period. It is clear that past solutions have not done enough to solve the climate issue, and with a new legal agreement to be decided in 2015 the time to act is now. Climate change is unlike any problem that humanity has yet faced, and its impacts will be felt on the environmental, economic, political, and societal levels, so our solutions must take the same approach. Instead of isolating climate change and removing it from all contexts, policy makers should be engaging with issues that elevate the problem to its rightful complexity. Development, as a concept, is inextricably linked with climate change, and if the global community ever hopes to see real improvement made on either of these matters, it is time they started focusing on the bigger picture, not just the individual pieces of the puzzle.

Bringing clean energy access to the developing world might be unfeasible in the way that I have proposed, but I do hope that it serves to generate international discussions that take into consideration the boundless opportunities facing us here and now. It is possible that we can find a way out of the climate crisis without sacrificing human dignity, perhaps even in a manner that would allow us to come away having gained something, but only if serious changes are made. Policy makers need to be mindful of the failures of the past and the opportunities of the present, in order to come away with a solution for a better future, and that starts here and now.

Bibliography

- Ahlenius, H. (2008). "Projected Agriculture in 2080 Due to Climate Change". [graphic]. *Environment and Poverty Times #5: Pro-Poor Growth Issue*. Retrieved from *GRID Arendal: A Center Collaborating with UNEP*.
- Baer, P., Athanasiou, T., Kartha, S. & Kemp-Benedict, E. (2008). *The Greenhouse Development Rights Framework: The Right to Development in a Climate Constrained World*, revised second edn. Berlin: Heinrich Boll Foundation, Christian Aid, EcoEquity and the Stockholm Environment Institute.
- Beg, N., Morlot, J., Davidson, O., Afrane-Okesse, Y., Tyani, L., Denton, F., Sokona, Y., Thomas, J., La Rovere, E., Parikh, J., Parikh, K. & Rahman, A. (2002). Linkages Between Climate Change and Sustainable Development. *Climate Policy*, 2:2, 129-144. Retrieved from <http://www.tandfonline.com/doi/pdf/10.3763/cpol.2002.0216>
- Bird, B., Brown, J. & Schalatek, L. (2011). Design Challenge for the Green Climate Fund: Climate Funds Update – Climate Finance Policy Briefs, January 2011. *Overseas Development Institute*. Retrieved from <http://www.odi.org.uk/resources/details.asp?id=5256&title=design-challenges-green-climate-fund>
- Birdsall, N., Rodrik, D. & Subramanian, A. (2005). If Rich Governments Really Cared About Development. *Working Paper, International Center for Trade and Sustainable Development, Geneva*.
- Blanchard, O., Criqui, P., Kitous, A. & Viguier, L. (2003). Combining Efficiency With Equity: A Pragmatic Approach, in I. Kaul, P. Conceicao, K.I. Le Goulven & R.U. Mendoza (eds), *Providing Global Public Goods: Managing Globalization*, New York, NY: Oxford University Press.
- Bredenkamp, H. & Pattillo, C. (2010). Financing the Response to Climate Change. *International Monetary Fund*. Retrieved from <http://www.economicswbinstitute.org/essays/imf-greenfund.pdf>
- Campbell-Lendrum, D. & Corvalan, C. (2007). Climate Change and Developing-Country Cities: Implications for Environmental Health and Equity. *Journal of Urban Health*, 77(1), 109-117. doi: 10.1007/s11524-007-9170-x
- Caperton, R. (2011). The Green Climate Fund Is Good for Business and Humanity. *Think Progress: Climate Progress*. Retrieved from <http://thinkprogress.org/romm/2011/12/16/390847/the-green-climate-fund/?mobile=nc>

- Capterton, R. & Light, A. (2011). Making the Green Climate Fund a Reality: A Durban Push Could Launch Tool to Help Developing Countries Respond to Global Warming. *Center for American Progress*. Retrieved from http://www.americanprogress.org/issues/2011/12/green_climate_fund.html
- Center for Climate and Energy Solutions (C2ES). (2010). What is Black Carbon? *Center for Climate and Energy Solutions*. Retrieved from <http://www.c2es.org/publications/black-carbon-climate-change>
- Center for Climate and Energy Solutions (C2ES). (2012). Outcomes of the U.N. Climate Change Conference in Doha, Qatar. *Center for Climate and Energy Solutions*. Retrieved from <http://www.c2es.org/docUploads/c2es-cop-18-summary.pdf>
- Chaum, M., Faris, C., Wagner, G., Buchner, B., Falconer, A., Trabacchi, C., Brown, J. & Sierra, K. (2011). Improving the Effectiveness of Climate Finance: Key Lessons. *Joint project between The Environmental Defense Fund, Climate Policy Initiative, Overseas Development Institute and Brookings*.
- Cooper, R. (1998). Toward a Real Global Warming Treaty. *Foreign Affairs*, 77(2) 66-79.
- de Gouvello, C., Zelenko, I., & Ambrosi, P. (2010). *A financing facility for low-carbon development*. (No. 9780821385210). Washington, D.C.: The World Bank. doi:10.1596/978-0-8213-8521-0
- Department for International Development, Directorate General for Development European Commission, United Nations Development Programme, & The World Bank. (2002). *Linking Poverty Reduction and Environmental Management: Policy Challenges and Opportunities*. Washington, D.C. Retrieved from http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2002/09/27/000094946_02091704130739/Rendered/PDF/multi0page.pdf
- Dubash, N. (2009). Climate Change and Development: A Bottom-Up Approach to Mitigation for Developing Countries? In Stewart, R. B., Kingsbury, B., & Rudyk, B. (Eds.), *Climate finance: Regulatory and funding strategies for climate change and global development*. New York: New York University Press.
- Easterly, W. (2001). *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics*. MIT Press, Cambridge, Massachusetts.
- Easterly, W. (2006). *The White Man's Burden: Why the West's efforts to aid the rest have done so much ill and so little good*. Penguin Books.
- (The) Economist. (2012). *Lighting the Way*. The Economist: Technology Quarterly – Q3 2012.
- Etuati, K. (2008). Challenges and Recommendations for Clean Development Mechanism Aiming to Improve Women's Livelihood in the Pacific Region. *Pacific Islands Applied Geoscience*

Commission: Community Lifelines Programme. Retrieved from http://www.sprep.org/att/IRC/eCOPIES/pacific_region/660.pdf

Fullerton, D., Bruce, N. & Gordon, S. (2008). Indoor Air Pollution from Biomass Fuel Smoke is a Major Health Concern in the Developing World. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 102(9), 843-851. doi: 10.1016/j.trstmh.2008.05.028

Guruswamy, L. (2007). Collapse: Can International Law Protect the Earth's Natural Resources? – Judging Treaties. *The American Society of International Law: Proceedings of the 101st Annual Meeting*, March 28-31, 2007, Washington, DC.

Guruswamy, L. (2012). International Environmental Law: In a Nutshell. *Thomson Reuters*, 4th ed., United States of America.

Haines, A., Smith, K., Anderson, D., Epstein, P., McMichael, A., Roberts, I., Wilkinson, P., Woodcock, J. & Woods, J. (2007). Policies for Accelerating Access to Clean Energy, Improving Health, Advancing Development, and Mitigating Climate Change. *The Lancet*, 370(9594), 1264-1281.

Haines, A., McMichael, A., Smith, K., Roberts, I., Woodcock, J., Markandya, A., Armstrong, B., Campbell-Lendrum, D., Dangour, A., Davies, M., Bruce, N., Tonne, C., Barrett, M. & Wilkinson, P. (2009). Public Health Benefits of Strategies to Reduce Greenhouse-Gas Emissions: Overview and Implications for Policy Makers. *The Lancet*. doi: 10.1016/S0140-6736(09)61759-1

High-Level Advisory Group on Climate Finance (AGF). (2010). Report of the Secretary-General's High-Level Advisory Group on Climate Change Financing. *United Nations*. Retrieved from http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGF_reports/AGF%20Report.pdf

Hultman, N. E., Boyd, E., Roberts, J. T., Cole, J., Corbera, E., Ebeling, J., & Liverman, D. M. (2009). How Can the Clean Development Mechanism Better Contribute to Sustainable Development? *Ambio*, 38(2), 120-2. Retrieved from <http://search.proquest.com/docview/207668773?accountid=14503>

International Fund for Agricultural Development (IFAD). (2010). *Rural Poverty Report 2011: New Realities, New Challenges: New Opportunities for Tomorrow's Generation*. Rome, Italy: International Fund for Agricultural Development.

Johnson, F. & Lambe, F. (2009). Energy Access, Climate and Development. *Commission on Climate Change and Development – Stockholm Environment Institute*. Retrieved from <http://www.ccdcommission.org/Filer/commissioners/Energy.pdf>

Kammen, D. (2010). Renewable Energy. In S. Schneider, A. Rosencranz, M. Mastrandrea, & K. Kuntz-Duriseti (Eds.), *Climate Change Science and Policy* (pp. 446-455). Washington, DC: Island Press.

- Kammila, S., Nyandiga, C., Wanjiru, L., Salvemini, D. & Kurukulasuriya, P. (2010). Millennium Development Goals and Climate Change Adaptation: The Contribution of UNDP-GEF Adaptation Initiatives Towards MDG3. *United Nations Development Programme*. Issue #2.
- Kenny, C. (2011). *Getting Better: Why Global Development is Succeeding – And How We Can Improve the World Even More*. New York, NY: Basic Books – Perseus Books Group.
- Lam, N., Smith, K., Gauthier, A., & Bates, M. (2012). Kerosene: A Review of Household Uses and Their Hazards in Low- and Middle-Income Countries. *Journal of Toxicology and Environmental Health Critical Review*, 15(6), 396-432. doi: 10.1080/10937404.2012.710134
- Lattanzio, R. (2011). *International climate change financing: The green climate fund (GCF)*. (CRS Report for Congress No. 7-5700). Congressional Research Service.
- Lattanzio, R. & Leggett, J. (2011). *International climate change financing: Needs, sources, and delivery methods*. (CRS Report for Congress No. R41808). Congressional Research Service.
- Lawson, V. (2007). *Making Development Geography*. London: Hodder Education.
- Legros, G., Havet, I., Bruce, N., & Bonjour, S. (2009). The Energy Access Situation In Developing Countries: A Review Focusing on the Least Developed Countries and Sub-Saharan Africa. *The United Nations Development Program and The World Health Organization*. New York, NY: Environment and Energy Group; Bureau for Development Policy.
- McDonald, M. (2010). Climate Change Impacts on the Achievement of the Millennium Development Goals: Can We Afford Not to Integrate? *Realizing Rights: The Ethical Globalization Initiative; Global Campaign for Climate Action; Global Call to Action Against Poverty*. Retrieved from <http://www.slideshare.net/Z3P/a3e76>
- McMichael, A., Woodruff, R. & Hales, S. (2006). Climate Change and Human Health: Present and Future Risks. *Lancet*, 367, 859-69. doi: 10.1016/50140-6736(06)68079-3
- Modi, V., McDade, S., Lallement, D., & Saghir, J. (2005). *Energy Services for the Millennium Development Goals*. New York: Millennium Project; United Nations Development Programme; World Bank; Energy Sector Management Assistance Programme.
- Orellana, M. (2010). Climate Change and the Millennium Development Goals: The Right to Development, International Cooperation and the Clean Development Mechanism. *Sur – International Journal on Human Rights*, 7, 12, 144-183.
- Padma, T., Bafana, B. & Nordling, L. (2011). Climate Deal Leaves Questions on Green Fund and Tech Transfer. *Nature: International Weekly Journal of Science*. Retrieved from <http://www.nature.com/news/climate-deal-leaves-questions-on-green-fund-and-tech-transfer-1.9638>

- Parks, B. & Roberts, J. (2010). Addressing Inequality and Building Trust to Secure a Post-2012 Global Climate Deal. In M. Boykoff (Ed.), *The Politics of Climate Change: A Survey* (pp. 111-135). New York: NY, Routledge.
- Patz, J., Campbell-Lendrum, D. Gibbs, H. & Woodruff, R. (2008). Health Impact Assessment of Global Climate Change: Expanding on Comparative Risk Assessment Approaches for Policy Making. *Annual Review of Public Health*, 29, 27-39. doi: 10.1146/annurev.pubhealth.29.020907.090750
- Peck, M. (2011). Epidemiology of Burns Throughout the World – Part I: Distribution and Risk Factors. *Burns*, 37(7), 1087-1100. doi: 10.1016/j.burns.2011.06.005
- Pedersen, A. (2009). Financing Energy Access on the Edge of the World. *Colorado Journal of International Environmental Law and Policy*, 21:2, 355-380.
- Podest, E. (2012). Conclusions and Reflections: Eleventh-Hour Agreement. *Global Climate Change: NASA's Eyes on Earth*. [blog].
- Powell, A. (2012). Climate Change on World Stage: Q&A with Robert Stavins on Prospects for Adopting a Plan to Confront It. *Harvard Gazette*. Retrieved from <http://news.harvard.edu/gazette/story/2012/12/climate-change-on-world-stage/>
- Practical Action. (2013). *Poor People's Energy Outlook: Energy for Community Services*. Practical Action. Practical Action Publishing Ltd., Warwickshire, UK
- Prins, G., Galiana, I., Green, C., Grundmann, R., Hulme, M., Korhola, A., Laird, F., Nordhaus, T., Pielke, Jr., R., Rayner, S., Sarewitz, D., Shellenberger, M., Stehr, N., and H. Tezuka. (2010). The Hartwell Paper: A new direction for climate policy after the crash of 2009. *Institute for Science, Innovation & Society, University of Oxford; LSE Mackinder Programme, London School of Economics and Political Science*.
- Prins, G. & Rayner, S. (2007a). Time to Ditch Kyoto. *Nature*, 449(7165), 973-975. doi:10.1038/449973a
- Prins, G. & Rayner, S. (2007b). The Wrong Trousers: Radically Rethinking Climate Policy. *Institute for Science, Innovation and Society, Oxford, UK*. Retrieved from <http://eureka.bodleian.ox.ac.uk/66/1/TheWrongTrousers.pdf>
- Ramanathan, V. & Carmichael, G. (2008). Global and Regional Climate Changes Due to Black Carbon. *Nature Geoscience*, 1, 221-227. doi: 10.1038/ngeo156
- Rao, P. K. (2010). *The architecture of green economic policies*. Heidelberg; New York: Springer.

- Rittel, H. & Webber, M. (1973). Dilemmas in a General Theory of Planning. *Elsevier Scientific Publishing Company – Amsterdam*. Retrieved from <http://www.springerlink.com/content/m5050140x48140m3/>
- Ritter, K. & Casey, M. (2012). UN Climate Conference: Kyoto Protocol Extended at Doha, Qatar Talks. *Huffington Post: Green*. Retrieved from http://www.huffingtonpost.com/2012/12/08/un-climate-conference-kyoto-doha-qatar_n_2262371.html
- Roberts, J. T. & Parks, B. C. (2007). A Climate of Injustice: Global Inequality, North-South Politics, and Climate Policy. *The Massachusetts Institute of Technology: Cambridge, Massachusetts; London, England*.
- Roberts, J. T., Stadelman, M. & Huq, S. (2010). Copenhagen's Climate Finance Promises: Six Key Questions. *International Institute for Environment and Development (IIED) Briefing, February 2010*. Retrieved from www.iied.org/pubs/pdfs/17071IIED.pdf
- Romani, M. & Stern, N. (2011). Delivering Climate Finance: Principles and Practice for Funding the Fund. *Centre for Climate Change Economics and Policy Grantham Research Institute on Climate Change and the Environment. London: London School of Economics and Political Science*.
- Sachs, J., Mellinger, A., & Gallup, J. (2001). The Geography of Poverty and Wealth. *Scientific American, March, 70-6*.
- Smit, B. & Pilifosova, O. (2001). Adaptation to Climate Change in the Context of Sustainable Development and Equity. J.J. McCarthy, O. Canziani, N.A. Leary, D.J. Dokken, K.S. White (Eds.), *Climate Change 2001: Impacts, Adaptation and Vulnerability*. IPCC Working Group II, Cambridge University Press, Cambridge, pp. 877–912.
- Smith, D. (2006). *Just One Planet: Poverty, Justice and Climate Change*. Warwickshire, UK: Intermediate Technology Publications Ltd.
- Smith, K. & Haigler, E. (2008). Co-Benefits of Climate Mitigation and Health Protection in Energy Systems: Scoping Methods. *Annual Review of Public Health, 29*, 11-25. doi: 10.1146/annurev.pubhealth.29.020907.090759
- Smith, S. & Todaro, M. (2008). *Economic Development: 10th Edition*. [textbook]. New York, NY: Addison Wesley
- Stewart, R. B., Kingsbury, B., & Rudyk, B. (2009). *Climate finance: Regulatory and funding strategies for climate change and global development*. New York: New York University Press.
- The World Bank. (2012). Climate Change and the World Bank. *The World Bank*. Retrieved from <http://climatechange.worldbank.org/overview>

- United Nations. (1992). United Nations Framework Convention on Climate Change. *FCCC/INFORMAL/84 GE.05-62220 (E) 200705*.
- United Nations. (1998). Kyoto Protocol to the United Nations Framework Convention on Climate Change. Retrieved from <http://unfccc.int/resource/docs/convkp/kpeng.pdf>
- United Nations. (2007). *Secretary-General Address to High-Level Event: SG/SM/11175, GA/10619, ENV/DEV/950*. Department of Public Information, News and Media Division, New York. Retrieved from <http://www.un.org/News/Press/docs/2007/sgsm11175.doc.htm>
- United Nations. (2012). UNFCCC and the Kyoto Protocol. *Gateway to the United Nations Systems Work on Climate Change*. Retrieved from <http://www.un.org/wcm/content/site/climatechange/pages/gateway/the-negotiations/the-un-climate-change-convention-and-the-kyoto-protocol>
- United Nations Committee for Development Policy. (2009). *Achieving sustainable development in an age of climate change: Policy note*. New York: United Nations.
- United Nations Framework Convention on Climate Change. (2011a). Report of the Transitional Committee for the Design of the Green Climate Fund. *United Nations Framework Convention on Climate Change*. Retrieved from http://unfccc.int/cooperation_and_support/financial_mechanism/green_climate_fund/items/5869.php
- United Nations Framework Convention on Climate Change. (2011b). Annex I – Draft Governing Instrument for the Green Climate Fund. Retrieved from http://unfccc.int/files/cancun_agreements/green_climate_fund/application/pdf/advance_version_fccc_cp_2011_6_report_of_the_tc_to_the_cop.pdf
- United Nations Framework Convention on Climate Change. (2011c). Decision 3/CP.17 – Launching the Green Climate Fund. *FCCC/CP/2011/9/Add.1*. Retrieved from <http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf#page=55>
- United Nations Framework Convention on Climate Change. (2012a). Transitional Committee for the Design of the Green Climate Fund. *United Nations Framework Convention on Climate Change*. Retrieved from http://unfccc.int/cooperation_and_support/financial_mechanism/green_climate_fund/items/5869.php
- United Nations Framework Convention on Climate Change. (2012b). Full Text of the Convention: Article 2. *United Nations Framework Convention on Climate Change*.
- United Nations Framework Convention on Climate Change. (2012c). Full Text of the Convention: Article 3. *United Nations Framework Convention on Climate Change*.
- United Nations Framework Convention on Climate Change. (2012d). Kyoto Protocol. *United Nations Framework Convention on Climate Change*.

- United Nations Statistics Division. (2008). Millennium Development Goals Indicators: The Official United Nations site for the MDG Indicators. *United Nations Statistics Division*. Retrieved from <http://mdgs.un.org/unsd/mdg/host.aspx?Content=indicators/officiallist.htm>
- Verweij, M., Douglas, M., Ellis, R., Engel, C., Hendriks, F., Lohmann, S., Ney, S., Rayner, S. & Thompson, M. (2006). Clumsy Solutions for a Complex World: The Case of Climate Change. *Public Administration*, 84(4), 817-843. doi: 10.1111/j.1540-8159.2005.09566.x-il
- Victor, D. (2010). Global Warming Policy After Copenhagen. [lecture]. *Willard W. Cochrane Lecture in Public Policy – University of Minnesota*.
- (The) World Bank. (2010). *Overview: Changing the Climate for Development*. World Development Report 2010. Retrieved from <http://web.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTWDRS/0,,contentMDK:23062354~pagePK:478093~piPK:477627~theSitePK:477624,00.html>