

# Climate change and carbon trading: new avenues for actuaries assignment



## CLIMATE CHANGE AND CARBON TRADING: NEW AVENUES FOR ACTUARIES

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Kwatra) Executive summary The increasing risk of Climate change can be measured by the fact that natural catastrophes in 2008 cost the global economy \$225 billion, which is one of the costliest year in the history of Insurance business. It will have an impact on Insurance sector in terms of changing pattern of mortality, more frequent property claims etc.

Climate change is different than any other risk seen by insurance industry in the sense that it will have huge impact as the time progresses in the form of increased frequency and intensity of natural disasters, thereby causing heavier insurance losses in companies' balance sheets. In this paper we have focused mainly on challenges faced by the insurance industry due to climate change and new avenues for actuaries in emerging carbon markets as a solution to the climate problem. Actuaries are known to analyze past events, build complex models, assess the current possible scenarios and predict what lies ahead.

We have made an endeavour to explain the working of carbon markets, prospective role of an actuary in such markets and other actuarial solutions to climate change. We have also highlighted that Actuaries role is not just to consider the change in risk factors due to climate change in existing insurance products but they can also play a key role in carbon management by assessing the risk associated with various projects and can help companies in minimizing carbon liabilities. Actuaries and climatologists can work together to construct weather related catastrophe models and can employ them to stimulate future scenarios.

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Actuaries with their skill set can help in evaluation and pricing of carbon transactions. Actuaries have responsibility in advancing companies on the development of corporate climate change strategy and new insurance products that incentivize green investments. Introduction The list of disasters: tornadoes in Oklahoma, hailstorms in Sydney, Hurricane Floyd in America, Tsunami in Asia, are just some of the examples which shows the fundamental changes happening in the world's climate. Climate change is blamed for a significant increase in the amount of damages and insurance losses throughout the world.

Hurricane Katrina was the costliest north Atlantic tropical cyclone ever, which hit the gulf coast region of United States on August 28th, 2005. Overall economic impact of hurricane Katrina was estimated to be about 150 billion dollars. If global warming can be as disastrous as some people expect, then insurance companies will be the units to feel the brunt of damages caused by such natural calamities. Climate change is among the biggest challenges faced by us and the generations to come. Its impact will be huge as compared to what we have seen till now.

The average number of major weather-related catastrophes such as windstorms, floods and drought is now three times as high as at the beginning of the 1980s. The question is not about whether Global Warming is happening or not, the question is how fast it is happening and the magnitude of impact it might have in the years to come. Insurance sector is and would be facing the heat of changing pattern of climate and should not be content with the outlook that it can adapt itself effortlessly to it.

It is probable that climate change will produce throughout the world extreme values of insurance relevant parameters, which can reflect natural disasters of unmatched severity. In this paper, we will focus on two areas in which actuaries could usefully become involved: ??? Challenges faced by the insurance sector due to the effects of global warming, e. g. changing demographics, change in projections, change in capital requirements for long term viability or sustainability, etc. ??? Role of Actuaries in emerging carbon markets.

Actuaries not only possess the analytical skills to evaluate the quality and bias of research methods, but also the skills to model complex dynamic populations, pricing risk transfer and the commitment to understand the parameters underlying the assessment of long term risk in as much analytical detail as necessary. The commitment to properly interpreting weather-related patterns is equally crucial. How actuarial skill set can be allied with the environmental issues? Changing climate is a huge problem and to understand its effects and tackle them, no one group of professionals have a strong hold.

The best possible solution lies in the cooperation of experts from various disciplines like Climatology, Environmental Engineering, IT, Actuarial etc. The specialists' skills from various disciplines can be applied to solve particular problems, and subsequently to provide solutions to the bigger questions relating to climate change. Actuaries are not known to provide solutions to environmental problems, but their skill set can be utilized to answer specific problems and align their solutions with others. The question is ' How an

Actuary can become involved in environmental issues? The main points are <https://assignbuster.com/climate-change-and-carbon-trading-new-avenues-for-actuaries-assignment/>

as follows: 1. In contrast to most other financial professionals, actuaries can handle the impact of uncertainty and can consider alternative scenarios. Furthermore, they can explore the impact of scenarios on business and environment. 2. The major impact by environmental or climate related disasters will be felt by insurance industry. Any claims or premium rating, capital requirements and appropriate reserving will have to be considered. 3. Actuaries can do Quantitative analysis and decision making where the data is scanty and unreliable. . Actuaries are concerned with the “ long term”, specifically looking at asset and liability profiles. Environmental impacts, specifically climate change, are also “ long term”. 5. Complex modeling exercises can be carried out that combine both the financial and technical factors with appropriate margins/ provisions for ensuring long term viability and sustainability. 6. Actuaries have valuable skills that could be vital in this area: actuaries’ key skills are making financial sense of long-term risk and thereafter communicating the results.

This input is often missing in debates on the environment. Climate Change and Insurance Impacts of climate change on the insurance sector are likely already manifesting and are projected to become enormous overtime. The risk of Climate change is a concern for Insurers as it is to be feared that environmental disasters, which are projected to keep rising as the climate changes, could expose them to larger losses. The most widely discussed insurance-related consequences of climate change are the impacts of property damage from extreme weather events.

Worldwide insured losses in 2005 from such weather-related property loss events approached \$80 billion, or four times those from 9/11. If extreme  
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weather events increase in frequency and/or severity, conventional wisdom and arrangements for the insurance sector will be brutally challenged.

According to a report by Munich Re, Losses have increased by 11 percent per year since 1980, and overall losses due to weather-related events total \$1.6 trillion in original values, with insured losses amounting to approximately \$465 billion.

In the period from 2000-2008, overall losses totaled over \$750 billion, whilst insured losses came to around \$280 billion due to the impact of climate change. Climate-change factors can exponentially increase risk to human health, which can affect the existing patterns of mortality and in turn the claims arising due to health and the life insurance. While climate change will clearly affect insurers as policyholders suffer damage from extreme weather events, climate change will also implicate insurers in other ways as climate-related liability risks increase.

Liability insurance risks, broadly stated, are risks to insurers from claims of third-parties who allege injury or property damage that may be the fault of the insured. These losses due to climate change will have adverse impacts on insurance affordability and availability, as well as associated impacts on insurer revenues and profitability. In addition to underwriting risks, both sides of the industry (Property-Casualty and Life-Health) have enormous investments in the real estate and the capital markets, some of which are subject to climate-change risks.

Insurance markets may have insufficient capital to cover continued increased losses, especially if their investments are over weighted with

climate-vulnerable industries. But the good news is, insurers have already started gearing up for climate change. E. g. Citing fears of rising costs from climate change, insurance companies have begun changing the terms of their policies to encourage customers to act greener. Another recent initiative includes reimbursing property owners when they install energy-saving devices or use environmentally friendly materials as they rebuild damaged homes or commercial buildings.

Global Warming Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level". All these changes can be explained by Global Warming. The scientists' concerns about climate change first caught wide public attention in the summer of 1988, the hottest on record till then. International panels of experts began to warn that the world should take active steps to cut greenhouse gas emissions.

Global warming is the gradual increase in the average temperature of the Earth's atmosphere due to the greenhouse effect caused by increased levels of carbon dioxide, CFCs, and other pollutants. Global surface temperature increased 0.74 ± 0.18°C (1.33 ± 0.32°F) between the start and the end of the 20th century. According to the new Climate model projections summarized in the latest IPCC report, the global surface temperature will probably rise a further 1.1 to 6.4°C (2.0 to 11.5°F) during the twenty-first century. . [pic]

Source: Graphical description of risks and impacts from global warming from the Third Assessment Report of the Intergovernmental Panel on Climate Change. Later revisions to this work suggest significantly increased risks. There is no doubt anymore in the mainstream scientific community that the Earth is warming, and increasing evidence shows that humans have a significant part in it. Researchers have also been able to document that the increased concentration of greenhouse gases in the atmosphere results from human activities such as the burning of fossil fuels, deforestation and land degradation, cattle ranching, and rice farming.

**Greenhouse Gases** The “greenhouse effect” is the heating of the Earth due to the presence of greenhouse gases. Shorter-wavelength solar radiation from the sun passes through Earth’s atmosphere, and then is absorbed by the surface of the Earth, causing it to warm. Part of the absorbed energy is then reradiated back to the atmosphere as long wave infrared radiation. Little of this long wave radiation escapes back into space;???? the radiation cannot pass through the greenhouse gases in the atmosphere. The greenhouse gases absorb these waves and reemits the waves downward, causing the lower atmosphere to warm.

Carbon dioxide, methane, and nitrous oxide are all long-lived greenhouse gases. -Carbon Dioxide (CO<sub>2</sub>) is the most prominent Greenhouse gas in Earth’s atmosphere. The amount of carbon dioxide in the atmosphere has increased from about 280 parts per million (ppm) in 1850 to 387 ppm by March 2009, which exceeds by far the natural range of the last 650, 000 years (180 to 300 ppm). Other gases have more potent heat-trapping ability molecule per molecule than CO<sub>2</sub>, but are simply far less abundant in the <https://assignbuster.com/climate-change-and-carbon-trading-new-avenues-for-actuaries-assignment/>



atmosphere and being added more slowly. Methane is formed when plants decay and where there is very little air. It stays in the atmosphere for only 10 years, but traps 20 times more heat than carbon dioxide. The amount of methane in the atmosphere has increased from about 700 Parts per billion (ppb) in 1750 to 1774 ppb by 2005 which exceeds by far the natural range of the last 650, 000 years (320 to 790 ppb). -Nitrous oxide is added as a result of using nitrogen based fertilizers, disposing of human and animal waste in sewage treatment plants, automobile exhaust. It has risen by more than 15% since 1750.

It is important to reduce emissions because the nitrous oxide we release today will still be trapped in the atmosphere 100 years from now. -

Fluorocarbons is a general term for any group of synthetic organic compounds that contain fluorine and carbon. Hydroflouorocarbons do not harm or breakdown the ozone molecule, but they do trap heat in the atmosphere, making it a greenhouse gas, aiding in global warming. The world's leading scientists project that during our children's lifetimes global warming will raise the average temperature of the planet by 2 to 6 degrees Fahrenheit, or 1-3. 5 degree Celsius.

In contrast the Earth is only 5 to 9 degrees Fahrenheit or about 3-6 degrees Celsius warmer today than it was 10, 000 years ago during the last ice age. Man-made global warming is occurring much faster than at any other time in at least the last 10, 000 years. This information would suggest that the warming Earth is experiencing now is not a natural phenomenon, but caused by the increased concentration of greenhouse gases. Impact on INDIA The

Hindu Kush and Himalayan glacial melts that comprise the principal dry-  
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season water source of many of the major rivers of the Central, South, East and Southeast Asian mainland.

Increased melting would cause greater flow for several decades, after which “some areas of the most populated regions on Earth are likely to ‘run out of water’” as source glaciers are depleted. The Tibetan Plateau contains the world’s third-largest store of ice. Temperatures there are rising four times faster than in the rest of China, and glacial retreat is at a high speed compared to elsewhere in the world. The Himalayan glaciers that are the sources of Asia’s biggest rivers ??? The Ganges, Indus, Brahmaputra, Yangtze, Mekong, Salween and Mekong, Salween and Yellow??? could diminish as temperatures rise.

Approximately 2.4 billion people live in the drainage basin of the Himalayan Rivers. India, China, Pakistan, Bangladesh, Nepal and Myanmar could experience floods followed by droughts in coming decades. In India alone, the Ganges provides water for drinking and farming for more than 500 million people. It has to be acknowledged, however, that increased seasonal runoff of Himalayan glaciers led to increased agricultural production in northern India throughout the 20th century. Climate Change and Actuaries As actuaries, we know very well how to analyze trends and assess the impact of best and worst-case scenarios.

If warming is not limited to less than 2 degree Celsius, it is possible that feedback processes (for example, methane release) could take control out of our hands and drive temperatures higher, up to 5 degree Celsius or more above today’s levels. By learning about the danger and understanding the

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urgency, actuaries can help others understand the risk we are taking with the climate. Apart from the impact on the global economy, life, pensions and healthcare actuaries will need to consider the impact of global warming on life expectancy and human health.

Actuaries will need to incorporate these new environmental issues, making assumption-setting an increasingly challenging task. If insurers are looking at extreme weather events, they're bound to look closely at cause and effect. An actuary generating a property insurance rate filing for coastal storms could apply a regression analysis of property claims by region across the country. Impact studies of individual storms have allowed the parameterization of their effects for future projections.

More recent catastrophe models try to simulate the impact of coastal storms of varying strength and landfall with detailed information about potential exposures, developing several claims impact scenarios for any given year. Actuaries could play a role in assessing the financial consequences of projected climate impacts, reviewing climate impact model assumptions and considering the practicality of mitigation efforts. Greater collaboration between actuaries and climate impact modelers might result in improved climate impact projections and greater public understanding of climate change.

At the very least, actuaries might sharpen their estimation of climate risks. Actuaries and Climatologists can work together and build models so as to accurately make projections based on the mutual knowledge sets they specialize in. By determining a region's total climate risk ??? calculated by

combining existing climate risks, climate change and the value of future economic development ??? and using a cost-benefit analysis to create a list of location specific measures to adapt to the identified risk, the Working Group was able to evaluate current and potential costs of climate change and how to prevent them.

From an insurance perspective, the climatic factors??? longer fire seasons, hotter summer temperatures, droughts, strong winds??? are exacerbated by human development and the accumulation of hazardous fuels. Measure to mitigate the impact of Climate change: Carbon Trading Increasing global awareness of environmental problems has urged a need to move toward environmentally sustainable and viable economies. This is giving birth to an array of emerging markets and innovative market mechanisms to achieve such goals.

One such creative market mechanism is the carbon credit trading system designed to facilitate reduction of carbon dioxide emissions, one of the most prevalent greenhouse gas, and to internalize the costs of pollution by polluters. The concept of carbon credits came into existence as a result of increasing awareness of the need for pollution control. It was formalized in the Kyoto Protocol. On the initiative of UNO (United Nations Organization), Kyoto protocol was signed in 11 December 1997 and it came into force from 16 December 2005.

The Kyoto protocol is an agreement by which the ratifying countries have agreed to reduce their emission of greenhouse gases. Under the protocol, initial target is to reduce greenhouse gas emission to 5.2 per cent below

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1990 base level (but, compared to the emissions levels that would be expected by 2010 without the Protocol, this target represents a 29% cut). As of November 2009, 187 states have signed and ratified the protocol. The Kyoto protocol aims to tackle global warming by setting target levels or by setting quotas for nations to reduce greenhouse gas emission worldwide.

Countries, in turn, set quotas on the emissions of businesses. Businesses that are over their quotas must buy carbon credits for their excess emissions, while businesses that are below their quotas can sell their remaining credits. By allowing credits to be bought and sold, a business for which reducing its emissions would be expensive or prohibitive can pay another business to make the reduction for it. This minimizes the quota's impact on the business, while still reaching the quota. In fact, according to the United Nations Framework Convention on

Climate Change (UNFCCC) and the Kyoto Protocol, there are currently three major mechanisms to meet greenhouse gas emissions targets and enables developed countries with quantified emission limitation and reduction commitments to acquire greenhouse gas reduction credits. These mechanisms are: ? Joint Implementation (JI) - The first is technical emissions reduction which refers to establishing a technological emissions system, including new energy, underground carbon dioxide storage and energy efficient technology systems, to fundamentally reduce greenhouse gas emissions. The second is the Clean Development Mechanism (CDM) proposed by the UN which urges relevant countries to help developing countries reduce emissions in exchange for carbon dioxide emissions rights. ? International Emission Trading (IET) - Emissions trading, allows <https://assignbuster.com/climate-change-and-carbon-trading-new-avenues-for-actuaries-assignment/>

countries that have emission units to spare - emissions permitted them but not "used" - to sell this excess capacity to countries that are over their targets.

Joint implementation allows a country with an emission reduction or limitation commitment under the Kyoto Protocol to earn emission reduction units (ERUs) from an emission-reduction or emission removal project in another country. Under CDM, a developed country can take up a greenhouse gas reduction project activity in a developing country where the cost of greenhouse gas reduction project activities is usually much lower. Such projects can earn certified emission reduction (CER) credits, each equivalent to one tonne of CO<sub>2</sub>. Under IET, countries can trade in the international carbon credit market.

Participants can buy units to cover any emissions above their targets, or sell units if they reduce their emissions below their targets. The presence of a market for these units creates a value for emissions reductions which stimulates investment in the most cost-effective areas. Emissions trading leads to reduction in compliance costs compared to meeting the same target through domestic/internal means only. Other units traded in the carbon market are: -An emission reduction unit (ERU) generated by a joint implementation project. -A?? certified emission reduction (CER) generated from a clean development mechanism project activity.

**WHAT IS CARBON TRADING ?** Carbon trading is basically a commercialized activity that originates from protecting the earth from harmful emission of gases from industries. The concept of carbon credit is that of giving benefits

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to the units which pollute less and penalizing the units that pollute more. A central authority fixes the limit of the amount of a pollutant that can be emitted into the environment. Now this limit becomes the permit of pollutants allowed into the environment. This permit is devised into several smaller units and distributed to several companies in the form of permit or credit or allowance.

This permit or credit or allowances gives licenses to emit a fix amount of pollutant into the environment. Now if a company, say ABC Co. Ltd, is able to emit only 80000 tonnes of greenhouse emissions out of 1, 00, 000 tonnes allotted to it, then ABC Co. Ltd will be having 20, 000 tonnes of emission as 'credit outstanding' in its 'pollution' account. On the other side, if a company say XYZ LTD emits 120, 000 tonnes instead of 100, 000 tonnes allotted to it then XYZ LTD will be having 20, 000 tonnes of 'debit balance' in its pollution account.

Now ABC CO. LTD will be able to transfer its excess 'credit balance' to debit balance account of XYZ LTD. So both the companies' pollution account will be matched and the environment also is able to digest a certain scientifically fixed amount of pollutants. This transfer from ABC CO. LTD to XYZ LTD will be for some monetary consideration and hence it is referred as carbon trading. Carbon credit, as defined by Kyoto protocol, is one metric tonne of carbon emitted by burning of fossil fuels. Carbon credits are a tradable permit scheme.

Carbon credits are certificates awarded to countries that are successful in reducing emissions of greenhouse gases. The GWP (Global Warming

Potential) factors are used to convert each of the five gases (like methane, for example) that are not CO<sub>2</sub> into tonnes of CO<sub>2</sub> equivalent (CO<sub>2</sub>E), which is the standard of trading. A credit gives the owner the right to emit one tonne of carbon dioxide. For trading purposes, one credit is considered equivalent to one tonne of CO<sub>2</sub> emissions. Such a credit can be sold in the international market at the prevailing market price.

How buying carbon credits attempts to reduce emissions? Carbon credits create a market for reducing greenhouse emissions by giving a monetary value to the cost of polluting the air. This means that carbon becomes a cost of business and is seen like other inputs such as raw materials or labor. A business would buy the carbon credits on an open market from organizations that have been approved as being able to sell legitimate carbon credits. One seller might be a company that will plant so many trees for every carbon credit you buy from them.

So, for this factory it might pollute a tonne, but is essentially now paying another group to go out and plant trees, which will, say, draw a tonne of carbon dioxide from the atmosphere. As emission levels are predicted to keep rising over time, it is envisioned that the number of companies wanting to buy more credits will increase, which will push the market price up and encourage more groups to undertake environment friendly activities that create for them carbon credits to sell. Another model is that companies that use below their quota can sell their excess as ' carbon credits.

The possibilities are endless; hence making it an open market. To bring the buyers and sellers of carbon trading on one platform and to augment the

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process of carbon trading, carbon credits are traded at CO<sub>2</sub>E exchange in Britain, CDM (Clean Development Mechanism) exchange in Europe. In India recently, MCE (Multi Commodity Exchange) has announced carbon trading exchange with license agreement from Chicago climate exchange. Like the usual stock exchange, carbon credits have all spot transactions, forward settlement and options of trading.

The European Union Emission Trading Scheme is the largest multi-national, greenhouse gas emissions trading scheme in the world and was created in conjunction with the Kyoto Protocol. It contains the world's only mandatory carbon trading program. The Carbon trading program caps the amount of carbon dioxide that can be emitted from large installations, such as power plants and carbon intensive factories and covers almost half of the EU's Carbon Dioxide emissions. Perhaps the most successful emission trading system to date is the SO<sub>2</sub> trading system under the framework of the Acid Rain Program of the 1990 Clean Air Act in the United States.

Under the program, which are essentially cap-and-trade emissions trading system, SO<sub>2</sub> emissions are expected to be reduced by 50% from 1980 to 2010. Many businesses have welcomed emissions trading as the best way to mitigate climate change. Enforcement of the caps is a problem, but unlike traditional regulation, emissions trading markets can be easier to enforce because the government overseeing the market does not need to regulate specific practices of each pollution source. However, monitoring (or estimating) and verifying of actual emissions is still required, which can be costly. What critics say about the working of Carbon Credits? Critics doubt whether these trading schemes can work as there may be too many credits <https://assignbuster.com/climate-change-and-carbon-trading-new-avenues-for-actuaries-assignment/>

given by the government, such as in the first phase of the European Union's scheme. Once a large surplus was discovered the price for credits bottomed out and effectively collapsed, with no noticeable reduction of emissions. It is also argued that emissions trading does little to solve pollution problems overall, as groups that do not pollute sell their conservation to the highest bidder.

Overall reductions would need to come from a sufficient and challenging reduction of allowances available in the system. Big opportunity for Indian companies Many companies in cities and even in smaller towns of India are now doing a new form of business. The business of these firms are somewhat related to trading but it is a departure from usual commodity or stock trading. It is the trade of 'polluting gases'. Firms involved in such a business are then said to be involved in carbon trading.

Usually banks come into the picture in this kind of trading as they keep the records of debit and credit of 'polluting account'. Many companies are using carbon credit to boost the bottom line of their balance sheet. Almost all industrialised countries are huge buyer of carbon credit and all developing countries, where industrialisation has not reached its peak, are supplier of carbon credit. Japan is the largest buyer of carbon credit while India and Brazil are amongst the largest suppliers of carbon credit.

Being a developing country, India is exempted from the requirement of adherence to Kyoto protocol. India, however can sell the carbon credits to the developed countries. Most of the beneficiaries of the carbon trading are those companies that are investing in windmills, Biodiesel, Biogas. Actually

by investing in such an alternative non-polluting source of energy, these companies will earn carbon credit in the form of CERs (Certified Emissions Reductions) to the tune they have not polluted the environment.

These CERs will be sold by the Indian companies to companies, say in Japan, at market prevailing rate of CERs and make profit. Companies like Torrent Power have started projects, which enhance energy efficiency and in turn have earned CERs points. These CERs will be sold by Torrent Power to companies in developed countries and is expected to earn approximately Rs 200 crores. Several Indian companies are adopting such processes in their production units, which result in earning of CERs.

Similarly, companies like Chennai Petroleum, Jaypee Associates, Grasim Industries, and Gujarat Fluoro Chemicals are going to make huge profits through carbon trading. Tata Steel is currently working on more than 17 CDM projects with Ernst & Young and these projects are at various stages of approval at United Nations Framework Convention on Climate Change. Carbon trading has brought a huge opportunity for Indian companies. Companies can earn CERs by adopting energy saving and environment protecting methods and in turn can earn huge incomes by selling them.

This opportunity will not exist forever for Indian companies. Once India is accepted as an industrialized country, she would have to adopt strict emission norms like other industrialized countries of the world and India may turn into a net buyer of carbon credit from other developing countries when that happens. Actuaries' Role Involvement of actuaries can be seen in advising companies, where they are conscientious of the financial impact of

global climate change policy and the requirements to be able to carry out environmentally sustainable activities.

Examples of such projects include formulation and development of corporate climate change strategies, assessment of emissions trading on energy markets, and commercial analysis of 'Clean Development Mechanism' projects. Several companies have already or are in the process of implementing clean development mechanism (CDM) projects. Clearly, these are areas of potential involvement for actuaries worldwide. They are not specific to local markets, giving actuaries a wonderful opportunity to collaborate internationally on critical global issues.

Over years, actuaries have developed composite tools and models for making financial sense of long term risk and for risk based management of asset and liabilities profiles. In the wake of rapid depletion of natural resources there is a need to question the current economic modeling which tend to focus on short term and doesn't account for likely shortage in the long run. Past 60 years have reflected rapidly growing fossil fuel use but as they are depleting at faster pace, now the future is likely to reflect the opposite. The risk ased management of our depleting natural resources can be carried out by carefully applying actuarial techniques. Such an approach can help resolve the conflict between those who think natural resource extraction has gone too far and those who think it can go further without affecting sustainability. As actuaries, we can have an imperative role to play when it comes to predicting and assessing the impact of global warming on the society as a whole, the measures to reduce global warming and offering recommendations to adapt to the new conditions in say 25 or 50 years' time.

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Many recent changes in financial services will bring about significant changes for the actuarial profession, and we seek new opportunities emerging from those changes. Some practical examples are the proposed zero carbon bonds for pension fund investment and climate change insurance. The necessary move of the global economy toward more sustainable economic activities is likely to bring further changes to financial markets and to corporate and societal risk management. We already see tremendous growth in the green investment market for reasons ranging from ethics to risk management to return enhancement.

This new economic view requires careful management of long-term assets and liabilities, as well as sophisticated modeling, valuation, and risk management tools. Actuarial skills are perfectly suited to these applications. Investment actuaries are already considering carbon trading as an investment vehicle and advising clients on ethical investment funds. They should adopt sophisticated fund risk management practices while investing the funds and these investments should be made in the companies which provide full disclosure of their emissions and engage in emission reduction strategies.

Non-life actuaries can design and price new policies associated with new technologies, and all actuaries should consider the global economic benefits of reduced carbon emissions. Potential Demand of Actuarial Skills in other spheres In the Pacific Northwest, consortiums of environmental advocacy non-profit groups, forestry corporations, and state and national regulators are now jointly designing forest management practice through a forest certification programme.

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These kinds of activities creates demand for composite and sophisticated ecosystem modeling encompassing environmentally sensitive forest risk management procedures, projections, and other risk management tools. As an example, comprehensive tree mortality studies can be one such ‘ actuarial type’ assistance that the consortiums or regulators may require to frame policies and formulate strategies. As an extension of this work, another potential area for actuarial applications is risk-based management of natural resources and asset/liability management of natural environmental assets against human infrastructure liabilities.

Recent Development: Copenhagen Summit Copenhagen summit was held in December, 2009. It refers to the 15th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). It reaffirmed the view that climate change is central to the political thinking of every country on the planet. The idea that addressing climate change is bad for business was buried at Copenhagen. Countries from both developed and developing worlds have announced low-carbon economic plans and are moving forward. Key points of the Copenhagen Accord A commitment “ to reduce global emissions so as to hold the increase in global temperature below 2?? C” and to achieve “ the peaking of global and national emissions as soon as possible” ??? New and additional resources “ approaching \$30bn” will be channeled to poorer nations over the period 2010-12, with an annual sum of \$100bn envisaged by 2020 ??? A Copenhagen Green Climate Fund will be established under the UN convention on climate change, to direct some of this money to climate-related projects in developing countries On the positive side, the Copenhagen Accord, for the first time, unites the US,

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China and other major developing countries in an effort to curb global greenhouse gas emissions.

The Kyoto Protocol did not achieve this – it imposed no obligations on developing countries to restrain the growth of their emissions, and the US never acceded to it. On the other hand, the summit did not result in a legally binding deal or any commitment to reach one in future. The accord calls on countries to state what they will do to curb greenhouse gas emissions, but these will not be legally binding commitments. The possibilities are endless. We need to be creative and contribute to newer ways to reduce global warming in our own individual capacity. As responsible children of Mother Earth, we need to stand by her and do every bit of ourselves, either by cooperating with others by means of our knowledge set or by being just responsible.

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Currently working as Actuarial Executive (US GAAP Valuation Department) in DLF Pramerica Life Insurance Company Ltd. Completed graduation from Kirorimal College, DU & has cleared 8 papers of Actuaries. ??? Deepa Gupta Post graduate in Management from Indian Institute of Modern Management & has cleared 6 Papers of Actuaries. Having two years work exp as Assistant Manager with ICICI Bank Ltd. ??? Subhash Goyal Currently working as Actuarial Trainee in Mercer India Pvt. Ltd. Completed Economics Hons. From Sri Venkateshwara College, DU & has cleared 5 papers of Actuaries. ??? Swati Kwatra Graduate from Kamla Nehru College, DU & has cleared 6 papers of Actuaries. All are student member of Institute of Actuaries of India and Institute of Actuaries of UK.