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Risky Business: A Micro & Macroeconomic Analysis of Policy Scenarios and Energy Mix Risks

THESIS SUMMARY REPORT

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2014/2015

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I. INTRODUCTION

There are a number of problems our generation has faced; global warming, the 2008 Financial Crisis, oil price shocks, etc, which have been met with denial and inaction by markets and governments[1]. These problems have produced events such as Hurricane Katrina, increased requirements by the Basel Accords, and global effects of oil price drops. These worst-case scenarios have produced the role of Risk Management. An integrated value-based Enterprise Risk Management program (ERM) distributes inevitable risk exposure over a number of possible events that deviate from an expected result, smoothing the magnitude of subsequent outcomes. Board of Directors and shareholders, at a microeconomic level, can engage strategically into satisfying compliance and disclosure requirements, while maximizing returns on investments[2]. Government bodies, at a macroeconomic level, can use ERM with respect "to their entities, and how this can better leverage their limited resources and help them achieve their strategic objectives"[3]. Currently, businesses and governments are beginning to realize "economic growth is producing unintended but perilous changes in the climate and earth systems[4]." Although there is some debate, climate change is a very real matter, proven through research from climate science, ecology, engineering, economics, politics, and international relations[5]. The primary source of global warming is the burning of carbon-based, fossil fuels that produce emissions of carbon dioxide (CO2), a type of greenhouse gas (GHG). Emissions originate from our personal lives, but are present at operational levels in businesses, government development, and trade. Methane, the second largest source of GHGs originating from livestock and wetlands, is 25 times more powerful than CO2 per pound

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[1] William Nordhaus, *The Climate Casino: Risk, Uncertainty, and Economics for a Warming World* (Yale University Press, 2013), p. 18.

[2] Sim Segal, *Corporate Value of Enterprise Risk Management: The Next Step in Business Management* (John Wiley & Sons, 2011), pp. xiv-xv.

[3] Ibid., p. xv.

[4] Nordhaus, *The Climate Casino*, p. 3.

[5] Ibid., p. 4.

(though it has a shorter lifespan) and is normally removed naturally[6]. Although there is a global decline of carbon intensity, or decarbonization (CO2 emissions are not growing as rapidly as world output[7]), global GHGs are still rising in many of the world's fastest growing cities[8], such as China and the Middle East. The first attempt at an international climate policy to reduce GHGs was the United Nations Framework Convention on Climate Change's (UNFCCC) Kyoto Protocol. It spurred international debate on global warming but did not provide adequate incentives to encourage countries to ratify, setting unrealistic targets. Climate policies are difficult to encourage participation because, while climate change affects the entire globe, costs are regionally incurred and affects accumulate far into the future; today's population will not see the final effects of a global climate policy. In the short-run (50-70 years), despite high switching costs in replacing existing infrastructure for renewable energies, if goods were priced according to carbon content, low-carbon goods would be cheaper. In the long-run (150 years), the switching costs would pay off. This research discusses emission risks within developed and developing economies, specifically in regards to trends in non-renewable and renewable energy sources, corresponding to the much-debated climate policy scenarios presented by the IEA in the short and long term. Applying micro and macroeconomics as the basis of rational decision-making, the use of ERM must extend via a bottom-up approach from businesses into government management and international policy.

II. RESEARCH CHAPTERS

CURRENT TRENDS

Nearly exclusively drawing upon the IEA's World Energy Outlook, Key World Energy Statistics 2014[9], Asia refers to all Asian countries, excluding China. OECD countries refer to nations who

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[6] United States Environmental Protection Agency, "Overview of Greenhouse Gases," http://epa.gov/climatechange/ghgemissions/gases/ch4.html, accessed January 2015.

[7] Nordhaus, *The Climate Casino*, p. 22.

[8] International Energy Agency, "World Energy Outlook 2014 Executive Summary" (PDF file), downloaded from IEA website, [https://www.iea.org/Textbase/npsum/WEO2014SUM.pdf], accessed 20 February, 2015.

[9] International Energy Agency, "Key World Energy Statistics 2014" (PDF file), downloaded from IEA website, [https://www.iea.org/publications/freepublications/publication/KeyWorld2014.pdf], accessed 20 February, 2015.

originally ratified the Convention on the Organization of Economic Cooperation and Development, including (but not limited to) Australia, Belgium, Canada, Germany, Greece, Italy, Japan, the United Kingdom, and the United States of America. Non-renewable energy sources are natural resources that have a decreasing resource stock with respect to its rate of exploitation[10]. Such resources include oil, natural gas, and coal. Renewable energy sources are natural resources that have an increasing resource stock with respect to its rate of exploitation, but cannot exceed the carrying capacity of the ecosystem. Renewables include wind, biomass, solar power, tidal energy, nuclear power, and hydro power[11]. Between 1973 and 2013, the Middle East had been the largest producer in oil, but dropped in share of production as China increased its oil production share. OECD countries experienced stable production in natural gas, but their production share decreased dramatically due to emerging markets' surge in production share. China and Asia largely affected the increase in share of production of coal, and OECD countries dropped half in production share. From 1971 to 2012, China and non-OECD Americas grew their hydro production share; OECD countries maintained stable production levels. Although share in production decreased due to increases in Non-OECD Europe and Eurasia, and China, OECD countries were the largest producing region of nuclear power. In final consumption, the Middle East, China, Asia and Africa had the largest increases compared to the rest of the world. Coal and natural gas are the contributors to the highest increases in emission production of CO2. While developed countries with mature economies are delving into less energy intensive supplies, reducing shares of production and supply of non-renewable energies, developing countries are experiencing rapidly expanding population and economies, requiring cheap fuels compatible with existing infrastructure. Thus, developed countries may be reducing their energy intensity and shares of production and supply, but the carbon offsetting is void due to developing countries' economic and energy demand requirements.

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[10] Simone Mori, "Lecture 3: Natural Resources." Economics and Management of Energy Business, Fall 2014, LUISS Guido Carli University, Rome, Italy, [http://docenti.luiss.it/mori/files/2014/09/3-Natural-resources.pdf], accessed March 17, 2015.

[11] Ibid.

METHODOLOGY

Value-based ERM aims to address risks from all risk sources, measure integrated impact of risks occurring simultaneously, aggregate exposure to the enterprise level, define the risk appetite of the enterprise, and integrate risk information into decision-making, business performance analysis, and incentive compensation[12]. Financial risks are unexpected changes in external markets, prices, rates, and liquidity supply and demand; strategic risks are unexpected changes in key elements of strategy formulation or execution; and operational risks are unexpected changes in elements related to operations, such as human resources, technology, processes, and disasters[13]. Although traditional risk management products are mistakenly deemed as value-based ERM, using a value-based ERM model means each risk scenario is assessed with an integrative approach, producing very pessimistic, pessimistic, optimistic, and very optimistic scenarios. These scenarios and subsequent strategies can be applied from firm levels to microeconomies and macroeconomies in order to establish relationships between businesses, national governments, and international cooperation. With respect to IEA climate scenarios and the use of ERM methodology, the risk scenarios are as follows: the Business As Usual case (BAU) as the baseline scenario, the New Policy Scenario case (NPS) as the optimistic scenario, and the 450 Ideal Policy Scenario case (450) as the very optimistic scenario. The pessimistic scenario will be briefly analyzed within a graphical context.

ECONOMICS

Global energy demand poses a monumental challenge for policymakers. Thus, motivational policies must intertwine at the roots of economies.

Microeconomics: Microeconomics explains firm dynamics with respect to maximizing profits and acting in self-interest. Perfectly competitive markets contain homogenous products, a perfectly

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[12] Vittorio Vecchione, "Session 1: Course Overview - ERM Introduction." Risk Management, Winter 2015, LUISS Guido Carli University, Rome, Italy, [http://docenti.luiss.it/vecchione/files/2015/02/Session-1-Course-Overview-ERM-introduction.pdf], accessed March 4, 2015.

[13] Sim Segal, *Corporate Value of Enterprise Risk Management,* p. 27.

saturated market of buyers and sellers, perfect information, and free firm entry and exit. Monopolistic markets are sole suppliers in their industry, are price setters, and are protected by some form of barrier to entry, such as a patent[14]. In perfectly competitive markets, firms make no profit and produce allocative efficiency. Monopolies are profit maximizers and produce deadweight loss. Welfare economics, an expansion on efficiency, uses Pareto-efficiency: the best possible situation where no one individual can be better off without making at least one other individual worse off, even if a deadweight loss is produced. To occur, it must comply with the three conditions: consumers and firms behave competitively in all markets; markets exist for all exchanged goods; and operators receive perfect information[15]. Externalities, a type of market failure, cause societies to forcefully incur costs or benefits. A positive externality exists when society benefits more than the firm. Negative externalities occur when the cost to society is more than the cost the consumer pays. Other market failures that are important to consider include imperfect, or asymmetric, information (moral hazard and adverse selection), free riding and tragedy of the commons in public goods, market power, and lack of markets, which can be intervened either ex-ante or ex-post. Game theory describes how firms act and react, where noncooperative game theory studies how firms interact when they are focused on their own self interest[16] and cooperative game theory studies how firms interact when they are working toward a collective goal. Prisoner's Dilemma, a special situation, describes incentives to cheat within a game.

Macroeconomics: The macroeconomy and the microeconomy are closely linked; if shocks to either take place, the other will be affected. Macroeconomic factors, such as unemployment rate, price indexes, interest and exchange rates, and imports and exports, are useful to governments. Variations in unemployment rates are predominantly due to increased globalization, the rise and fall of

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[14] Simone Mori, "Lecture 4: Regulatory Economics." Economics and Management of Energy Business, Fall 2014, LUISS Guido Carli University, Rome, Italy, [http://docenti.luiss.it/mori/files/2014/09/4-Regulatory-economics.pdf], accessed March 17, 2015.

[15] Ibid.

[16] David K. Levine, "What is Game Theory?," levine.sscnet.ucla.edu, [http://levine.sscnet.ucla.edu/general/whatis.htm], accessed April 2015.

significant industries, and the rapid growth of the technology sector[17]. With increased globalized and the introduction of many technology markets, labour is increasingly diverse within niche skill sets. Although people are free to move across markets, countries, and industries, some sets of skills cannot be easily transferred. Price indexes help governments create well-fitted, proactive policy by following trends. The Consumer Price Index (CPI), describes the monthly weighted average prices paid by consumers for a basket of goods[18]. The Producer Price Index (PPI), describes the average selling prices for given outputs for a basket of goods[19]. Interest and exchange rates are important factors used to determine a country's economic condition. Interest rates can attract or detract foreign capital, causing subsequent changes in exchange rates. Lastly, every country has different sets of local resources, which can create country-specific advantages in trade, either in the resource itself or in other skills developed within the country. Exporting and importing goods grows global markets and national economies. Exports are sales of goods from a domestic market to a foreign market and imports are foreign manufactured goods that are purchased by the domestic market[20].

RISK

Experts have concluded the following over the last century: 1) current CO2 concentrations are significantly greater than any level observed in 650,000 years; 2) increases in global temperature from 1900 to 2100 is estimated to be between 1.8 and 4.0 degrees celsius; 3) sea level rise for the 21st Century is estimated to be between 18 and 60 cm (excluding large ice sheets); 4) temperatures are expected to rise faster in the Arctic than global temperature; 5) by summer end of the 21st Century, the Arctic Ocean is predicted to be nearly ice-free; 6) increases in frequency and intensity of hurricanes; 7) acidification of oceans due to CO2 concentrations; and finally, 8) extreme weather

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[17] Mustafa Babiker and Richard S. Eckaus, "Unemployment Effects of Climate Policy," http://economics.mit.edu/files/2438, accessed April 2015.

[18] Investopedia, "Consumer Price Index CPI," http://www.investopedia.com/terms/c/consumerpriceindex.asp, accessed March 2015.

[19] Investopedia, "Producer Price Index PPI," http://www.investopedia.com/terms/p/ppi.asp, accessed March 2015.

[20] Study.com, "Importing and Exporting in a Global Market: Definition, Process & Importance", http://study.com/academy/lesson/importing-and-exporting-in-a-global-market.html, accessed June 2015.

forecasts[21]. From a policy framework perspective, the Intergovernmental Panel on Climate Change (IPCC) produces detailed Special Reports on Emissions Scenarios (SRES). These reports support the UNFCCC, which produces ratifying protocols, such as the Kyoto Protocol. In specific protocols, the UNFCCC can set binding limits but otherwise has no enforcement mechanisms in place. The biggest contributor to climate negotiations and the climate policy debate is the energy sector. In IEA's Special Report, the report "demonstrates that the energy sector, in its own interest, needs to address now the risks implicit in climate change – whether they be the physical impacts of climate change or the consequences of more drastic action later by governments as the need to curb emissions becomes imperative[22]." Non-OECD countries have increased their share of global emissions from 45 to 60 percent, and China was the biggest contributor to the increase in global emissions in 2012[23]. The importance of a comprehensive policy at this level, directly focusing climate policy negotiations to target energy businesses within all GHG-contributing nations, means governments will engage proactively in policy measures. Without this kind of policy, a reactive approach to policy measures will be taken, where governments and businesses will produce everything possible today to receive the highest profit conceivable, significantly contributing to GHG concentration for the future and leaving very little in resources.

POLICY SCENARIOS[24]

Pessimistic: There has not been much deliberation in climate scenarios worse than the BAU scenario. According to blogger David Roberts, if we continue on the path we are now, climate change could take on a life of its own[25]. By 2300, we could see global average temperature increase

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[21] Nordhaus, *The Climate Casino*, pp. 47-48.

[22] International Energy Agency, "Redrawing The Energy-Climate Map," (PDF file), downloaded from IEA website, [http://www.iea.org/publications/freepublications/publication/WEO_RedrawingEnergyClimateMap.pdf], accessed 10 April, 2015.

[23] Ibid.

[24] Refer to Appendix 1 and 2 at the end of this summary for Policy Scenario Graphs.

[25] TEDx Talks. "Climate Change is simple: David Roberts at TEDxTheEvergreenStateCollege," YouTube, published 12 June, 2012. [https://www.youtube.com/watch?v=A7ktYbVwr90], accessed June 2015.

by 12 degrees celsius, resulting in half of earth's currently inhabited land to be inhabitable, as human beings would literally die of hotness if they stepped outside[26].

Baseline: The baseline scenario is the hypothesis of continuing current trends in population, economy, technology and behaviour, including already planned improvements in efficiency. Rising trends in CO2 and average temperatures, increased energy efficiency in developed countries, ongoing industrialization in developing countries, and rapidly growing economies without further international climate policy cooperation represents real concern of the possibility that there will be an existential threat of climate change becoming irreversible. The risks associated with current trends in energy production and consumption are "likely to be most heavily concentrated in low-income and tropical regions such as tropical Africa, Latin America, coastal states, and the Indian subcontinent[27]."

Optimistic: The optimistic scenario takes into account broad policy commitments and plans announced by countries, including national pledges to reduce GHG emissions and phase out fossil-energy subsidies, even if the measures to implement these commitments have yet to be identified or announced[28]. Estimating a global average temperature increase of four degrees celsius, by 2100, the earth will experience the highest temperatures seen in 30 million years[29]. Sea levels may rise between three to six feet with the extinction of half the world's known species, and droughts will encompass over 40 percent of inhabited land, producing hundreds of millions of refugees driven from homes due to floods, lack of food and resources, etc[30].

Very Optimistic: The very optimistic scenario "sets out an energy pathway consistent with the goal of limiting the global increase in temperature to 2°C by limiting concentration of GHGs in the

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[26] Ibid.

[27] Nordhaus, *The Climate Casino*, p. 5.

[28] International Energy Agency, "Publications: Scenarios and Projections," http://www.iea.org/publications/scenariosandprojections/, accessed April 2015.

[29] TEDx Talks "Climate Change is simple: David Roberts at TEDxTheEvergreenStateCollege."

[30] Ibid.

atmosphere to around 450 parts per million of CO2[31].” Limiting global average temperature increase to two degrees celsius was largely a political decision, agreed upon by European climate negotiators about 10 years ago. The latest climate science from the last 10 to 15 years shows that a two degree celsius increase will happen much earlier than expected, which means scientists believe a two degree celsius increase is almost certainly too high to be safe for humanity, and too low to be possible to attain[32]. According to the IEA, to stabilize temperature, global climate emissions must peak within five to ten years, and decline every year thereafter. Every year countries and international policy is delayed, $500 billion is added to the amount of investment required to tackle and manage climate change[33].

RELEVANT AND IMMEDIATE RISK

Fate of Farming: This past May, California approved emergency drought procedures, the first time the state has called for such drastic measures in mandatory reduction of water use; the regulations required cities and water agencies to reduce consumption of water from anywhere between 8 and 36 percent, which gave the water board actionable authority to issue fines of up to $10,000 USD[34]. Where “the snowpack in the Sierra Nevada shrunk to a record low, groundwater levels plummeted across much of California, and in some areas of the Central Valley, the wells of hundreds of families have run dry[35],” farming could soon succumb to the same severe restrictions. Furthermore, these circumstances will lead to extreme fire hazards in the state’s forests and farmlands if temperatures continue to rise, and water remains scarce.

Natural Disasters: As oceans warm, the warming water fuels the formation of tropical storms, creating more destructive, higher intensity storms. Greater numbers of cases of Category 4 and 5

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[31] International Energy Agency, “Publications: Scenarios and Projections.”

[32] TEDx Talks “Climate Change is simple: David Roberts at TEDxTheEvergreenStateCollege.”

[33] Ibid.

[34] Ian James, “California board approves emergency water rules,” USA Today, May 6, 2015. [http://www.usatoday.com/story/news/nation/2015/05/05/california-water-restrictions-missed-targets/26928275/], accessed June 2015.

[35] Ibid.

hurricanes and storms, and increased droughts and wildfires have been attributed to higher temperatures[36]. Even with "storms of the same intensity, future hurricanes will cause more damage as higher sea levels exacerbate storm surges, flooding, and erosion[37]." Between 1970 and 2012, storms were responsible for 1.45 million of 1.94 million disaster deaths[38]. Furthermore, the cost of disasters increased by about 5.5 times to $864 billion USD in the last decade, with devastating storms such as Super Sandy and Hurricane Katrina accounting for $196.9 billion USD of the $2390.7 billion USD total allocated to cost of disasters[39].

Fracking: Hydraulic fracturing (fracking) is a type of "drilling process that injects millions of gallons of water, sand, and chemicals under high pressure into a well, cracking the rock…to release natural gas and oil[40]." This drilling method is prevalent in Texas, where increases in tremors have been reported. The disposal of drilling wastewater, believed to be the safest and most cost-efficient approach, has been scientifically linked to the growing number and strength of earthquakes[41]. In 2008, seven weeks after two disposal wells were built near the DFW airport in Texas, scientists found existence of well-induced earthquakes[42]. The answer to the question, if "wastewater stays in the disposal wells longer and more and more fluids are added, will the quakes become stronger[43]?" is yes. Policymakers in Texas suggest following Ohio's policies for detailed analyses of geological conditions before authorizing new disposal wells. However, even a decreased number of new wells

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[36] National Geographic, "Hurricanes, Engines of Destruction," http://environment.nationalgeographic.com/environment/natural-disasters/hurricane-profile/, accessed June 2015.

[37] Natural Resources Defense Council, "The Consequences of Global Warming On Weather Patterns," http://www.nrdc.org/globalwarming/fcons/fcons1.asp, accessed June 2015.

[38] Suzanne Goldenberg, "Eight ways climate change is making the world more dangerous," The Guardian, July 14, 2014. [http://www.theguardian.com/environment/blog/2014/jul/14/8-charts-climate-change-world-more-dangerous], accessed June 2015.

[39] Ibid.

[40] State Impact, "How Oil and Gas Disposal Wells Can Cause Earthquakes," http://stateimpact.npr.org/texas/tag/earthquake/, accessed April 2015.

[41] Ibid.

[42] Ibid.

[43] Ibid.

will continue to produce unexpected seismic activity. The next earthquake could have costly, devastating effects.

Black Swan Theory: The Black Swan Theory describes unexpected, random events that produce major effects. Although Black Swan events may not be directly correlated to temperature increases, if temperatures reached unprecedented levels, whatever global cooperation left would rapidly diminish as people flee their homes due to increases in war over food, inhabitable land, floods, and drought. It is important to imagine the possibilities of these worst-case scenarios.

RELEVANT AND LONG TERM RISK

Transient versus Long Run Equilibrium: Temperature response models from the IPCC's Fourth Assessment Report graphically explains smoothing of long run distributions of temperature increases[44]. Estimates of the transient response (70 years) to average temperature increases exhibits an increase of 1.8 degrees celsius. The long run, or equilibrium (150 years), exhibits an increase of over three degrees celsius. The difference in the responses is the amount of time it takes to experience these temperature changes. Transient responses are unlikely to curtail, but equilibrium responses provide the chance to stop, or at least, significantly reduce the inertia of the response.

Arctic Methane: Most scientists estimate the abrupt release of millions of tonnes worth of methane frozen in Arctic permafrost will propel climate change to accelerate at rates beyond control. Release of even fractions of the overall estimated methane stores could trigger sudden climate warming[45]. The speed at which methane is being released is occurring over a relatively short period of time; concentrations have increased two to three times in two centuries to levels that have never happened in the history of the earth[46]. Sea level rise will be the least of concern if methane in the earth's atmosphere intensifies so far beyond mitigation and restraint.

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[44] Nordhaus, *The Climate Casino*, pp. 42-43.

[45] National Science Foundation, "Methane Releases From Arctic Shelf May Be Much Larger and Faster Than Anticipated," http://www.nsf.gov/news/news_summ.jsp?cntn_id=116532, accessed April 2015.

[46] Ibid.

Coral Bleaching: Coral bleaching can be caused by changes in ocean temperatures, overexposure to sunlight, pollution or acidification of oceans, and extreme low tides. Other impacts, such as overexploitation, overfishing, increased sedimentation, increases in violent storms, and flooding are also stress-related events causing coral bleaching. At first glance, coral bleaching may not seem important; coral reefs only cover less than one percent of Earth's underwater ecosystems[47]. Regardless, coral reefs are classified as "hot spots"; systems containing the most varying, largest numbers of biological diversity and are in the gravest danger of extinction[48]. Reefs, particularly the Coral Triangle, serve as a feeding areas for over 3,000 fish, whale, sea turtle, and other marine species[49]. If these reefs die, extinction of many of these species is certain to occur. Furthermore, hypoxic areas in the oceans, referred to as dead zones, are increasing in numbers. Dead zones are areas with such low levels of oxygen, no life can survive there. Already, warmer waters hold less dissolved oxygen, and thus, for marine species that require more oxygen to survive with temperature increases, increased hypoxic zones could drive ecosystems to exhaustion.

RECOMMENDATIONS

Carbon Pricing: There are two forms of carbon pricing; emissions taxation and emissions trading. Emissions trading, referred to as cap and trade, is when countries are authorized limits of carbon they are permitted to emit. Each country issues emissions allowances to carbon-emitting firms, who have the ability to buy and sell allowances, creating a market for firms to trade on. Emissions taxing is when governments directly attribute a tax relating to the combustion of fossil fuels that produce carbon dioxide[50]. The market price of CO2 indirectly accomplishes a positive price for carbon, rather than zero, without the need for governments to micromanage its national firms.

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[47] The Nature Conservancy, "Oceans and Coasts, Coral Bleaching: What You Need To Know," http://www.nature.org/ourinitiatives/urgentissues/coralreefs/coral-reefs-coral-bleaching-what-you-need-to-know.xml, accessed June 2015.

[48] Ibid.

[49] Ibid.

[50] Nordhaus, *The Climate Casino*, p. 236.

Subsidies: An alternative to carbon pricing is creating fiscal incentives to lower cost and/or increase use of renewable energy technologies, promoting sustainability. It can be difficult to determine which activities are considered "green," and of those that are, which "green" activities should be subsidized, and which should not. Nevertheless, governments should inspire transitions from a carbon-based to a low-carbon based world by facilitating financial encouragement in the form of subsidies, in combination with carbon pricing mechanisms.

Personal Incentives: A cooperative policy between governments and their national firms should promote individual behavioural change in consumption habits. If goods contained related marginal carbon costs, resulting in added expenditure, people's daily behaviour would alter. If policies placed carbon costs on all goods, there would be a clearer reflection of the true cost those goods.

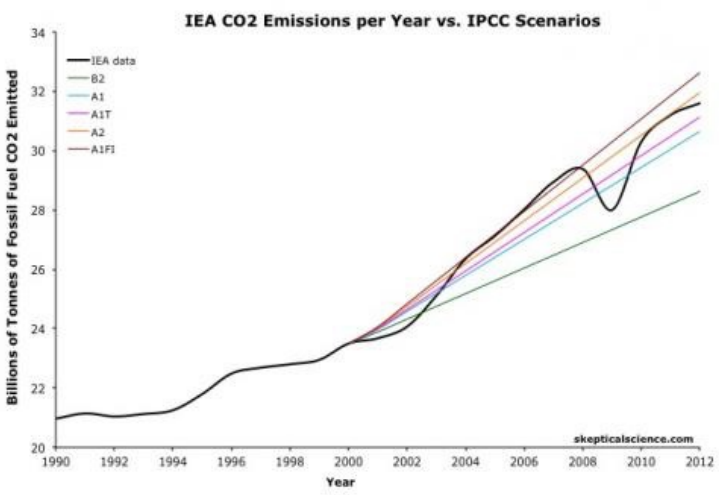
III. CONCLUSION

Traditionally, climate policy negotiations resulted in top-down policy approaches that attempted to reach unrealistic emissions targets, and were not favourable to ratifying countries and their domestic firms. The Kyoto Protocol was the epitome of this issue. With the goal of a more detailed climate policy, more and more countries are getting involved in the planning and discussion of a successor to Kyoto. The findings of this research have focused on relating immediate risks and long term risks to the IEA's emissions and temperature scenarios that are largely reliant on trends in global energy supply and consumption of carbon-based fuels. Thus, policies must be created that incentivize and encourage a movement away from this level of reliance and toward a low-carbon world. By examining the self-interested behaviour of businesses and industries, policies can be created to play to the motivation of profit-maximizing firms. Although value-based ERM methods have yet to be applied to these wider areas in macroeconomies, increasingly definitive processes are being solidified at firm levels. By initiating the implementation of value-based ERM frameworks at microeconomic and macroeconomic levels, while simultaneously motivating these businesses through incentivizing subsidies and carbon-pricing mechanisms, the execution of climate policies

from the bottom-up will be possible. However, countries must possess the desire and ambition to want to participate in these climate measures. In many ways, numerous countries around the world idolize the “American dream” lifestyle of North America. If the US is truly concerned about emissions reductions in creating a liveable environment for future generations to come, the US must act as a role model for other countries and promote involvement. If the US displays such a level of support, other countries are sure to follow. The bottom line behind these research findings is this; if the scientifically-proven transient and long term risks to human civilization, caused by human activities, are not convincing enough to persuade countries to want to take committed, integrative, and determined action today, our governments will have truly failed us all.

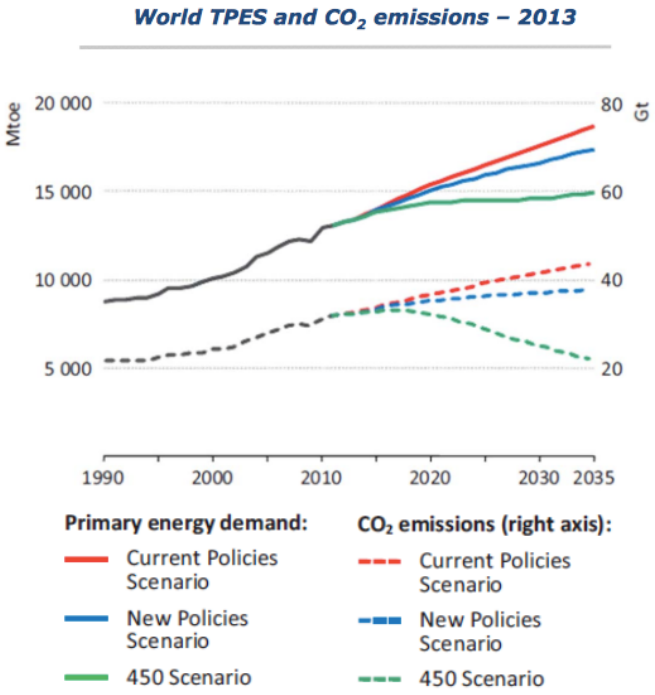
IV. APPENDICES

1. IPCC's Special Reports on Emissions Scenarios (SRES). On track with A2 in yellow.



(**Source**: Skeptical Science, "CO2 Emissions vs IPCC Scenarios," http://www.skepticalscience.com/graphics.php?g=20, accessed April 2015.)

2. IEA's World Total Primary Energy Supply Emissions Scenarios



(**Source**: Simone Mori, "Lecture 2: Global Energy Trends." http://docenti.luiss.it/mori/files/2014/09/2-Global-Energy-Trends-Sola-lettura.pdf, accessed March 17, 2015.)