Report on Regional Conference on

Integrating Global Responses to Climate Change and Energy Security

July 7-8, 2015

Kathmandu

Konrad Adenauer Stiftung

CENTRE FOR SOUTH ASIAN STUDIES

Integrating Global Responses to Climate Change and Energy Security

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"Integrating Global Responses to Climate Change and Energy Security"

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An Agenda For Action

Dr. Nishchal N. Pandey

Director,
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This is a comprehensive report based on the regional conference "Integrating Global Responses to Climate Change and Energy Security" organized by the Centre for South Asian Studies (CSAS) in cooperation with the Konrad Adenauer Stiftung (KAS) in Kathmandu on July 7-8, 2015. Foremost, I would like to thank Hon'ble Vice-Chairman of the National Planning Commission, Government of Nepal Prof. Dr. Govinda Raj Pokharel for taking time out of his busy schedule to be with us for the programme. I would also like to thank Dr. Genoveva Hernandez Uriz, Charge d' affaires a.i., at the Delegation of the European Union to Nepal for not only attending and speaking at the inaugural session but also providing us a comprehensive written paper for this publication. The conference proved to be an august gathering of experts and practitioners involved in the area of climate change and energy security in South Asia.

I would like to thank delegates from all the 8 SAARC countries who took time to come to Kathmandu, essentially, this made it a historic conference on its own. After the devastating earthquake two months earlier, Nepal was and (is) slowly coming back to normalcy and we would like to thank them for visiting our country, which in itself means a lot for us. There is a new promotional campaign line “If you want to help Nepal, visit Nepal”. I am thankful to former minister for environment of The Maldives Mr. Mohamed Aslam for having travelled through multiple transit hubs to come to Kathmandu.

There is no denying that global climate change has already had tremendous negative effects on our environment. Glaciers have shrunk, ice on rivers and lakes is breaking up earlier, plant and animal ranges have shifted. Effects that scientists had predicted in the past would result from global climate change are now occurring. South Asia is a critical area of the world to discuss and deliberate on the impact of climate change and also energy security because of its large, densely located population, rapid industrialization and endemic poverty. Political instability and state focus on other areas impinging on national security such as terrorism and insurgency has resulted in lesser priority being given to this critical issue.

Glacial runoff in the Himalayas is the largest source of fresh water for this part of South Asia and provides more than half the water to the Ganga. Glacial runoff is also the source of the Indus, the Brahmaputra, the Irrawady and the Yellow and Yantze rivers. According to an Intergovernmental Panel on Climate Change (IPCC), “glaciers in the Himayalas are receding faster than in any other part of the world and if the present rate continues,

the likelihood of them disappearing by the year 2035 and perhaps sooner is very high if the earth keeps getting warmer at the current rate. Climate change, if left unchecked, will increase the likelihood of severe, pervasive and irreversible impacts on people and ecosystems. Scientists have appealed to the world's policymakers to combat what has been described as the "challenge of our times".

In Lima, last year, more than 190 countries drew together a wish list of what they desired the 2015 Paris climate change agreement to be. Five months before the Paris meeting aimed at forging a historic global accord to cut climate warming emissions, significant signs of progress are emerging. President Obama and President Dilma Rousseff of Brazil announced that their nations had agreed to sharply expand electricity generation from renewable sources. China, the world's largest green house gas polluter submitted a plan to the UN with details of how it plans to shift its economy to reduce fossil fuel emissions by 2030. But all of us are aware that these pledges by themselves are not enough to save us from a future of extreme storms, droughts, food and water shortages, and rising sea levels.

We have a lot of experts who have giving their opinions and viewpoints on the fragility of eco-systems of the Himalayas and delving into detail of the Vulnerability Assessment and Adaptation Strategy in South Asia.

A section is entirely devoted to renewable energy and we are fortunate to have with us experts who have devoted years on this theme. Most of us are aware that over 800 million people in Asia do not have access to electricity. About three-quarters of them live in South Asia. Providing access to renewable sources of energy is essential to poverty alleviation, energy security, climate change mitigation, and the achievement of the Millennium Development Goals (MDGs) in the region. Through involving and empowering beneficiaries, from needs assessment to installation, operation, maintenance and evaluation, we aim to maximize the financial, social and environmental sustainability of our interventions in the long term.

The conference served not only as a platform to share ideas and generate awareness but also as a networking of individuals and institutions working in the field of climate change and renewable energy. I earnestly hope that this publication will serve as an useful background paper for future reference.

I would like to thank Dr. Wilhelm Hofmeister and the Konrad Adenauer Stiftung (KAS) for their continued support to the CSAS, to South Asia and to its commitment to protecting our environment.

Executive Summary

Hon'ble Prof. Dr. Govinda Raj Pokharel,
Vice Chairman,
National Planning Commission,
Government of Nepal

First of all, I would like to thank Dr. Nishchal Nath Pandey and KAS for organizing this very fruitful high level discussion on Climate Change in energy security, and integrating global responses. As you see, we have two levels of society based on physical development - the dichotomy between developed and developing countries- for the developed countries, the major issues are security concerns and climate change, for instance, but in South Asia, there are issues of malnutrition, child mortality, unemployment, disasters, poverty and lots of other concerns in our governance. These issues first must be tackled before we are to progress. But we also have very good resources. Our resources which are sustainable: subsistence agriculture, for instance, and lots of people are moving towards commercial agriculture as well; we have plenty of water resources, which we can use for irrigation, navigation, drinking etc; another resource we have is non-competitive resources: tourism, based on landscapes, biodiversity and coastal activities. All these three resources actually are affected by climate change. Agriculture, tourism and our water resources are severely affected because of changes in rain patterns, increased vulnerability to landslides and glacier melts and droughts from climate change. This is creating chaos in our communities, and even if we are not the creators of this problem, we are suffering from this, so we need to address these challenges.

But again, reaching a certain level of modern development, we are facing this problems, and we have to move on with our economic activities. Regardless of whether we're using fossil fuels or green resources, we need to move ahead in terms of economic growth, so that the livelihood of the people can be enhanced. That is a big challenge in our planet. So if we do not use a certain modern way of developing, we will be lagging behind, in all metrics and aspects. So going through the same path, we are also increasing vulnerability, especially in the Hindu Kush Himalayan region. We have emitted so many brown pollutants, which also affects our Himalayas. We have to move away from conventional way of using energy to modern energy, be it hydropower or solar energy or whatever.

While there are opportunities, there are challenges also. The unit cost of infrastructure is important as well, and as a result of climate change, there is a need to build strong dams, strong canals which increases the unit cost of infrastructure, and there's a question of who is going to compensate for that? Because to create another kilometer of black topped road, we need more money than before as a result of climate change. All these modern physical infrastructures need more investment, and that has to be mobilized from within or from outside.

Biodiversity is also affected by climate change, and our livelihoods our culture is also based on the biodiversity, which is being affected. It will also bring social chaos. Not only is it affecting our infrastructure, it is also affecting our culture and society.

The challenge for planners, now is how to mobilize resources and how to plan strong, robust development units, whether it is social, infrastructure, or environmental. We need to integrate climate change into the system, so we don't lose more money in the future, because weak infrastructure today will create losses in the future.

I am a bit critical of global responses to climate change. In 2008, during the economic recession in America and Europe, a lot of money 5-6 $ trillion was given to banks and automobile industries to bail them out, but to save planet earth, hardly 10 $ billion is committed in the same period. While we do need to run our economic engine, the seriousness towards climate change is questionable. In Copenhagen, the commitment was 100 $ billion but still that amount hasn't materialized. Although they have to respond, they have to align themselves in those global agendas, the seriousness isn't there. Although COP in Paris may be more fruitful on this green climate fund created in 2011, the fund itself hasn't been very effective. The seriousness towards climate change, still needs to be increased.

And one critical thing we also have to discuss is legally binding emission targets. How can Nepal and Bangladesh come up with binding emission targets? We are still in the 1900s in terms of our development, so how can we commit legally to reduce our emissions? So maybe it is too early for the LDCs to come up with their own targets, and we should get some freedom to move up the economic ladder.

For our country, I have the formula ICE-TEA- Tourism Energy Agriculture as TEA, and we build on this through Infrastructure, Capacity Building and Education and Enabling Environment as ICE. So with this ICE-TEA approach we can move and respond to these issues and build on this. So hopefully this, along with the presenters can give us perspective so we can also be part of the global agenda, and we can also indicate our development agenda.

All the best, and Thank you!

Prof. Imtiaz Ahmed,
Executive Director,
RCSS, Colombo

Thank you very much,

The chair, the co-hosts CSAS and KAS, Dr. Pandey, Dr. Hofmeister, the organizing team, and my friends.

First of all, I will try to present the issue of climate change and not to mention security of fragile states. These are huge concepts and each concept can mean lots of interesting things with different theories. The subject of change has always bothered humans. The earliest one, I think, would be the 5th century BC with the way Zeno tried to come up with this paradox, and the paradox was the flight of an arrow, which while in motion, is always at rest. That Zeno's paradox has ignited imaginations for centuries. It was Hegel, in

fact, who rightly understood what Zeno was trying to say. Aristotle thought Zeno was fallacious, because how can you have something motionless: the flight of an arrow, while in motion, is always at rest; this is long before photography came into existence, because these are all shots, at one point, which rolls together to become a movie or film. Now here is Zeno, challenging our mind, trying to point out the flight of an arrow while at motion is at rest. Hegel, in fact, said Aristotle is wrong in trying to say that Zeno was fallacious and says there is no motion, there is motion. Let me quote Hegel here said: Zeno's statement to motion was an objectively dialectical question. If Aristotle says Zeno denied movement because it contained inner contradiction, it is not to be understood that movement did not exist at all. The point is not that there is movement, and that this exists, the fact that there is movement is as sensuously certain as there are elephants. It is not in this sense that Zeno denied movement. The point in question denies this truth: the movement however is considered untrue, because in itself it contains a contradiction. What this means is that the motion itself requires the motionless, there cannot be a sense of the motion without the motionless. Any exclusive focus on the motion or the motionless is bound to make the interpretation of change and/or its absence partial.

Now this is very fundamental when we look at climate change. Because when we look at climate change, immediately, it looks, the change is so slow, the people are not sensitive, because it looks the world is fine. It really takes humans to get a sense of that change, in contradiction, because change you can actually say in terms of thousands of years; not to say the whole of SA was stuck with Africa. The Himalayas came about through the collision of these continents. Now that change for humans to understand takes centuries. It is not easy to sense. Climate Change certainly suffers from Zeno's paradox; because even if you say use less water, don't pollute, it still doesn't get humans excited. The concept is so hard to understand, because everyone thinks if I use a little bit more, what's the big deal?

The issue now here is not that climate change is not happening, it is happening, but how fast? For whom? That climate change for the disempowered for one, for the empowered it would be another. Change in one for people in the seas will be one, and the other for hills people will be different. One cannot universalize it and think everyone will take it in a similar way. So the question is why must we all suffer? Or do we all suffer in the same measure? Now here the notion of fragile state is critical, and it should not go unchallenged. No concepts as social scientist will say should go unchallenged. Regardless of how interesting a word it may be. Fragile states as a term must be challenged, because there is no question it is informed by a precise discourse and that discourse, I'm afraid, is a realist discourse. Core of realism is this fear, and this is precisely what we go for with extensive security, and end up with a security state. This discourse of fear is the hegemony discourse in the world. Now the question is modern states and thanks to realists, cannot live without dystopias. It's not the utopias they're after, it is the dystopias, the fearful future. Hobbes summed it up the best, I'm sure you are all familiar: "that the life of man

is solitary, nasty, crude, brutish and short" that's the dystopia. When you have that in your head, fear catches you up to an extent in fact that in the 20th century Roosevelt could not help realizing this pathological outcome of this discourse, if you remember, when he became President, the only thing we have to fear is fear itself. That was the sense that he was trying to point out. You cannot go far with fear in your heads. You will end up with completely different outcomes, humans will make an number of nuclear bombs so we can destroy the world not once as the divine predicted but nine times. Now why would want to destroy the world nine times? Once is good enough. But humans always like to challenge the divine, the spirit has always been there.

Now there were good reasons for this fear factor to haunt us. Because initially, we had one big dystopia, the first dystopia was created by George Orwell, the book he published "1984"; what the core message of the book was? Big brother is watching you. Now people thought George Orwell was talking about the totalitarian state of Stalin and all but he wasn't. Now that big brother created enormous security paradigm- to the point where you can say you can destroy the earth 9 times, not only that but if you moved through London, you could be photographed 400 times in a day without your knowledge. The CCTV will be clicking you all the time, the big brother is watching you. The fear has gotten to us. Now that was 1949, and the title was 1984.

In 2009/10 another creative novelist comes up with an interesting dystopia taking Q from Orwell and calls his novel 1Q84; I'm referring to Haruki Murakami. Now Q in Japanese, 9 is pronounced as Q, and this is his brilliance. Because he knows 1984 is no longer, and by giving that title 1q84, he makes the dystopia timeless, it can happen anytime. Now what is the core message of this dystopia; if George Orwell said that big people are watching you, Murakami says the little people are watching you. And these are the thugs, the terrorists, the miscreants. We have names for them in some of the countries we've got the names for these people, these little people. They are watching you, in fact, so now there are two dystopias.

And climate change, then, is the third dystopia. It will come to down to water, this third dystopia. If you only feel safe when you drink bottled water. I remember in 1971, during the liberation war, when I left for Havattala for India, and I literally drank from the river, it was perfectly alright. But now, the dystopia has gotten into. So now you have this water dystopia, now you can see where you are: you have Orwellian dystopia, the Murakami dystopia, and the water dystopia, the three dystopias making you stay home. With that dystopia I'm afraid you can't create a new society. Now challenges of fragile states including and this I must say that all states have pockets of fragile states. When the United States had 9/11, it had a trillion dollar defense budget, but it couldn't stop 17-18 little people to create a huge mess.

Now when we talk about fragile states including the pockets of fragile states, there are four gaps in relevance. The first is the development gap, why we have the gap in development? I have figures from the UN, which will make us rethink what is wrong

with human beings. The UN notes that while basic education for all who live in developing countries would cost somewhere in the region of 6$ bn a year to provide, the US alone already spends a staggering a 8$ bn on cosmetics. Now why would you spend 8$bn on cosmetics? You can solve the problem of entire developing world education with $6bn, still leaving you with 2$bn for cosmetics. There are interesting statistics on this gap; while it would take 13$ for basic healthcare across the world 11$bn on ice cream in Europe, 17$bn on pet food in Europe and US. 50$ bln. on cigarettes. So we can see the developmental gap in such an easy way. There is the money; they say we have the money and the technology to make the whole sahara desert green. But humans are not interested to do that, because we are not in the universal element, we are in nation paradigm.

The second gap is the income gap, which I refer to specifically to misgovernance in fragile states. In fragile states, misgovernance is profitable, good governance is not; because with misgovernance we can get a promotion, good job, and appointment. With good governance we get none of these things so why would we have good governance? That's the issue with fragile state, and that has created an enormous gap. It's not just a gap in terms of income and what is incoming also. Not all have access to the incoming.

The third gap is the technological gap. The technological gap that are different knowledge; people shy away from indigenous knowledge, and fragile states need to create their own knowledge. The more important issue here though is that we have become homotechnologicus; Gandhi had an interesting thing to say on this, because Gandhi was being attacked for his use of the spinning wheel, they said "you are taking us back to the Medieval age"; to which he responded "No, the use of Charka has nothing to do with going back in time…A person or sound person will know that the Charka is not just a piece of instrument made of wood, but an instrument that can give employment to all". Technology has to be for all. You cannot have technology for some, and that's the problem. Because we are homotechnilogicus, humans cannot live without technology. And since we're like this, we all need technology but some have it and some don't, we have pockets of fragile states. With a city, with a neighborhood, it can be everywhere.

Finally, there is an intellectual gap. The intellectual gap, if we talk of South Asia, it is so obvious, when it comes to literacy. We have a pathetic condition of literacy. Way back in 1870, Viceroy May wrote to his friend, and he said an interesting thing: "these babus, these gentlemen will never give the three Rs to the peasants: reading, writing and arithmetic. If we have to wait for that, we will turn into rocks" he was correct, even now, as the literacy is shocking in India, in Pakistan, wherever. Amartya Sen comes in his book says even in India, 80% don't have literacy, because he has a different way of measuring literacy. 80% aren't literate, because the test they were given, that they can pass an exam of what they learned in the first grade, they all failed. So if 80% of India is illiterate, how can you protect the constitution? Japan, in 1870, with their restoration, went for 100% literacy, and in 20

years, 95% of Japanese became educated. They asked the question, what is the difference between us and the west? They answered was education. I can't see why SAARC can't go for 100% education campaign, and we can do this with the technology we have, the internet, which is a dictionary, an encyclopedia, it's everything. We just need some sponsors to do it, we can make all South Asia educated in 10 years.

Let me end by asking what do we need? We need fresh utopias, we need to dream. First, we must go into the idea and develop this idea further; I have a book on it called "living with floods". It is quite natural for Bangladesh to have floods. Floods have made Bangladesh. Bangladeshis are people from the river, but they think water is just liquid. But the river is not just water, it is also sediment. We have good hydrologists, but no good sedimentologists. Taking the Bramaputra, for instance, only 20% comes from Tibet, the rest is rainwater that comes from the north of Bangladesh. Now if you stop that with dams, then Bangladesh will be finished. There will be no sediment, there will be no nutrients for the soil, there will be no bumper crops, and so forth. You must let sediment come, and creating a new Bangladesh is not just dams and bridges. The entire knowledge of the river has to be rethought.

We also need to think about mud housing. What about mud housing? I am talking in particular about delta countries, where housing is an important point to think about. Even in Pakistan, there are two story mud houses. Slowly, now, concrete houses have become modern, and that has different effects, one of which diminishes our indigenous knowledge. Then you have to live with quakes, and quakes by themselves don't kill us. It's the construction that kills us, so we need to create a new type of technology to withstand quakes, like in Japan, where the houses move. And all the Japanese know how to deal with earthquakes, we need to share good practices throughout, and living with this sort of calamities. And finally, living with climate change raises its own questions. And how do you live with climate change? You empower humans. It is only humans who can change, as Tagore once said, "Without humans, there is no beauty".

Let me end by saying that realizing living with floods, quakes and climate change needs a reconsideration of fragility. We cannot let fragility go uncontested. Climate Change can then only be handled effectively and humanly; let us be active not by reproducing dystopias, but by dreaming the impossible.

Dr. Wilhelm Hofmeister,
Head of the Regional Programme-Political Dialogue Asia, KAS

Dr. Nishchal Pandey, Director CSAS, Chair, participants and dear friends present in the conference.

It gives me great pleasure to be the part of this conference and discuss about the regional and global threats of climate change. KAS has been regularly organizing conferences on climate change and its consequences all over the region and beyond. Today the entire globe has been challenged and immensely affected by global warming and climate

change including South Asian and Southeast Asian regions. There is a general agreement that Climate Change is impacting small and developing countries in this region rather disproportionately compared to their size and their own meager contribution of the green house gases. The current debate about keeping the temperature below 2 degrees Celsius has been going through tough contestations in the poor and rich and developing countries' political spheres. The world particularly the developed western countries are largely very ill-prepared for the risks of a changing climate, especially the poor and most vulnerable who have contributed least to this problem.

As we all aware that United States and China account for the largest global green house gas emissions, however both the nations have pledged to strengthen cooperation on climate and clean energy and this would be the optimistic sign for all of us to further strengthen Climate Change and Clean Energy Cooperation goals. Nations bound to Kyoto protocol are based on the principle of common but differentiated responsibilities. Developed member countries including the member nations of European Union under this protocol are obligatory to reduce current emissions on the basis that they are largely responsible for the current levels of greenhouse gases. However, on the other hand, these agreements and goals seem ambitious to achieve.

India is the not only the most powerful and influential country in South Asia but it is also one of the fastest growing major economies. India itself is one of the most vulnerable country in-terms of effects of climate change and global warming therefore I think India in cooperation with other regional members should make a strong commitment to fight against climate change in the regional level and beyond. Moreover, since climate change doesn't respect borders, countries in South Asia must work together to share resources and knowledge to better withstand the impact of climate change in the region. This problem is not amenable to national solutions and hence regional collaborative efforts to mitigate adverse impact of climate change are inevitable. I am aware that SAARC as a regional body has taken several initiatives in this direction. To achieve these initiatives from SAARC, all the member countries should convince their respective governments to have a collective goal to defeat this common threat.

I thank you all for showing your constant commitments and representing your countries in this important conference.

Thank you!

Dr. Dietrich Brockhagen,
Executive Director,
Atmosfair, gGmbH,
Federal Republic of Germany

The international political response to climate change began at the Rio Earth Summit in 1992, where the 'Rio Convention' included the adoption of the UN Framework on Climate Change (UNFCCC). This convention set out a framework for action aimed at stabilizing atmospheric concentrations of greenhouse gases (GHGs) to avoid 'dangerous anthropogenic interference with the climate system.' The UNFCCC which

entered into force on 21 March 1994, now has a near-universal membership of 195 parties.

In 2015 COP21, also known as the 2015 Paris Climate Conference, will, for the first time in over 20 years of UN negotiations, aim to achieve a legally binding and universal agreement on climate, with the aim of keeping global warming below 2°C. The upcoming Paris Conference is different from the Copenhagen Conference: While the Copenhagen Conference was the sole platform in 2011 to address issues of Climate Change in a multilateral setting, the Paris Conference will only be a catalyst in a multitude of other mechanisms in operation to address climate change. These mechanisms can be categorized into three types: the UNFCCC negotiations themselves, national policies and frontrunner alliances.

The Copenhagen conference could potentially adjust the global trajectory from a 3.9° C path currently to a 3.0°C path. The conference could also lay the foundation for a 2.0°C trajectory to be adopted in the future, but finance for developing and emerging economies is the constraint upon which this is based; this is to be worked out in Marakesh in 2016.

In Paris, the key issues appear to be setting the ideal minimum targets for Nations in terms of their carbon emissions; making the Paris agreement binding, enforceable, and improvable is also just as important. Alongside these issues, climate finances and the capacity to raise the requisite 100 bn $ is the homework national diplomacies must do at the conference.

The upcoming Paris conference and a number of recent global developments that allow optimism: 2014 was the first year there wasn't an increase in emissions from the energy sector; there are reductions in the rate of coal consumption increase in India and the absolute consumption of coal in India; and finally, deforestation, especially in Brazil, has seen major declines.

Importance of the COP21

The importance of the COP21 is due to the fact that this conference is expected to reach a new global agreement that will bind all countries of the international community, from the developed countries (such as the United States and the European Union) that are more responsible for the current CO_2 concentration in the atmosphere, to emerging and developing countries (such as China and India) that significantly increased their emissions over the last few years. For this reason, in order to reach an effective and far-sighted agreement their commitment is fundamental.

Effective international cooperation can help the world develop along a 2°C pathway and adapt to the climatic changes already locked-in as a result of past and ongoing greenhouse gas emissions. It can also help countries seize the many opportunities and benefits associated with the transition to a low-carbon economy. The United Nations climate change conference in Paris at the end of 2015 is an important opportunity to advance toward those objectives.

The French Government, which will host the Paris summit, has indicated that it will seek a

'Paris Climate Alliance' as an outcome, based on four aspects:

1. A universal legal agreement, applicable to all countries
2. National commitments covering control and reduction of emissions
3. A financial and technology aspect aimed at scaling up finance and technology for climate change mitigation and adaptation while guaranteeing international solidarity with the most vulnerable countries
4. An 'Agenda of Solutions' aimed at implementing accelerators to ensure more ambitious progress, above and beyond binding commitments.

The legal agreement that is emerging is a hybrid agreement, involving a mix of centralized and decentralized, binding and non-binding elements. The agreement will be associated with 'intended nationally determined contributions' (INDCs) by countries to restrain and reduce emissions, the achievement of which will be non-binding internationally. The agreement is also likely to involve centralized, common processes to ensure the transparency of countries' efforts. It is widely hoped, that the agreement will also include a review-and-revision process for countries to increase the ambition of their commitments regularly over time.

Shahab Enam Khan,
Research Director,
Bangladesh Enterprise Institute (BEI),
Dhaka

Climate Change, Security and Development has become complex issue for Bangladesh. Bangladesh is recognized worldwide as one of the most vulnerable countries to the impacts of global warming and climate change. This is due to its unique geographic location, dominance of floodplains, low elevation from the sea, high population density, high levels of poverty, and overwhelming dependence on nature, its resources and services. Some of the major climate concerns in Bangladesh are food and energy insecurity, disasters vulnerability, new emerging diseases, loss of the Sundarban World Heritage Site and rise of sea level. In terms of discussing on these key threats, food Price in Bangladesh has tripled since mid-2007 and it will impose huge food crises particularly to the poor in the country. Variability in rainfall pattern, combined with increased snow melt from the Himalayas, and temperature extremes are resulting in crop damage and failure, preventing farmers and those dependent from meaningful earning opportunities. Energy has been seen as the key source for economic growth with seven percent raise in Bangladesh however in reality energy services are severely lacking in the country particularly in rural areas.

Climate change and its impacts impose huge environmental risk and threats to Bangladesh. Impacts of global warming and climate change have the potential to challenge our development efforts, human security and the future. The frequency and intensity of Bangladesh's vulnerability to disaster has been rapidly increasing in past few years.

Climate Governance Framework in Bangladesh

Government of Bangladesh (GoB) has taken some of the initiatives in-order to address the

disasters caused by Climate change. The Forest Act 1927 (Amended 1989), The Forest Policy 1994, The Environment Policy of 1992, Bangladesh Environmental Conservation Act, 1995 (Amended in 2010), National Biodiversity Strategy and Action Plan (NBSAP), 2004 are some of the major national policies that Bangladesh has adopted. Moreover in response to tackle the increasing environmental devastations the Government of Bangladesh and the international development community has placed high priority on building the country's capacity to mitigate and adapt to climate change. This has resulted in the creation of two primary funding instruments: The Bangladesh Climate Change Trust Fund (BCCTF), created by the GoB and The Bangladesh Climate Change Resilience Fund (BCCRF), created by international development partners and managed by the World Bank. Both programs will support implementation of the Bangladesh Climate Change Strategy Action Plan (BCCSAP), a national strategy and action plan for reducing socio-economic vulnerabilities to climate change.

To boost private sector investment, the government is developing a public-private partnership strategy that specifies the environment as an investment sector. The Bangladesh Green Development Plan aims to develop new programmes in environment, energy and climate change that address the climate change adaptation and mitigation needs of the poor. It focuses on demand side energy management by providing access to low-carbon fuels and energy and it should also create green jobs.

Given Bangladesh's existing CC framework and the pending issues, Bangladesh is hoping for the best outcome from the 21st Conference of the Parties (COP) on climate change. The Lima conference (COP 20) virtually collapsed as nations were too far apart to arrive at an agreement. Bangladesh is a prime example of a vulnerable developing nation that faces formidable challenges in all these areas, and it will be directly affected by the decisions that are made, or not made, at the conference. Bangladesh wants the CoP of the United Nations Framework Convention on Climate Change to reach an effective deal which would make the high emitting nations legally obligated reduce the carbon emission to prevent climate change impacts.

Climate change and flood risk reduction in the Himalayas

Dr. Mandira Singh Shrestha,
ICIMOD, Kathmandu

The Hindu Kush Himalayan region is one of the most hazard prone regions of the world. Its fragility stems from its susceptibility to multiple hazards of geological as well as hydro meteorological origin such as earthquakes, landslides, floods, flash floods, droughts, wildfires, cloudbursts etc. The physical and socio-economic characteristics of the Himalayan region combined with the changing risk factors such as environmental and climate change and population growth have rendered the region highly vulnerable.
Impacts of climate change and climate variability have been well observed in the Himalayas, in particular, with respect to recession of snowline, formation of glacial lakes, and changes in biodiversity in the

ecosystems. Several studies indicate that most of the glaciers in the Himalayas have been shrinking at accelerated rates in recent decades. As a result of rapid melting of glaciers, glacial runoff and frequency of Glacial Lake Outburst Floods (GLOF) causing mudflows and avalanches have increased.

and settlements along the flooded river. In the history of the world, some catastrophic glacial lake outbursts floods (GLOF) have caused extensive damage and loss of life further downstream.

According to ICIMOD there are 8790 glacial lakes along the selected location of the Hindu

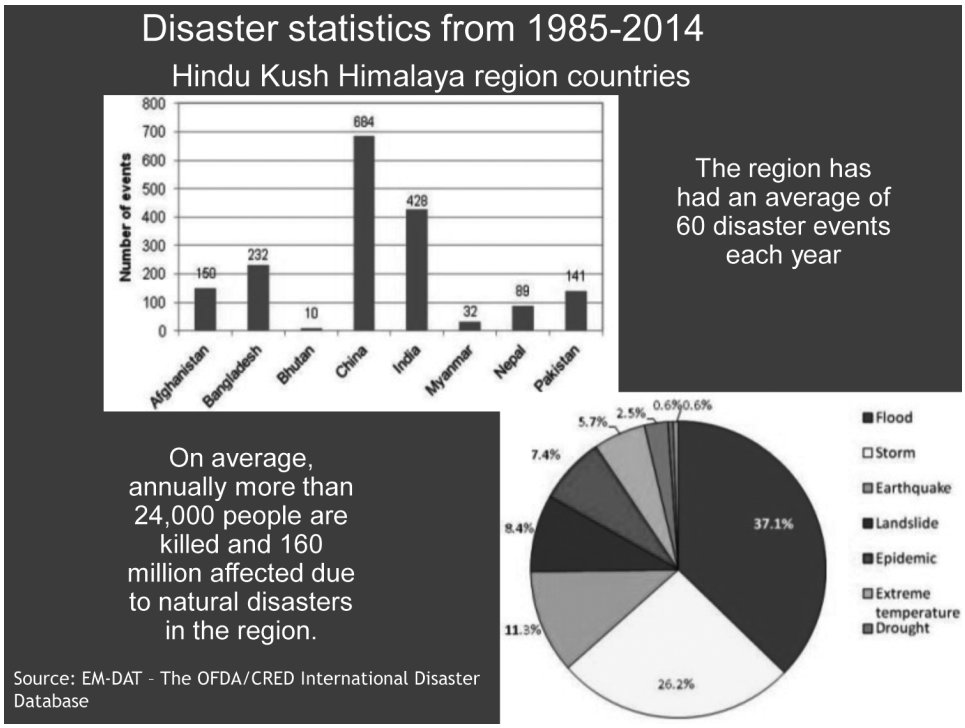

Fig: Disaster Statistics from 1985-2014: Hindu Kush Himalaya Region Countries

For the countries laying under the shadow of the great Himalayas the threat of glacial Lake Outburst floods have assumed a dangerous proportion beyond imagination. One of the reasons is that the end moraine (a loose mix of rock debris) of these lakes makes them potentially unstable as the volume of lake water increases the moraine dam is stressed which eventually may give way to hydrostatic pressure and release much or all of the lake water. The resultant surging flood water can be sudden and disastrous to people

Kush-Himalayas of which 204 are liable to burst out at any moment leading to massive floods downstream. ICIMOD adds that at least 35 glacial lake outburst floods have already happened in Bhutan, China and Nepal during the 20th century. According to ICIMOD remote sensing study, in Nepal alone more than 1400 glacier lakes have come up owing to the melting of the Himalayan ice under the impact climate warming; of these six are vulnerable to outburst with the potential to cause havoc in

the downstream human settlements. Three lakes, Imja, Thulagi and Tsho Rolpa, have been studied and investigated and more detailed investigations of potentially dangerous glacial lakes are called for. Ultimately, climate warming will continue inevitably, and also the accelerated glacier thinning and retreat. Many Nepali villages along the snow-fed river basins have become extremely vulnerable to the threat of glacier lake outburst floods. Moreover, since the Hindu Kush-Himalayan range is admittedly one of extreme seismic instability, the earthquake hazards make glacial lake outburst flood assessment all the more issues of extreme urgency, particularly for Nepal.

Flood frequency in the Hindu Kush region has been increasing, but there is greater inter-annual variability and spatial dispersion for these floods. Amongst floods, however, trans-boundary floods are the most problematic- even though only 10% of floods are trans-boundary, they cause 30% of all casualties from floods. The issue with trans-boundary Rivers is that there is shared vulnerability across national borders, and cooperation is the key to deciding whether or not the threat of trans-boundary floods is addressed. This is because of the diversity of technical, scientific, and institutional know-how across nations, and how this can be used to collective advantage. Some bilateral agreements/treaties exist in South Asia, but there are issues of High-altitude monitoring stations being sparse as well as a lack of exchange of real-time data especially across national boundaries.

There are number of mechanisms through which trans-boundary flood reduction can be done. Moreover there are a number of opportunities on this front: establishing an End to end flood forecasting system – people

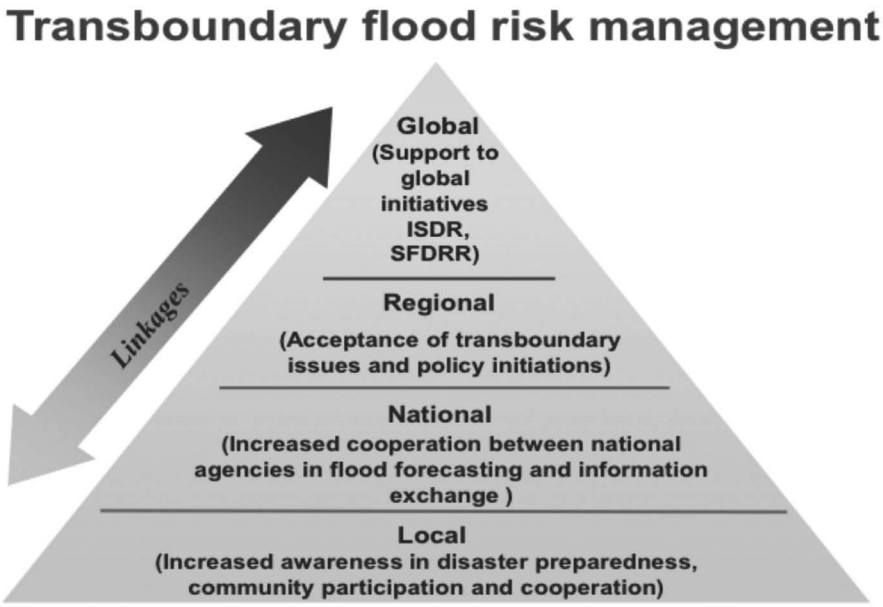

Fig: Transboundary flood risk management

centered early warning system to vulnerable communities is a possibility; using new technology and advanced scientific knowledge for monitoring, assessing, forecasting and communicating information can also be adopted to address the threat of floods. There can be new initiatives in regional cooperation and information sharing - SAARC Climate change declaration, action plan, alongside capacity building in flood risk management – prevention, preparedness and mitigation. And the SAARC can make its agenda to mainstream flood risk management into development processes, as well as improving trans-boundary coordination and collaborative efforts. And for climate change in general, there are a number of measures that can be adopted as well. Promoting a multi hazard approach and multi hazard risk and vulnerability analysis and mapping is a possibility. Continuing to bridge data and information gap to inform policies is important, as is enhancing regional cooperation in data and information sharing. And ultimately, developing real-time regional information systems, to strengthen community resilience and adaptation strategies as well as assisting and inform policy making, and to provide a platform for regional cooperation towards comprehensive disaster risk reduction should be the road forward.

Agriculture, Food Security and Climate Change in Nepal: An Overview of Adaptation Practices in the Himalayas

Dr. Smriti Dahal ,
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Changes in temperature, precipitation and the frequency with which extreme weather events occur are just a few of the many manifestations of climate change. Although predictions regarding the impact of climate change on specific ecosystems and population groups are imprecise, it is unquestionable that variations in weather patterns will have negative implications for agriculture and food security.

Nepal's economy depends on agriculture. Total area of Nepal is 147,181 km² divided in mountains (35%), hills (42%) and terai (23%). A total of 3091000 ha area is cultivated for agriculture, and it accounts over 38 % of the gross domestic product (GDP). The country is susceptible to disasters, including flash flood, GLOF and melting snow in the mountains and droughts and inundation in the terai.

Nepal will be particularly hit by climate change. Atmospheric temperature in Nepal is rising at a rate higher than the global average, with a 1.8°C increase between 1975 and 2006, while precipitation has become increasingly unpredictable. Furthermore, threats to biodervisity, deforestation and increased frequency of extreme weather events have affected agricultural production and undermined the livelihoods of the rural poor. High levels of poverty and the dependency on subsistence farming by a large portion of Nepalese farmers have limited the coping ability of the rural poor and increased the percentage of those who are food insecure.

Access

Country	Prevalence of under nourishment (%)		Number of undernourished population (million)		Prevalence of food inadequacy (%)	
	1990-92	2010-12	1990-92	2010-12	1990-92	2010-12
Afghanistan	-	-	7	12	54.4	45.2
Bangladesh	34.6	16.8	37	25	-	-
Bhutan	-	-	-	-	-	-
India	26.9	17.5	240	217	35.4	27.5
Maldives	10.9	5.6	-	-	17.6	11.4
Nepal	25.9	18.0	5	5	34.9	27.7
Pakistan	26.4	19.9	30	35	34.9	25.9
Sri Lanka	33.9	24.0	6	5	44.8	32.0

Source: FAO Statistical Year Book 2013

Fig: State of food insecurity (1)

Nepal has various types of agricultural zones like plains, hills, mid hills, high hills and mountains. Changes in agri-zones lead to the change in cropping pattern of the zone. Climatic parameters have potential impact to change the ecological distribution of agricultural crops. If shifting of climatic zones occurred rapidly due to climate change, extinction of biodiversity might be severe. Effects are mainly on cold-water fish, herbs, pasturelands, tree lines (apple trees) and livestock. Increase in temperature cause more damage on agricultural sectors in Terai region and will be more favorable to agriculture in the hills and mountains. As temperature increases, cropping pattern as well as vector born disease of human and livestock's can be expected to shift in higher eco zones too. Some lands, which are presently undesirable due to different weather factors, may be desirable in near future. For example: maize, chilly, tomato and cucumber are now being adopted in Mustang district of the country. Overall it is concluded that impact of climate change in agricultural sectors will have negative impacts in the long run.

Nepal is a nation with very limited food security, and that the impact of climate on agriculture and food security are significant. In this regard, More than 60% of the cultivated area in Nepal is fully reliant on monsoonal rainfall and unpredictable weather patterns, as a result of climate change, are affecting production of staple crops. A shift in climatic zones has resulted in extinction of various indigenous vegetative varieties; there is a loss of local land races of both crops and domestic animals; there exists scarcity of water to drying up of wells; these all take place as a result of climate change. Furthermore, Climate change is expected to increasingly affect the livelihoods of farmers, especially those who are economically more vulnerable.

Mustang is one of the most severely affected districts in Nepal as a result of climate change: Average rainfall doubled from 1982-1992 to 1992-2002; there was a decrease in snowfall from 5-6 times a year to 1-2 times a year. In terms of agriculture, rainfall unpredictability has affected agriculture production; furthermore, there's been a

Climate change impact in South Asia

Country	Storm			Biodiversity		
	Affected people	*Additional* affected people	Intensity of impact	Contraction of biological zone km2	Additional contraction	Intensity of Impact
	2010	2030		2010	2030	
Afghanistan	...	...	Low	10,000	20,000	Acute
Bangladesh	400,000	600,000	Acute	100	250	Moderate
Bhutan	...	...	Low	250	450	Acute
India	300,000	350,000	Moderate	15,000	30,000	Moderate
Maldives	5	15	Low	..	..	Low
Nepal	..	..	Low	200	400	High
Pakistan	4,500	8,750	High	2,000	4,000	High
Sri Lanka	2,500	60	Moderate	1,250	2,750	Moderate

Source: Climate Vulnerability Monitor 2012

Fig: State of food insecurity (2)

negative impact on apple farming – decrease in production, increase in moisture in air has caused diseases in apples.

For adaptation in Mustang, shifting in apple farming to higher altitude has taken place; farmers are now in higher altitudes, which used to depend on livestock and trade, are now developing apple orchards. There now exists usage of pesticides by farmers to fight the pests; farmers in lower altitude are turning towards production of green vegetables like cabbage, cauliflower, cucumber, chili and tomatoes; and now there are constructions of small ponds for water storage.

In Jumla, on the other hand, there occurred a massive reduction in food production – impact on the production of rice and winter crops that require snow/rainfall to maintain soil moisture (wheat, barley, corn, potato) – this is caused by a change in precipitation patterns resulting from Climate Change. The adaptation practices in response are, poorer households replace paddy with wheat and Ragi; People from lower incomes start selling their labor in the community and migrate to India; women from poor households were eating more chino and millet although less preferred than rice. Richer households have different adaptation strategies: they use a crop diversification strategy– introduction of vegetable farming for consumption and sale. They buy irrigated land and sell non-irrigated land, they store grains, and they explore new agriculture technologies, as well as new crop varieties.

There needs to be an understanding of these practices, an evaluation of what works best in Nepal, and through information sharing, throughout SAARC, and the provision of supporting practices based on this comparative knowledge.

Evidence of Climate Change in Nepal and Nepalese Agriculture

- Late or pre-monsoon, unusual precipitation, decreased rainy days and intense rainfall events caused more runoff and low groundwater recharge.
- Extreme fog conditions have recently been observed in the terai regions.
- Traditional rainfalls of Jestha and Ashar (mid July) have been shifted in Shrawan and Bhadra in Kathmandu. It has affected negatively in the paddy production. The Journal of Agriculture and Environment

- Receding snowfall and retreating of the glaciers (small glacier mountain shrinking at alarming rate) due to increase in atmospheric temperature in mountain environment.
- Kathmandu valley frost day decreasing, winter cold shifted to a month later than regular and snowfall in Kathmandu.
- Mosquito from Terai and Mid-hill being able to survive in high- hills (Ilam, Mustang and Helambu area)
- Cold wave in Nepal in 1997/98 had negative impacts on agricultural productivity and showed reduction in the production of crops by 27.8, 36.5, 11.2, 30, 37.6 and 38 % in potato, toria, sarson, rayo, lentil and chickpea respectively.

Climate change is real and underway, so there is a need of impact identification and adoption to cope with vulnerabilities in agricultural sector. Nepal being a under developed country is moving towards vulnerable situation due to climate change. As it is known, its effects cannot be completely controlled but effective planning and change in human habit towards a low carbon economy can slower down possible disasters.

Green Energy Technology, Energy Conservation and Climate Change Mitigation in South Asia

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Human activity is overloading our atmosphere with carbon dioxide and other global warming emissions, which trap heat, steadily drive up the planet's temperature, and create significant and harmful impacts on our health, our environment, and our climate. The traditional energy system is the main contributor to greenhouse gases (GHGs) emissions and, therefore, to climate change whereas renewable energy (RE) emits no or help to reduce the GHGs emission. In addition to this benefit, renewable energy technologies (RETs) provide multiple socioeconomic benefits in many development deficit (rural) areas and may serve as a good reliable option for adaptation to climate change.

According to the IEA (International Energy Agency), "Global emissions of carbon dioxide stood at 32.3 billion tonnes in 2014, unchanged from the preceding year. The preliminary IEA data suggest that efforts to mitigate climate change may be having a more pronounced effect on emissions than had previously been thought.

The IEA attributes the halt in emissions growth to changing patterns of energy consumption in China and OECD countries. In China, 2014 saw greater generation of electricity from renewable sources, such as hydropower, solar and wind, and less burning of coal. In OECD economies, recent efforts to promote more sustainable growth-including greater energy efficiency and more renewable energy-are producing the desired effect of decoupling economic growth from greenhouse gas emissions."

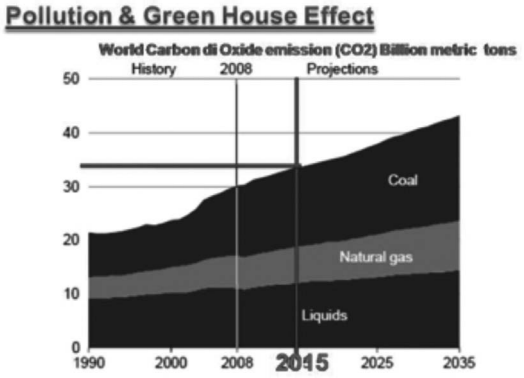

Fig: Pollution and Green House Effect

Low Carbon Development is an innovative way of thinking about development pathways in a new global landscape, based on using natural resources in a sustainable manner. These development pathways seek to catalyse investment and innovation, which will underpin sustained growth and give rise to new economic opportunities. Connecting socio-economic development concerns with the potential for green growth allows policy makers, organisations and citizens to develop together in sustainable ways. The burning of hydrocarbons leads to increased atmospheric concentration, which subsequently leads to spectral absorption and greater heat generation- this heat generation, as we understand it, is the cause of global warming and more broadly, climate change.

The methods of effective climate change mitigation are both demand side- reducing the demand for hydrocarbons either by using less or other forms of energy- and supply side- making existing hydrocarbon conversion technologies more efficient. Prof. In South Asia, there is a fundamental inconsistency in addressing climate change through a need for greater economic development and industrialization, which calls for greater energy consumption, but at the same time, climate change imperatives mean that we should decrease our energy consumption. A number of mechanisms established to pursue alternative energy fronts as well as climate change mitigation, such as the National Mission for Green India, Green Lanka for Sustainable Future and so forth.

The Asian approach can be to sensitize citizens about energy utility and its relevance to climate change and related adverse effects on life. Consumers, as stakeholders of the sustainable Global Economy can only gain from supporting and implementing greener technologies. There should be a transformation in the usage of renewable and green energy sources that complements and drives economic growth.

Renewable Energy Programme and Intended Nationally Determined Contribution (INDC) of India

Mr. Nitya Nanda,
Fellow,
TERI, India

India has very limited reserves of oil and gas but reasonably large reserves of coal, thus in this context, as coal is cheaper than other sources of energy, coal became central to India's energy supply. Yet at the same time, energy access, both in terms of absolute lack of access as well as average use are pretty low in India, which means that energy consumption can only grow in India, and coal usage subsequently will certainly increase. However, much of this energy needs to be imported, and imported energy constitutes

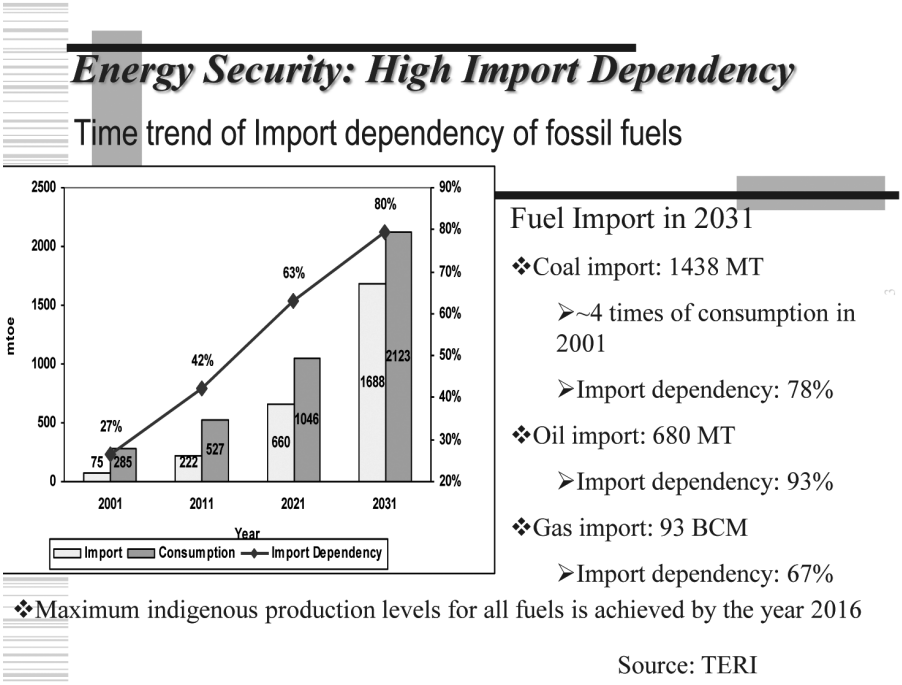

Fig: India's Energy Import Dependency

some 31 per cent of total supplies in India in 2012.

India's Future Energy Scenario

GDP expected to grow – 8 – 9 %

Energy demand expected to grow by 4.5-5.5%

Coal reserve: 13000Mt (extractable),

R/P ratio = 80 years (but only about 40 years with required growth)

Oil reserve: 1130Mt; R/P = 33 years

Gas reserve: 1100BCM; R/P = 32 years

Intended Nationally Determined Contribution (INDC) of India

In its INDC, India has pledged to improve the emissions intensity of its GDP by 33 to 35 per cent by 2030 below 2005 levels. It has also pledged to increase the share of non-fossil fuels-based electricity to 40 per cent by 2030. It has agreed to enhance its forest cover which will absorb 2.5 to 3 billion tonnes of carbon dioxide (CO_2, the main gas responsible for global warming) by 2030.

India has accepted the huge impact that climate change is exerting and will exert on different sectors of its economy and has agreed to enhance investments to adapt in vulnerable sectors like agriculture, water resources, coastal regions, health and disaster management. India has also reiterated its need for international finance and technology support to meet its climate goals. In this regard, it has said it would require at least US $ 2.5 trillion (at 2014-15 prices) to meet its climate change actions between now and 2030.

India's INDC also highlights some tough challenges for the world. The INDCs submitted by all major emitters indicate the cumulative emissions of the world between 2012 and 2030 would be in the range of 700

to 800 Gt of CO_2. According to the report of the Intergovernmental Panel on Climate Change (IPCC), to meet the $2^{O}C$ temperature increase target, the world has an emission budget of only 1,000 billion tonnes of CO_2 till 2100. The world will consume most of this budget by 2030, leaving a small space for developing countries in Asia and Africa to grow in the future.

Furthermore, there are a number of issues that come about with the adaptation of renewable energy sources. Though the Government of India has adopted ambitious targets on renewable energy (175GW of solar and wind by 2022), there is enough skepticism around Indian experience in terms of achieving targets in general and targets in electricity sector in particular especially given the failure of the universal access to electricity by 2012 plan, as well the ease of adopting coal based electricity production. Also, Electricity is in the concurrent list of Indian constitution (meaning both central and state governments have authority to adopt law and policies) and hence state governments will have role; the central by itself does not have complete sovereignty over such policy matters, and there is also a part played by regulators and private players will also have a role.

Thus, seeing these issues in adopting renewable energy, India's intended Nationally Determined Contributions will be aspiration, and not binding: it will make statements of intent- being a top 5 solar producer by 2020, for example, but its commitment to economic growth prevents concrete plans.

Climate Change Impact & Renewable Energy Use: Pakistan Case Study

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Islamabad

The three key components in the Pakistani security paradigm are, the environment, the economy and extremism; for Pakistan, there is a vital connection between these three components and each cannot be examined in isolation.

Environmental insecurities, energy scarcity and climate change present rapidly growing threats to human development and security in Pakistan. Both natural and man-made factors contribute to these problems. They include a rapidly growing population, urbanization, industrialization, the unsustainable harvesting of resources and inadequate, poorly implemented state policies. The consequences can be seen in the form of severe health hazards, food and livelihood insecurity and the increasing vulnerability of marginalized communities that are heavily dependent on natural resources.

Pakistan presents a classic example of a developing country that is highly vulnerable to the adverse impacts of climate change but has done little to contribute to the solution. Pakistan is only responsible for an estimated 0.8 per cent of global GHG emissions and ranks 135th in the world in terms of per capita GHG emissions. Consequently, Pakistan's major concerns with respect to climate change are related to adaptation, particularly in the areas of water, agriculture and disasters.

Currently, 61% of Pakistan's energy is sourced from non-renewable sources (36% oil, 27% natural gas and 5% coal) whereas 34% of energy is sourced from renewable sources- more specifically, hydropower. There is existence of a huge deficit in energy production and consumption in Pakistan, amounting to 12000 MW: subsequently, only 61% of the Pakistani population has access to electricity.

The issue of inadequate production to poor governance, and poor long term planning and a reactionary mindset towards energy and the environment within this broader issue is highly problematic. Weak governance exacerbates Pakistan's other vulnerabilities - floods, glacier melts, water stress- especially given it's two neighbors, India and China both are high carbon emitters. There should be proactive policies, alongside greater civil society engagement and dialogue with neighbors as the key towards addressing Pakistan's security issues in context of the environment.

Pakistan is blessed with range of ecological zones such as glaciers, high mountains, tropical forests, riverine belts, deserts, and coastal ecosystems. Different zones however require unique strategies to deal with climate change and energy issues and hence, policies should also be made accordingly, in order to reap tangible results.

Existing policy and Institutional initiatives on climate change:

Climate related policy in Pakistan has to be multi-faceted endeavor cutting across a number of priority sectors as well as being embedded in an interlinked array of economic and political decisions. Moreover, any such response has to be developed within the overall context of the international policy framework comprising the Climate Change Convention and the Kyoto Protocol as well as the national environmental context. Within these broad parameters, the national policy response for managing the Climate Change problem can be classified into three major categories namely mitigation, adaptation and associated institutional/capacity support.

Pakistan has responded to the overall environmental challenge by enacting several pieces of legislation and policy initiatives aimed at incorporating environmental concerns into mainstream development planning. This policy response is embedded in the PEPA (1997) Act with the PEPC being the apex decision making body. The associated implementation frameworks consisting of the Ministry of Environment and the EPAs at federal and provincial levels have been formalized through the National Environment Policy (2005). In addition, Pakistan has approved an array of environment related policies including; National Forest Policy, National Energy Conservation Policy (2006), National Renewable Energy Policy (2006) and Policy for Development of Renewable Energy for Power Generation (2006).

On the Climate Change front, Pakistan signed the United Nations Framework Convention on Climate Change (UNFCCC) in June 1994. The country, subsequently, adopted the Kyoto Protocol in 1997 and acceded to it on 11th January 2005. As a follow up to these international commitments, the country has undertaken climate related studies including

the UNEP country study on adaptation, the first National Communications on Climate Change and the Task Force report on Climate Change (2008). All these reports have managed to create institutional and stakeholder awareness about the climate issue as well as build a strong constituency for formulation of a comprehensive national policy on climate change which can be driven by a clear national goal and guiding principles and implemented through a targeted action plan.

Integrating Global Responses to Climate Change and Energy Security: an EU Perspective

Dr. Genoveva Hernandez Uriz

Chargé d'Affaires a.i.
EU Delegation to Nepal

I would like to start by thanking the Centre for South Asian Studies (CSAS) and the Konrad Adenauer Stiftung (KAS) for inviting me today. I am very glad to see again my old friends Dr. Nishchal N. Pandey and Dr. Wilhelm Hofmeister.

An invitation to say a few words about the EU perspective on climate change is a pleasure and an honour because this is one of our core policy priorities. The first thing I would like to underline is the sense of urgency. Climate change affects us directly. As the Intergovernmental Panel on Climate Change (IPCC) points out, the window of opportunity for staying below the 2°C limit is closing very fast. 2015 is a decisive year for climate negotiations. Our best efforts are needed to make Paris successful.

The EU has been at the forefront of the development of a robust international framework to address climate change. But we would be very poorly served if we did not clean our own house (in the literal sense of the word), by applying stringent policies in our own countries.

The EU has established a comprehensive system of environmental protection covering all aspects from energy efficiency to the reduction and recycling of waste, the management of water bodies, the conservation of natural habitats, more environmentally-friendly land-use and agriculture and more sustainable and resilient cities. We have passed legally binding legislation to ensure an ambitious emissions' reduction target on which we are already delivering.

How is this put into practice? An important challenge is decoupling- breaking the link between economic growth and increased emissions. Breaking this link is occurring in all Member States. Between 1990 and 2012, the EU reduced its own greenhouse gas emissions by 19% while the economy grew by 45%. No doubt, however, that the economic crisis of the last few years has convinced us that a low carbon economy is the only way out.

Five years ago, the EU adopted the Strategy Europe 2020 for sustainable and inclusive growth. Its specific targets aimed to ensure that, by 2020, EU greenhouse gas emissions would be cut by 20% (below the 1990 level), 20% of energy would come from renewables and energy efficiency would be improved by 20%.

In October 2014, EU leaders further

strengthened their commitment by adopting the 2030 climate and energy framework. Three key elements of the framework are: (i) the binding target to reduce EU domestic greenhouse gas emissions by at least 40% by 2030; (ii) increasing the share of renewable energy to at least 27% of the total consumption; and (iii) an indicative target of 27% of energy savings. In the long run, our objective is that in 2050, our emissions will have been reduced by 80%.

A key instrument in the implementation of this policy is the Emissions Trading System, a pioneer mechanism which has created the world's biggest carbon market. It covers some 45% of emissions from energy-intensive sectors in the Union, Iceland, Liechtenstein and Norway, including aviation emissions within EU airports. The way it operates is by putting a cap on carbon emissions and placing a price on them. This has been useful to bring the business sector on board because a company can, not only save, but actually make money by reducing its emissions.

Similar 'Cap-and-trade' systems are spreading to other parts of the world, including in Asia. The EU would like to see the international carbon market develop through the creation of a network of compatible emission trading systems. We also advocate the inclusion of aviation in this system and we support the work conducted by the UN agencies towards this goal.

There is still a lot of work to do. Some 55% of the EU's emissions are not covered by the EU ETS. The sectors concerned include transport, buildings, agriculture and waste. To ensure these emissions are addressed, Member States have signed up to an 'effort-sharing' agreement which sets binding national targets covering the years up to 2020 included.

At the same time, the EU is still heavily dependent on energy trade: we import 53% of the energy we consume. In March this year, EU Heads of State agreed to create an Energy Union. An important aspect of that plan is the de-carbonisation of the economy, by improving energy efficiency (for example in buildings and in the transport sector) and investing heavily in research to develop competitive renewable energies.

Nowadays, Europe accounts only for around 9% of global emissions: while our lead is vital, and our responsibility higher, this can only be a collective effort**,** because climate change knows no borders and worldwide, greenhouse gas emissions continue to rise every year.

The EU was instrumental in the development of the UN Framework Convention on Climate Change, signed in 1992, and the 1997 Kyoto Protocol. An important feature that has allowed us to be strong is that, in international negotiations on climate change, the European Union speaks with one voice, rather than acting as a scattered group of medium and small nations. We will also come as one to the Paris COP.

The EU believes the new agreement should preferably take the form of a Protocol under the UNFCCC and enter into force as soon as it is ratified by countries totaling 40 Gigatonnes of CO2 equivalent. This is

equivalent to approximately 80% of 2010 global emissions. The EU, China and the US should show political leadership by joining the Protocol as soon as possible.

To be effective, the new Protocol needs to have the broadest geographical coverage and the highest possible level of ambition. Countries with the greatest responsibilities and capabilities need to make the most ambitious contributions, but it is important that all countries are on board and committed to playing their part. Today, more than half of the world's emissions come from developing countries; the agreement needs to address this for the regime to produce results.

The EU has set out its vision for a robust new agreement, which aims to limit the rise in global average surface temperature to below 2°C compared to pre-industrial times. To achieve this, it should have the following elements:

- A common legal framework applicable to all countries; including legally binding, fair and ambitious targets for emissions reduction commitments. These should be based on evolving global economic and national circumstances
- It should be dynamic, including a mechanism to review and strengthen countries' targets in light of the below 2 degree goal
- It should be transparent, thus holding all countries accountable – to each other and to the public – for meeting their targets

Additionally, all countries should be encouraged to participate in climate finance, technology development and transfer, and capacity building. Since both public and private finance play an important role, the Protocol should provide a framework to mobilise investments in low-emission, climate-resilient programmes.

The prospects are better than in the past. Over the last 12 months, there has been growing global public and political momentum for increased climate action. In November last year, the largest emitters, the US and China, announced their post 2020 targets. The Lima climate conference saw pledges to the Green Climate Fund, which will be used to assist developing countries, pass $10 billion − with almost half of this coming from EU Member States.

Perhaps a beautiful aspect from our experience in this work is that it has allowed the creation of new alliances of like-minded countries, overcoming traditional divides (such as North/South, East/West). Another important lesson is the need to integrate climate change in all areas of our work, including our development agenda. This is all the more the case in highly vulnerable countries like Nepal, from where I will draw a few examples.

In our support strategy for Nepal covering the period 2014-2020, the climate change dimension is taken into account in our sectors of intervention and particularly in our first priority, the sustainable rural development of Nepal's rural areas by transforming agriculture from a sector largely based on low-value production to a competitive, sustainable, and inclusive one, that brings economic growth, improved livelihoods, and food security, whilst reducing vulnerability to

climate change and natural disasters.

The Regional Strategy Paper 2014-2020 for Asian countries aims at fostering regional cooperation in selected areas. Priority sectors of the new regional strategic document are: 1) Support to Regional Integration; 2) Aid to uprooted people; 3) Green economy. A particular focus will be put on climate change. Under the regional cooperation, Nepal benefits from the Switch Asia programme which aims to promote sustainable production and consumption patterns in local industries.

Nepal has also benefitted from the EU-supported Global Climate Change Alliance (GCCA) Facility, which was established in 2007 to strengthen dialogue and cooperation with developing countries, in particular least developed countries (LDCs) and small-island developing States (SIDS) on climate change issues.

The EU is supporting a number of actions directly aiming to support to the fight against climate change in Nepal. A few examples of projects are an initiative to build climate change resilience (in partnership with DFID and UNDP), interventions to turn waste into energy or a regional programme to support livelihoods and climate change adaptation for vulnerable mountain populations in the Himalaya and Hindu Kush.

Let me close by saying a few words about South Asia and the role of SAARC. In this forum of experts, there is no need to insist on the vulnerability of South Asia to climate change, with all the disasters coming in its wake: lost livelihoods, displaced populations, water scarcity, floods and health crises.

The challenges are many and, at the same time, in this region there is no shortage of talent, dynamism and entrepreneurship. Personally, I have been impressed by the innovative ideas I have seen: varieties of water resistant rice, biomass plants, methanisation of waste, energy efficient traditional constructions, just to mention a few.

If regional cooperation is useful in other fields, we can say that in this one, it is indispensable. The adoption of instruments such as the SAARC Agreement on Rapid Response to Natural Disasters, SAARC Convention on Cooperation on Environment, and the declared commitment by SAARC leaders to a legally binding instrument in Paris are steps in the right direction. The challenge now is making all these efforts systematic and coordinated, particularly by facilitating the cooperation of private and civil society actors across borders.

In this regard, let me congratulate the Centre for South Asian Studies (CSAS) and the Konrad Adenauer Stiftung (KAS) for the excellent work they are conducting in this field by stirring the debate and putting forward ambitious proposals.

I wish you a very fruitful conference.

Climate Change Security Threats and National Adaptation in Afghanistan

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Introduction

Afghanistan has an arid and semi-arid climate is landlocked that covers slightly over 652,000 km^2 land with cold winters and hot summers, with an estimated 30.5 million population (World Bank, 2013). The highest point in Afghanistan is Mount Nowshak at 7,484 m and the lowest 240m in Qarqin district of Jawzjan province, approximately 27 percent of Afghanistan lies above 2,500 m elevation.

Population growth rate is 3.8%, 13% have access to safe drinking water, 21% access to sanitation in 1970's but 12% today. Management of solid and hazardous management does not exist and air quality is not good.

The climate varies substantially from one region to another due to dramatic changes in topography, but the country on the whole is dry within the Desert or Desert Steppe climate classification.

Afghanistan is an agriculture-based economy, but only a small part of the land area (an estimated 12 percent) is suitable for arable farming or horticulture (irrigated and rain-fed). Although estimates vary, it is thought that about 3.3 million hectare (five percent of the total land area) is irrigated and regularly cropped, while 4.5 million hectare (seven percent) is rain-fed and is cropped depending on precipitation and the average precipitation in depth is 327mm/year.

Climate Hazards in Afghanistan

Key climatic hazards in Afghanistan include periodic drought; floods due to untimely and heavy rainfall; flooding due to melting of snow and ice; increasing temperatures; frost and cold spells; most vulnerable to climate change are water resources, forestry and rangeland, and agriculture.

Drought and mismanagement of our water resources affect agricultural productivity, desertification is reducing carrying capacity of our land, and the unsustainable harvesting of our forest resources marks the loss of a national treasure. Natural resources provide the livelihood basis for up to 80% of the Afghan population, their sustainable use and management is therefore of essential importance to the well-being of both present and future generations.

Wetland of Hamoon-e-Puzak, Nimroz: Impact of drought

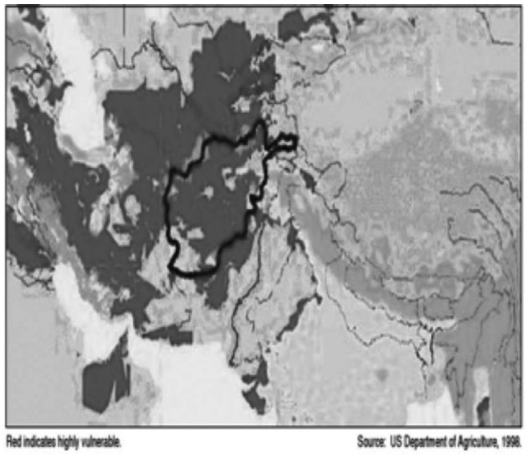

Figure.1 Assessment of vulnerability to desertification and impact of drought

Water is key to the health and wellbeing of Afghan people and essential to maintain agricultural productivity. However, both surface and groundwater resources have been severely affected by the drought, as well as by uncoordinated and unmanaged extraction. This is further complicated by changing climatic conditions at the global level.

Pasture, bush, and forests around the country have been severely affected by unsustainable management.

Impact of Climate Change in Afghanistan

Temperature increase of 1 to 2 degrees Celsius 1970-2004, projected to increase by more than 4^{o}C degrees by 2090 will have extreme impact on snow and ice in Hindu Kush.

The precipitation rate reduced by 5-20% and runoff is up to 40% less than 1980-1999. Adaptation and mitigation potential is zero and overall vulnerability to climate change is very high.

Institutional Framework and Capacity Assessment

The recent establishment of an environmental function within the centralized government system reflects Afghanistan's development priorities. In 2002, the new department was first housed in the Ministry of Irrigation, Water Resources and Environment (MIWRE) as the Department of Environment. In January 2005, the Department of Environment was separated from MIWRE and was subsequently declared an independent Department of Environment. In May 2005, the environmental function was given the status of an independent National Environmental Protection Agency (NEPA).

NEPA's capacity to implement its mandate remains relatively limited but the impending completion of the Priority Reform and Restructuring (PRR) process will provide a stable organizational structure with staff hired under appropriate Terms of Reference following a transparent recruitment process.

The organizational transition of the environment function since 2002 has precluded the consistent development of technical and managerial skills within both NEPA and other governmental authorities involved in environmental management.

Similarly, there has been little opportunity in Afghanistan's recent history to develop a functioning education and administrative system to support environmental management. Thus the capacity of both NEPA and other government institutions to both conduct environmental management and implement this strategy requires significant training and capacity development.

National Environmental Strategy

The National Environment Strategy aims to improve the quality of life of the people of Afghanistan through conservation, protection and improvement of the country's environment.

The Strategy uses a mainstreaming approach to provide direction for the integration of environmental issues and policies into Afghanistan's development priorities in order to contribute to increased economic growth and poverty reduction.

The following goals shall be achieved:

- Secure a clean and healthy environment for the people of Afghanistan.
- Ensure effective management of the country's environment through participation of all stakeholders.
- Attain sustainable economic and social development while protecting the natural resource base and the environment of the country.

Key donor-funded projects implemented with support from the Afghan Government

Afghanistan's compliance with the Rio Conventions:

- UNEP: Capacity building and institutional development program for environmental management;
- ADB: Initial inventory of Afghanistan's greenhouse gases;
- Pastoral Engagement, Adaptation and Capacity
- Enhancement (PEACE) Project: aims to reduce the social and economic risks associated with livestock production in Afghanistan;
- Agro Meteorological Project in Afghanistan provides climatic information, validation of satellite monitoring and ground truth crop forecasts;
- WFP National Risk and Vulnerability Assessment (NRVA) of Afghanistan, collects information at community and household levels to better understand livelihoods of rural settled populations
- Catholic Relief Services (CRS) has initiated a sustainable land management program that aims at combining bio-physical watershed restoration activities with support for income generation and the provision of agricultural services.
- ECODIT: Biodiversity Support Program for NEPA (BSP/NEPA) supports the building of institutional capital (human, financial and technical resources) for improved capacity to coordinate and monitor environmental management in Afghanistan.
- ADB: Rural Land Administration Project (RLAP) has concentrated on trialing new methodologies for community

administration of rural land records, supporting the preparation of a comprehensive land policy, and developing recommendations for reform of relevant government institutions.

- Afghan Conservation Corps (ACC) aims to generate long-term improvements in the livelihoods of the Afghan people through sustainable natural resource management, biodiversity conservation and environmental rehabilitation.
- International Centre for Integrated Mountain Development (ICIMOD) has established a Biodiversity and Community Forestry Programme in Afghanistan that aims to strengthen the natural resource management sector by providing increased access to institutional and policy innovations from the Hindu Kush Himalayan region.
- Green Afghanistan Initiative (GAIN), administered by WFP, is a joint programmed of the United Nations that aims to increase natural vegetation and forest cover, provide alternative sustainable livelihoods, increase environmental awareness through education, and build capacity at institutional and community levels.
- The Food and Agricultural Organization (FAO) of the UN supports the rehabilitation and development of the agriculture and natural resource sector and assists the country towards becoming food secure and self-reliant.
- In May 2005, National Environmental Protection Agency was established which is currently directly under the responsibility of the President's office.
- It acknowledges the present environmental problems and institutional setting, including lack of relevant regulations, standards and data as well as weak institutions and their unclear mandates.

Most Important Challenges for the National Environment Strategy

- Throughout Afghanistan, weak environmental institutions need to be strengthened, responsibilities need to be established clearly and coordination needs to be improved.
- The scarcity of qualified, trained and experienced human resources is particularly acute in the field of environmental management.
- Scarce allocation of funds to the development of environmental management as compared to the challenges facing Afghanistan's environment is a major concern.
- NEPA is a fledgling institution, and the environmental mandate is a new one– factors that contribute to its low status among governmental institutions.
- Enforcement of legislation is a challenge in a country that has not known rule of law for decades.
- Mobilization and involvement of the general public as environmental stewards, is key, as is the early sensitization of the young generation by including environmental themes into education curricula.

- The role of women in sustainable natural resources management, domestic waste management, sanitation management, and domestic emissions management, is not well understood.
- Low awareness in governmental institutions with regard to environmental issues.
- Poor collaboration among the relevant government institutions in utilizing existing environmental coordination mechanisms

Green Climate Fund (GCF) and Bangladesh

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Green Climate Fund (GCF) is a financial mechanism under the United Nations Framework Convention on Climate Change (UNFCCC). It was proposed in the Conference of Parties (COP) of 2009 in Copenhagen and the design was finalized during the 2011 COP in Durban. The main objectives of the GCF are to support developing countries related to mitigation, adaptation, capacity building and, technology development and transfer.

It is estimated that GCF will need $450 billion per year from 2020 on - $350 billion for reduced emissions and $100 billion for the impacts of climate change. The fund has already secured $10 billion in financial pledges. It is now ready to start investing in climate sensitive projects and programs. However, there are long-standing debates and negotiation challenges for effective mobilization and channelling of the fund. For example, what role the GCF would play in providing sustained finance at adequate levels? How it would fit the existing development assistance and climate financing architecture? Whether sources beyond public funding would successfully contribute to it? How it would allocate and deliver assistance efficiently and effectively to developing countries? In addition, the channelling of new, additional, adequate and predictable fund, the governance structure, confirming the commitment from the developed countries, and enabling National Implementing Entities (NIE) are also considered major challenges for the GCF.

Bangladesh is considered as one of the most vulnerable countries for climate change. Coastal areas of the country and its "deltaic hotpots" are at risk. The country raised the issue in the international forums and actively supported the necessity of GCF to help the victim countries affected by climate change. In the national level, Bangladesh initiated climate financing in climate adaptation activities. In the global climate change negotiations, it has actively been participating as a member of LDC groups as well as Group of 77 and China. The country is eager to be benefited from the GCF. Its preparedness and capacity building for climate change negotiation needs rigorous evaluation. In this respect, the main objectives of this paper are to understand the core debates on GCF negotiation and to identify the challenges for Bangladesh to be benefited from GCF.

Nevertheless, the GCF is confronting many debates in design, scope, governance and implementation. The governing instrument states that the GCF is to be "accountable to and function under the guidance of the

Conference of Parties (COP)". The COP would have approval over all rules and guidelines proposed by the board of GCF. The COP also would have direct authority over the selection and release of all board and secretariat members. However, there is an apprehension that the complete dependence on the COP may contain effective functioning of the GCF. Keeping the fund independent from the COP may help it to take decisions more effectively. The COP has to decide and can help the GCF to make more functional. The role of the World Bank in the GCF remains under debate. The World Bank as interim trustee of the GCF is subject to review after three years of fund operation. But, when World Bank once became a trustee, it is hard to believe that the rearrangement of the institutional framework would be possible. Moreover, there are also criticisms that the World Bank is not always in favour of developing world, rather critics say the bank as non-transparent, overly bureaucratic, and serves the interest of the developed world. Despite the criticism, it is argued that no other institution would be able to provide better confidence for the developing countries to deal with financial issues.

There is very little elaboration on the sources of funding. The COP decided that the member countries, public and private sources, including alternative sources will contribute in the GCF. There is no specific mechanism to balance between private and public contribution and between developed and developing countries. The confirmation of uninterrupted flow of financing is essential to make the fund effective. Countries have yet not made any effective commitment in this regard. The mobilisation of fund needs the attention of the member countries. Before formation of the GCF, the expectation was that it would be an institute to serve as an "umbrella" for climate change financing. But, it is now developed as an institution which takes the direct responsibility for channelling fund for the developing countries. The other financing i.e. the Adaptation Fund, the Global Environmental Facility and Climate Investment Fund of the World Bank may overshadow or replace the GCF. Conversely, the GCF may face inadequacy of fund to existing arrangements in the eyes of potential donors. In the COP 17, the parties agreed that "all developing countries to the convention are eligible to receive resource from the fund". It includes middle income countries like Brazil, India, South Africa, and China. The USA is objecting inclusion of these countries arguing that it would create difficulties for the least developed countries to compete in the process of access to the fund.

The GCF board was tasked to "balancing" between the allocation in the mitigation and adaptation activities. Donor countries are mainly keen on focusing on mitigation activities, where the developing countries and the civil society organisations are focusing on the adaptation by the GCF. Any allocation formula is not developed yet. Moreover, the access to the fund again remains a challenge for the developing countries. The countries have to submit proposals, where the capacity building for the proposals also would be a challenge. The GCF has no mechanism to evaluate the necessity of any country.

Bangladesh has nominated its Economic Relations Division (ERD) of the Ministry of Finance as National Designated Authority (NDA) to facilitate access to the GCF. It launched an inclusive consultation process and short listed 14 national institutions considering them potential of being National Implementing Entity (NIE). However, the country needs to address to exploit full benefits from the GCF. Foremost challenge would be the Environmental Impact Assessment (EIA). To assess the impacts of climate change and adaptation necessities sufficient scientific knowledge. Such assessment also needs regular update and continuity. To gain from the GCF, it is necessary to strengthen project development and management capacity. In this respect, engaging different stakeholders within government and non-governmental levels is urgent. It would help the country to consolidate bargaining capacity in the international level.

The country needs to improve institutional capacity in the area of environmental and social safeguard policy and practices. It has EIA guideline, which is widely practiced in public and private sector projects, and EIA includes social safeguard issues as well. Another critical issue would be formation of credible bankable projects or programmes to be forwarded to the GCF for funding. Different ministries have developed project ideas and it will be translated into bankable projects for submission to the GCF. It requires further effort and will probably be the most important task before the country in the near future to get access to the GCF. Last but not least, the transparency and accountability of the allocated funds is also important. A wider institutional architecture in the risk management of public funds, where auditor general's office, accounts department, finance cell of different ministries, internal audit and monitoring process of different institutions, implementation, monitoring, evaluation and accountability through public accounts committee can play a critical role.

The GCF fund has already found an institutional framework and started functioning. However, its governance framework, institutional capability and fund mobilisation and channelling are facing heated debate in global climate change negotiations. The power and function of its board, the legitimacy of the World Bank as trustee, the "balance" between mitigation and adaptation fund need proper direction. The commitment of developed world as well as the capacity building of the developing countries can make it an effective network to face the calamities of climate change. Bangladesh can take lead in the GCF negotiations and integrate developing countries to ensure sufficient allocation of fund for climate change adaptation. At the domestic level, Bangladesh needs proper environmental assessment mechanism and enlarging institutional frameworks to expand adaptation activities. Capacity building for developing project proposals, timely submission to the GCF, proper use of the fund and ensuring monitoring capability are also essential for Bangladesh.

Climate Change Adaptation Program Implementation: Bhutan's experience

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Abstract

As a small, least developed and land locked country in the Eastern Himalayas, Bhutan already faces significant challenges for development but climate change threaten the achievements in development made thus far.

Bhutan lacks resources for meeting most of its development needs let alone adaptation measures required to address the additional burdens to address the impacts of climate change. Having identified 25 glacial lakes which are of huge threat to the country and erratic monsoon pattern, coupled with Bhutan's huge dependence on hydropower and agriculture for the economic growth creates a perfect arena for Bhutan to be the most vulnerable to climate change. This demands Bhutan to place the highest priority for climate change adaptation programs.

Introduction

People in the Himalayan region are challenged with changes due to global warming. Glaciers are melting, leading to changing river flows and an increased risk of floods (Kusters & Wangdi, 2013). The increased risk of floods including the catastrophic glacial lake outburst floods is threatening the livelihoods of Himalayan farmers and vital infrastructure. The risk of floods is increased due to formation of artificial lakes because of increasing rate of glacial retreat and storage of water behind the unstable moraine dams at high altitude.

Bhutan is a small country located in the heart of the Himalayas, sandwiched between two Asian giants: China in the North and India in the East, West and South. The country has a complex topography of deeply incised narrow valleys and rugged mountain ranges. The elevation increases rapidly from about 150 meters along the southern border to mountain peaks above 7000 meters in the north. This geographical diversity combined with equally diverse climatic conditions contributes to Bhutan's wide range of biodiversity and ecosystems.

Bhutan is one of the few countries in the world, which emits negligible quantity of green house gases. Thus, *Climate Action Tracker* rated Bhutan as 'role model' as Bhutan has communicated her goal of remaining carbon neutral through the negligible quantities of green house gases emitted. Green house gases emitted in Bhutan is quantified to less than 2.23 MtCO2-e

corresponding to approximately 3tCO2-e per capita. However, if emissions sequestered by forestry are accounted for, Bhutan emerges as negative emitter of green house gas. During the 15th session of conference of parties (COP15) in Copenhagen, the Royal Government of Bhutan committed to remain carbon neutral (NEC, 2012). This can be attributed largely to the large intact of forest cover and limited level of industrialization.

Bhutan has always emphasized on the importance of conserving environment at large, and forest cover in particular.

In-fact Article 5 of The Constitution of the Kingdom of Bhutan (n.d, p. 11) is purely dedicated to the environment, which states that '*Every Bhutanese is a trustee of the Kingdom's natural resources and environment for the benefit of the present and future generations and it is the fundamental duty of every citizen to contribute to the protection of the natural environment, conservation of the rich biodiversity of Bhutan and prevention of all forms of ecological degradation including noise, visual and physical pollution through adoption and support of environment friendly practices and policies'*. The Constitution further states that *'The Government shall ensure that, in order to conserve the country's natural resources and to prevent degradation of the ecosystem, a minimum of sixty percent of Bhutan's total land shall be maintained under forest cover for all time'* (n.d, p. 12).

Bhutan and Natural Resources

Conservation of environment is one of the four pillars of Bhutan's development philosophy of Gross National Happiness. Thus, the Royal Government of Bhutan's developmental activities have always been in line with the protection of environment and the priority has always been in the sustainable use of natural resources in all its policies, plans and programs. Forests cover about 80.89% of the total geographic area of the country including 70.46% of tree cover and another 10.43% of shrubs (NSB, 2014). With the kind of protected area system, Bhutan is one of the few countries in the world, where communities still live inside the protected areas and benefit from it. Bhutan has a network of 10 protected areas connected by biological corridors that, prevents the formation of conservation islands. Including one Royal Botanical Park, half of the country (51.44%) is declared protected areas (DoFPS, 2014).

Bhutan has four major river systems with numerous tributaries streams and natural lakes, which are dependent mainly on glaciers, snow, forests and seasonal rainfall. The Amo Chhu, the Wang Chhu, the Punatsang Chhu and the Drangme Chhu are the Bhutan's four major rivers all of which drain into the Brahmaputra river in India. All the river systems originate within the country except for three rivers viz. Amo Chhu, Gongri Chhu and Kuri Chhu, which originate from the southern part of the Tibetan Plateau. Bhutan has estimated hydropower potential of 30,000MW (RGoB, 2008) of which 23,760MW (DHPS, 2013) has been identified and assessed to be technically feasible. So far, only about 6.5% of the total hydropower potential is harnessed.

Bhutan is predominantly an agriculture-based society with about 62% of the population

depending on agriculture sector for their livelihood (World Bank, 2014). Smallholder subsistence farmers who occupy the majority of arable land and produce most of the crop and livestock dominate agriculture sector in Bhutan. The majority of the farmers are subsistence farmers with average land holdings ranging from 1-4 acres (NEC, 2006).

Vulnerability

Bhutan is highly vulnerable to various climate-related impacts and natural hazards due to great variations in precipitation, and steep high-elevation terrain. Apart from experiencing natural landslides and erosion, the mountainous region is becoming increasingly susceptible to glacial lake outburst floods (GLOFs), which are thought to be a result of glacial melting due to climate change. Meteorological data indicates the increase in temperature in Bhutan: more sharply in higher altitudes than lower altitudes (NEC, 2011).

There are an estimated 2674 glacial lakes in Bhutan, of which 562 are associated with glaciers (NEC, 2011). NEC, 2011, p.8, reports *"Glaciers in Bhutan are retreating rapidly by 8-10m/year for debris free glaciers and 30-40m/year for debris covered glaciers. Due to rapid melting, 25 glacial lakes are considered potentially dangerous with the threat of glacial lake outburst floods"*. All the major rivers in Bhutan (Mo Chhu, Pho Chhu, Mangde Chhu, Chamkhar Chhu, Kuri Chhu and Pa Chhu) originate from glaciers and glacial lakes of the higher Himalayas. GLOF in Bhutan occurred in 1957, 1960, 1968, 1994 and 2015 with varying intensity and damage to life and property in the lower valleys. Besides these threats, extreme climate events are also becoming more frequent with episodes of high rainfall over short periods such as cyclone Aila in May 2009. Aila (Table 1) brought record rains and rivers to flood levels throughout the country so much so that flows in Punatsang Chhu were higher than during the 1994 GLOF (NEC, 2011).

Given its fragile mountain ecosystems, high dependency on monsoon rains for agriculture and the ever-present threats of GLOFS from its northern mountain ranges and huge dependency on hydropower resources creates

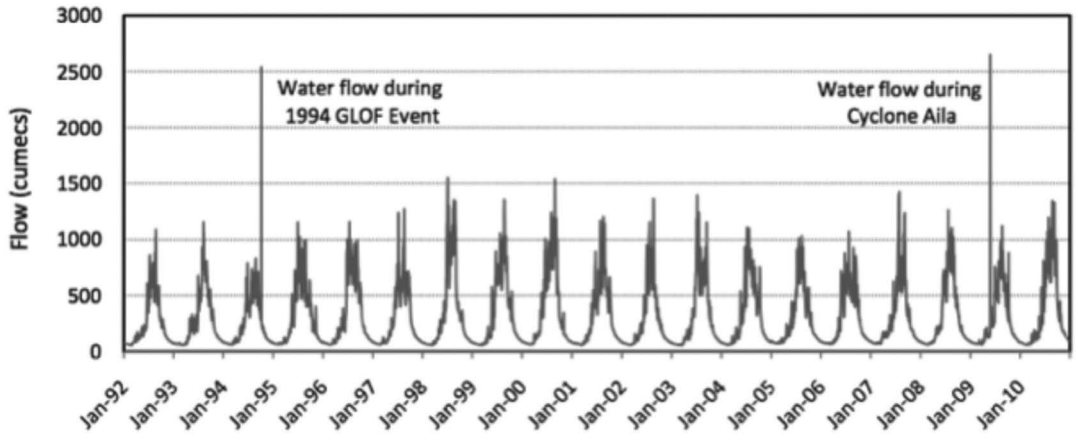

Table 1 : Water volumes of the Punatsang Chhu (NEC, 2011)

a perfect platform for Bhutan to be vulnerable to the climate change effects. Hydropower development plays a vital role for the rapid growth of Bhutan's economy: power exports contribute to about 25% of the Gross Domestic Products (GDP) and hydropower infrastructure development contributes another 25% of GDP. Agriculture sector contributes to 12% of the total GDP (World Bank, 2014). This recognizes that, not only human lives and livelihoods are at risk but the very backbone of the nation's economy is at the mercy of climate change hazards.

Adaptation Programs

Since, Bhutan is faced with negative impacts of climate change, there is need for Bhutan to develop a pragmatic set of approaches which, will prepare the nation to tackle the impacts of climate change and attempt to reduce vulnerability of the nation's natural resources, human communities, development goals, and economic outlook.

Recognizing the vulnerability of Bhutan to the effects of climate change, Bhutan strengthened commitment to managing the impacts of climate change through several efforts including the development of National Adaptation Plan of Action (NAPA). Bhutan also committed to taking all necessary measures to address climate change. In COP15, the Royal Government of Bhutan delivered a declaration titled, "Declaration of the Kingdom of Bhutan – The Land of Gross National Happiness to Save our Planet" wherein Bhutan committed to "keep absorbing more carbon than we emit- and to maintain our country's status as a net sink for Green House Gases" (NEC, 2011).

Realizing that climate change is not just an environmental problem but a serious challenge to sustainable development and the livelihood of the Bhutanese people, the government came up with National Adaptation Plan of Action (NAPA) 2006. NAPA prioritized 9 projects for the climate change adaptation program in Bhutan (NEC, 2006, p.25):

1. Disaster Management Strategy (Pilot Implementation of Food Security and Emergency Medicine)
2. Artificial Lowering of Thorthormi Glacier Lake
3. Weather Forecasting System to Serve Farmers and Agriculture
4. Landslide Management and Flood Prevention (Pilot Scheme in Critical Areas)
5. Flood Protection of Downstream Industrial and Agricultural Area
6. Rainwater Harvesting
7. GLOF Hazard Zoning (Pilot Scheme – Chamkhar Chhu Basin)
8. Installation of Early Warning System on Pho Chhu Basin
9. Promote Community-based Forest Fire Management and Prevention

However, of the nine priority climate change adaptation areas identified by NAPA 2006, only three priority areas were addressed mainly due to the constraints in funding (NEC, 2012). Following are the implemented priority areas:

1. Artificial Lowering of Thorthormi Glacier Lake

The project was able to successfully lower the Thorthormi Lake level by 504 centimeters and the level of two subsidiary lakes adjacent to Thorthormi Lake by 336 and 508 centimeters. This has helped in reducing water pressure on the thin moraine dam between the lakes besides achieving the overall target of reducing the lake level by 5 meters in October 2012 (NEC, 2012).

2. GLOF Hazard Zoning (Pilot Scheme – Chamkhar Chhu Basin)

GLOF hazard zonation and mapping was completed along with identification of high-risk zone and evacuation sites in the Punakha-Wangdi and Chamkhar valleys. GLOF and flood awareness were promoted through the national media besides developing the capacities of community in community based disaster risk management.

3. Installation of Early Warning System on Pho Chhu Basin

Manually operated GLOF early warning system is installed and is operational in 21 identified communities to warn people living downstream vulnerable areas. The very recent GLOF experienced by Bhutan was in 28 June 2015, when Lemthang Lake burst. GLOF early warning systems were put to test by that outburst resulting in no casualties.

Since the time has elapsed after the first NAPA document was published, it called for a need to revise the NAPA document in order to review and revise the cost and implementation status of the six remaining projects, which were left un-implemented. The revision of NAPA was also felt important as the NAPA 2006 failed to consider other climate risks and hazards such

Figure 1: Lemthang Lake as of 12 June 2015 (Photo: Leki Wangdi - Laya Range, JDNP)

as windstorms and cyclones. Thus, NAPA 2012 revised and prioritized following eight projects (NEC, 2012, p.8):

1. Landslide management and flood prevention
2. Disaster risk reduction and management – planning disaster management interventions and providing emergency medical services to vulnerable communities
3. Enhancing national capacity for weather and seasonal forecasting in Bhutan
4. Application of climate resilient and environment friendly road construction
5. Community based food security and climate resilience
6. Flood protection of downstream industrial area
7. Rain water harvesting and drought adaptation
8. Community-based forest fire management and prevention

All the adaptation measures addressed by the Royal Government of Bhutan through the implementation of NAPA 2006 were all related to GLOF as it demanded the greatest priority. It was given due importance because of the fact that, Bhutan's economy is hugely dependent on hydropower and to prevent disastrous consequences to the downstream communities. However, Bhutan's farming communities are the most vulnerable group as farm productions are highly dependent on monsoons, which have become un-predictable and accountable to climate change. In one of the case studies in Punakha District (known as rice bowl of Bhutan as this district produces maximum rice in Bhutan), Kuster and Wangdi (2013), reported on various adaptation measures practiced by the communities with regards to the un-predictability of the monsoon.

Though the availability of water in Bhutan seems very high at 109,000 m^3 per capita (NEC, 2012), ironically water scarcity is reported within the country in many places. This is because, major source of drinking and irrigation are mainly from local springs, streams and minor tributaries while majority of rivers flow along the deep gorges. The increasing demand for clean water coupled with scarcity of water resources reported, warrants development of adaptation measures, as it is expected to worsen due to the impact of climate change on water resources.

With the scarcity of water resources reported in Mongar town in the eastern part of Bhutan, community forestry was established in a place called Yakpugang to protect the watershed, which serves as source of water to the town. This has lead to the successful implementation of Payment for Ecosystem Services (PES) scheme between the municipal authority of the Mongar town (service recipient) and Yakpugang community forestry management group (service provider). This is one form of localized climate change adaptation programs, which may be encouraged to adapt to some of the localized and immediate climate change effects.

Conclusion

Climate change is likely to have adverse impact on Bhutan in her search for sustained, environmentally sound economic and social development. Such an impact would include significant decline in agricultural production,

as well as harm forests and water resources. Already, frequent landslides, prolonged dry periods and unprecedented heavy monsoon rain affecting agriculture and biodiversity are visible in recent years, which may be accounted for climate change.

Current adaptation projects are clustered within the areas of GLOFS, since these are the areas identified as key threats to the country. However, there seems to be gaps in the current adaptation program as it overlooks the agriculture sector as well as projects that focus on the impacts of climate change on hydropower. These two important areas, which are critical for the country's economic development are susceptible to the climate change in the future, thus, it demands urgent need to prioritize adaptation program in these two areas.

Benefit sharing from ecosystem services should be promoted through the establishment of PES scheme. This will not only form the localized climate change adaptation activities but will also help in enhancing the management of natural ecosystems through the direct economic benefits to the local communities, who shall form the custodian of the natural ecosystem.

Vulnerability and adaptation assessment in the key sectors of water, agriculture, hydropower and glaciers highlight the high degree of vulnerability of the people of Bhutan to climate change. Though the adaptation actions to address vulnerabilities and impacts of climate change have been identified, Bhutan shall require support of the international community to ensure implementation and to avoid bearing the brunt of what is not deserved.

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Island Dynamics in Response to Sea Level Change, an Adaptation Challenge for Maldives

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The future persistence and stability of atoll islands is of significant global interest under predictions of accelerated future sea level rise. Low-lying reef islands provide the only land for habitation in atoll nations. These islands are expected to become inundated and erode as a consequence of rising sea level. Numerous reports suggest entire islands will erode away rendering the people of atoll countries as environmental refugees. While there is seldom quantitative information presented to validate such assertions it is apparent that understanding the future trajectories of island morphological adjustment to rising sea levels is critical for informing adaptation responses in atoll nations.

The Maldives archipelago comprises a double chain of coral reefs located 700 km southwest of Sri Lanka and constitutes the central section of a submarine ridge that connect the Lakshadweep Islands (to the north) and Chagos Islands (to the South). The Maldives archipelago extends 868 km from Ihavandhippolhu in the north ($6^{o}57'$ N) to Addu atoll ($0^{o}34'$ S) just south of the equator. The reef system of Maldives supports approximately 1200 low-lying reef islands. The Maldivian population of 331,000 inhabit 200 islands throughout the archipelago. As one of the only four atoll nations on earth, The Maldives is commonly regarded as extremely vulnerable to the future sea-level and climatic change.

Over the past 130 years, there has been an unambiguous increase in averaged global mean sea level (GMSL) of approximately 200 mm, with 20^{th} Century rates of 1.5-2.0 mm/yr. based on tide gauge records and faster rates from 1993-2009 of ~3.3 mm/yr. since the availability of satellite altimetry. Tide data from Maldives show that the rate of sea-level rise in The Maldives is between 3mm/yr – 4.1mm/yr. With the rising seas, the islands of Maldives are expected to erode and eventually drown within the next 1 – 2 centuries.

This study presents an analysis changes in islands in the second largest atoll of Maldives, Huvadhoo atoll (Fig 1), based on analysis of aerial imagery spanning four decades. The objective is to establish the plannimetric adjustments of islands and examine spatial differences in island change within the atoll. The atoll has a perimeter of 261.4 km with an area of 3,279 km^2. The atoll has 241 reefs with a total area of 437.9 km2. Huvadhoo has 241 vegetated islands that have a total land area of approximately

2753.7 ha. Island size ranges from 0.01 ha to 238.1 ha. The majority of islands (200) are located around the atoll periphery (Fig 1 C&D). However, 41 islands are located on lagoonal patch reefs (Fig 1 E). Nineteen of the islands are inhabited, though only one of lagoon islands is inhabited.

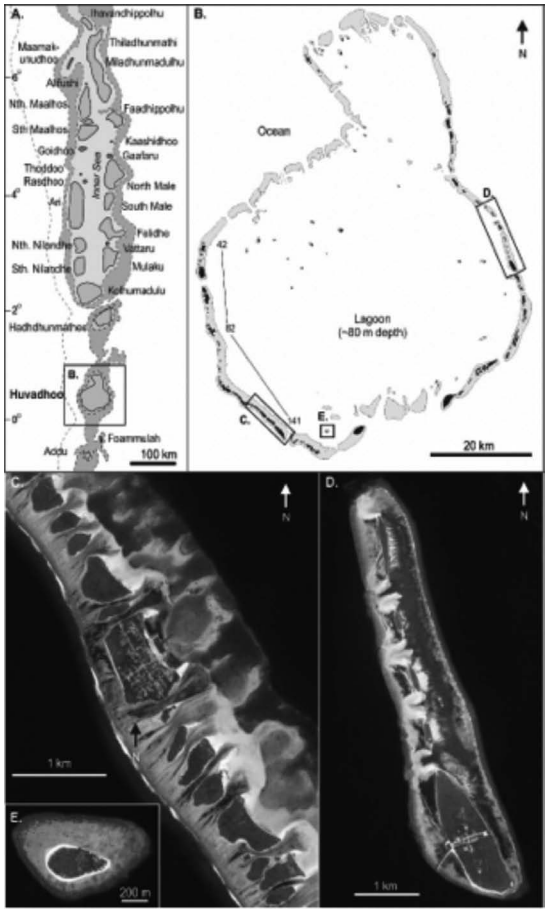

Fig 1. Maldives archipelago (A), Huvadhoo atoll (B), Atoll peripheral islands (C & D), A patch reef lagoonal island (E).

A total of 184 vegetated islands from Huvadhoo atoll were analysed using comparative analysis of aerial photography and satellite imagery. The sample of 184 islands is 76% of the total 241 islands in the atoll and includes 155 islands located on the atoll peripheral rim and 29 islands on lagoonal faros. The timeframe of analysis varies slightly due to availability of imagery and ranged from 37 to 45 years since 1969.

Summary of results of this comparative analysis on changes in island characteristics for the period of the study is presented in Table 1. Aggregated at the atoll scale the analysis shows there was a reduction in net land area of approximately -10.5 hectares (or -0.4%) across the period of analysis. However, there was significant variation in island response. At total of 84 islands (44.5**%** of total islands) contracted in area by 3% or more during the period of analysis. Collectively, these islands lost 55.4 ha over the study period. In contrast, 36 islands (20.7**%** of total islands) expanded in area (by 3% or more) totalling approximately 42.3 ha. The remaining 64 islands (34.9% of sample) remained relatively stable, less than ± 3% of their original size. Excluding this subset of stable islands the total change in island area equalled -13.1 ha or approximately -0.53% of the initial atoll land area.

The data also showed that not every island behaved the same. The way these islands behaved can be categorised into 11 different types. Table 2 summarises these 11 different categories of change. The results of this study evidently show the islands of Maldives are highly dynamic landforms that are very sensitive to changes to hydrodynamics around them. The results also raise a number of questions when predicting the future of island nations.

Island group	All	Erosional	Accretional	0-1 ha	1-5 ha	5-10 ha	10-20 ha	20-100 ha	>100 ha
No. Island	184	83	37	32	63	37	24	24	4
Mean area ha	13.39	8.25	15.91	0.57	2.64	6.41	13.4	42.13	177.2
Total area ha	2463.17	684.34	558.49	18.33	166.2	237.3	321.48	1011.04	708.9
Net change ha	-9.06	-50.55	47.46	-2.62	-7.12	-9.88	-1.6	7.76	4.25
% change in area	-0.37	-7.39	8.5	-14.29	-4.28	-4.16	-0.5	0.77	0.6
Max change ha	8.05			0.28	0.24	0.74	2.43	6.71	8.05
Min change ha	-5.48			-0.89	-0.86	-1.42	-1.05	-5.48	-3.85
Mean change %	-4.7	-15	11	-12	-5	-5	-0.41	0.97	0.72
Max change %	72			72	10	10	20	17	4
Min change %	-89			-89	-39	-23	-7	-10	-2

Do these results mean the islanders need not to worry about rising sea-level? The answer to this question is YES they have much to worry about their future with the rising sea-level. The results indicate that islands are responding to changing hydrodynamic environment caused by changing climate and sea-level. The islands are trying to keep up with the changes. Is there a threshold sea-level at which island dynamics can no longer balance loss and gain in land area? The answer is, YES there will be but we don't yet know that level precisely.

The issue of climate change and atoll island nations is more complex than just sinking with the rising seas – much need to be understood if we are to make a safe future for the atoll island communities.

Island change type	No. Islands	Location	Character of island change
Erosion			
Type 1: Lagoon Migration	9	W-SW	Erosion of ocean shoreline and lateral margins of reef perpendicular islands. Accretion of lagoon shoreline. Net movement of island lagoonward.
Type 2: Contraction	56	N-W	Erosion on majority of entire island shoreline. Island contraction with little/no net movement on reef platform.
Type 3: Ocean migration	2	W, SE	Erosion of lagoon shoreline. Notable accretion of ocean shoreline. Net movement of island toward reef edge.
Type 4: Parallel migration	3	W, W, E	Differential erosion and accretion on lateral flanks of reef perpendicular island promotes alongshore migration of island.
Type 5: Lagoon extension	2	W	Ocean shoreline stable, erosion of lateral flanks of reef perpendicular islands and lagoon accretion. Island extends further across lagoon sand flats.
Type 6: Rotation	3	N, NW, SW	Differential erosion of ends of reef parallel islands causes island rotation with little or no net displacement of the centroid on the reef surface.
Type 7: Migration	4	N, E, SW	Migration of islands on lagoonal reef platforms and net reduction in island area.
Accretion			
Type 7A: Migration	4	N-W	Migration of islands on lagoonal reef platforms and net increase in island area.
Type 8: Expansion	32	N-W	Ocean shoreline stable, accretion on entire or majority of island shoreline causing net increase in island area. No net significant migration of island on reef surface.
Type 9:Lagoon migration	2	W, SE	Displacement of ocean shoreline and increased accretion of lagoon shoreline. Net displacement of island lagoonward.
Type 10: Rotation:	1	SW	Remobilisation of sediment reservoir and accretion resulting in rotation of shore parallel islands.

Table 2. The way islands behaved over the period of this study.

India's Environmental Politics: Changing Contours and New Dynamics

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Introduction

One of the reasons why climate change has become an issue of immense pertinence within India today besides international pressure being imposed on the state to raise its pre-2020 emission reduction targets is because of the disjoint between Prime Minister Modi and the Centre. While, on one hand, the Prime Minister is, vehemently, vocal about India's enhanced efforts to reducing its carbon footprint in the atmosphere, the Centre and other civil society constituents being sceptical about India's enhanced climate change ambitions have made the process difficult by largely equipping themselves to the principle of equity historical contributions, common but differentiated responsibilities and polluters-pay-principle that incidentally permits India to continue consuming fossil fuels.

In the run up to the COP21 this year, India's Intended Nationally Determined Contributions (INDCs) to be submitted to the UNFCCC factor a key role in shaping India's position on climate change. India, thus far, has been accused of hampering the negotiating process by remaining affixed in its developmental policies. However, India's recent mitigation and adaptation declarations by the government has provided slim transparency and changed the narrative on India's participatory role in the international negotiating process on climate change.

Recently, a Parliamentary standing committee urged the Ministry of Environment, Forests and Climate Change to appoint a high-level committee to renew and revise present environmental laws[1]. Earlier this year, Prime Minister Modi insisted the country on taking a lead in countering the challenges posed by climate change by ramping up the production of solar energy from 20 GWs to 100 GW by the year 2022[2]. Arvind Subramanian, Chief Economic Advisor to the government of India, also called for greater proactivity on domestic green action plans[3]. India has exhibited

1. Mayank Aggarwal, "Environment ministry asked to form new committee to review laws," *Livemint,* 22 July 2015, http://www.livemint.com/Politics/ N7zmauhg5sJBLaneE0sfqM/ Parliamentary-panel-asks-environment-ministry-to-form-new-co.html
2. Anindya Upadhyay, "Modi embraces the dollar to help spur an Indian solar power boom," *Livemint,* 30 June 2015, http://www.livemint.com/Industry/5lNMvHK
3. Arvind Subramanian, "Green Road to Paris," *The Indian Express,* 13 May 2015, http://indianexpress.com/article/opinion/columns/green-road-to-paris/

remarkable progress on the domestic front in terms of employing a carbon-taxing regime, boosting afforestation, launching pollution-check mechanisms etc. asserting India's vision towards greener pastures vis-à-vis sustainable development.

However, India, occupies a dual position in the global climate political scenario today. One, as that of a developing economy that has low historical and per capita emissions, and two; of a large and rapidly growing economy with a need for rising emissions. In a nutshell, India's argument imposing its requisite to further utilise the carbon space puts to question the state's unabated efforts towards climate change and global warming. As a result, despite proposing several ameliorative measures for climate change and environmental concerns, India till date appears to be in quandary regarding its concerned climate change ambitions.

Current ordeal

As compared to other international stakeholders, India has undeniably taken positive actions to combat climate change within the country. For example, as illustrated above, increasing excise duty on petroleum and swapping the carbon regime from subsidisation to taxation, India has been the only state in the globe to have had made such drastic alterations in its fuel sector in recent times. According to a source published by the International Energy Agency (IEA)[4], India became the only state to augment domestic petroleum taxes during 2014-15 and this was considered to be a significant shift in diesel and petrol products from 0.00% to 0.14% and 0.21% to 0.34%, respectively. This was considered to be a significant shift in India's domestic structure because while other states were significantly lowering their carbon taxes, India was the only state succeeded by China to have imposed inflated prices.

Moreover, the government committed to completely wipe out hydro chlorofluorocarbons (HCFCs) by the year 2030. The Prime Minister has also dedicated a commitment towards clean energy and environment documented in his book[5] titled 'Convenient Action' that portrays his 12-years of service in Gujarat as chief minister. Currently, the government still abides by its pledge introduced during Copenhagen to cut its carbon emissions by 20-25% from 2005 levels by 2020. The impending INDCs to be submitted in September this year may pose a revised figure (with meagre change). However, India needs to shift its equity position and stress on the multiple ongoing challenges that hold the state back from playing a lead role in the climate change negotiation process this year.

India's commitment to take on renewable energy alternatives is not weighed against the odds. The problem lies within the

4. Arvind Subramanian, "Green Road to Paris," *The Indian Express,* 13 May 2015, http://indianexpress.com/article/opinion/columns/green-road-to-paris/
5. Narendra Modi, "Convenient Action," 21 April 2012, http://www.narendramodi.in/ ebooks/ convenient-action-2

government's/prime minister's yearning to shift from a non-renewable energy regime to a renewable one. Understandably, this is the ultimate objective that one must strive for. However, without evaluating the pros and cons of renewable energy within our socio-political, economic, technological and environmental capacities one may just aptly apply the term, 'beating around the bush'. The state is not taking into consideration the persisting limitations that come with renewable energy. Any further dialogue or commitment regarding climate change will be deemed as nebulous and superfluous if taken these into consideration.

India receives 20+ percent more sunlight than most states and has lower labour costs, however, the state's renewable energy capacity is 13 per cent while its generational capacity stands at 6 per cent. Today, India is second to China in importing coal. Intermittency/variability, location-specific potential, higher costs, disposability, etc. are some of the popular disadvantages that could draw us away from than taking on renewables in full swing. However, making renewable energy viable for producers is relatively easy but whether the rest of the state has the potential to handle it remains to be envisaged. With states such as Germany solving their energy problem, India is still working on resolving its capacity problem. Besides, solar not meeting the evening demand when the peak requirement is felt, it also fails to contribute in rural electrification. Waste management and grids not being seamlessly connected are other flaws that deter the surge of renewable energy in India.

When states make commitments s uch as eradicating non-renewable energy by 2100 rarely does one take into account the intricacies that challenge the very context of renewables itself. The state is at a juncture where it cannot afford to make pompous acclamations regarding its climate change commitments without a proper, thought-through research mechanism. Policies and commitments must run aside setbacks and limitations as has been India's international approach regarding developmental emissions. This is the only way with which we may curtail (if not completely avert) the posed dangers of climate change in the future.

India's options

On the international front, India played a substantial role in shaping its position in the global climate negotiation scenario. For instance, India modified the IPCC's formulation of 'common but differentiated responsibilities' from 'common responsibilities'. India also played a leading actor in accelerating funding whilst urging the need for creating a separate institutional mechanism for climate funding. The coverage of climate change in Indian media has also been on a steady rise. In a study conducted during 2009-10, global climate politics dominated the coverage by 57%. The data suggests continued growth of climate coverage in Indian media. Despite possessing immense potential to play a leading role in climate negotiations, India ranks 155 out of 178 countries in the recent Environmental Performance Index (EPI) prepared by Yale and Columbia[6].

6. Country Index, EPI 2014, http://epi.yale.edu/epi/cuntry-rankings.

However, the Government of India has embarked on a series of plans and policy development processes. These include:

The National Action Plan on Climate Change: The NAPCC was established in 2008 with eight national missions that aimed at not only espousing to the principles of protection, national growth, inclusivity etc. but to also form the core of the overall national mission. The missions included the Solar Mission sought to enable 20,000 MW of solar power by 2022. The National Water Mission, energy efficiency, agriculture, Himalayan ecosystems, sustainable agriculture, sustainable habitat, a green India mission focused on the forest sector, and the strategic knowledge mission. However, multiple criticisms arose with the plan stating that it had neither a vision nor an agenda. Lack of commitment to equity, the co-benefits approach, and no coherence between the missions suggested further review and deliberation in the plan's focus.

State Action Plans on Climate Change (SAPCC): The SAPCCs were intended to achieve coherence across states in the implementation of climate measures, and have also been created in the state jurisdiction across several areas relating to adaptation within the NAPCC. However, from time to time, there seems to be a regular clash in the federal system between the centre and states regarding financial allocation for the implementation of plans. Most of the published documents also do not have targets, timelines, and financial implications nor do they specify the period of operation.

For instance, Karnataka's initial document mentions the actions already undertaken or proposals by different departments. Interestingly, the departments of energy, PWD, Housing, Urban development, Animal Husbandry are not provided with significant feedback. The department of agriculture does not state its mission on agriculture. Moreover, the draft of Rajasthan also provides an interesting reason for not having physical or financial targets met, "since actions proposed will cover two planning periods (11^{th} and 12^{th}) specific physical and financial targets have not been proposed", and "some activities are new and long term and would need substantial investments into research, training and capacity building at the individual and institutional level before these can be implemented".

A macro overview: Most of the plans developed are done excluding the views of experts, researchers, academics and civil society in the state while a significant number of them are completely devoid of geography, economy and the social intricacies of the state. Many of the states are being assisted by the WB, UNDP, DFID, etc. that proves how state plans tend to be influenced by international climate change politics. Most states have developed the plans without mapping or conducting vulnerability assessments of the regions or sectors.

Moving onto greener pastures?

With the government introducing its pledge to reduce the emission intensity of the economy by 20-25% from 2005 levels by 2020, India is set at par with most international stakeholders to prevent global

temperatures from exceeding 4˚C. In order to take the process forward, the government also established an 'Expert Group on Low Carbon Strategies for Inclusive Growth' under the Planning Commission. The group was tasked to provide recommendations for India's low carbon growth to meet the Copenhagen pledge.

As a result, what should India's approach be towards the forthcoming and highly anticipated COP21 climate change negotiations scheduled in November this year? The answer lies in gearing up domestic capacities (as has India's position been throughout) whilst continue to explore alternative ameliorative measures within the renewable energy domain so as to reduce the implications for climate change in the state for itself and simultaneously exhibit itself as a more concerned member in the global environmental negotiation process.

Indiaspend[7] recently reported that India has "bucked a global trend of declining CO_2 emissions to emerge as the world's fastest-growing major polluter and is the single most critical player when it comes to global climate change". The latest edition of British Petroleum's Statistical Review of World Energy[8] also pointed out that "for the first time in history, India's CO_2 emissions increased by 8.1% in 2014, accounting for the largest share of global emissions growth". India needs to be cognizant of the fact that the gap between India and other global polluters is steadily accelerating. In other words, India's emissions growth rate is racing at a time when emissions of other states are either stagnant or declining.

India merely grappling with the issue will not suffice the dialogue process in COP21. Approaches that were long dormant, such as energy efficiency, need grave stimulus through the potent combination of energy security and climate mitigation. However, this integration also introduces institutional complexity and new politics. Institutionally, climate policy must now be interwoven into the complex governance apparatus of India's federal system.

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7. Sanjai Jose, "India Is Now World's Fastest-Growing Major Polutter," *IndiaSpend,* http://w.w.w.indiaspend.com/cover-story/india-is-now-worlds-fastest-growing-major-polutter-66600
8. http://w.w.w. indiaspend.com/cover-story/india-is-now-worlds-fastest-growing-major-polutter-66600 Accessed on 1 August 2015

Climate Change in Nepal: Implications for Security

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Climate change has emerged as a major threat to national security. This paper attempts to look at some of the major indicators of climate change in Nepal, implications for security, policy and structural conundrums, and security implications for three major areas of concern for Nepal.

Nepal's young geology, rugged and steep topography, relatively intense precipitation regime, location in an active tectonic area make Nepal the world's 11th most at risk from earthquakes, 30th from floods, and 20th most multi-hazard prone country.

On October 2014 at Thorong La Pass in Mustang, trekkers had a deadly face-off with climate change. A freak storm swept in, triggering an avalanche′ that left at least 27 trekkers dead.

"Storms in that region are getting stronger. It is not inconsistent with what scientists have been saying," according to John Stone, an IPCC lead author and adjunct professor at Carleton University in Ottawa.

Global warming could shrink glaciers in Mount Everest region by 70 percent, according to a new scientific study, the first detailed modelling study of all glaciers in the Everest region. The study, published in international scientific journal *The Cryosphere*, paints a grim picture of the impact of climate change on the world's tallest peak by 2100. "The biggest result here is that the glaciers in the basin, we find them to be more sensitive to temperatures than anyone had expected before," said Joseph Shea, a glacier hydrologist with ICIMOD who led a team of researchers. One extreme model run glacial loss by 2100 could be 99 percent, and the low end glacier loss was 70 percent. The glacial melt was not just the result of rising temperature in the model but a trend in overall warming "raises the elevation of the freezing level, which has two secondary effects: the area exposed to melt will increase, and the amount of snow accumulation will decrease." [The Washington Post, 27 May 2015].

A 2001 study identified 3,252 glaciers and 2,323 glacier lakes in Nepal of which 20 were potentially vulnerable GLOFs including Imja Lake, Thulagi, and Tsho Rolpa [ICIMOD 2001]. The number of such lakes has declined between 1960 and 2007 but the area and density of those that remain have expanded.

Security Implications

Climate change is a threat to national security. It is a "high probability, high impact" threat.

Its direct implications include extreme weather events such as drought, floods,

storms could devastate communities and their livelihood. It threatens strategic infrastructures such as major highways, airports, power installations, and telecommunications. In order to cope with such threats, risks to strategic infrastructure need to be assessed.

Indirect implications are losses to the national economy due to climate change events, social and political conflict on resource sharing such as water, impact on housing, food in security, and livelihood, induces instability, hunger, and poverty.

Policy Conundrums

There are several structural policy conundrums. The military has been left out entirely in the climate change initiative despite a major role they play during a national disaster and subsequent rescue and relief operations. Nepal Army is also not visible at all in climate change security planning despite the threat it poses to national security.

Sectoral policy conundrums are even more distressing. Climate change initiatives in the country have ignored key areas that are most affected by climate change: water, energy, and food. There are reports from several villages suggesting major water shortages because natural water springs are either drying or unable to cope with increasing demand from expanding population. In the Terai, groundwater is being exploited but it has in some areas high arsenic contamination mainly because the region contains sedimentary layers of sand, gravel deposits interlocked with flood plains carried by rivers. Surface and ground water in the Kathmandu Valley suffers from natural and anthropogenic contaminations. Industry, domestic waste, and discharge of untreated sewage contaminate surface water. Energy security is getting worse. A country claimed to be rich in hydropower potentials generates as much hydropower as diesel plants do to meet deficit, in addition to imports from India. People are looking for alternatives such as solar power. Economic interests have prevented any plans to secure energy security in the country. The issue in food security is not just "access" but also "affordability" and "availability." Food imports from India has been growing, adding to the widening trade deficit.

Failure to address climate change threats to food, water, and energy security may compel Nepal to respond too late with a high cost. An early preparation will save more lives, save resources, and thus strengthen national security. Investments are needed in undertaking serious studies that climate change impact is having on food, energy, and water. The urgency of formulating a national security policy and creating a national security council with a greater involvement of the army is greater now than any time in history.

Seeking Adaptation Measures in the Changing Climate Condition in Central Himalayan Foothills Case of Gandaki Basin

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Abstract

Accelerated glacial melting and retreat, shifting of the tree lines, erratic rainfall, and increased temperatures are some of the indications that climate change is posing serious threats to natural resources, human health, people's livelihood and sustainable development. Such changes are mainly due to rapid growth of dynamic population, technological and economic advancement, materialistic development through exploitation of the resources from nature have indeed resulted intense change in climate and our environment. This study is an approach towards identifying the livelihood scenario of rural community and its relationship with environment stressed by the climate change as well as further identification of vulnerability level in order to suggest any alternative adaptation practice that ensures sustainable livelihood.

Context

There is a worldwide consensus that global warming is a real, rapidly advancing and widespread threat facing humanity this century (Bhusal, 2009). Change in climate is a natural phenomena as it is changing since the origin of earth (Smith, 2007). However, the natural rate of climate change is very slow where the species would have enough time to adapt the change (Darwin, 1859). But, if the change is accelerated by anthropogenic activities then it would take place in high rate, not allowing species to adapt that change. This finally creates adverse impacts on lives, people's livelihood and development of society (World Bank, 2010). During the past few decades, the world has been experiencing significant increase in global temperature resulting into climate change (Bhatta, 2011). The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2007) cleared that global warming is mostly due to man-made emissions of greenhouse gases (mostly CO_2). Emission associated with the land-use change, such as agricultural fertilizers, livestock, deforestation, and burning, account for about 30 percent of the total green house gas emission. (World Bank 2010). By century's end, it could lead to the warming of 5 degree Celcius or more compared with preindustrial times and to a vastly different world from today, with more extreme weather events, most ecosystems stressed and changing, many species doomed to extinction, and whole island nations threated by inundation. (Ibid). That is why the global climate change has become one of the most visible environmental concerns of the 21st century (IWGCCH, 2009). As a part

of the globe, LDCs and developing countries cannot remain untouched from this changing climate and its consequences. Although these countries' contribution to global greenhouse gas emissions is insignificant, it is among the most vulnerable countries to climate change impacts (Care Nepal, 2009). Moreover, when the country is mountainous, the effects are even more hostile due to its geographical fragility like ruggedness, narrow gorges and steep slopes, elongated large watersheds having narrow bottlenecked outlets causing flash floods and bursting of lakes and landslides lead to significant soil erosion. For instance, countries like Nepal and Bhutan including the geography of Northern India, Northern Pakistan and Tibet that lie at very critical part of the Himalaya that are also drained by eight major rivers originated from high altitude glaciers; Indus, Ganges, Jhelum, Brahmaputra Sapta Koshi, Saptagandaki, Karnali and Mahakali. In Nepal alone, more than 100 major glacial lakes located in Himalaya Region are rapidly melting especially: Imja and Tso Rolpa. (Mool *et. al* 2009). The recent Gorkha Earthquake (7.9 Richter in Magnitude) and its aftershocks have put these geological structures in peril. Rapid glacial retreat and high chances of GLOF (Glacial Lake Outburst Flood) at high altitude have put the entire region into a disaster prone zone. Whilst being a global issue, climate change is a major environmental and social challenge for countries lying at the lap of HKKH range (LFP, 2010, ICIMOD 2013). Add to this, weak economy and feeble livelihood condition of the people mainly from the community having low and middle income are under more risk and thus are susceptible to the climate change and its impacts due to their limited capacity to cope with hazards associated with the changes in climate particularly in such geographical challenging regions (Kates, 2000). Low income countries and its poor communities are more vulnerable to the effects of climate change due to its high dependence on climate-sensitive sectors like glaciers, watershed, rain-fed agriculture and forestry, and its low financial adaptive capacity (Karki, 2007). In Nepal alone, over four million Nepalese people depend on climate sensitive sectors like agriculture and forestry for their livelihood (Garg et al., 2007) where agriculture also provides a livelihood to nearly 81% of the labor force in this country. In addition, because Nepal is a major tourist destination, a significant fraction (10 percent of US $ 20 billion GDP) of foreign income is independent on the country's natural resources (Khadka, 2011). A heavy reliance on tourism and agriculture makes Nepal's economy very sensitive to climate variability (World Bank, 2009 cited in Khadka, 2011). Rural population, notably the ones highly dependent on land-based resources for their livelihoods, are likely to be the most negatively affected by changes in ecosystems caused by climate change (ICIMOD- Technical 6 Report, 2010).

Rationale and Methods

In a mountainous country like Nepal where the geographical, climatic and cultural diversity is so high within small spatial range, macro-spatial research about climate change and its various features seldom addresses the livelihood vulnerability of the community at micro-level. It is important to conduct comprehensive studies in each geographical

and climatic pocket areas and develop appropriate adaptation policies and strategies that suit best to each geographical and climatic location. In this context, a small attempt has been done to conduct a study in such ecological, geological, geographical and economic hotspot. We can't change the global phenomena of climate change because it is unequivocal and even our best efforts are unlikely to stabilize the temperatures at anything less than 2 Degree Celsius above preindustrial temperatures, warming that will require substantial adaptation (World Bank 2010). Thus, this study is an approach towards identifying the livelihood scenario of rural community and its relationship with environment stressed by the climate change as well as further identification of vulnerability level in order to suggest any alternative adaptation practice that ensures sustainable livelihood. The study has been guided by the objectives of identifying and analyzing the changing trend of hydro-meteorological features like temperature, rainfall and river discharge. Also it tries to get some idea about people's perception about changing climate and its existing impacts on different dimensions of their livelihoods like agriculture and other nature based traditional occupations. Also this study attempts to predict some of the climatic changes likely to occur in the future and simultaneously suggest some locally suitable adaptive-livelihood strategies to cope with such changes. However, the study is limited within geographic, geological and climatic feature of Chitwan valley, Gandaki basin in Central Himalayan Foothills. The study has been done by adopting random sampling techniques to find 30 commercial farmers spread over the valley within Narayani Basin, from 4 to 21 kilometers North to India-Nepal border. Farmers from Rampur, Jutpani and Bachhauli from Chitwan district and Gaidakot and Amarapuri from Nawalparasi district were interviewed. Similarly meteorological and hydrological data have been acquired from four meteorological stations (Bharatpur Airport, Rampur, Jhuwani and Gaindakot) and three hydrological stations (Kaligandaki (410), Narayani (450) and Rapti (460) respectively.

2. Analysis

2.1 Climate change and its effects

The findings of the survey reveal that 73% of the people have heard about the term climate change and do think that it is happening. People blame humans for such changes as a result of excessive industrialization, emission of carbons in the form of smoke and soot, land degradation and deforestation for resulting such consequences. Local people have been reporting that the temperature has increased in the recent past and also state that the humidity is going up as they sweat more. Night time temperature is rising than the day time in their perception. Also another observation was the decreased rainfall duration and more occurrences of flash floods. Consistently long spell of warm days was not so frequent before but are occurring now-a-days quite often. The thermal comfort survey done in past five years in the region too revealed that fact that people's resistance to tolerate heat has increased by 0.8 Degree Celsius. Exactly two third of the respondents reported about decreasing productivity and increased pests including mosquitoes. Changing pattern of rainfall has troubled

them to conduct traditionally-scheduled agricultural activities like planting, watering, and harvesting timings. Eighty percent reported about change in monsoon pattern—mostly delayed and not lasting long. The most striking factor is the duration of rain has decreased but intensity has increased. People hardly see the light drizzle continuously occurring for two to three days now days which were very common before. Everyone accept about increased drought period, even within monsoon season with more occurrences of storm and hailstorms. The availability of water is rapidly declining in nearby rivers and streams—both in winter and monsoon seasons, according to eight percent of the respondents. Abundance, quality and quantity of surface water are in decreasing order with increased temperature as stated by same number of the respondents. Ground water tables have been lowered by 3.57 feet affecting irrigation and water availability for drinking and for conducting household chores. People rightly blame erratic nature of rain—high intensity and low duration, as the water downpour within small period of time leads to excessive run-off with low infiltration and percolation to recharge ground water level. Within past twenty years, up to seventy percent of the total spring sources have been dried in Northern Chitwan, (Southern Foothills of Mahabharata) having abundant sources of spring water and spouts. Locals blame for prolonged drought period (especially between October to May) for drying up of such water sources. However, successful community based forestry programs have lead to increased greenery and thereby availability of more water in such regions. The access to ground water has decreased by 5.18 minutes (except Jutpani Area in Northern Chitwan) and surface water by 3 minutes in the last 10 years. Irrigation in the agricultural fields is conducted with the help of well in most of the cases. 83% irrigate their fields with the help of water from well and the remaining 17% depend on river and irrigation canal for agriculture. Lowering of ground water table and drying of surface water level are worrying local people in general and farmers in particular. Paddy, maize, wheat, millet, mustard, potato, cauliflower were the most common crops grown in the study site and all the respondents had agricultural land from 0.86 Ha to 4.67 Ha with average land holdings of 1.94 Ha as agriculture was either their primary or major secondary level occupations. There has been decrease in the paddy production by 12.78 percent. In comparison to the last 10 years, the productivity of paddy has decreased by 207.25 kg per hectare in average. As water in winter is more difficult to manage, thus two third of the respondents stated about the decreasing rate of wheat production and the analysis of the finding revealed that in comparison to the last 10 years, the productivity of wheat has decreased by 413.55 kg per hectare in average. The productivity of maize is decreasing according to two third of the respondents, while only 10 percent of respondents stated that the production is increasing and 17 percent do not produce maize and the remaining 7 percent stated that the production is same as before. People living close to water sources were found to have increased maize production. The findings showed that the productivity of maize is actually decreasing

by 331.45 kgs per hectare in average in the last 10 years time period. The findings showed that 93% of the total respondents mix more organic and less synthetic fertilizers into their fields. Similarly 7% use only organic manure for a better production of their crops. The use of organic fertilizer has increased by 63.66 kgs per hectare in average in the period of last 10 years. Whereas the inorganic fertilizer usage has increased by 11.011 kg per hectare in average in the last 10 years time period. Low productivity has been resulting significant use of fertilizer and pesticide use that are creating detrimental impact on soil itself and to the nearby surface water bodies by increasing the nutrient level and causing eutrophication inducing more invasive wild aquatic plants to grow.

The findings and analysis of the field survey concluded that there is alteration in temperature, the precipitation pattern, occurrence of drought period, and river water discharge. The discussion regarding the precipitation pattern revealed that the time period of rain, amount as well as intensity of rain has changed as compared to the previous years. The response reported by local people on climate change thus is in line with meteorological and hydrological data records.

Three stations (Rampur, Bharatpur Airport and Jhuwani met-station's data have been acquired and assessed to analyze the meteorological action and trend). The result showed that there is a rise (by 1.63 degree Celsius) in average annual minimum temperature in last 32 years (1983-2014) in the study site. Monsoon and winter mean minimum temperatures depict the rising trend of 1 and 1.7 Degree Celsius respectively. Local people's perception too showed the same result as locals complained about the increasing warm afternoons and relatively less cold winters. The mean annual maximum temperature too has gone up by 0.58 (30.6 to 31.18) Degree Celsius. Both monsoon mean maximum temperature and winter mean maximum temperature are increasing by 0.5 and 0.1 Degree Celsius respectively. The annual average rainfall is in increasing trend by 20 mm in last 32 years. Similarly monsoon and winter mean rainfall too is in increasing trend with increased precipitation by 118 mm and 21.2 mm respectively. The fact is, the mean average rain fall is increasing in monsoon season along with increased temperature is mainly because of its erraticity. In the past twenty six years, the afternoon (14:30-17:30 PM) rainfall has declined by 0.6 mm that has caused more "duration of sunshine" during this time to increase the temperature. Moreover, decreased number of rainy days and increased duration of sunshine in monsoon has also been increasing the mean maximum and minimum temperatures. The farmers' perception about climate change and real time hydro-met data were found highly correlated according to Karl Pearson's Correlation Coefficient.

Similarly, hydrological study reveals the fact that the snow fed rivers are drying up rapidly than the rivers originating from springs from middle mountains and draining through urbanized areas like East Rapti. The three major rivers drain through Chitwan Valley of Gandaki Basin are Kali Gandaki, Sapta Gandaki and East Rapti. So, this section includes the annual as well as monsoon and winter season water flow discharge (in m^3/s)

from these rivers. The monsoon season comprises the month of June, July, August and September, and winter means December, January and February.

The Station No-410 data of Kali Gandaki River shows that the discharge has declined significantly in past 32 years (1964-1995) from average annual discharge of 491 to 283 m^3/s. There is significant decline in the mean monsoon and winter discharge of the river—from 1074 to 743 and from 132.2 to 68.6 m^3/s respectively.

The Station No-450 data of Narayani River also has the similar case with moderately declined average annual discharge from 1509 cusec to 1486 cusec in past 31 years (1980-2010). Add to this, **t**he average monsoon as well as winter season discharge is decreasing in Narayani River by 3587 to 3389 cusec.

But quite surprisingly, the national station number 460 data showed that the discharge rate of Rapti (non-snowfed) River has been increasing in the recent past by 18 and 23 percent (43.2 to 51.2 cusec) in monsoon and (9.32 to 11.43) in winter respectively.

Adaptation alternatives—Way forward

A diversity of natural assets will be needed to cope with climate change and ensure productive agriculture, forestry and fisheries along with accelerated breeding program to conserve wider pool of genetic resources including wild varities. Viz. Crop varieties performing well under drought, heat and enhanced CO2. Also Integrated Pest Management can greatly overcome the excessive use of synthetic fertilizer and pesticide use to ensure soil fertility. Farmers must be provided with trainings about climate resistant cash crops farming and other microenterprise business.

As construction of small ponds and green corridors to facilitate easy migration for wild animals to get exposure to wider range for food and water, even in adverse seasons, so this should be promoted. Integrated water management including watershed management and rainwater harvesting and more afforestation in marginal lands can overcome water problems. Also, installation of biogas plants greatly helps reduction in deforestation and carbon with significant time saving of women. Financial capital gained from carbon trade can be utilized in providing subsidies in more biogas installation, solar lightings and organic fertilizers use and manufacturing.

Telemetric station based flood early warning system may become a very good way to mitigate the possible water induced hazards.

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Renewable Energy and Adaptation: A Pakistani Perspective

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Introduction

Pakistan is highly vulnerable to climatic threats and faces acute energy crisis; both are adversely impacting the socio-economic development in the country. Climate Change and huge imbalance in the energy mix in favour of fossil fuels has increased the importance of renewable energy (RE) in the country as it not only reduces greenhouse gas emissions and ensures green growth but also enables Pakistan to stake claim for 'green climate fund'. At present, more than 60 percent of Pakistan's power is generated from oil and gas, and about 30 percent from hydro power. The role of renewable energy resources is growing fast in the context of the climate change mitigation efforts across the world. Pakistan has been quite slow in according importance to tapping renewable energy resources of the country. Pakistan has enormous potential in hydro, wind and solar resources that can be harnessed to meet its rapidly growing energy requirements; correct its energy mix in favour of cheaper and cleaner energy; reduce its greenhouse emissions and ensure sustainable development. It attempts to analyze the linkage between Climate Change and renewable energy; the potential renewable energy resources of the country; the barriers in the development of RE resources and the advantages of exploiting RE resources of Pakistan.

Renewable energy & Climate adaptation:

The contribution of RE sources to world energy supply has grown over the past decade and half- from 13.6 percent in 2001 to 19 percent in 2012. According to Renewable Global Status Report 2014, contribution of RE to world energy supply was 13.6% in 2001 which grew to 16.6% in 2010 and is projected to go up to 23.6% in 2020; 34.7% in 2030 ; and 47.7% by 2040.[1]

It is estimated that by 2050, 2/3rds of world's energy will come from Alternate Energy sources. There is growing realization that RE should be integrated in the mitigation and adaptation strategies. The Intergovernmental Panel on Climate Change (IPCC), in its reports[2] has put considerable emphasis on the need for investing in more renewable energy, including solar, wind and hydropower. In South Asia, there is growing emphasis on

1 RENEWABLES 2014: GLOBAL STATUS REPORT, http://www.ren21.net/Portals/0/documents/Resources/GSR/2014/GSR2014_full%20report_low%20res.pdf

2 See, *Special Report on Renewable Energy: Sources and Climate Change Mitigation*, IPCC, 2012. *Climate Change 2014: Mitigation of Climate Change,* IPCC, 2014.

utilizing renewables and RE energy now contributes up to 12.9% of the total primary energy supply which is estimated to increase to 43% by the year 2030 and 77% 2050.[3]

Energy landscape of Pakistan

The total installed power generating capacity in Pakistan is 23,578 MW and the demand is growing at the rate of 10% annually and is estimated to reach 32,000 MW by 2020. Energy demand is spurred by growing industries, rapid urbanization and increasingly extreme temperatures and is likely to quadruple in the next 20 years. The actual power production today stands at just 12,000 MW. The energy shortfall is estimated to range between 2500-5000 MW; depending on the seasonal variation in hydropower and peak hour timing. Estimated cost of power crises to the economy is around Rs. 380 billion per year, around 2 % of GDP. Current energy mix heavily relies on fossil fuels: Oil 35.1%; Hydel 33%; Gas 27%; Nuclear 6%; Coal 0.1%. The percentage of hydroelectric power in the energy mix has fallen from 60% in 1962, to only 29 % in 2009-10. It marginally increased to 34% in 2012-13.

Potential Renewable Energy resources

Pakistan is very rich in RE resources such as hydel, wind, solar, bio energy, ocean energy & geothermal energy. Hydropower potential is estimated at 59,796 MW while small hydro potential accounts 3100 MW; wind power potential is about 200,000 MW; solar power 2.9 million MW of which 50000 MW is considered exploitable. Geothermal energy is 500 MW. Bio-energy such as bagasse cogeneration 1,800 MW; waste to power is 500 MW. Overall, the renewable energy sources can meet 17 to 30 % of Pakistan's energy needs by 2030. Small and medium sized solar power, small hydropower, and wind power projects can meet the local demand easily without exerting more pressure on the grid.

Hydropower potential: Hydropower is the cheapest and cleanest renewable source of energy. Globally, there are over 11,000 hydroelectric power plants operating in 150 countries, contributing about 20 % share to total energy-mix. At present installed capacity for hydropower generation in Pakistan is only 6,792 MW or just over 11 % of gross, or about 16% of exploitable resources, far from being realized. Per unit cost of hydel electricity in Pakistan is Rs. 1.59 while oil-based per unit cost is Rs. 18. The life-time of a hydropower station is between 40 to 80 years. Annual operational and maintenance cost is 1-4% of capital cost.

Most of the hydro power potential sites lie in the mountainous areas in northern region in Khyber Pakhtunkhwa 24736 MW; Gilgit-Baltistan 21725 MW; Azad Jammu & Kashmir 6450 MW and Punjab 7291 MW. River wise identified hydro potential is - Indus 39717 MW; Jhelum 5624; Swat 1803; Kunhar 1480 MW; Poonch 462 MW; Kandiah 1006 and others 9704 MW. Although there has been emphasis on development of hydro resources in the country, it has faced snags at the implementation level.

3 Kanwar Muhammad Javed Iqbal & Muhammad Iqbal Tabish, *Energy Policy in SOUTH ASIA: The Way Forward to Prompt Regional Trade,* SAARC CCI Policy Paper, May 2012. http://www.icci.com.pk/data/downloads/91/528548894_1.pdf p.11.

The 1995 hydel policy envisaged a policy framework and package of incentives for private sector hydropower generation projects. Applications were received for development of around 2,000 MW of hydropower projects but except New Bong Escape, all other projects could not survive due to snags in implementation of the policy and domination of public sector in hydropower generation. The 2002 power policy stated that hydel projects in the private sector will be implemented on Build-Own-Operate-Transfer (BOOT) basis, but could not take off. In 2001, WAPDA prepared 'Hydropower Development Plan-Vision 2025' which included 5 mega hydropower projects with generation capacity of 9,500 MW to be completed by 2016. These included 4500 MW Diamir Bhasha, 969 MW Neelum-Jehlum (NJ), 1100MW Kohala, 7000 MW Bunji and 4300 MW Dasu. All of them are lagging behind their original schedule, resulting in cost escalation.

In the recent times, 2013 Energy Policy laid emphasis on shifting Pakistan's energy mix towards low cost sources such as hydel gas, coal, nuclear and biomass. It states that local and foreign investment will be aggressively sought for small and medium size run of the river hydel projects and selected hydel projects under development will be positioned for privatization. The 2013 energy strategy has also emphasized on the development of the *Indus Cascade* which can add about 12,000 MW of hydropower to the system and bring down the cost of power generation. The plan spanning over next 15-20 years envisages development of Indus Cascade between Tarbela and Diamer-Basha that would add about 10,000 MW of electricity generation annually. Total cascade installed capacity is going to be about 22,000 MW. The hydropower projects in Indus cascade are Diamer-Bhasha; Dasu, Pattan, Thakot, Tarbela and Ghazi Barotha. Many of these projects were earlier part of Vision 2025. Currently, Wapda is executing 18 hydel power generation projects under medium and long-term plan. Government claims that 12 projects can be completed in next six years that would generate 13,671 MW, but independent energy experts are quite skeptical about it.

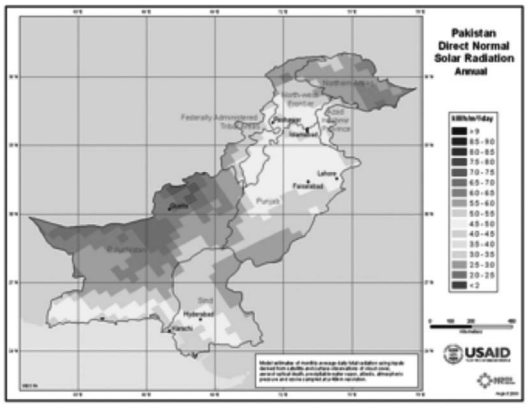
Challenges to hydropower development: The development of hydropower faces three major constraints: the seasonal variations in river discharges, huge capital cost for the mega projects and competition with irrigation needs and lack of reservoirs. Besides, the policy issues and bureaucratic delays have badly affected the implementation of the projects resulting in cost escalation. i.e., cost of Diamer-Bhasha has gone up from $6.5bn in 2005 to $12.5 bn in 2012 and now stands at $14.5 bn. The project originally estimated to be completed by 2016-2017 is now expected to be delayed till 2023.

Harnessing Solar and Wind Energy resources: In 2006, the government approved the Policy for Development of Renewable Energy for power generation including small hydro, wind, solar. Target was set to add 5 percent, approximately 10,000 MW electricity through renewable energy by 2030 besides replacement of 5 percent diesel with bio diesel by year 2015 and 10 percent by year 2025. The Policy tried to provide incentives to attract private sector investment in the renewable energy sector.

Earlier, Pakistan Council of Renewable Energy Technologies (PCRET) (2002), Alternate Energy Development Board (AEDB) (2003) were set up to play a major role in promoting the development of infrastructure for RE power generation in the country. The policy generated some interest in RE but the progress has been very slow. In 2012, Alternative/Renewable Energy (ARE) policy was updated which focused on securing RA technologies and providing fiscal incentives to both local and foreign investors. Currently, Renewable Energy-solar and wind accounts just 255 MW of Pakistan's power output.

Solar Energy: Pakistan lies in the area of one of the highest solar insulation in the world and has immense solar resources, suitable for both photovoltaic (PV) and thermal solar power applications. The North Eastern part of Sindh, Quetta valley and Central Punjab receive maximum solar radiation, where sun shines between 7 and 8 hours daily or approximately more than 2300–2700 hours per annum. Solar energy potential is 2.9 million MW with exploitable potential of 50,000 MW. Pakistan is building solar power plants in AJK, Punjab, Sindh and Balochistan. The programme is under development by International Renewable Energy Agency, China and Pakistani private sector.

Quaid-e-Azam solar power Park at Bahawalpur is the country's first solar power project with 1000 MW. The first 100 MW

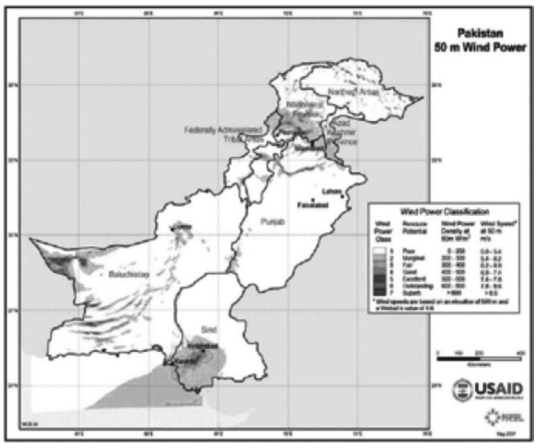


solar power unit with a cost of $131.15 million started functioning in May 2015 and according to official sources another 300 MW will be added by the end of the year. Around 22 solar power projects having a cumulative capacity of 772.99 MW are under different stages of development and can achieve commercial operation by 2015-16.[4] Solar Energy prices becoming competitive with fossil fuels, have already reached grid parity, opening market opportunities for Solar PV in Pakistan. In terms of off grid uses, solar water pump, water heaters and street lights are becoming attractive. Solar energy is especially suited to remote areas in the country where connectivity to the national grid is difficult. A solar village electrification programme has also been launched by the government. About 3,000 solar home systems have been installed in 49 villages in the Tharparkar district of the country's Sindh province, the AEDB is planning to install systems in a further 51 villages in the province and in 3,000 villages in neighbouring Balochistan. More than 40,000 villages of Pakistan have no access to electricity.

4 Parvez Jabri, "22 solar power projects of 772.99 MW under development", *Business Recorder*, February 12, 2014. http://www.brecorder.com/pakistan/industries-a-sectors/157528-22-solar-power-projects-of-77299-mw-under-development.html

Wind Energy: There has been incremental growth worldwide in wind energy in the past few decades. In 2009, worldwide wind capacity reached 159,213 MW which increased to 369,597 in 2014.[5] The wind map developed by National Renewable Energy Laboratory (NREL), USA in collaboration with USAID, has indicated a potential of 346,000 MW in Pakistan. The Gharo-Keti Bandar wind corridor spreading 60 KM along the coastline of Sind and more than 170 km deep towards the land alone has a potential of approximately 50,000 MW.[6] The wind corridor is the most attractive to investors due to good resource potential as well as its close proximity to major load centres and the National Grid. Despite huge potential, until recently Pakistan had not given due importance to the development of wind energy in the country. Pakistan's first 50 MW Wind Power Project Jhampir went into operation on December 24, 2012 and currently about 150 MW is coming from wind energy.

Currently, there are several wind projects on the way. Approval is granted for setting-up 41 wind power projects exceeding 3000 MW. 22 parties have been allocated sites for setting up projects totaling 1100 MW. The objective is to have share of at least 5% of total National On-Grid Power generation capacity through wind energy by year 2030. Risks associated with wind power are defined as of variability of wind speed which effects energy output of the wind IPP.



The wind energy also provides an opportunity for rural electrification in remote villages of the country which are not connected with main grid. It is estimated that more than 5,000 villages can be electrified through wind energy in Sindh, Balochistan and Gilgit Baltistan.

Constraints in Harnessing Renewable Energy

The biggest challenge facing renewable energy technologies is to excel in state of the art technologies where more renewable options can generate energy at cost that is competitive with conventional sources. There are financial barriers as energy gap analysis show that the Pakistan requires an upfront

5 *Global Wind Report 2014*, p.8. http://www.gwec.net/wp-content/uploads/2015/03/GWEC_Global_Wind_2014_Report_LR.pdf

6 'Work likely to start on Bhasha Dam by June', *The Dawn,* May 10, 2012. http://www.dawn.com/news/959438/work-likely-to-start-on-bhasha-dam-by-june

investment of U$ 10 billion (at 2010 prices) if it wants to meet its current energy gap of 5000 MW through incremental renewable as compared to meeting it through incremental coal.[7] The country cannot meet this huge investment through its own resources. There are many other challenges including poor infrastructure, institutional barriers, inconsistencies in the government's policies, poor information, lack of capacity and training and lack of social awareness and acceptance of RE.

Renewable energy & Climate financing: According to the National Economy and Environment Development Study 2011, Pakistan requires around US $6 bn to $14 bn for climate change adaptation measures while mitigation efforts will cost around $8 bn to $17 bn dollars from now to 2050. Pakistan cannot cope with these challenges from its own resources. For this, the country needs to develop climate change related projects to get its monetary share from the multiple funds such as Clean Development Mechanism, Adaptation Fund, Special Climate Change Fund and Global Environmental facility, that have been set up to provide finance for climate adaptation. Recently established, Green Climate Fund, a US $100 billion fund for climate change mitigation and adaptation also offers opportunity in this context. Currently, Pakistan receives around $3 million for a climate adaptation fund and $3.5 million in Glacier Lake Outburst Funding through international aid which is very small. Pakistan needs to develop sellable projects and enhance its capacity to get share from the global fund. With global Green Climate Fund (GCF) becoming functional, there is a need to design National Green Climate Funds.

Conclusion

Pakistan should reverse its energy mix by increasing reliance on renewable energy resources which will not only reduce its carbon footprint but also ensure off grid rural electrification and sustainable development. Besides, hydro, wind and solar energies are the possible clean and low cost renewable resources available in the country. The potential, for the use of alternative technologies, which has never been fully explored in Pakistan, should be realized. The cost of renewables will continue to decline while the cost of fossil fuels based power generation is expected to increase in the coming years which make RE more attractive. Run of the river along with small hydro projects should be prioritized as they are relatively cheaper, take less construction time and are environment friendly. Political consensus on the big hydro projects should be forged. Public-private partnership in small and medium hydropower plants, solar and wind projects should be encouraged. This will help in raising financial resources for these projects. Pakistan also needs to focus on the conservation of energy and increase energy efficiency as it not only saves significant cost but also provides emission savings.

7 Malik Amin Aslam Khan, *National Economic and Development Study* (NEEDS), February 2011. https://unfccc.int/files/adaptation/application/pdf/pakistanneeds.pdf p. 44.