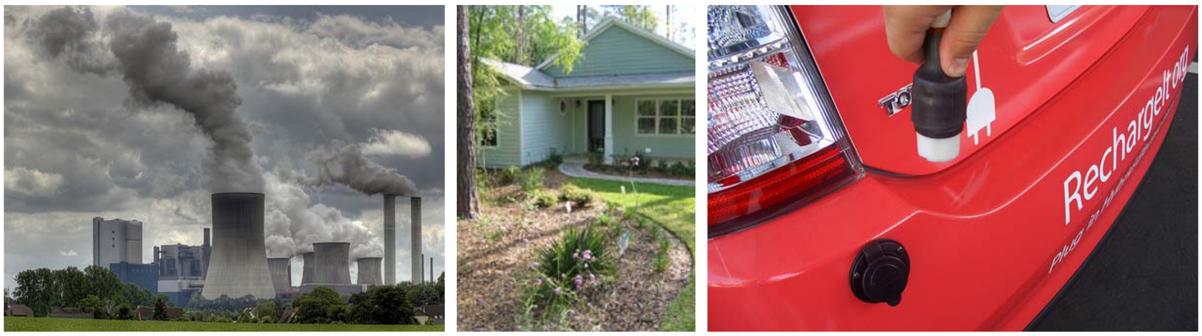
DRAFT WHITE PAPER & MODEL CONTRACT

Climate Change, Peak Oil, and Greenhouse Gas Emissions Reductions: Mitigating the Convergence Via Energy Efficiency in the Built Environment[1]



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[1] This white paper and draft emissions trading agreement do not constitute legal advice or the provision of, or any agreement to provide, any form of legal services.

[2] Photo #1: Coal power plant south-west of Düsseldorf and Neuss, Germany. Photo by Br uno & Lígia Rodrigues (CC) © 2006. Photo #2: Energy efficient house. Photo by University of Florida. Photo #3: Plug-In Hybrid Electric Vehicle. Photo by Flickr User Hysterical Bertha (CC) © 2007.

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Abstract

As a result of the interconnected challenges of climate change and peak oil, the global economy is expected to become increasingly carbon constrained in the near future. There are both positive and negative synergies in the proposed mitigation strategies and potential future scenarios within this convergence of climate change and peak oil. Carbon markets and/or other regulatory alternatives can serve as prosperous pathways to greenhouse gas (GHG) emissions reductions and energy switching strategies. Pacala & Socolow (2004) suggested "improvements in [energy] efficiency and conservation probably offer the greatest potential to provide [GHG emissions mitigation] wedges." More specifically, the building sector accounts for approximately 48% of annual U.S. GHG emissions (36% of the direct energy related GHG emissions and an additional 8-12% of total GHG emissions related to the production of materials used in building construction) (AIA, ; Architecture2030, 2007; Nässén, Holmberg, Wadeskog, & Nyman, 2007).

Furthermore, individual households account for approximately 50% of the GHG emissions in the building sector (Abrahamse, Steg, Vlek, & Rothengatter, 2007; Greening, Ting, & Krackler, 2001). Though the U.S. Climate Change Science Program estimates homes can achieve GHG emissions reductions up to 70% with current best practices (McMahon, McNeil, & Ramos, 2007), considerable challenges await GHG emissions mitigation in the residential sector. Within the voluntary carbon offset markets, the three most significant challenges are defining additionality, monitoring and verification of the actual offsets, and enforcement of ownership (Gillenwater, Broekhoff, Trexler, Hyman, & Fowler, 2007). Additional challenges include leakage, securitization, and permanence of GHG emissions reductions.

This white paper provides a brief background on the interlinked challenges of climate change and peak oil, the role of the building sector within carbon trading schemes, the unique opportunities and constraints for energy efficiency and energy conservation, and the implications of climate change mitigation and adaptation for Florida's urban infrastructure. Draft contract language for GHG emissions reductions purchase agreements (ERPAs) is also provided.

The model contract for an emissions trading agreement is intended to draw attention to the various issues that need to be addressed when entering an emissions reduction market. The footnotes give the reader background information, explanations, and examples to help clarify the provisions and the issues addressed. The sample language can be helpful to develop a contract specific to a project; however, it is not intended to be legal advice, and legal issues specific to both the area and businesses involved in the project should be thoroughly researched when developing a contract. Changes in the legislative landscape should also be monitored throughout the development of a project and contract.

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I. Introduction

A. The Interlinked Challenges of Climate Change and Peak Oil

Energy is a foundational resource upon which all life forms depend. Human civilization has grown in population, expanded food production, and advanced technologically in direct proportion to the accessibility, flexibility, and density of the energy resources at our disposal. Specifically, fossil fuels have been both humanity's biggest boon, by driving the industrial and modern agricultural revolutions, and its biggest boondoggle, by driving us toward a climate crisis and fostering inefficient development patterns entirely reliant on a continuously growing base of energy inputs, especially petroleum, natural gas, and coal.

The dual challenges of anthropogenic climate change and peak oil are arguably today's preeminent concerns for continued human progress. The evidence for these interrelated concerns is briefly discussed below. Fortunately, many of the mitigation strategies for these two challenges overlap. However, there are also potential mitigation strategies for the climate change challenge that may provide minimal benefit or even hinder the mitigation potential for peak oil and vice-versa.

Though there is no single "silver bullet" solution and mitigation will take a multi-factorial "buck-shot" approach. Arguably, the best and most cost-effective mid-term "silver bb" is energy efficiency and conservation in our built environment. These strategies branch both the vertical infrastructure (i.e. buildings) and the horizontal infrastructure (i.e. transportation, urban planning, etc.) of the built environment. However, this white paper focuses entirely on these strategies in buildings, though some references are made to the potential convergence of energy feedstocks for the building and transportation sectors and the need for a holistic mitigation approach.

Pacala & Socolow (2004, p. 969) state "improvements in efficiency and conservation probably offer the greatest potential to provide wedges" and specifically consider cutting "carbon emissions by one-fourth in buildings and appliances projected for 2054" as one of 15 major wedges[5]. In the original paper Pacala & Socolow (2004) suggest a 7-wedge mitigation scheme. As a result of increases in GHG emissions since publication, this mitigation scheme is now considered to require 8-wedges out of a possible 15 total proposed. Each wedge (*Figure 1*) "represents an activity that reduces emissions to the atmosphere that starts at zero today and increases linearly until it accounts for 1 GtC/year of reduced carbon emissions in 50 years" (Pacala & Socolow, 2004, p. 968).

Many of the technologies necessary to increase building energy efficiency exist today, yet are underutilized. Despite approximately 80% of Americans regularly expressing strong environmental concern, closer to 20% of Americans actually translate this concern into concrete changes in their everyday practices (Kempton, Boster, & Hartley, 1996; Lucas, 2005). Ironically

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[5] For more information on climate stabilization wedges including details on each type of wedge and educational resources for educators visit http://www.princeton.edu/~cmi/resources/stabwedge.htm.

the seemingly easiest and most powerful mid-term mitigation wedge may be the least used if we fail to determine meaningful and lasting strategies to promote energy efficient behavior change. This combination of fostering energy efficiency (via building systems improvements) and energy conservation (via building occupant behavior change) can and should begin today. Merging these efforts with the financial incentives of carbon markets (whether voluntary or cap-and-trade) will speed their integration.

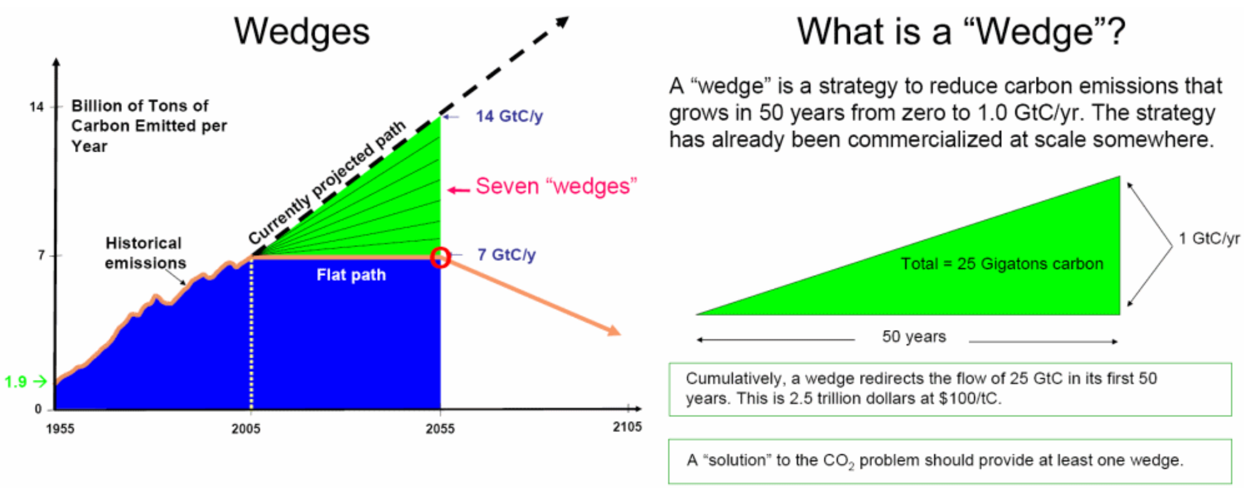

Figure 1:Pacala and Socolow's mitigation wedge concept. It is important to note that since the original publication of the wedge concept in 2004, the increase in GHG emissions have necessitated an increase to an eight wedge scheme. Image Credit: The Carbon Mitigation Initiative at the Princeton Environmental Institute.

1. Climate Change

The Intergovernmental Panel on Climate Change Fourth Assessment Report (AR4) Synthesis Report states "warming of the climate system is unequivocal…[and] most of the observed increase in global average temperatures since the mid-20th century is *very likely* (>90%) due to the observed increase in anthropogenic greenhouse gas [GHG] concentrations" an increase in likelihood since the IPCC Third Assessment Report (IPCC, 2007b, pp. 2, 6). Of these anthropogenic GHGs, "the largest known contribution comes from the burning of fossil fuels" which lead primarily to atmospheric increases in carbon dioxide (CO_2), though human activities also result in emissions of other greenhouse gases such as methane (CH_4), nitrous oxide (N_2O), and the halocarbons (IPCC, 2007a, p. 100).[6] The role of the built environment in both the generation of these anthropogenic GHG emissions, and the mitigation schemes designed to reduce these human climate impacts is explained in further detail later in this paper.

2. Peak Oil

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[6] A complete explanation of the science behind climate change can be found in the IPCC Fourth Assessment Report: Working Group I Report "The Physical Science Basis" (http://www.ipcc.ch/ipccreports/ar4-wg1.htm). More specifically, the most succinct coverage of the science basis can be found in the "Frequently Asked Questions" section (http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-faqs.pdf).

A recent report from the U.S. General Accounting Office succinctly described the importance and context of oil in the global economy as follows (US-GAO, 2007, pp. 6-7):

> "Oil—the product of the burial and transformation of biomass over the last 200 million years—has historically had no equal as an energy source for its intrinsic qualities of extractability, transportability, versatility, and cost. But the total amount of oil underground is finite, and, therefore, production will one day reach a peak and then begin to decline. Such a peak may be involuntary if supply is unable to keep up with growing demand. Alternatively, a production peak could be brought about by voluntary reductions in oil consumption before physical limits to continued supply growth kick in. Not surprisingly, concerns have arisen in recent years about the relationship between (1) the growing consumption of oil and the availability of oil reserves and (2) the impact of potentially dwindling supplies and rising prices on the world's economy and social welfare. Following a peak in world oil production, the rate of production would eventually decrease and, necessarily, so would the rate of consumption of oil."

The theory of peak oil, or the point at which maximum rate of oil production is reached followed by terminal decline, originated in 1956 when M. King Hubbert, a Shell geoscientist, predicted the United States domestic oil production would peak around the late 1960s to early 1970s[7]. Peak oil theory applies across scales to individual oil fields, producing countries, and the globe as a whole. Though the actual production peak was higher than Hubbert's prediction, his theory has matched the historical record fairly closely over the 50 years since his prediction (*Figure 2*).

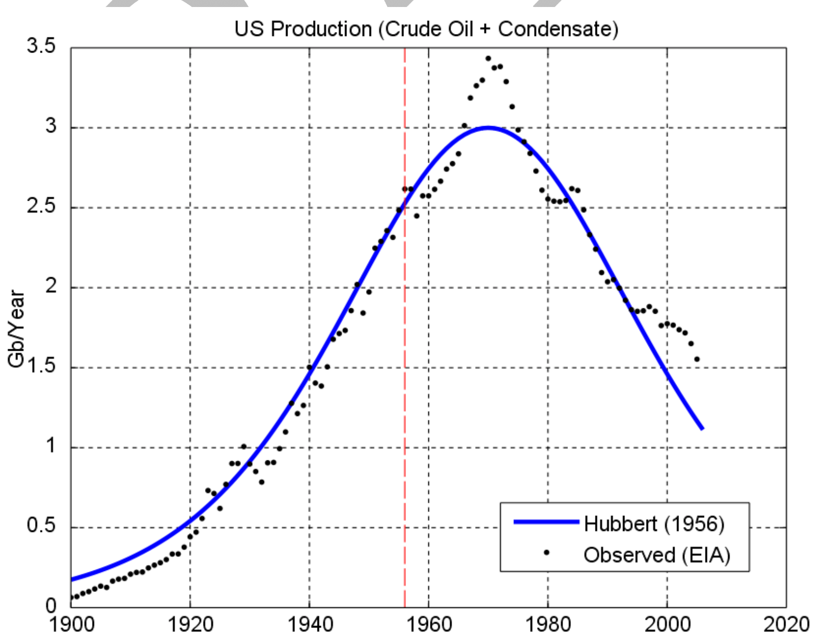


Figure 2: US Lower-48 oil production (crude oil only) and Hubbert high estimate (URR= 200Gb, K=6%, 1970), the red dotted line indicates the 1956 year (prediction year). Data from the EIA. Image Credit: S. Foucher (CC).

[7] See http://en.wikipedia.org/wiki/Peak_oil for more information.

Estimates of global peak oil vary considerably with the “pessimists” projecting an imminent peak and fairly steep decline anytime within the next 1-10 years while the “optimists” project a peak with an extended plateau and slow decline beginning in about 30 years (Bakhtiari, 2004; Khebab, 2007; Laherrere, 1999; US-GAO, 2007). (Khebab, 2007) regularly provides updates to major international peak oil models dividing production estimates into three categories based on their respective major prediction agencies and individuals: (1) *business as usual* (EIA, IEA, CERA) projecting peak oil generally within the 2030-2038 window; (2) *bottom-up analysis* (Skrebowski, ASPO, Koppelaar, Bakhtiari, Smith, Robelius, ACE from The Oil Drum) projecting peak oil generally within the 2005-2012 window; and (3) *curve fitting* (Deffeyes, Laherrere, Hubbert linearization via Staniford, loglet analysis, Generalized Bass Model via Guseo, Shock Model via WebHubbleTelescope from The Oil Drum, Hybrid Shock Model) projecting peak oil generally within the 2005-2018 window. *Figure 3* provides a summary of these major projections showing how the mean and median predictions compare to the International Energy Agency (IEA) 2006 prediction and the forecast based on anticipated population growth and current per capita consumption trends.

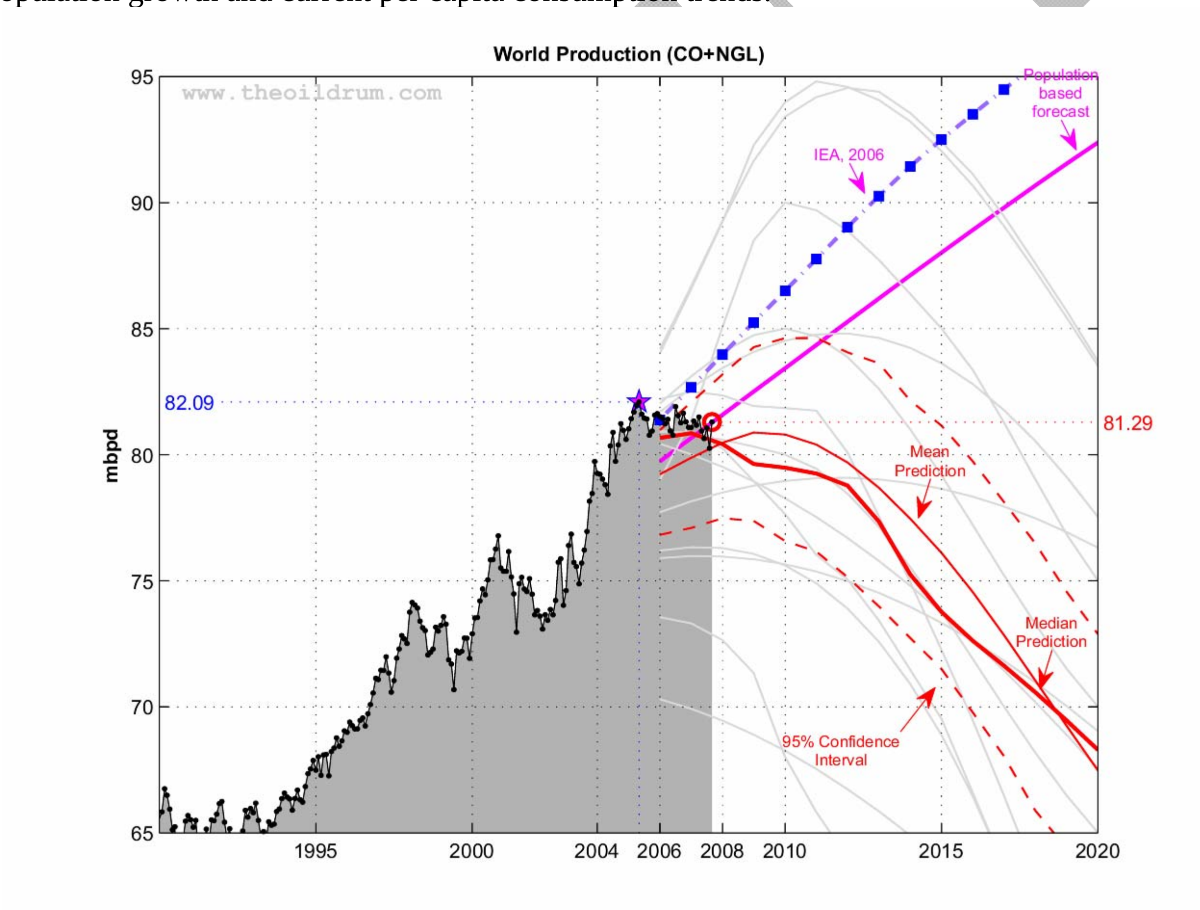


Figure 3: World oil production (EIA Monthly) for crude oil + NGL (as of Khebab December 2007 update). The median forecast is calculated from 13 models that are predicting a peak before 2020 (Bakhtiari, Smith, Staniford, Loglets, Shock model, GBM, ASPO-[70,58,45], Robelius Low/High, HSM). 95% of the predictions sees a production peak between 2008 and 2010 at 77.5 - 85.0 mbpd (The 95% confidence interval is computed using a bootstrap technique). Image Credit: http://www.theoildrum.com/files/PU200712_Fig3b.png.

"Key uncertainties in trying to determine the timing of peak oil are the (1) amount of oil throughout the world; (2) technological, cost, and environmental challenges to produce that oil; (3) political and investment risk factors that may affect oil exploration and production; and (4) future world oil demand" (US-GAO, 2007). Regardless of these uncertainties and the disagreement in the timing of a global peak in oil production, a U.S. Government sanctioned report concluded a peak oil crash mitigation program would require initiation a minimum of 20 years before the peak occurs in order to avoid a world liquid fuels shortfall and serious economic damage (Hirsch, Bezdek, & Wendling, 2005). Only the most optimistic predictions for oil production provide a 20+ year cushion, but just barely and every year we delay a mitigation program shrinks the gap. Unfortunately, recent news stories seem to reinforce the pessimists projections for a near term peak within the 2005-2018 window with many influential leaders in the energy and transportation industries extolling the virtues of conservation and efficiency improvements[8].

B. *Why Peak Oil Matters to Building Energy Efficiency and Climate Change Mitigation*

The building sector and the transportation sector are currently energized by separate energy resources. The global transportation sector is almost entirely (i.e. > 95%) petroleum based (EIA, 2007; US-GAO, 2007). More specifically, the transportation sector accounts for approximately two-thirds of all U.S. petroleum consumption with approximately 60% of transportation uses coming from light vehicles (US-GAO, 2007, pp. 9-10) (*Figure 3*). Conversely, the U.S. building sector is reliant on utility-based electricity from a mix of fuels with approximately 49% coal, 20% natural gas, 19% nuclear, 7% hydroelectric, <3% other renewables, and <2% petroleum (EIA, 2007) (*Figure 4*).

[8] Chevron uses their "Human Energy" campaign to raise awareness about the emerging energy challenges with a series of television, print, outdoor, and online advertisements. The entire campaign including all its advertisements can be viewed interactively at www.willyoujoinus.com. Recently the Chief Executive of Royal Dutch Shell Plc, Jeroen van der Veer stated, "after 2015, easily accessible supplies of oil and gas probably will no longer keep up with demand" (van der Veer, 2008). As a result of the need to mitigate the supply and demand gap in oil and gas resources (i.e. peak oil and peak natural gas) and the need to mitigate climate change, van der Veer, laid out two potential future scenarios for the world's energy infrastructure. "In the Scramble scenario, nations rush to secure energy resources for themselves, fearing that energy security is a zero-sum game, with clear winners and losers," stated van der Veer. He goes on to describe the "Blueprints scenario [as] less painful, even if the start is more disorderly [with] numerous coalitions [emerging] to take on the challenges of economic development, energy security, and environmental pollution through cross-border cooperation." John B. Hess, Chairman and Chief Executive of Hess Corp., surprised many attendees at a February CERA conference on energy resources by expressing similar concerns about falling short of oil supply expectations before 2015 (Fletcher, 2008). Over the last year, both the Shell and Total Chief Executives expressed skepticism in the International Energy Agencies' projections for 116 million barrels of oil a day globally by 2030 and stated the days of "easy oil" are over and even 100 million barrels of oil a day by 2030 are "optimistic" (Crooks, 2007; Voss & Patel, 2007). Even the International Energy Agency itself sounds a bit schizophrenic about future global energy supplies as evidenced in the English translation of an interview with IEA Head Claude Mandil in the French paper Le Monde (Guillet, 2007). In a March 2008 Bloomberg Markets Magazine article, multiple key stakeholders in the automobile manufacturing and investing industries are quoted expressing deep concerns about the conventional oil supplies, the environmental impact of unconventional oil production, climate change, and the future of automobiles and their manufacturers (Lippert & Ohnsman, 2008).

Diagram 2. Petroleum Flow, 2005
(Million Barrels per Day)

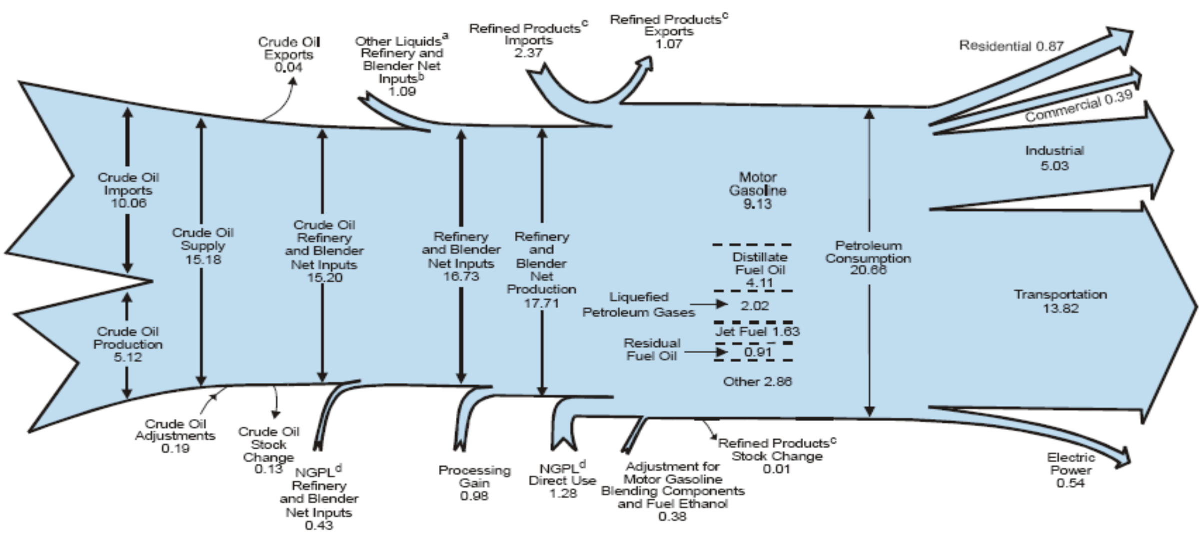
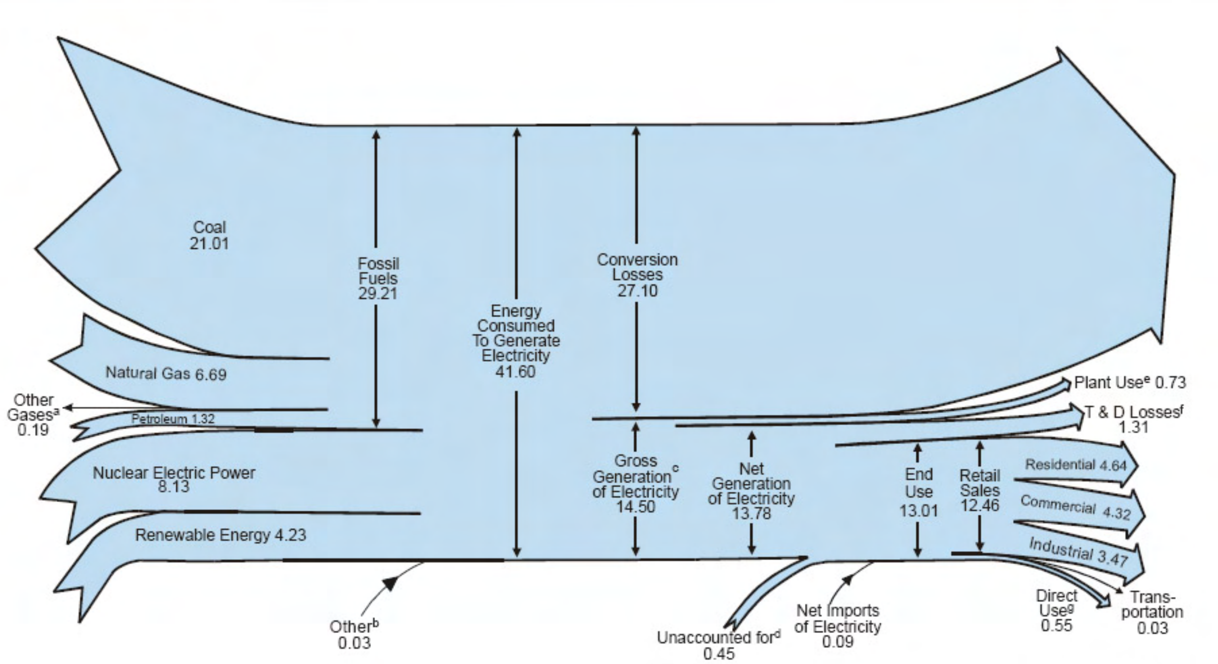


Diagram 5. Electricity Flow, 2005
(Quadrillion Btu)



Figures 3 & 4: Only 0.07% of the energy used to generate electricity was consumed by the transportation sector in 2005. Likewise, only 6.1% of the petroleum consumed was used by the residential and commercial building sector in 2005. Image Credits: Petroleum Flow - http://www.eia.doe.gov/emeu/aer/diagram2.gif and Electricity Flow - http://www.eia.doe.gov/emeu/aer/diagram5.html.

Future climate change and peak oil mitigation strategies may lead to competition for common energy sources between the transportation and building sectors through both direct[9] and indirect[10] means (Farrell & Brandt, 2006; Hirsch et al., 2005; Reynolds, 2008). A recent energy and climate change policy paper for the Garnaut Climate Change Review, an independent study commissioned by Australia's State and Territory Governments, projects the electrification of the transport sector to result in "a currently unforeseen 20 – 50% addition to [Australian] national electricity demand by 2030" (Reynolds, 2008, p. 2). Furthermore, Farrell & Brandt (2006, p. 5) state:

> "the oil transition brings more long-term environmental concerns than long-term economic or security threats because tradeoffs have strong potential to be resolved by accepting increased environmental damage in order to avoid economic or security risks…other technologies could also diversify the supply of transportation energy such as advanced, environmentally friendly biofuels; hydrogen; or partially or fully electric vehicles utilizing low carbon electricity (possibly including fossil fuels plus CCS [carbon capture and storage], renewables, or nuclear power). Demand reduction, through fuel efficiency and better transportation planning should also play a role. These other approaches have their own challenges, but at least they do not have the climate change risks of fossil SCPs [substitutes for conventional petroleum]."

Taking a lowest cost and/or SCPs approach to mitigating peak oil without considering the environmental impacts at local, regional, and international scales will only hinder the worldwide effort to mitigate climate change. Simultaneously, mitigating climate change without considering the need for a rapid response to peak oil and the dynamics of the global petroleum industry will only place nation-states and individual households at economic risk as oil resources become more expensive and less available.

The near term focus on mitigating each should be in technologies and strategies that have dual benefits for both challenges. Energy efficiency in the building sector offers these dual benefits by reducing the use of fossil fuels to heat, cool, and light buildings while simultaneously creating an opportunity for the transportation sector to move toward grid-based electrification.[11] Additional synergies such as utility peak load shaving may be realized as the transportation sector moves toward electrification and vehicle batteries are available for charging off-peak and discharging on-peak.

[9] Direct building and transport energy competition may include grid connected light rail, plug-in hybrid electric vehicles, hydrogen fuel production via electrolysis, and other means.
[10] Indirect building and transport energy competition may include synthetic transportation fuels from coal liquefaction, oil sands that require natural gas inputs, and/or other processes that use energy sources previously used to primarily generate electricity and heat and cool buildings.
[11] It is important to remember that like energy efficiency in the building sector, the best option for reducing GHG emissions and mitigating peak oil in the transportation sector is through a combined focus on fostering fuel efficiency, fuel switching (to lower carbon fuels), and most importantly creating more walkable multi-modal communities that provide transportation options beyond individual light cars and trucks.

1. The Heavy Burden and Profound Opportunity of the Building Sector

Within the United States, the building sector accounts for approximately 48% of annual GHG (greenhouse gas) emissions, with 36% of the direct energy related GHG emissions and an additional 8-12% of total GHG emissions related to the production of materials used in building construction (AIA, 2006; Architecture2030, 2007; Nässén et al., 2007). Transportation of materials and other activities related to constructing buildings would add even more CO2 emissions to the building sector (Nässén et al., 2007). Additionally, the ratio of embodied energy consumption for the building sector is estimated at approximately 15-25% from the construction phase and 75-85% from the operations phase assuming a 50-year building lifespan (Nässén et al., 2007; Olgyay & Herdt, 2004).

Specifically, the residential sector within the OECD consumes approximately 20-25% of primary energy use meaning households account for over 50% of the CO2 emissions within the building sector (Abrahamse et al., 2007; Greening et al., 2001). Grid connected utilities provide the vast majority of the electricity to power these buildings and are expected to undergo market pressures to reduce these associated GHG emissions.

The greatest potential for an effective near-term mitigation wedge for both climate change and peak oil comes from energy conservation and efficiency improvements in the built environment (Pacala & Socolow, 2004). The climate stabilization triangle envisions "seven [originally, but now eight] equal pieces, or 'wedges,' each representing one billion tons a year of averted emissions 50 years from now (starting from zero today)" (Socolow & Pacala, 2006). Though there is no silver bullet for mitigating climate change, each 25% reduction in electricity use in residential and commercial buildings can account for one mitigation wedge (Socolow & Pacala, 2006).

A recent report by the U.S. Climate Change Science Program estimates that homes can achieve carbon emission reductions up to 70% with current best practices, leaving much of the success in the residential sector up to mitigating policies and individual behavior change (McMahon et al., 2007). Similarly, the U.S. Department of Energy Building America program aims to reduce the energy use of new homes by 70% by 2020[12]. Furthermore, the American Institute of Architects estimates that the U.S. built environment will undergo 75% turnover via new or significantly renovated buildings and infrastructure during the thirty year period from 2005 to 2035 (AIA, 2006; Architecture2030, 2007).

The knowledge and technology necessary to significantly reduce energy use in the building sector is best summarized in the IPCC AR4 Working Group 3 Report Chapter on Residential and Commercial Buildings and a recent report by McKinsey&Company:

> "The key conclusion of section 6.4 is that substantial reductions in CO2 emissions from energy use in buildings can be achieved over the coming years using existing, mature technologies for energy efficiency that already exist widely and

[12] See this link for more information: http://www.eere.energy.gov/buildings/info/homes/newconstruction.html.

> that have been successfully used (*high agreement, much evidence*). There is also a broad array of widely accessible and cost-effective technologies and know-how that can abate GHG emissions in buildings to a significant extent that has not as yet been widely adopted.” (Levine et al., 2007, p. 406).

> “Improving energy efficiency in buildings and appliances – 710 megatons (mid-range) to 870 megatons (high-range)[13]. This large cluster of negative-cost options includes: lighting retrofits; improved heating, ventilation, air conditioning systems, building envelopes, and building control systems; higher performance for consumer and office electronics and appliances, among other options. *While this category of abatement options would cost the least from a societal point of view, persistent barriers to market efficiency will need to be overcome* [our emphasis].” (Creyts, Derkach, Nyquist, Ostrowski, & Stephenson, 2007, p. xiv).

The authors of the McKinsey&Company report (Creyts et al., 2007, p. 20) go on to state that slightly over 50% of the abatement potential for either their mid-range or high-range cases can be attributed to the combination of the buildings-and-appliances and the power sectors. And most importantly, the report clearly shows that many of the mitigation strategies in the buildings-and-appliance sectors are negative cost options, meaning they provide a higher long-term monetary savings than the immediate-term investments necessary for implementation. Furthermore, “capturing the potential in these two interdependent sectors at the same time would be complicated by misaligned incentives that pervade the utility system today. These misaligned incentives often place power producers’ sustained earnings at odds with resource efficiency” (Creyts et al., 2007, p. 20).

Florida along with the 14 other states in the Southeastern U.S. Census Region make up the most significant share of GHG abatement opportunities within the buildings-and-appliances sector. Specifically, in McKinsey & Company’s 2030 Mid-Range Case (Creyts et al., 2007, p. 24), these 15 states house 40% (146 million) of the U.S. population, account for 40% (3.88 gigatons CO_2e/year) of U.S. GHG emissions, and offer 39% (1.13 gigatons CO_2e/year) of the total U.S. GHG emissions abatement potential. More importantly, of these 1,130 megatons CO_2e/year of abatement potential (2030 Mid-Range Case), the buildings-and-appliances sector within the Southeastern U.S. accounts for 32% (361.6 megatons CO_2e/year), which ultimately equates to 49.8% of the total 726.1 megatons CO_2e/year available in the buildings-and-appliances sector nationwide (Creyts et al., 2007, p. 24). In other words, half of the opportunities for U.S. GHG emissions reductions via building energy efficiency are anticipated to be available in the 15 states of the Southeastern U.S. At a theoretical price of $20/ton, the value of energy efficiency in the Southeast will be $7.2 billion annually.

As evidenced in these passages, the building sector is a prime mover in the global economy that also results in its extraordinary contribution to anthropogenic climate change. However, within the United States mitigation opportunity abounds as this sector is anticipated to undergo rapid turnover in the next three decades. The knowledge and technology to make our buildings more energy efficient, less carbon intensive, and less expensive to operate exists today. The question is, will we collectively act on this knowledge?

[13] Note: These megaton figures are for abatement potential per year through 2030.

2. The Implications of Non-Point Sources & Behavior Change

Arguably, the most persistent barrier to market implementation of these building energy efficiency strategies is the complex and dynamic nature of behavior change. Trends in recent years show a shift in the proportionate impact of pollution vectors from large point-sources (such as large companies, factories, etc.) to smaller, more distributed non-point sources (such as small groups, households, and individuals) (Brewer & Stern, 2005; CBASSE, 1998; Montgomery, 2007; Stern, 2005; US-CST, 2007). Simultaneously policymakers and researchers are increasingly recognizing the behavioral considerations of diverse challenges and the potential for solutions via social processes and interventions to modify individual choices (Brewer & Stern, 2005; CBASSE, 1998; Montgomery, 2007; Stern, 2005; US-CST, 2007).

For better and for worse, the energy conservation and efficiency wedge is a complex mix of building science and social science. In one example of the diverse challenge from social processes, recent field studies from the Energy Center of Wisconsin have suggested that programmable thermostats may be achieving considerably lower savings than their estimated potential. These failures of a technologically proven product result from misuse, misunderstanding, indifference, or other behaviorally driven factors. This has led the EPA to consider withdrawing this product's ENERGY STAR® certification mark as of May 1, 2008. It is possible that a similar phenomenon could cause ENERGY STAR® Qualified New Homes to fall short of their pre-occupant HERS index.

In general, household energy conservation interventions have shown mixed results with the most successful interventions consisting of combined campaigns using both antecedent (specifically goal setting and commitment) and consequence (specifically feedback) protocols (Abrahamse, Steg, Vlek, & Rothengatter, 2005; Abrahamse et al., 2007; Bartiaux, 2007; Gram-Hanssen, Bartiaux, Jensen, & Cantaert, 2007; McCalley & Midden, 2002; PNNL, 2007). Part of these mixed results arise from the fact that approximately 80% of Americans regularly express strong environmental concern, yet barely 20% of Americans actually translate this concern into concrete changes in their everyday practices (Kempton et al., 1996; Lucas, 2005).

However, insights into potential pathways for bridging the "value-action gap" are emerging in the social sciences. When social capital and information networks are strong and interconnected, sustainability and environmental planning initiatives tend toward greater degrees of success (Blake, 1999; Selman, 2001). Meaningful social norms and networks visibly convey social approval/disapproval, group performance feedback, and allow for the establishment of group identity (Schultz, 1998; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Congruently, buildings and land may suitably serve as tangible indicators of group identity (Ledgerwood, Liviatan, & Carnevale, 2007). Additionally, these "communicative tools are more likely to be effective when combined with regulatory or economic instruments" (Beerepoot, 2005).

These regulatory and economic instruments, such as cap-and-trade carbon markets and carbon tax schemes, are transpiring at scales from local to international. In order to quantify the role buildings play in contributing to or mitigating GHG emissions, efforts are emerging to make building performance data more transparent for social norming, economic valuation, and verification of carbon credits, especially in the European Union, California, and other progressive nations and states (Bowles, 2007; California, 2007; EST, 2007; EU, 2002; UK, 2007). However, efforts to make building performance data more transparent and accessible must be evaluated for their implications on confidentiality, personal privacy, and legal considerations (Gutmann & Stern, 2007).

II. Energy Efficiency Certificates (EECs)

Though the timing is uncertain and the details unspecific, most near-term projections point to a mandatory cap-and-trade carbon marketplace being initiated in the United States similar to the marketplace(s) in other countries which began implementing the Kyoto Protocol in January 2008. "As of mid-February 2008, lawmakers [in the 110th U.S. Congress] had introduced more than 180 bills, resolutions, and amendments specifically addressing global climate change and greenhouse gas (GHG) emissions."[14] Additional statewide and regional efforts have begun emerging across the country increasing the likelihood that some form of carbon market and/or carbon taxes will be implemented in the United States. A recent article in *Nature Reports Climate Change* provided a good summary of carbon offsets and markets (Gillenwater et al., 2007):

> "A [greenhouse gas] GHG 'offset' is an intangible economic commodity that represents the avoidance or sequestration of GHG emissions. GHG offsets are derived from distinct projects, involving anything from low-carbon energy production, to energy efficiency measures, the destruction of GHGs such as methane and nitrous oxide, and tree planting and soil carbon enhancement activities. Offsets offer buyers a potentially lower-cost alternative to reducing their own emissions. The geographic source of GHG emissions is irrelevant to their climate change impact. Therefore, GHG emission reductions are a global, rather than local, public good and can be traded in a global market."

The three most significant challenges to voluntary carbon offset markets are defining additionality, monitoring and verification of the actual offsets, and enforcement of ownership (Gillenwater et al., 2007). Other critical considerations include leakage, securitization, and permanence. As evidenced in the previous paragraphs, the potential for significant, cost effective, near-term GHG offsets exists in building efficiency improvements. Alternative electrical power projects are traded using renewable energy certificates (RECs, also commonly known as green tags, tradable renewable certificates, or green certificates) and typically represent

[14] See "Global Warming Solutions: What's Being Done" on the Pew Center on Global Climate Change Web site for more information about emerging state, federal, international, and business policies (http://www.pewclimate.org/what_s_being_done).

1 megawatt-hour (MWh) of electricity generated from renewable energy resources[15]. Whereas, energy efficiency certificates (EECs, also commonly known as white tags or energy efficiency credits) represent indirect GHG offsets through reduced use of electricity via demand side management (DSM), including building systems improvements and behavioral changes[16]. Background on carbon market products, establishing baselines, and the six challenges to voluntary carbon offset markets are discussed in further detail below using EECs in residential and commercial buildings as the project example.

A. Creating a Carbon Market Product Through Energy Efficiency & Conservation

Carbon market offset products need three major attributes: (1) they must result in a measurable net reduction in greenhouse gas (GHG) emissions as compared to business-as-usual (i.e. what would reasonably have occurred in the product specific sector without the project; (2) they must have a specified and legally binding owner, such as a utility, an urban developer, a builder, a retailer, or a buyer; and (3) there must be transparency and strong confidence in the accuracy of the product, its quantification, and its measurement and monitoring (Willey & Chameides, 2007, p. 10).

A carbon market product pursuing energy efficiency credits (EECs) could be as simple as renovating existing buildings to perform more efficiently, fostering measurable energy conservation through behavior change, and/or constructing new buildings to energy efficiency standards more stringent than the local code requirements. One example of this is the proposed Allston Science Complex at Harvard University which will be designed to "produce fifty percent less greenhouse gases (GHG) than a typical laboratory designed to the current ASHRAE 90.1 Standard (2004)" (Bowles, 2007, p. 2). Within this same Expanded Environmental Notification Form, The Commonwealth of Massachusetts has proposed that the "full build-out of the Allston campus will result in a thirty percent reduction in GHG emissions for buildings" (Bowles, 2007, p. 2).

The type of strategies and technologies available to realize these energy efficiency improvements in the building sector are described in the IPCC Fourth Assessment Report (AR4) as follows:

> "Efficient lighting and daylighting; more efficient electrical appliances and heating and cooling devices; improved cook stoves, improved insulation; passive and active solar design for heating and cooling; alternative refrigeration fluids, recovery and recycling of fluorinated gases; *Integrated design of commercial*

[15] For more information about RECs visit: http://www.eere.energy.gov/greenpower/markets/certificates.shtml?page=0 (or) http://eetd.lbl.gov/ea/ems/cases/TRC_Case_Study.pdf.

[16] For more information about EECs visit: http://www.sterlingplanet.com/upload/File/Sterling%20Planet%20White%20Tags%20Fact%20Sheet.pdf (or) http://www.dps.state.ny.us/07M0548/workgroups/WG1_NYS_PSC_Final_Comments.pdf.

> *buildings including technologies, such as intelligent meters that provide feedback and control; solar photovoltaics integrated in buildings.*" (IPCC, 2007b, p. 24). [17]

These strategies are already being fostered in new construction through voluntary third-party green building rating systems such as the U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Rating System[18], the GreenGlobes[19], ENERGY STAR®[20] and a variety of local and statewide green building programs[21]. Carbon market products pursuing energy efficiency credits (EECs) via improved new construction would benefit from utilizing these emerging standards for modeling and quantifying potential building operational performance.

Whereas, new construction EECs would compare modeled building performance to actual performance during occupancy, EECs pursued as a result of renovations to buildings or behavior change interventions would likely be based on analysis and comparison of pre and post renovation/intervention building performance. Both require monitoring but the extent of their GHG emissions reductions will be based on different baselines.

B. Establishing the Baseline

According to the International Emissions Trading Association (IETA), a baseline "means the scenario that reasonably represents the anthropogenic emissions by sources or anthropogenic removal by sinks of GHGs [greenhouse gases] that would occur in the absence of the Project…" (IETA, 2006, p. 1). Essentially, the carbon markets require that a baseline of business-as-usual (BAU) GHG emissions be established for all respective offset projects so that actual emission reduction can be appropriately quantified and credited.

Within the U.S. building sector, any GHG emission offsets related to energy efficiency would likely be based off of a combination of local, state, and/or federal building codes and land development regulations defaulting to the agency with jurisdiction. Within Florida this would presuppose the state building code as it is preemptive and does not allow local governmental codes to be more restrictive. In other states, this preemption may not exist.

It is also important to normalize the EECs as the carbon intensity of the electricity consumed by the building(s) will be dependent on the mix of energy fuels used to generate electricity by the local electrical utility[22]. Likewise, normalization would need to account for natural gas and/or any other energy fuels used directly within the household for heating, cooling, water heating, and appliances. Furthermore, it is possible to incorporate a carbon intensity to the water

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[17] Note: key mitigation technologies and practices currently commercially available are in standard text and *those projected to be commercialized before 2030 are shown in italics*
[18] See http://www.usgbc.org/ for more information.
[19] See http://www.thegbi.org/home.asp for more information.
[20] See http://www.energystar.gov/ for more information.
[21] See http://www.myfloridagreenbuilding.info/ for more information about the options for Florida.
[22] Though each utility has its own mix of electricity generating fuels, specific national percentages of this fuel mix were discussed in the previous section of this paper entitled *Why Peak Oil Matters to Building Energy Efficiency and Climate Change Mitigation.*

consumption of the building(s) which would have the dual effect of fostering building water use efficiency as well as placing a value on this efficiency. Like electricity, water efficiency would also need to be normalized for its carbon intensity based on the local water utility's mix of fuels for potable water withdrawal and distribution and for wastewater return, treatment, and disposal.

1. Baselines for New Construction

Establishing baselines for new construction can be complex as the baselines are context specific to unique characteristics such as local codes, building type, building size, building systems and other characteristics. Additionally, when emissions reduction purchase agreements (ERPAs)s involve energy efficiency credits (EECs), both parties must agree upon the baseline calculation protocols and their reliability at projecting the actual building performance during subsequent occupancy. The two key considerations for determining the EECs possible in a high performance new building are first, understanding the jurisdictional codes and second, running an energy simulation model to compare the high performance building to a code minimum building for that particular region.

The best place to look for a specific jurisdictional code is the U.S. Department of Energy – Energy Efficiency and Renewable Energy (EERE) *Building Energy Codes Program*[23]. More specifically, the EERE *Status of State Energy Codes* Web page provides a summary of each state's energy code with pertinent contact information and links to each state's respective building code Web site[24]. As mentioned above in the Florida example, some states have preemptive statewide codes that preclude local governments from establishing more restrictive energy performance requirements. In those states without preemptive statewide codes, further investigation into local governmental requirements may be necessary for establishing baselines and ensuring additionality[25].

The U.S. Department of Energy EERE also provides extensive information about 343 different building energy modeling software tools[26]. Applications range from whole building analysis tools in energy simulation, load calculation, and green buildings to more specific applications on indoor air quality, water conservation, atmospheric pollution, etc[27]. A recent report entitled *Contrasting the Capabilities of Building Energy Performance Simulation Programs* provides a review of the top 20 energy modeling applications[28].

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[23] See http://www.energycodes.gov/ for more information.
[24] See http://www.energycodes.gov/implement/state_codes/index.stm for more information.
[25] A potentially helpful Web site archiving some local governmental codes is http://www.municode.com/. Additionality is discussed later in this paper.
[26] See http://www.eere.energy.gov/buildings/tools_directory/ for more information.
[27] See http://www.eere.energy.gov/buildings/tools_directory/subjects_sub.cfm for a list of software tools categorized by subject area. The applications with the most relevance to modeling building energy efficiency can be found in the *Energy Simulation* category. *Understanding the Energy Modeling Process: Simulation Literacy 101* provides additional information about energy modeling and can be found at http://www.buildinggreen.com/features/mr/sim_lit_101.cfm.
[28] This report can be found at http://www.eere.energy.gov/buildings/tools_directory/pdfs/contrasting_the_capabilities_of_building_energy_performance_simulation_programs_v1.0.pdf.

Other resources that may provide guidance to buyers and sellers of EECs are the independent third-party green building rating systems referenced in the previous section. These rating systems compare baseline business-as-usual buildings to proposed high performance building designs to quantify whether green building certification is warranted. Currently, non-residential buildings and residential buildings over 3 stories use ASHRAE Standard 90.1-2004[29] as the baseline threshold in most cases.

Residential buildings 3 stories or fewer most commonly rely on the standards established by the ENERGY STAR® Qualified New Homes program[30]. Using the HERS Index system, this program provides both as-designed energy models of performance prior to construction and as-built energy testing of actual building system performance post construction[31]. The reference baseline home for the HERS Index currently uses the 2006 International Energy Conservation Code (IECC). Some states and local governments may have energy codes even more restrictive than the 2006 IECC (such as Florida), thus requiring an even more efficient baseline than that used in the ENERGY STAR® Qualified New Homes program in order to meet additionality tests. GHG emissions reductions resulting from reduced water use could be calculated via comparisons of specified indoor fixtures and outdoor irrigation strategies in participating residential buildings as compared to jurisdictional building code minimums for their respective comparable baselines.

2. Baselines for Existing Building Retrofits

In some ways, establishing baselines for existing buildings should be easier than new construction as the buildings will have been in operation for a period of time prior to the planned energy efficiency retrofit project(s). Theoretically, the building's utility billing data could be taken from electrical, gas, and water utility providers using an agreed upon baseline date(s). For example, a retrofit project may choose the 1990 consumptive use data as the baseline as this is an archival GHG emissions date used for baseline calculations in the Kyoto Protocol[32]. However, one problem with taking one historic year is that it may have had irregular local weather conditions with temperatures and precipitation patterns that fell outside of a multi-year longer-term mean. These irregularities could have led to similarly irregular energy and water consumption (in either high or low directions).

For these reasons, calculating baselines for energy efficiency retrofit project(s) in existing building(s) would benefit from taking a multi-year average centered around a desired baseline date such as 1990 and/or at a minimum would account for the heating and cooling degree days

[29] See http://www.ashrae.org/technology/page/548 for more information. The ASHRAE *Advanced Energy Design Guides* (http://www.ashrae.org/technology/page/938) provide detailed information and recommendations for pathways to achieve energy savings of 30% or more over the minimum ASHRAE code requirements. Separate guides are provided for *Small Office Buildings*, *Small Retail Buildings*, and for *K-12 School Buildings*.
[30] See http://www.energystar.gov/index.cfm?c=new_homes.hm_index for more information.
[31] See http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_HERS for more information.
[32] See http://unfccc.int/kyoto_protocol/items/2830.php for more information on the Kyoto Protocol.

affecting the building(s) systems and its occupants during the baseline year(s)[33]. Though the consumptive end use data is collected by utility providers, there are still potential data tracking and standardization challenges such as: (1) inaccuracies in property appraiser and/or MLS data regarding the size of buildings; (2) incompatible database protocols within and across utilities; (3) legal considerations involving data transparency; (4) data anomalies and outliers resulting from unoccupied buildings, etc.

C. Additionality Considerations for Energy Efficiency Certificates

In order for greenhouse gas (GHG) emissions reductions, such as energy efficiency certificates (EECs), to be valid they must first be additional, "that is any reductions in GHG emissions and increases in stores of carbon produced by the project would not have occurred without the project" (Willey & Chameides, 2007, p. 12). The Voluntary Carbon Standard[34] (VCS) requires projects to demonstrate additionality by passing one of three types of tests: (1) the project test; (2) the performance test; and (3) the technology test. Using the VCS as an example, most energy efficiency projects would likely follow "the project test" and its three steps as excerpted from the VCS 2007 framework[35] as follows:

- Step 1: Regulatory Surplus
    - The project shall not be mandated by any enforced law, statute or other regulatory framework.
- Step 2: Implementation Barriers
    - The project shall face one (or more) distinct barrier(s) compared with barriers faced by alternative projects.
        - Investment Barrier – Project faces capital or investment return constraints that can be overcome by the additional revenues associated with the generation of VCUs.
        - Technology Barriers – Project faces technology-related barriers to its implementation.
        - Institutional Barriers – Project faces financial, organizational, cultural or social barriers that the VCU revenue stream can help overcome.
- Step 3: Common Practice
    - Project type shall not be common practice in sector/region, compared with projects that have received no carbon finance.
    - If it is common practice, the project proponents shall identify barriers faced compared with existing projects.
    - Demonstration that the project is not common practice shall be based on guidance in the GHG Protocol for Project Accounting, Chapter 7.

[33] Note, this would require a similarly complex monitoring regime incorporating heating and cooling degree days over the lifetime of the emissions reduction purchase agreement to ensure accuracy when comparing actual performance to baseline performance.
[34] See http://www.v-c-s.org/ for more information.
[35] See http://www.v-c-s.org/docs/VCS%202007.pdf (page 14-15) for more information on additionality and the three types of tests allowable by the Voluntary Carbon Standard 2007.

In conjunction with the project test above, verifying additionality for energy efficient building renovations would require demonstrating: (1) that the retrofits were not required by a local, state, or federal regulatory agency; (2) that barriers to the retrofits were only overcome via the generation of voluntary carbon offsets; and (3) that the efficiency gains expect go above and beyond the code minimum and/or current common practice improvements for the respective types of building systems and technologies being installed. Ultimately the renovated building would need to show actual efficiency gains as compared to the baseline chosen for the GHG emissions reductions contract.

Energy efficient new building construction may be a bit more complex as it would require energy modeling be performed on the building with a comparison between the code minimum building and/or current common practice (i.e. a baseline determined by the jurisdictional building regulatory agency and the local climatic region) and the as-designed building with its additional high performance energy efficiency systems and technologies. Whether or not a building's energy efficiency gains would qualify as additional will depend on the unique characteristics of its local building code and the local climate. For example as mentioned earlier, the State of Florida has a pre-emptive statewide building code that does not allow local governments to require performance standards beyond the statewide language. This would mean that all Florida buildings would be compared to the same standard regardless of the county, with the exception that some natural climatic characteristics may vary between the southern and northern extremes of the state.

Conversely, the State of Texas does not have a pre-emptive code. This allows local governments to implement standards that are more stringent than the Texas statewide minimums. In October 2007, the City of Austin, Texas adopted a series of code amendments that will incrementally increase the energy efficiency requirements such that a home built in Austin in 2015 will be required to perform at a level 65% more efficient than a similar home built to the City of Austin Energy Code that was in effect in November 2006[36]. If other local governments in Texas do not follow Austin's lead, it might be possible that a home built outside Austin city limits in 2015 designed to perform 65% more efficient than a similar home from 2007 could claim GHG emissions offsets via energy efficiency, whereas the exact same home built within the City of Austin, even if only a few miles away, would merely be code minimum and thus not qualify for additionality within carbon markets. Though these nearby projects might pass the first step of proving regulatory surplus, they still might fail the third test if it is common practice for builders in the area to meet the City of Austin's code minimum because this is what the regional marketplace competitively expects. Issues regarding local codes and additionality of building energy efficiency must be more thoroughly discussed with regards to voluntary and cap-and-trade carbon markets to better understand how additionality can be verified.

D. Leakage of Energy Efficiency Certificates

Another important consideration for any carbon market product is the issue of leakage, or the "changes in GHG emissions or carbon stocks that occur outside of a project's boundary but that nevertheless can be attributed to the project's activities" (Willey & Chameides, 2007, p. 91). A

[36] See http://www.ci.austin.tx.us/news/2007/zech_release.htm for more information.

common example of leakage can be found in avoided deforestation projects. A particular parcel of land that is not currently under protection from deforestation, development, or some other land altering activity may qualify as a carbon offset project by establishing and financing a land conservation program to protect the trees and the carbon they sequester[37]. However, the GHG emissions anticipated to be avoided by protecting the land from logging may simply be diverted (i.e., leaked) to other lands to meet demand for timber products, thus negating the potential GHG emissions reductions designed to result from the project.

There are many types and causes of leakage, but the example above reinforces the concerns surrounding GHG emissions reduction activities in the absence of complementary demand side management strategies. In other words, projects that protect one area from resource depletion and/or GHG emissions may only shift these activities to other previously unutilized or underutilized areas when demand for those resources persists. Additionally, projects that increase efficiency in the use of resources and/or allow for the same production or work output at lower material or carbon intensities (i.e., energy efficiency projects) may inadvertently lead to increased use of those resources and their associated GHG emissions over the medium to long term.

This latter example is known as Jevons' Paradox (or the rebound effect) and was first expressed in 1865 by William Stanley Jevons (Alcott, 2005; Polimeni & Polimeni, 2006). The rationale for this counterintuitive effect is most often attributed to the cost reductions associated with efficiency gains and the tendency for people to consume more when costs come down (Alcott, 2005; Polimeni & Polimeni, 2006). Polimeni and Polimeni (2006) believe that the response to Jevons' Paradox lies in changing consumption behaviors and not in the conventional wisdom of merely improving technologies. In many ways the mandatory cap-and-trade carbon marketplace is an ideal pathway to both fostering more efficient technologies while simultaneously limiting the potential for activation of Jevons' Paradox though the use of continually more restrictive quotas and/or rationing over time (Alcott, 2005). It remains to be seen if the voluntary cap-and-trade carbon marketplace would have the same effect.

In the context of the built environment, the need to prevent leakage and also to avoid Jevons' Paradox is a clear and present challenge. For example, if an energy efficiency related project for new construction only measures the GHG emissions reductions associated with the lower operational energy use, there is a risk that these emissions may have leaked into the construction phase of the project. This could result from situations where the building materials and construction practices used to provide the increased operational efficiencies also had a higher carbon footprint during building construction. One potential example could be exchanging a wood stud framed building envelope for an insulated concrete form (ICF) building envelope. The wood stud walls have a lower GHG emissions footprint than the concrete walls because the trees used for the studs sequestered a certain amount of GHGs during their lifetime while there are significant GHG emissions associated with the energy and water use of cement manufacturing for the concrete walls **(*NEED CITATION AND VERIFICATION*)**.

[37] This assumes the land protection strategy meets additionality requirements, has a measurable baseline, has permanence, has a long-term monitoring and verification plan, and/or all the other conditions required for Emissions Reduction Purchase Agreements according to commonly accepted international standards.

However, it could be argued that a concrete home might last longer than a wood stud home, especially in a natural disaster prone region such as Florida[38]. The concrete home might also be constructed with a percentage of flyash or other portland cement replacement materials. The improved durability and energy efficiency of an insulated concrete form home may ultimately result in a lower lifecycle carbon footprint than a conventional wood stud home given a long enough time horizon. Contrastingly, a conventional wood stud home could be designed and built for improved hurricane resistance and energy performance thus potentially matching the insulated concrete form home's durability and efficiency with potentially less GHG emissions during its lifecycle. Unfortunately the devil is in the details and a built environment project should ideally be analyzed over its entire anticipated lifecycle in a cradle to cradle fashion.

Another potential form of leakage from a built environment project is related to urban densities. Density bonuses[39] have been used by local and state governments as an incentive to encourage a variety of locally desirable urban development practices. Within Florida an example might be where a local government offers density bonuses in exchange for the construction of ENERGY STAR® and/or Florida WaterStar℠ homes. Though the improved energy and water efficiencies may not be required by the preemptive statewide building code, they are being requested by the local government. Should the GHG emissions associated with these efficiency gains be considered additional? If so, are they only additional for the original densities and/or sizes of the homes and not for the bonus densities and/or sizes incentivized by the local government?

In other words, if the additional housing units or larger housing sizes were granted conditionally on the developer and its builders meeting specific energy and water efficiency goals, can the GHG emissions reductions associated with these efficiency gains be confidently verified as additional? If the project was likely to be approved without density bonuses even in the absence of the improved energy and water performance strategies, then it is probably fair to claim the GHG emissions offsets of the original allowable units as additional. However, the additional units or increased sizes for the units only became possible in the context of the efficiency gains being achieved, and thus these additional units and their offsets would probably not qualify as additional.

Furthermore, would these additional housing units need to be subtracted from the original units as a form of leakage? It could be argued that the very decision for a developer to undertake energy and water efficient construction practices in the context of a density bonus incentive is merely a way to leak these GHG emissions reductions into the construction of additional units. However, this argument could be moot if the density bonus incentive is treated as more of a transfer of density rights where the total number of allowable dwelling units within a specific jurisdiction is capped at a specific number. It is only when the bonus dwelling units add to the pre-existing total dwelling units allowable through local comprehensive plans that concerns like this arise. The crux of leakage often comes back to the argument for mandatory caps or quotas

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[38] See the UF IFAS Program for Resource Efficient Communities *Performance Under Pressure* fact sheet series for more information about the durability and energy efficiency of insulated concrete forms (ICFs) - http://www.flash.org/resources/files/ICF2005-05-04.pdf.

[39] Density bonuses may include additional housing units and/or larger housing units than allowable by local regulations in exchange for specific desirable practices such as achieving affordable housing goals, etc. See http://www.housingpolicy.org/glossary.html#D for a definition of density bonuses.

which would minimize leakage by transferring carbon emissions instead of merely shifting them from one location or activity to another.

E. Verification and Monitoring of Energy Efficiency Certificates

Currently, there is no agreed upon standard for monitoring and verification of voluntary carbon offsets (Gillenwater et al., 2007). However, the most important considerations in monitoring, measurement, and verification (MMV) plans include quantifiablity, transparency, trackability, and independent third-party review. In many ways, the building sector lends itself to high quality MMV more than other GHG emissions reductions sectors (such as afforestation, avoided deforestation, and other carbon sequestration strategies). All utility connected buildings already have their energy and water consumptive end use tracked for billing purposes. Though the transparency of these data can and should be improved, the quantifiability of the associated carbon footprint is easily accessible through coefficients related to local energy production and distribution and water pumping, distribution, and wastewater treatment.

The pre-existence of the quantifiability and trackability of these data points provides reduced opportunity costs for MMV of building efficiency related GHG emissions reductions projects. With the emergence of geospatial information systems, the World Wide Web, and other information gathering and dissemination technologies, the transparency hurdle should be fairly easily overcome. Furthermore, as the transparency improves it will become easier for independent third-party review to take place. Currently most independent review of improved practices in the built environment takes place through one or more of the national, regional, and/or local green building rating systems[40]. Though these rating systems and their verification processes can be rigorous and beneficial in fostering better design and construction, they often do not have requirements for operational success of the buildings. Within the voluntary and cap-and-trade carbon markets, MMV of actual building performance, and thus GHG emissions reduced, is an absolute necessity.

Some of the potential monitoring, measurement, and verification plan (MMV) options include the following:

- The Voluntary Carbon Standard 2007[41]
    - The VCS relies heavily on various standards from the International Organization for Standardization (ISO), specifically, ISO 14064-1:2006[42], ISO 14064-2:2006[43], ISO 14064-3:2006[44], and ISO 14065:2007.

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[40] This includes the U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Rating System (www.usgbc.org) and the GreenGlobes (http://www.thegbi.org/home.asp) as examples of national programs and the Florida Green Building Coalition (www.floridagreenbuilding.org) as an example of a regional program specific to the state of Florida.

[41] The Voluntary Carbon Standard 2007 - http://www.v-c-s.org/docs/VCS%202007.pdf.

[42] ISO 14064-1:2006 specifies principles and requirements at the organization level for quantification and reporting of greehouse gas (GHG) emissions and removals. It includes requirements for the design, development, management, reporting and verification of an organization's GHG inventory. See this link for more information: http://www.iso.org/iso/catalogue_detail?csnumber=38381.

- The Gold Standard Validation & Verification Manual for Voluntary Offset Projects[45]
- IETA –Validation & Verification Manual[46]
- International Performance Measurement and Verification Protocol (IPMVP)[47]

The Voluntary Carbon Standard (VCS) 2007 appears to be the most suitable standard for the current voluntary (i.e., pre-mandatory cap-and-trade) era in the United States. Though the VCS is designed as an international standard, the other international standards and protocols referenced above seem more focused on the Kyoto Protocol and its Clean Development Mechanism (CDM) which revolve around mandatory cap-and-trade schemes. The VCS excerpts the ISO 14064-2:2006, Clause 5.10 and requires monitoring of GHG emissions reductions projects to include as follows[48]:

- The project proponent shall establish and maintain criteria and procedures for obtaining, recording, compiling and analyzing data and information important for quantifying and reporting GHG emissions and/or removals relevant for the project and baseline scenario (i.e., GHG information system). Monitoring procedures should include the following:
  - Purpose of monitoring;
  - Types of data and information to be reported – including units of measurement;
  - Origin of the data;
  - Monitoring methodologies, including estimation, modeling, measurement or calculation approaches;
  - Monitoring times and periods, considering the needs of intended users;
  - Monitoring roles and responsibilities;
  - GHG information management systems including the location and retention of stored data.

Additional information about monitoring, validation, and verification can be found in the resources referenced in the footnotes from this section.

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[43] ISO 14064-2:2006 specifies principles and requirements and provides guidance at the project level for quantification, monitoring and reporting of activities intended to cause greenhouse gas (GHG) emission reductions or removal enhancements. It includes requirements for planning a GHG project, identifying and selecting GHG sources, sinks and reservoirs relevant to the project and baseline scenario, monitoring, quantifying, documenting and reporting GHG project performance and managing data quality. See this link for more information: http://www.iso.org/iso/catalogue_detail?csnumber=38382.

[44] ISO 14064-3:2006 specifies principles and requirements and provides guidance for those conducting or managing the validation and/or verification of greenhouse gas (GHG) assertions. It can be applied to organizational or GHG project quantification, including GHG quantification, monitoring and reporting carried out in accordance with ISO 14064-1 or ISO 14064-2. Furthermore, ISO 14064-3:2006 specifies requirements for selecting GHG validators/verifiers, establishing the level of assurance, objectives, criteria and scope, determining the validation/verification approach, assessing GHG data, information, information systems and controls, evaluating GHG assertions and preparing validation/verification statements. See this link for more information: http://www.iso.org/iso/catalogue_detail?csnumber=38700.

[45] The Gold Standard Validation & Verification Manual for Voluntary Offset Projects - http://www.cdmgoldstandard.org/uploads/file/GS_VER_VVM.pdf.

[46] IETA –Validation & Verification Manual - http://www.ieta.org/ieta/www/pages/index.php?IdSiteTree=1146.

[47] International Performance Measurement and Verification Protocol (IPMVP) - http://www.evo-world.org/index.php?option=com_content&task=view&id=61&Itemid=80.

[48] See the VCS 2007 (http://www.v-c-s.org/docs/VCS%202007.pdf), section 5.11, page 16 for more information.

F. Enforcement of Ownership

Another concern for carbon offset markets is "the challenge of determining ownership of a particular emission reduction…for example, the rights to make specific environmental claims are often disputed with energy-efficiency or renewable-energy projects where investors, equipment suppliers, utilities and electricity customers are all involved" (Gillenwater et al., 2007). Conventional grid connected electricity generation is the point source for GHG emissions in the building sector. However, buildings themselves including their systems and those occupants operating these systems are the end users of grid connected electricity and ultimately determine how much electricity is used and thus the extent of GHGs emitted.

So who owns the carbon offsets when the building sector becomes more energy efficient than business-as-usual? This is the central question surrounding the challenge of enforcement of ownership. Depending on the GHG emissions reduction purchase agreement, building performance baselines, local codes, and other considerations, it could be possible for the utility provider, the land developer, the building contractor (and/or other building professionals), the homeowners association, and/or the individual homeowner to lay claim to these carbon offsets. As of yet, there are no consensus standards or legal mechanisms in place to prevent the same voluntary carbon offsets from being sold to multiple buyers (Gillenwater et al., 2007). The key considerations to ensure enforcement of ownership will be consistent rules, transparency in registry transactions and offset retirement, and the monitoring of actual emissions reductions per the agreed upon baselines (Gillenwater et al., 2007).

One area that may have a considerable effect on enforcement of ownership and other issues surrounding EECs is the growing discussion about a "load-based" cap and trade scheme as an alternative to "source-based" cap and trade. One of the reasons advantages of a load-based system is the expectation that it promotes end-use energy efficiency better than a source-based system[49]. This discussion is more related to the mandatory carbon marketplace anticipated to be implemented in some states, regions, and/or federally in the foreseeable future. However, valuable lessons might be learned about the interaction between load-serving entities and energy efficiency by following this discussion.

G. Securitization

Securitization is "a structured finance process, which involves pooling and repacking of cash-flow producing financial assets into securities that are then sold to investors…[which] often utilizes a special purpose vehicle (SPV)…in order to reduce the risk of bankruptcy."[50] Within the context of energy efficient credits (EECs), securitization is the process of reducing the risk of monetary losses should an EEC project not achieve its agreed upon carbon offsets.

[49] California and Oregon appear to be taking the lead in discussions about load-based cap and trade options. A good primer on load-based emissions caps can be found at ftp://ftp.cpuc.ca.gov/puc/energy/electric/climate+change/JulieFitchPresentation.ppt
. Additional resources are available at the California Climate Change Portal http://www.climatechange.ca.gov/.
[50] Definition provided by http://en.wikipedia.org/wiki/Securitization.

For example, if a buyer enters into an emissions reduction purchase agreement (ERPA) based on one or more buildings achieving energy savings of a certain percentage beyond jurisdictional code minimum baselines, securitization of these offsets provides a strategy for the purchase of additional carbon offsets should the building(s) fail to meet their designed levels of energy and water efficiency. If this example consisted of a new residential community, one pathway to provide securitization could be collateral payments through the community's homeowners association fees. Essentially the homeowners could be charged for the value of their total carbon emissions offset (such "X" tCO_2/year per home) at the beginning of each year and offered a full or partial refund at the end of the year based on their actual performance.

This homeowners association fee structure would provide assurance to the buyer of the EECs that the seller can make monies available as collateral for agreed upon performance levels. One unique benefit of this type of arrangement and the transparency of penalties and rewards might be the additional incentive of each homeowner to consciously live in an energy efficient fashion so they can achieve their modeled energy performance and realize the value of their carbon offsets via their annual refund.

Insurance and financial companies have begun to take notice of the value of climate change mitigation via energy efficiency in the built environment. AIG offers *Carbon Credit Delivery Insurance* to "insure monetary losses resulting from the risk of non-delivery of or non-generation of carbon credits due to technological performance, credit or political risk[51]." They also anticipate soon offering *Carbon Credit Insurance Endorsements* for both parties in emissions reduction purchase agreements. AIG's other environmental initiatives include *The Sustain-a-Build*[SM52] *Initiative* which offers 10% discounts on premiums for new PLL policies for properties certified by the U.S. Green Building Council's LEED Rating System and *Upgrade to Green*[SM53] which enables property insurance holders to rebuild damaged properties to recognized "green" standards after a covered loss.

H. Permanence

Another important consideration of emissions reduction purchase agreements is permanence, or the duration of the project and the avoidance of GHG emissions reversal at some point in the future. Reversal is a risk for some land-use related carbon offset projects such as no-till farming and reduced emissions from deforestation and forest degradation (REDD). These risks arise from threats such as forest fires which would release carbon stored in the conserved trees and changes in farming practices and/or in the cycling of carbon in the soil.

Within the realm of energy efficiency certificates (EECs), the threat of reversal comes primarily from the complexities of human behavior in coordination with the potential failure of engineered building efficiency systems to meet their designed performance levels due to improper design,

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[51] See http://phx.corporate-ir.net/phoenix.zhtml?c=76115&p=irol-govresponsinitatives for more information.
[52] See http://media.corporate-ir.net/media_files/irol/76/76115/releases/121207a.pdf for more information.
[53] See http://media.corporate-ir.net/media_files/irol/76/76115/releases/111307b.pdf for more information.

installation, operation, and/or degradation in performance over time. The human behavioral component was discussed briefly earlier in this paper.

A strong metaphor for how human behavior can reverse engineered efficiency systems can be found in the transportation sector. The U.S. EPA estimated fuel economy of passenger vehicles provides a projection of the fuel use of each model of vehicle based on a set of testing assumptions. Unfortunately, many of these assumptions do not mirror real world driving conditions. In the real world, conditions that may affect the actual fuel used and emissions generated include as follows[54]:

Behavioral or Maintenance Condition	**Affect on Vehicular Fuel Economy**
Aggressive driving	↓ up to 33% highway and 5% city
Excessive speed	↓ between 7 – 23% for speeds above 60 mph
Excessive weight	↓ of 1 – 2% per 100 lbs of excess weight with increased effects for smaller vehicles
Others: excessive idling, using roof racks, not using cruise control, not using overdrive gears, etc.	Uncalculated
Improperly tuned engine	↓ approximately 4% for minimally out of tune, up to ↓ 40% for serious maintenance issues such as a faulty oxygen sensor
Dirty air filter	↓ up to 10% for clogged air filter
Improper tire inflation (both under and over inflated)	↓ approximately 0.4% for every 1 psi drop in pressure for all four tires
Improper motor oil	↓ approximately 1 – 2% for using improper motor oil for vehicle's engine type

Source: U.S. Department of Energy

Other behavioral considerations include the frequency and distance of passenger vehicle use and the frequency and number of occupants within the vehicle (i.e., driving alone or carpooling). Similarly, behavioral and maintenance issues are critical factors in the real world energy consumption and associated GHG emissions for buildings. For example, recent field studies from the Energy Center of Wisconsin have suggested that programmable thermostats may be achieving lower savings than their estimated potential as a result of misuse, misunderstanding, indifference, or other behaviorally driven factors[55]. This has led the EPA to consider withdrawing this product's ENERGY STAR® certification mark as of May 1, 2008. It is possible that a similar phenomenon could cause ENERGY STAR® Qualified New Homes to fall short of their pre-occupant HERS index, reinforcing the need to more transparently quantify actual building performance instead of mere modeled performance.

The discrepancy between the modeled performance of buildings and building systems with their real world performance only reinforces the value of EECs in the carbon markets as they will

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[54] See http://www.fueleconomy.gov/feg/drive.shtml for more information.
[55] See http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/thermostats/Summary.pdf for more information.

provide the needed transparency and performance monitoring to help close the gap. Like other GHG emissions reduction sectors, energy efficiency has permanence risks. However, if buildings are designed properly and education and motivation is provided for occupants to operate them properly, there is a high likelihood for successfully realizing the potential for the built environment to profitably assist with climate change mitigation.

III. Additional Opportunities and Constraints of Climate Change Mitigation in the Built Environment

Though the examples described thus far have dealt primarily with energy consumption and secondarily with water consumption during the operational occupancy phase of buildings, there are other opportunities for mitigating climate change via improvements to our business-as-usual built environment. Some of these items include: (1) reductions in construction and demolition solid waste; (2) integration of materials with lower, net-neutral, or net-negative carbon intensities; (3) considerations in land cover change resulting from urban development; (4) reductions in GHG emissions associated with the construction phase of buildings; and (5) urban design and planning that reduces the need for carbon intensive light vehicles and other multi-modal transportation considerations.

In one recent study, an economic input-output life-cycle assessment (EIO-LCA) model was used to estimate that "low-density suburban development is more energy and GHG intensive…than high-density urban core development" by a factor of 2.0-2.5 per capita and 1.0-1.5 per unit of living space (Norman, MacLean, & Kennedy, 2006, p. 10). This model considered infrastructure construction materials (for dwellings, utilities, and roads), building operations, and transportation associated GHG emissions. The authors (Norman et al., 2006) concluded with a call to prioritize policies that reduce automotive transport, increase public transit use, shift to higher density land uses centered around existing urban cores, and reduce the operational energy use associated with the high density buildings within the urban core. Much research can still be done, however, enough is known to begin implementing GHG emissions reduction projects via resource efficiency in the built environment through a more complete approach to planning, design, construction, operations, and decommissioning of our buildings and urban infrastructure. These projects offer both the lowest hanging near-term mitigation wedges and a high degree of quality and permanence in both the voluntary and mandatory cap-and-trade carbon markets.

IV. Conclusion

As evidenced in this white paper, it seems likely that a carbon constrained future is on the horizon. The dual challenges of anthropogenic climate change and global peak oil are interlinked and thus necessitate holistic solutions that consider the unique qualities of both challenges. Regardless of the approach, be it voluntary vs. mandatory or market-based vs. fee-based, greenhouse gas (GHG) emissions reductions and alternatives to fossil energy sources will play an increasingly significant role in economic activities at local, national, and international scales. The best near-term mitigation wedge for both challenges and for any approach rests in energy efficiency and conservation in the built environment.

As our society becomes more conscious of energy change and moves toward regulation of greenhouse gas emissions regulation, the building sector will consider ways to capitalize on these trends while reducing its own emissions. While local, state, and national governments have begun to focus on regulating and reducing emissions from the industrial sector, there is a great potential for developers to fund the cost of energy efficient building practices by entering an emissions reduction market on a voluntary basis.

The energy efficiency component of the voluntary carbon marketplace is still being defined. All stakeholders involved in the decision making processes at the planning, design, construction, and operations phases of our built environment have a chance to assist in this definition. This white paper aimed to provide context about the need for, and the opportunities and constraints of, GHG emissions reductions via energy efficiency and conservation strategies. The model contract that follows was developed to provide a foundation for the formation of emissions reduction purchase agreements for energy efficiency products. The authors of this white paper and its model contract respectfully request any feedback readers may have about its content or its aim to raise awareness and speed the implementation of this important climate change and peak oil mitigation wedge.

V. A Model Contract for the Sale of Greenhouse Gas (GHG) Emissions Reductions Via Energy Efficiency in the Building Sector

Effective on ______, __________ (Seller) and __________ (Buyer) enter into this contract for the ownership rights to carbon emissions reductions. The parties agree to the following:

1. Parties to the Contract
Seller is _________, located at _______________. The contact representative for Seller is _____________. Buyer is _________, located at _______________. The contact representative for Buyer is _____________.

2. Background of the Contract[56]

3. Definitions[57]

A. "Greenhouse Gas (GHG)" means greenhouse gas as defined by the Kyoto Protocol, including all amendments to the Protocol and decisions made under the auspices of the Protocol.

B. **"Product"** means ___[58]. The right being bought and sold is a contractual right[59]. Rights and responsibilities that accrue to the product due to future legislation are transferred with the product.

C. "Baseline" means the scenario that reasonably represents the anthropogenic emissions by sources or anthropogenic removal by sinks of GHGs that would occur in the absence of the Project.[60]

D. "Tonnes" means tonnes of carbon dioxide (CO_2) equivalent.

E. "Additional" means any reductions in GHG emissions and increases in stores of carbon produced by the project would not have occurred without the project.[61]

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[56] This should include information on how the parties relate to each other, and the purpose of the contract. Any other information parties consider pertinent may be included here.
[57] Parties may choose to use other sources for definitions, but should clearly define what each term means to prevent future confusion.
[58] The definition of "product" should clearly define the scope and nature of the rights to be transferred, to avoid future conflicts, and will vary with the wishes of the parties. *See* "Creating a Carbon Market Product Through Energy Efficiency & Conservation," p. 13, *supra*.
[59] If used in an area where legislation has been passed concerning the ownership of carbon emissions reductions, this right would potentially be a legislative right, with the rights and responsibilities enumerated in the legislation. Absent legislation, the right is defined and controlled by contract law.
[60] Definition as specified in the "Code of CDM Terms" published by the International Emissions Trading Association, as amended and supplemented on and before the date of the signing of this contract.
[61] NOTE: Emitters operating under a mandatory cap-and-trade system do not have to consider *additionality* when identifying the internal activities and practices that will be adopted to meet the emissions allowances or cap. That's because their emissions cap is their baseline, and any reductions in emissions represent a GHG gain. Definition and

F. "Vintage" means the year(s) of generation of the emissions reductions.

G. "Project Activity" means______.[62]

H. Terms Not Defined by This Contract[63]
Except for terms defined in this section, definitions of terms relating to the interpretation and enforcement of this contract are specified in the "Code of CDM Terms" published by the International Emissions Trading Association, as amended and supplemented on and before the date of the signing of this contract.

4. Product to Be Bought and Sold

A. Seller will provide Buyer with ________ tonnes of product, with a ______ vintage, generated from the project activity. The product provided by the Seller will be the first ____tonnes generated by the project activity.[64] Buyer will pay Seller $______ for this product.

B. Options for Additional Product[65]

i. Amount and Vintage of Options
Buyer has the option to purchase ___[%/tonnes] of the emissions reductions generated by the project activity, with a ____ vintage, at a price of ______% below market price.

ii. Method for Exercising the Options
Buyer must notify Seller, in writing, of Buyer's intent to exercise the option(s) set forth in this section no later than ______. Buyer will pay Seller the purchase price for all exercised options no later than ____days after providing notice to Seller. If Buyer does not notify Seller, in writing, of Buyer's intent to exercise the option(s) on or before _______, Seller may either choose not to sell to Buyer, or Seller may change the conditions of purchase prior to selling to Buyer.

Note excerpted from Willey & Chameides, *Harnessing farms and forests in the low-carbon economy: How to create, measure, and verify greenhouse gas offsets* 12, 209 (2007).

[62] This should include a complete description of any and all projects that will be used to produce the product. Parties may leave the specific methods for reduction up to the Seller, include a description of the specific methods that will be used for producing these emissions in the definition, or include a contract provision that requires Seller use particular methods to achieve the emissions reduction goals. For example, a subsection of "Product to Be Bought and Sold" entitled "Method for Production of Product" could include clauses stating: "Seller will install _____ at the project activity site. Seller will maintain/will contract with ____ to maintain the ______."

[63] If the parties wish to buy/sell in the international market, other terms may be necessary. For example: "International Rules" means the UNFCCC, the Kyoto Protocol, the Marrakesh Accords, any relevant decisions, guidelines, Modalities and procedures made by the COP/MOP and Executive Board, in each case as amended from time to time; "Project Design Document" or "PDD" means a description of the Project prepared in accordance with the International Rules.

[64] This clause may be included if the Seller will be selling to multiple parties. This will provide the order for distribution of product if a shortage occurs.

[65] Depending on the negotiations between parties, several clauses would be appropriate here. This section should clearly define what the future rights of the parties will be.

C. Other Products and Values

Buyer does not have a right to any product not enumerated in this section. Any other environmental benefits and values[66] resulting from the product will belong to the [Buyer/Seller].

5. Terms of Payment

A. Total Purchase Price

Buyer will pay Seller a total of _______ for the product enumerated in section 4 of this contract.

B. Due Date of Payment[67]

1. Down Payment

Buyer will pay Seller ______ at the time of signing of this contract.

2. Installment Payments

Buyer will pay Seller $____ , in ____ installments of $_____. Buyer will pay the first installment no later than ______. Buyer will pay the remaining installment payments no later than______, with the last payment occurring no later than _______.

3. Late Payments

If Buyer does not pay Seller on or before the dates specified in subsection 5(b), Buyer will pay Seller a late fee of ______.

B. Method of Payment

Buyer will deliver payment to Seller at _[bank account or address]_ by__[certified check/certified mail, etc]____.

C. Taxes on Goods and Services

The purchase prices enumerated in section 5 are [inclusive/exclusive] of all goods and services taxes.[68]

6. Delivery of Product

A. Date of Delivery[69]

Seller will deliver ____ tonnes of product with a vintage of ____ no later than ________.

B. Transfer of Title

1. Transfer under Contract

Buyer will transfer title to the product to Seller [at the time the contract is signed and executed/at the time the product is registered with _____.]

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[66] Additional benefits and values resulting from green building may include resulting protection of wetlands, a reduced water usage, or more efficient storm water drainage system, which may have separate marketability.

[67] Payment terms may be modified to suit the parties, including payment at time of delivery.

[68] If the purchase price includes taxes, a provision should be made for the possibility of additional goods and services taxes coming from future legislation, and note the responsible party.

[69] Parties may specify a particular event which will trigger the obligation to deliver instead of a date (i.e., a piece of legislation being enacted).

2. Transfer under Future Legislation
If legislation is passed which requires additional procedures for transfer of title, Buyer will be responsible for the cost and completion of the procedures. Seller will provide Buyer with any necessary information or documentation in Seller's possession, and participate in any procedures that require Seller's participation for completion.

C. Mechanism for Delivery[70]
Seller will deliver the product to [Buyer/Verifier designated in section 8/Third Party] at ________.

D. Taxes, Levies, and Fees
All taxes, levies, and fees associated with the transfer of the title to the product will be paid by [Buyer/Seller].

E. Shortage of Product
If Seller does not provide the full amount of product to Buyer, Seller will:[71] If Seller produces the full amount of the product from the specified project activity, but fails to provide it to Buyer, Seller will pay Buyer liquid damages in the amount of three times the value of the shortage of product[72]. If the product is relied upon for compliance with legislation, and a shortage causes Buyer to incur penalties for noncompliance, Seller will compensate Buyer for the amount of the penalties.

7. Security for Product
Seller will acquire security for the fulfillment of Seller's obligations under this contract in the amount of $____ per year for ___ years. Seller will acquire security with ________. Seller will list Buyer as the beneficiary of the security.[73] If Seller does not acquire the required amount of security, _____.[74]

8. Verification of Product

____

[70] Parties will need to specify here what exactly will be delivered, since the emissions reductions are not a physical object to be delivered. Parties can use options for "delivery" such as transfer of title, registration in a database, delivery of a verification report, etc.
[71] Parties should choose one or several options to cover a shortage. These options include, but are not limited to: Seller will physically replace the shortage of product with an equal product from a different project activity. Seller will pay Buyer the greater amount of (a) repayment of any monies Buyer provided Seller for the product shortage; or (b) Buyer's actual cost of an equal replacement product.
[72] This clause may be added to prevent Seller from selling the contracted product to another party and paying contract damages to Buyer. Damages may be any specified amount, agreed on by both parties. Three times the value of the shortage is often seen as the penalty in proposed national legislation for failure to meet the stated cap.
[73] The exact terms of the security and the ability to make Buyer a direct beneficiary will depend on the financial institution backing the transaction. This section should be drafted with full knowledge of and compliance with those terms. Insurance companies, such as American International Group, Inc. (AIG), have begun to insure transactions involving greenhouse gas emissions. Buyer may also securitize the transaction through internal measures, such as homeowner's association fees. *See* "Securitization," p. 24, *supra*.
[74] The contract should set out what happens if security cannot be acquired (should Seller have right to find new security, or do the parties cancel the contract?).

A. Designation of Verifier
[Buyer/Seller] will contract with _____ (Verifier) to verify the amount and validity of the product. [Buyer/Seller] will bear the costs of verification of the product.

B. Standard for Verification
[Buyer/Seller] will use the _______[75] standard for verification of the product.
[Buyer/Seller] will use the Florida Building code and ________ [76]to establish the baseline for the project activity.

C. Transfer under Future Legislation
If legislation is passed which requires additional procedures for verification, [Buyer/Seller] will be responsible for the cost and completion of the procedures. Seller will provide Buyer with any necessary information or documentation in Seller's possession, and participate in any procedures that require Seller's participation for completion.

9. Progress Reports

A. Production of Progress Reports
[Buyer/Seller] [will provide/will contract with Verifier to provide] progress reports to Buyer and Seller annually. [Buyer/Seller] will deliver the reports to both Buyer and Seller no later than _______ of each year. [Buyer/Seller] will bear the cost of producing the progress reports.

B. Content of Progress Reports[77]
Except for the first progress report, [Buyer/Seller] will provide all [data on/information relating to] _______ for the time period beginning on the date of the latest report and ending on the date of the current report in each progress report. For the first progress report, [Buyer/Seller] will provide [data on/information relating to] ______ for the time period beginning on the date of the [signing of this contract/commencement of project activity] and ending on the same date of the following year.

C. Effect of Unsatisfactory Progress Report
If the progress report is unsatisfactory to Buyer, Buyer may terminate the contract, following the procedures set out in section 15.[78] Buyer must notify Seller in writing that the report is unsatisfactory to Buyer no later than ___ days after the date of receipt of the progress report. If Buyer does not notify seller that the report is unsatisfactory in accordance with this subsection, the report will be deemed satisfactory.

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[75] *See* "Verification and Monitoring of Energy Efficiency Certificates," p. 21, *supra.*
[76] *See* "Establishing the Baseline," p. 14, *supra*, and "Additionality Considerations for Energy Efficient Certificates," p. 17, *supra*.
[77] Parties should be sure that the progress report will include all information that they will wish to review. This may include energy data, results of inspections and maintenance reports from the verifier, and other data specifically related to the project activity.
[78] The parties should clearly define what "unsatisfactory" means if they include this clause. Parties may also require a certain number of unsatisfactory reports prior to termination, or include a chance for Seller to correct any problems noted.

10. Assumption of Risks[79]
Buyer understands that there is no certainty that the product will be recognized as having value under future legislation. Buyer assumes the risk of devaluation of the product, restriction of rights, and other losses due to changes in law or court action [at the time of delivery/time of purchase of the product/time of signing of this contract]. Prior to [delivery/purchase of the product/signing of this contract], Seller assumes all risks associated with the product.

11. Warranties[80]
Seller warrants that Seller has legal title to the product, and that the product is free from encumbrances. Seller warrants that the product has not been registered in an emissions reduction program, except as provided for in this contract. Buyer and Seller warrant that they have the authority to enter into and perform the obligations of this contract.

12. Liability and Indemnification[81]
At the time of signing, Buyer holds harmless and indemnifies Seller against any liability for damage or injury caused by or relating to Buyer's use of the product. Buyer and Seller waive the right to seek "special damages" for punitive, incidental, indirect, or lost business and profit damages.

13. Confidential Information[82]

A. Types of Confidential Information
Confidential information includes: __________. Information that is in the public domain, already known to the other party at the time of disclosure, or required to be disclosed in accordance with law is not confidential information.

B. Use of Confidential Information
The receiving party will not disclose any confidential information provided by the disclosing party, except _______.[83] If the receiving party discloses confidential information, the [disclosing party may terminate the contract following the procedures set out in section 15/receiving party will pay the disclosing party damages in the amount of ______ no later than ___ days after the disclosing party becomes aware of the disclosure].[84]

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[79] Parties will also wish to identify and include all risks associated with the particular project activity, and allocate the risk accordingly, depending on negotiations. Buyer or Seller may wish to take on more or less risk, and this should be reflected in both the purchase price and contract provisions.
[80] Parties will add other warranties based on their negotiations and the nature of the project activity.
[81] Parties will have to decide to what extent they wish to limit their liability to each other and to third parties. Indemnification may be required for leakage issues, depending on the nature of the project activity. "Leakage" means changes in GHG emissions or carbon stocks that occur outside a project's boundary but that nevertheless can be attributed to the project's activities (NOTE: projects whose emissions are directly capped by a regulatory system do not need to account for leakage). Willey & Chameides, *supra*, at 91.
[82] The parties should list any information that they wish to remain confidential. The terms of the contract may be included as confidential information.
[83] Parties should specify the limits of who may see confidential information, including any limits within Buyer or Seller's own organizations. If parties wish to limit what uses confidential information can be put to, this should be specified here as well.
[84] Options for a breach of confidentiality can include damages or termination of the contract. Parties may also wish to differentiate between accidental and deliberate breaches.

B. Effect of Expiration or Termination
Any obligation under this section survives the expiration or termination of this contract. The receiving party will either destroy or return to the disclosing party any confidential information no later than ___ days after the expiration or termination of the contract.

14. Default of Obligations

A. Events Constituting Default
The following events are considered default in relation to this contract:

i. Seller fails to deliver the product as specified in section 6.
ii. Buyer fails to make a payment as specified in section 5.
iii. Buyer or Seller breaches a warranty, or a warranty is proven to have been materially false at the time given.
iv. Seller fails to comply with Seller's verification obligations as specified in section 8.

B. Remedies for Default
Remedies for the events listed in subsections A(i), (ii), and (iv) are listed in sections 6, 5, and 8 respectively. If the defaulting party fails to comply with these remedies, the non-defaulting party may seek termination of the contract, following the procedure set out in section 15. If a party defaults under subsection (iii), the non-defaulting party may seek termination of the contract, following the procedure set out in section 15

C. Exclusivity of Remedies
The remedies specified in this section [are the exclusive remedies available to a non-defaulting party/are in addition to any other remedy provided in law or equity].

15. Termination of Contract

A. Procedure for Termination
If a party has a right to terminate this contract under any section of this contract, the terminating party must provide notice to the other party no later than ____days prior to the date of termination. The notice must include the grounds for termination of the contract. The non-terminating party [does/does not] have the right to cure any defects.[85]

B. Effect of Termination
Buyer will pay Seller any remaining payments due on product delivered prior to the date of termination of the contract no later than ____ days after the date of termination. Seller will deliver to Buyer any remaining product due for payments made prior to the date of termination of the contract no later than ____ days after the date of termination. Buyer and Seller will return or destroy confidential information, as set out in section 13(B).

16. Force Majeure[86]

[85] Parties will also want to provide for the return of any upfront monies, possibly with interest, and any penalties negotiated.
[86] Parties will have to decide what events will constitute "force majeure" (i.e. anything beyond the reasonable control of the party/parties affected by it). In Florida, events such as flooding and hurricanes might be considered

17. Assignment of Rights
Except as provided in subsection(s) ___[87], any assignment of rights under this contract to a third party requires the written consent of both contracting parties. Consent shall not be unreasonably withheld by either contracting party[88].

18. Rights of Other Parties
Third parties do not have any rights to enforce this contract. Third parties do not have the right to the benefits of this contract.[89]

19. Arbitration of Disputes
Prior to taking a dispute to court, Buyer and Seller must attempt to resolve any disputes through arbitration.[90]

20. Choice of Law
The parties to this contact have mutually chosen Florida law to govern this contract. Accordingly, this contract is governed by Florida law.

21. Choice of Forum
The parties have agreed in the course of their negotiations to resolve any dispute arising under this contract in the courts of ______ County, Florida. _______ County is, therefore, the exclusive forum for the resolution of any such dispute, and the parties have agreed to exclude jurisdiction or venue in any other forum. If a dispute arises, the parties must resolve it in the courts of ______ County.

22. Severability of Provisions
The provisions of this contract are severable. If any provision of this contract is determined to be invalid, the remaining provisions continue in effect.

23. Finality and Entirety of Contract
This contract is the entire and final agreement of the parties. All prior agreements and negotiations are merged in these provisions.

"force majeure." Parties can list specific events, a general definition, or a combination of both. Parties will also have to define what will happen if a "force majeure" event occurs (such as right to terminate the contract, refund of monies, and elimination of damages for shortage). Force majeure is defined as "an event or effect that can be neither anticipated nor controlled. The term includes both acts of nature (e.g., floods and hurricanes) and acts of people (e.g., riots, strikes, and wars)." Black's Law Dictionary (8th Ed. 2004).

[87] For example, a party may request delivery to a third party under subsection 6(C).

[88] This clause may be included if parties think they may wish to assign their rights. It may also be excluded if parties have researched each other thoroughly, intend to contract only with each other, and wish to be able to veto the assignment of rights without having to explain any particular reasoning.

[89] In the alternative, Buyer and Seller may specify a party with these rights, including a sister, subsidiary, affiliate or holding company. A verification company may also be given the right to enforce the terms of the contract.

[90] Parties may choose to include arbitration as an option. Arbitration can either be binding or non-binding, but the specific procedure and forum for arbitration should be specified. Arbitration may be useful for this contract because of the uncertainty surrounding this type of transaction. Issues may arise that neither party anticipated, and may be readily resolve through the arbitration process.

24. Survival of Obligations and Rights
All obligations and rights which are either stated to survive after the expiration or termination, or by their nature and context are obviously intended to survive, shall survive the expiration or termination of this contract.

25. Relinquishment of Rights under Contract
The failure of either Seller or Buyer to strictly enforce any right under this contract does not act as a relinquishment or modification of that right.

26. Modifications to Contract
The Buyer and Seller must both sign a supplemental writing in order to modify this contract. The supplemental writing must set forth the modification to the contract. If both parties do not sign a supplemental writing setting out the modification, the modification has no legal effect.

This contract is effective on _______.

____
Seller's Name
Seller's Address

____
Buyer's Name
Buyer's Address

VI. Additional Resources

Major International Emissions Trading Association (IETA) Example Contracts and Emissions Reduction Purchase Agreements (ERPAs)

- IETA – Emission Reduction Purchase Agreement Version 2 (2004)
    - http://www.ieta.org/ieta/www/pages/download.php?docID=450
    - NOTE: Some sources on the Web suggest this 2004 Version 2 ERPA is a simpler document that would be easier to replicate or modify than the 2006 Version 3 ERPA.
- IETA – Emission Reduction Purchase Agreement Version 3 (2006)
    - http://www.ieta.org/ieta/www/pages/download.php?docID=1793
- IETA – Code of CDM Terms Version 1.0 (2006)
    - http://www.ieta.org/ieta/www/pages/getfile.php?docID=1794
- IETA – Emissions Trading Master Agreement for the EU Scheme Version 2.0 (2004)
    - http://www.ieta.org/ieta/www/pages/getfile.php?docID=314
    - UNFCC COP 7 – Marrakesh Accords (Referenced in the IETA Documents)
        - http://unfccc.int/cop7/
        - (See Addendum 2, Page 38, Section H – Monitoring, Paragraph 53)
            - http://unfccc.int/resource/docs/cop7/13a02.pdf

Other Potentially Helpful Example Contracts and Emissions Reduction Purchase Agreements (ERPAs)

- Emission Reduction Purchase Agreements: A Seller's Perspective
    - http://www.cdmdna.emb.gov.ph/cdm/secured/uploads/CDM1803195073306017_Emission_Reduction_Purchase_Agreement__ERPA__FINAL.pdf
- Emissions Reduction Purchase Agreements: Factors to Consider in Negotiation
    - http://www.wbcsd.org/web/projects/climate/ghg-forum2006/chance.pdf
- Environmental Markets Association – Master Agreement for the Purchase and Sale of Emissions Products
    - http://www.environmentalmarkets.org/page.ww?section=EMA+Document+Library&name=Master+Agreement+For+the+Purchase+and+Sale+of+Emissions+Products
- International Bank for Reconstruction & Development – General Conditions Applicable to Certified Emission Reductions Purchase Agreement: Clean Development Mechanism Projects (2006-02-01)
    - http://carbonfinance.org/docs/CERGeneralConditions.pdf

Potentially Helpful Example CDM Projects with an Energy Demand Management Focus

- UNFCCC – Clean Development Mechanism (CDM) Home Page
    - http://cdm.unfccc.int/index.html
- Project 0079: Kuyasa low-cost urban housing energy upgrade project, Khayelitsha (Cape Town; South Africa)
    - http://cdm.unfccc.int/Projects/DB/DNV-CUK1121165382.34/view

- Project 0686: Improvement in energy consumption of a hotel
    - http://cdm.unfccc.int/Projects/DB/DNV-CUK1160721623.56/view

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