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Carbon Policy Matters: Why the Construction Industry Should Support a Carbon Tax

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Abstract:

The construction industry, private owners and government agencies ignore the risks posed by policy at their peril. Construction and development have a symbiotic relationship. Real estate research and professionals assume that cap-and-trade would be beneficial and profitable as they upgrade their buildings potentially saving on their cap. Construction research focuses on modeling the impact of climate change, not modeling the impact of different policies on the industry. However, climate models indicate that carbon emissions in the United States and Western Europe need to decline upwards of 80% (Japan) to 95% (US) from 2002 levels by 2050 to limit warming to the 2-degree target. To achieve these levels of reductions it is more than likely that cap-and-trade will impose significant costs on building and infrastructure owners in the long run. Permits to pollute are bought and traded, with no permits; there is no allowance for pollution. With no pollution allowances, construction would grind to a halt, having significant implications for the construction industry which is an energy and GHG intensive industry (cement, glass, steel, mining and transport of all of these materials). Who is willing to pay more for carbon permits, existing facilities (building and infrastructure) or the builders of new facilities? The researchers believe existing facilities, as carbon permits would pose an unacceptable risk for new builders. As a result, we believe that the construction industry, private owners and government agencies should get behind a carbon tax and in particular a carbon tax with reinvestment to rebuild the power infrastructure significantly reducing emissions without the fear of ending new construction.

KEYWORDS: Climate Change, Carbon Tax, Cap and Trade, Construction, Development

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I. INTRODUCTION

The construction industry needs a policy perspective to understand the different impacts that cap-and-trade versus a carbon tax will have on the industry. Although 2050 seems like a long way off, it is only 34 years away. Many reports recently published point to significant changes to the natural environment and it seems 2016 is off to a very hot start and could be the hottest year on record (Lawler, 2016). With reports being published on global warming, climate change and impacts to coastal cities and buildings due to the melting ice in the Arctic and Greenland resulting in sea levels rising the reasons for politicians to take action will multiply. And regardless of whether individual organizations or their leaders believe human induced emissions are causing climate change, the resulting policy will impact companies significantly because it will impact future projects.

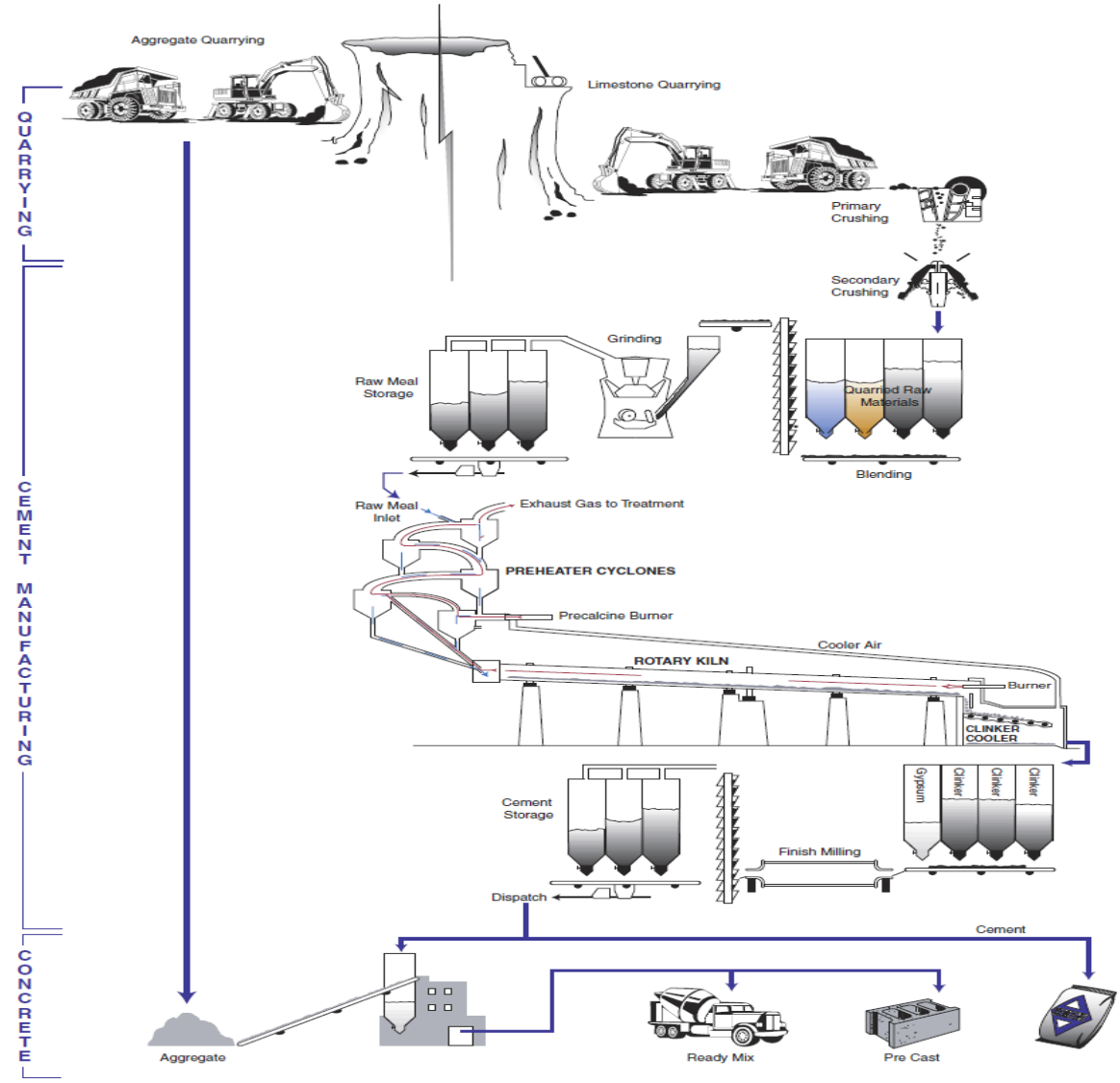
This impact will depend solely on policy, as a carbon tax allows for unlimited emissions provided that a tax is paid for each ton of carbon emitted, while a cap-and-trade limits the level of allowed emissions (within the trading region, could be a country, a subset of states or group of countries such as the EU-ETS) and then allows those permits to be traded freely, allowing the supply and demand to determine the tax applied to a ton of carbon. The principle behind both is similar, however, with strict limits on emissions it is anticipated that the price per ton of carbon under a cap-and-trade could escalate significantly, especially in later years as emission allowances decline significantly (Beach, 2009).

Under a carbon tax, projects could continue as they do today, as the developer/owner would pay for emissions or have the constructor pay for emissions and reimburse the constructor or expect it to be incorporated into the price. Under a cap-and-trade, the developer, owner or contractor would need to acquire permits (purchase them on the open market) and incorporate that price into the project. But, as a project continues to emit carbon following construction the owner or developer would need to ensure that future permits are available to continue viable operations or shut-down prematurely.

Energy Intensity in Construction

The process of construction, particularly infrastructure and buildings, is very energy intensive particularly with the primary components of concrete, steel and glass. Figure 1 illustrates how the process of creating concrete, steel and glass begins at a mine requiring significant energy inputs, from mining equipment, heavy vehicles, transport, processing into a product to be used on a construction site, and then the transport of materials and manpower to the construction site. Cement, steel and glass can have upwards of 50% of their total value in energy (EPA, 2013 and World Steel Association, 2013). One ton of cement releases approximately one ton of carbon dioxide (Rubenstein, 2012).

Figure 1: From Quarry to Concrete (Glass and Steel): Significant Embedded Energy.



Source: https://www1.eere.energy.gov/manufacturing/industries_technologies/imf/pdfs/eeroci_dec03a.pdf

In this article, the researchers seek to explain the impact of policies on the industry, provide an introduction to climate change (Section II), a response to climate change (Section III) that discusses carbon taxation and a cap-and-trade and the impact on the construction industry, an alternative tax structure (carbon tax with reinvestment) to produce a benefit and cost certainty (Section IV) enabling the construction industry to thrive, and conclude (Section V) with why the industry should be proactive and support a carbon tax with reinvestment to preclude a bad policy from being implemented.

II. CLIMATE CHANGE

Due to human created emissions, the world is experiencing a significantly changed climate. The consequences of global climate change are far reaching. Over a 50-year period, the

National Aeronautics and Space Administration examined global temperatures. The study indicated that the rising temperatures lead tropical forests to work less effectively the planets key source of absorbing carbon dioxide from the planet's atmosphere (Wang, 2013).

Noted climate scientists have offered analyses that attributes the majority of the last 50 years' increase in the average global temperature to human induced greenhouse gases (GHG) (U.N. Framework Convention on Climate Change)[5] emissions (Parmesan, 2013). Additionally, it seems that the 14 hottest years in recent recorded history have all come in the last 15 years. With oceanic temperatures reaching record highs, and Arctic ice melting faster than most models predicted (Transcript of Obama's Climate Change Speech, Bloomberg, 2013).

Assemblages of climate scientists have come to the conclusion that the earth may have already been irrevocably damaged by excess carbon emissions and those damages have effectively changed the atmospheric composition of our planet (Craig, 2010). According to the Intergovernmental Panel on Climate Change (IPCC), the consumption of fossil fuels is responsible for the majority of anthropogenic GHG emissions (Intergovernmental Panel on Climate Change, 2011). As a result of greenhouse gases, energy is trapped in the atmosphere causing it to warm (EPA Analysis, 2008). The name of this phenomenon is the greenhouse effect, in the correct proportions this is natural and necessary event that supports life on Earth (EPA Analysis, 2008). However, the excess greenhouse gases that are trapped act as a blanket around the earth, which not only causes havoc with the natural environment it negatively affects the built environment as well.

III. POLITICAL RESPONSE TO CLIMATE CHANGE

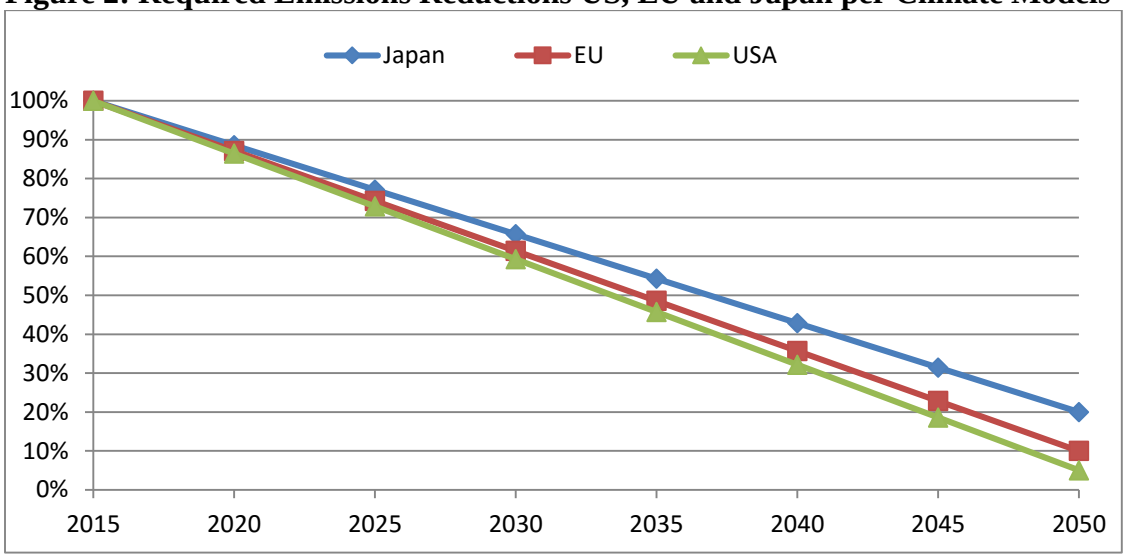
Greenhouse gas (GHG) is a global problem that requires global solutions (EPA Analysis, 2008). Several nations have been searching for some type of climate change legislation that will result in the lowering of GHG emissions (Loewentheil, 2013). Significant disagreements exist between nations as to what steps will achieve the intent of lowering carbon emissions exists. A fairness question has been raised since developed nations never faced such parameters as they were developing (Diplo), which has moved the discussion towards contraction and convergence.

Carbon emissions are not stationary and travel around the Earth's atmosphere creating a global issue due to worldwide climate change (Gersbach & Noemi Hummel, 2011). If the current models were to continue as theorized, and countries around the world remain unwilling to take serious steps to mitigate their emissions of carbon, the result of the increased build-up of GHGs around the world is anticipated to increase the rate of rise in the sea level to twice what occurred during the pre-industrialized levels before the end of this century (Alley et al., 2007). The world is in desperate need of a new plan and direction, one that actually moves to unify the world in the combined effort to effectively reduce GHG emissions.

Under IPCC models and estimations by most climate scientists the following reductions in emissions are needed, this includes 80% for Japan, 90% for the E.U. and 95% for the U.S. These reductions are demonstrated in Figure 2, using current emissions levels. The concept of the size of these reductions is to contract and converge emissions across countries using a per person basis (Brown, 2014) to achieve equity and therefore buy-in by other countries.

[5] U.N. Framework Convention on Climate Change, 1949 U.N.T.S. I-30822 (defining "greenhouse gases" as "those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation")

Figure 2: Required Emissions Reductions US, EU and Japan per Climate Models



This significant reduction in required emissions may or may not be met. However, it is possible that politically this strategy could be adopted. As such, we make the simplifying assumption that this strategy needs to be met. The alternative is uncertain climate change that could have a significant impact on sea level, climate and agriculture, and emissions due to increased heating and cooling requirements from a changing climate. Increases in sea level would result in significant costs of relocating people and infrastructure (roads, pipelines, ports, buildings, etc.).

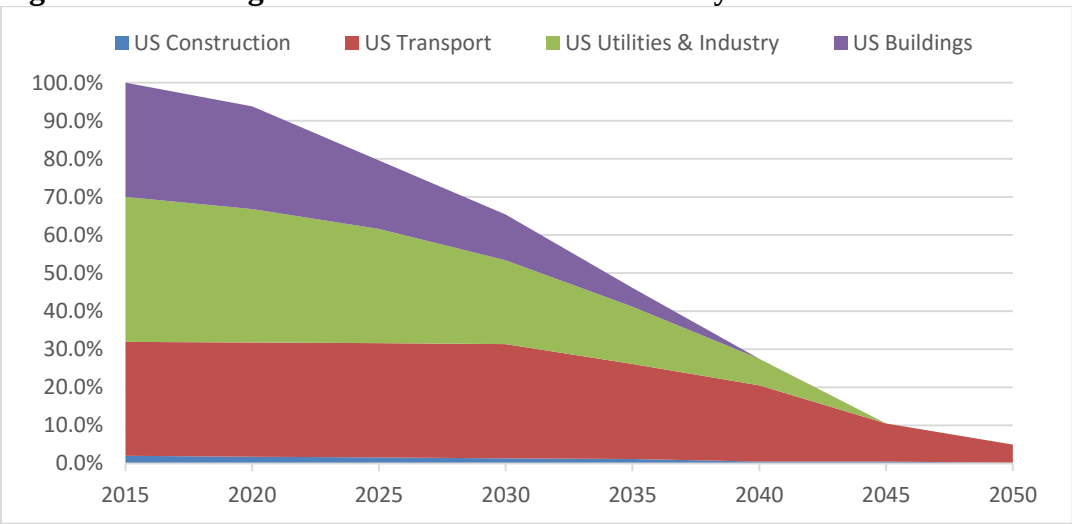
Allowing the infrastructure (pipelines, roads, highways) and buildings to go underwater would have a significant negative environmental impact, violating multiple federal regulations, including the Clean Water Act (CWA, 1987), the Coastal Zone Management Act and Reauthorization (CZARA, 1972), National Pollution Discharge Elimination System storm water permit under Section 402 of the CWA and the Intermodal Surface Transportation Efficiency Act (ISTEA, 1991) among others (EPA, 1995). Rising sea levels affect the impact of storms, such as hurricane Sandy that cost New Jersey $30 billion (State of New Jersey, Dept. of Environmental Protection, n.d.), insurers $28.2 billion and had an economic loss of $65 billion. Further, a staggering number of homes and businesses (642,000) were damaged in New York and New Jersey. The impact of this storm resulted in Congress declaring that homeowners living in high-risk areas (i.e. coastal towns) are now mandated to have flood insurance (Sebayan, 2014). More importantly, hurricane Sandy resulted in significant insurance cost increases that could eventually exceed 500%, impacting the cost of operating real estate (Dawsey, 2013). This is an important omen for the construction industry.

While the Supreme Court prevented President Obama's efforts to regulate coal emissions in Feb. 2016, this was only managed with a 5-4 vote, with the four liberal members dissenting (Liptak and Davenport, 2016). This was a defeat for President Obama as the Supreme Court blocked his climate change rules (de Vogue, Berman and Liptak, 2016). While this lawsuit involved 29 states and the energy industry, if Merrick Garland, President Obama's proposed

replacement for Supreme Court Justice Antonin Scalia has been on the court that the vote would have been 4-5 (de Vogue, 2016).

It is necessary to note that President Obama, and Candidates Hillary Clinton and Bernie Sanders have called for at least an 80% reduction in emissions by 2050 (Bryce, 2015). Figure 3 demonstrates a reduction in emissions of 95% by 2050. Whether this requirement is imposed politically by 2050 or 2070 is not relevant, what matters most is how we achieve this reduction as this will have the greatest impact on the construction industry.

Figure 3: Modeling a 95% Reduction in Emissions by 2050



There are two competing methods that have been proposed to be utilized to diminish GHG emissions through market based strategies.

Carbon Tax

The first of these competing methods is called carbon taxation. This is a tax that is applied to emissions, with a charge per ton of carbon dioxide emitted (Young, 2009). This approach is often acclaimed for its fair strategy (Waggoner, 2009). All carbon emitters, at every level of industry and economic class create negative externalities in the form of pollution (Sewalk, 2014). A carbon tax makes it possible to internalize these negative externalities (Duff, 2003). In effect, a carbon tax mandates that the polluter must endure the costs it has imposed on the environment (Sewalk, 2014).

In implementing a carbon tax, proponents of this system suggest that the tax be refunded to the payers by either dividing it equally among all players or reducing the other taxes charged (i.e. income tax rates). In the equal dividends scenario, the revenues are rebated to all residents of a particular member country in equal portions. In the tax shift approach, every revenue dollar is allowed to reduce the existing tax base by an equal amount (Metcalf, 2011). Even if either of, or both of the revenue return directions makes the public more favorable to a carbon tax, there is no guarantee that the underlying objective of reducing carbon emissions will be achieved by enacting this type of carbon tax. A carbon tax is cost (price) certain but lacks benefit certainty (guaranteed reductions in emissions).

Cap-and-Trade

In order for a governmental body to create a cap-and-trade system for GHG, it has been suggested that some sort of governmental agency would have to first be established and tasked with setting a maximum level of pollution which would be the cap for carbon emissions (Hahn and Stavins, 2011). Once that cap (limit) has been set in place the industries/firms that have been targeted would be required to reduce their emissions of GHG to a level under the cap that was set (Hahn and Stavins, 2011). If an industry/firm does not need or use its allowable pollution limits amount, it has the ability to sell these credits to polluters that are unwilling or unable to meet the industry set standards for emissions of GHG. This supply and demand driven structure appears to create a market for emissions. That market is intended to encourage innovation in clean technologies to further address the mission of lowering GHG emissions (Hahn and Stavins, 2011). The structure of a cap-and-trade makes it benefit certain, assuming all emissions are accounted for and the only way to pollute is to purchase emissions with strict enforcement of those permits.

Perhaps (cynically) the greatest advantage of cap-and-trade is that in the current political climate it avoids the use of the word tax while allowing politicians seem current on the issue and present paths to potentially address climate change (Stavins and Hahn, 2010). Environmental groups tend to be drawn to cap-and-trade because a cap (limit) is seen as a clear restriction for polluters. The key assumption is that a cap-and-trade will incentivize industry/firm to pursue a reduction in emissions (Sewalk, 2013) as industry has to pay for permits to pollute.

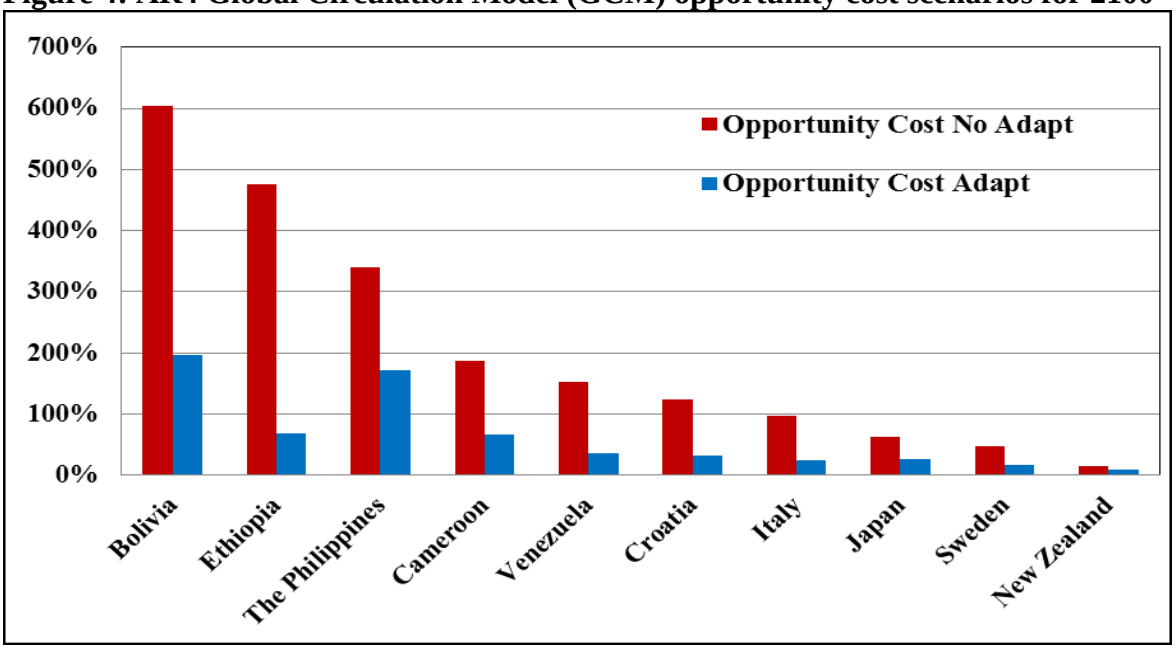
In order to reach these conclusions, two assumptions have to be accepted: (1) carbon emissions cap set by a governmental agency will be acceptable and will no cause further damage to the natural environment and (2) that trading on a carbon emissions market is the most cost effective means of reducing carbon emissions to the levels set by the governmental agency. Perhaps the biggest cons of cap-and-trade are in determining a baseline amount of emissions and reduction targets, how those allowances will be allocated throughout various industries/firms and how those offsets will be used (Nell, 2009). Furthermore, if the target reductions are to be achieved, the cap will be lowered continually, if not systematically, to a point that may burden the construction industry to a point of complete halt. Peak oil can occur not only from geological perspective but from a cap-and-trade perspective as well. As in the case of the sulfur market of the 1990's, while this yielded reduced sulfur dioxide and therefore sulfuric acid on farm lands, the types of pollution shifted from sulfur to carbon resulting in the unintended consequence of increased carbon dioxide emissions from using Western coal (bitumen) rather than Eastern coal (anthracite) (Nell, 2009).

Infrastructure Impacts

The impacts on infrastructure due to climate change are alarming. Research was performed that compared across ten countries the impact on roads through 2100, this has given a clear metric of what those costs can look like being reactive verses being proactive. That study included ten economically and geographically diverse countries and examined the potential impact of 54 distinct AR4 Global Circulation Model (GCM) scenarios of future climate change on these countries' existing networks of roads (Schweikert et al, 2014). The result of that study is shown in Figure 4. Without the adaption and implementation of a tax policy to achieve the benchmarks needed to avoid further climate change, this is but a snapshot of the unintended consequences of indifference. If the cost to maintain and repair the current road system exponentially increases, the cost of further development will come to a halt. The cost of

purchasing construction products and services would exceed the value of the intended project rendering construction as unsustainable industry.

Figure 4: AR4 Global Circulation Model (GCM) opportunity cost scenarios for 2100



IV. RATIONAL RESPONSE (CARBON TAX WITH REINVESTMENT)

As noted above, a carbon tax is cost certain as the price is known and a cap-and-trade is benefit certain because emissions are limited. The implication of climate change is that unless energy becomes much cleaner, products either need to become much more energy efficient or we simply need to do less of whatever it is we do today. This is how cap-and-trade is modelled. So, is there a better alternative? The authors believe there is, and it is called a carbon tax with reinvestment.

Any type of carbon tax will generate revenue. For example, set a tax at $20 per ton of carbon (a relatively modest tax rate) and it would generate approximately $100 billion per year. The reasons that a carbon tax with reinvestment is better in this situation than cap-and-trade are as follows: (1) it provides both cost and benefit certainty, (2) the legislation would be relatively short and not need extensive addenda, (3) implementation would be straight forward, (4) enforcement is simplified (rate per dollar produced based on emissions intensity), (5) revenues are collected and reinvested in new infrastructure, 6) it could coordinate easily with existing laws, and (7) would be very effective environmentally (Sewalk, 2014). This tax should be implemented as soon as possible in the form of a carbon tax with reinvestment. It is how the revenue will be used that will play a large role in the equity of the tax.

After breaking down United States households into income and regional groups, a study showed lower income groups would not only be affected greater by climate change, but would also be impacted greater by a tax on carbon emissions because of heating and electricity costs. Just to assume that a carbon tax would encourage power innovations does not advance us closer to a viable solution. To firmly position our future by having the most direct impact on our power sector, the tax revenue will be directed to constructing new infrastructure. Our current power

plants will be replaced with nuclear, geothermal, solar, wind facilities, and perhaps others.[6] As the process of shifting energy sources is underway, there will be no added expense for the shift.

It is important to keep in mind that utilities provide power as base load (produced 24 hours a day) and peak load (designed to meet peaks in demand that occur in the morning, during the day and especially late afternoon in the summer). Utilities also provide the bulk of power used by our industry and buildings. Current base load is powered by coal and nuclear power, which produce power 24/7. Natural gas, while feasible to produce base power, is more commonly used for peak power. Hydroelectric, assuming abundant water supplies are available may be used for either base or peak power. Wind and solar are named intermittent, this is because they cannot be relied on to produce power when power is needed. Battery storage using either batteries or hydroelectric pumping could potentially, when combined with wind and solar, could overcome this, once battery storage has improved significantly enough. Deep geothermal could operate as a base power plant.

The need to provide power when power is needed requires an investment in nuclear and deep geothermal (to replace coal and to a significant extent natural gas) to provide power at all times. While wind and solar will add significantly to the capabilities, it is assumed that battery technology makes significant enough leaps to become viable by the mid-2020s or 2030 to allow wind and solar to begin to replace a significant part of peak load. The key assumption here is that the public and government would support a tax that replaces infrastructure to minimize climate change, however, at least the public would not be willing to endure significant reductions in lifestyle and per capita income.

A carbon tax with reinvestment would pay for the construction of all of the power plants and as Figure 3 demonstrates, could eliminate emissions from utilities, industry and buildings by 2040. Undertaking a significant move towards battery operated vehicles using power from clean power plants would allow us to reduce transport emissions significantly by 2050 so that overall emissions are a fraction (5-10%) of current emission levels. The authors note that displaced coal workers could find jobs in power plant construction, that the standard of living would continue to rise as clean power replaces fossil fuel power, and the introduction of so much power and battery use would allow the construction industry to mine in a clean manner, process materials cleanly and transport those materials to construction sites using clean battery or hydrogen fuel powered vehicles, machinery and equipment.

Over time the energy cost will decrease because the newly constructed power plants will not be burdened with a carbon tax. The adoption of a Carbon Tax with Reinvestment with directed investments into the supply side of the power and energy equation would mean that within a period of twenty years, the United States could achieve a 38.67% to 74.91% reduction in carbon emissions across the building and utilities sector, as clean new power plants are brought on line. The end game payout for the United States tax citizen results in cheap clean energy and a shift in geo-global politics that offers the United States independence from fossil fuel and the unrest that comes with those relationships, as well as the ability to bring production back to the United States as this tax encourages local production rather than imports.

V. CONCLUSION

The construction industry partnered with the owners (real estate developers) need to understand the issues involved in the potential adoption of the two competing options to address

[6] The logistics of this transfer of ownership go beyond the scope of this paper, but will be discussed in a separate article.

the impact of climate change (carbon tax and cap-and-trade). These options are not as interchangeable as some may believe. While it would seem that cap-and-trade presents a less adversarial position because politicians are not tasked with the negative word attachment of tax, it could have a significant impact on the construction industry (permits to build may not be available and current building owners may choose to purchase permits to keep those buildings inhabited rather than build new ones). With potential limits on the horizon (34 years is a very short time period), with no guarantee that these can be mitigated especially if the impacts of climate change are strongly felt, it would be wiser for the industry to back a carbon tax. In particular a carbon tax with reinvestment. The success of the 1990's sulfur market is an optical illusion as cap-and-trade that only kicked the pollution can down the road and exchanged an acid rain problem for a climate change problem by exacerbating carbon dioxide emissions.

A carbon tax with reinvestment provides a solution that offers both cost and benefit certainty. The revenue from the carbon tax will be used to construct new and non-fossil fuel burning power plants. This would actually be tremendously beneficial for the industry. As those newly constructed power plants are being constructed jobs will be created. The benefit to the United States citizen will be clean and cheap electricity. Avoiding further climate change, comparing the impact on roads in ten countries through 2100 research will ultimately assist in insuring the continued strength of the construction industry both in horizontal and vertical construction. The results from that research coupled with the findings of a carbon tax with reinvestment can help policy makers at both the national and international levels make the case to their constituents an easier educational discussion.

And the construction industry, private owners and government agencies would benefit by being proactive to ensure that legislation enacted would ensure a positive reduction in emissions while ensuring that the industry remains active and assists in the reduction in GHG emissions.

VI. FUTURE RESEARCH

In the process of doing this research, we crossed some interesting research questions that the authors hope to address in a future paper. Assuming stakeholders do not take action in time to reduce emissions and address climate change, who would be responsible for moving coastal infrastructure and buildings? It is known that rising waters could take away property rights and make infrastructure and buildings below a rising sea worth nothing. But could builders and building owners be liable? For reflection, the authors reference an analogy in U.S. mining laws, which changed in 1977 (Surface Mining Control and Reclamation Act of 1977). Prior to 1977, a miner could establish a mine, and did not need to reclaim the land to its original or similar state. Post 1977 and this legislation, miners were now responsible financially for this. A method of minimizing these costs was to keep mines operating, but if coal has to shut down due to a cap-and-trade there are significant questions as to whether they can afford to clean up (Mufson and Warrick, 2016). If climate change impacts coasts as expected, could infrastructure and building constructors and owners be jointly liable for removing and relocating infrastructure and buildings? This is worthy of consideration, and if so, the authors would encourage the construction and real estate industries to get behind legislation that could solve climate change while minimizing the industry's potential financial liability. After all, those building on the coasts and below sea level should be fully aware of the risks and the limited lifespan of these buildings and infrastructure, and could well face legislation deeming this so.

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