

# HighNoon Delivery Report

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HighNoon

## AGENDA

### Open Science and Policy Seminar 'Climate Change and Adaptation' Final Results of HighNoon



SEVENTH FRAMEWORK  
PROGRAMME

4<sup>th</sup> April, 2012

Silver Oak Hall, Habitat Center Complex  
Lodhi Road, New Delhi, India

8.30 - 9.00	Registration and Tea/Coffee
9.00 - 10.30	<p>Opening and welcome Welcome: <b>Dr. Arabinda Mishra</b>, Director, Earth Science and Climate Change Division, TERI</p> <ul style="list-style-type: none"> <li>• Keynote address: <b>Dr R.K. Pachauri</b>, Director-General, TERI and Chair IPCC</li> <li>• Special remarks: <ul style="list-style-type: none"> <li>- <b>Dr Shailesh Nayak</b>, Secretary, Ministry of Earth Sciences, Govt of India</li> <li>- <b>Dr T. Ramasami</b>, Secretary, Department of Science and Technology, Govt of India</li> <li>- <b>Dr Phillipe de Taxis du Poet</b>, Head, Science &amp; Technology of the EU Delegation in India</li> </ul> </li> <li>• Concluding remarks <ul style="list-style-type: none"> <li>- <b>Mr. E.J. Moors</b>, HighNoon Coordinator, ALTEERRA, Netherlands</li> </ul> </li> </ul>
10.30 - 11.00	Coffee/Tea break
11.00 - 12.30	HighNoon objectives, findings and highlights presented by <b>Mr. E.J. Moors</b> , HighNoon Coordinator, ALTEERRA, Netherlands
12.30 - 13.30	Video documentary of HighNoon stakeholder participation in the case study sites Lunch
<b>Future steps</b>	
13.30 - 15.00	<p>Research on Climate Change Adaptation Chair/moderator: <b>Prof A. K. Gosain</b>, Head, Civil Engg. Dept., Indian Institute of Technology, Delhi Reflection by:</p> <ul style="list-style-type: none"> <li>• <b>Dr. R.J. Harding</b>, Research Director, Centre for Ecology and Hydrology, UK</li> <li>• <b>Dr. Akhilesh Gupta</b>, Advisor, Department of Science and Technology</li> </ul> <p>Identified gaps</p> <ul style="list-style-type: none"> <li>• <b>Mr. Christian Siderius</b>, Senior Researcher, ALTEERRA, Netherlands</li> </ul> <p>Opportunities and priorities Open discussion</p>
15.00 - 15.30	Coffee/Tea break
15.30 - 17.00	<p>Implementation of adaptation Co-Chaired by <b>Dr. Annemarie. Groot</b>, Senior Researcher, ALTEERRA, Netherlands and <b>Ms. Suruchi Bhadwal</b>, Associate Director, Earth Science and Climate Change Division, TERI</p> <p>Reflection by:</p> <ul style="list-style-type: none"> <li>• <b>Dr. D.K. Das</b>, Agro-meteorologist, Department of Agriculture, Government of West Bengal</li> <li>• <b>Mr Debal Ray</b>, Chief Environment Officer, Department of Environment, Government of WB</li> <li>• <b>Mr. Ashok Kharya</b>, Director, Ministry of Water Resources</li> </ul> <p>Implementation examples</p> <ul style="list-style-type: none"> <li>• <b>Dr. Ashok Mishra</b>, Assistant Professor, Indian Institute of Technology, Kharagpur</li> <li>• <b>Dr. David Collins</b>, Professor, University of Salford, Manchester</li> </ul> <p>Opportunities and priorities Open discussion</p>
17.00 - 17.30	<p>Closure</p> <ul style="list-style-type: none"> <li>• Summarize: <b>Dr Prodipto Ghosh</b>, Distinguished Fellow, TERI</li> <li>• Way forward and vote of thanks: <b>Mr. E.J. Moors</b>, HighNoon Coordinator, ALTEERRA, Netherlands</li> </ul>
17.30	Reception and Dinner

## Report of HighNoon Open Science and Policy Seminar Delhi, 4 April 2012

### Opening and Welcome

Dr Arabinda Mishra (Director, Earth Science and Climate Change Division, TERI)

Dr Mishra welcomes all participants, especially the keynote speakers and panel members to the HighNoon Open Science and Policy Seminar.

This seminar is the final dissemination event of the HighNoon project that for 3 years studied adaptation options to changing water availability in Northern India with Himalayan glacier retreat and changes in the monsoon patterns. The HighNoon project is funded by the European Commission, under Framework Programme 7 (FP7).

Dr R.K. Pachauri (Director-General, TERI and Chair IPCC)

The glaciers are the water towers of the world. We notice now quick changes in the climate change due to anthropogenic greenhouse gas (GHG) emissions. Recently IPCC brought out a new report on extreme events and disasters. Heat waves, for example, was once in 20 years but will now probably take place every 2 years. The perception is that temperature in the mountains is now much higher than approx. 50 years ago. You can see profound changes because the rhododendrons bloom a month earlier and the altitude on which apples grow has moved higher up. Extreme precipitation increases and the rainfall is less evenly distributed and falls in large quantities.

In this regard the research project HighNoon is important. Downstream water management will have to change to prevent a major loss of human welfare. Agriculture will suffer and as urbanization is ongoing this will also be affected. The results of this research project benefits the population in the Ganga basin in India and the developments will have impacts beyond the countries boundaries.

The president of Pakistan will visit India in few days and may be interested in the HighNoon outcomes because in 2010 massive floods occurred in Pakistan, which was repeated in 2011. That is clearly an indication how fragile life and livelihoods of people are. The importance of extreme precipitation events should not be underestimated because it does not have an effect on the mountains, but also on the people downstream.

While it is important to the world to adapt, we also cannot get away from reducing emissions of GHGs. If the consequences of the effects on social systems exceed thresholds and turning points it will be a major effort from societies to adapt to future climate changes. It is an imperative to the world that we bring down and stabilize the gases in the atmosphere. There is no one silver bullet to address the challenges of climate change, we need to work on all sides.

Dr Shailesh Nayak (Secretary, Ministry of Earth Sciences, Govt of India)

Dr Nayak expresses the importance of the HighNoon research because these results are extremely useful for the Himalayan region. Snow and glaciers are a major component in the earth system and changes in that will severely affect the world. Large populations depend on the water of the Himalaya glaciers. We need to understand the mass balance and other parameters of the glaciers such as snowfall.

We need to understand the pretty fast rapid of climate changes in the last 200 to 300 years. In the past civilizations were lost by lack of water. We have to do a large amount of studies, especially on ice cores, to get insight how the availability of water gets affected by climate changes.

Another issue is energy in case of a decrease of the cover of snow and ice. More energy is absorbed by the oceans if there is no ice. We have technology but we need more knowledge to survive the changes to come.

Dr T. Ramasami (Secretary, Department of Science and Technology, Govt. of India):

Indian and European scientists have intensively collaborated in this project and that strengthens the outcomes and results in 'open science'. India has a national data sharing policy and open and accessible data is a great step forward in science and transition. And a lot of data is needed on different aspects.

HighNoon focuses on the Ganga and Ganga basin, which is the lifeline for a civilization since 10,000 years. Therefore it is extremely important that we understand the dimensions of changes of this lifeline and we should look at it as critically and openly as possible. To understand heat management completely we should not only look at the top of the mountains but the inferno below is also very important. We need to know the geological consequences of a seismologic active area. A complete picture and open science is important for well-founded policies.

The Department of S&T will learn from the HighNoon outcomes and from the discussions today because we are in the process of establishing a centre for and glaciology and therefore we like to receive as many advices and reports as possible. The spring of knowledge is very critical and important and we hope that HighNoon will increase the economic freedom of the people in the region.

Dr Philippe de Taxis du Poet (Head Science and Technology of the EU delegation in India)

HighNoon is a scientific project with an international dimension, of European and Indian researchers. But HighNoon is not the only research project of India-Europe: 150 projects in very different sectors are on-going. It is a bottom up way of enhancing collaboration. There is also another, more top-down, way because the EU and the Department of Science and Technology of India define joint areas of interest and launch calls for proposals simultaneously in India and Europe.

I want to draw your attention that this year, in July 2012, there will be the final call for FP7 with a total budget of 10 billion €, including the theme 'Environment and Water'. Anyone in the world can, together with European partners, submit an application. The next programme (Horizon 2020), runs from 2014-2020 and has a budget of 80 billion € over 6 years and it will also be open for international collaboration. The topics to be included are under discussion but 'Environment and Climate Changes' will be one of the priority topics. The very first call for proposals will be at the end of 2013 or early 2014.

A joint declaration on future cooperation on research and innovation cooperation between Europe and India is signed after the DSDS summit, by Mr Kumar, the Minister of State for the Department of S&T, and by the Trade Commissioner on behalf of the European Commission. The collaboration is scaled up to 'Science and Technology'. Both in India and Europe innovation is an important topic and we consider it a win-win situation to collaborate.

To have a stronger and better collaboration among Indo-European research we are defining a partnership between Europe and India for 27 member states. There are 3 pillars for this partnership:

1. Larger scale, scope and impact. (in order to match the scale of India).
2. Common societal challenges: climate, health, food, inclusive & innovative societies;
3. Enhanced synergies between India and EU. Budget constraints within EU makes it more needed to collaborate together.

Mr Eddy Moors (ALTERRA, HighNoon Coordinator)

Although some important steps are made in HighNoon, not all problems are solved. We will face new problems in the coming years, but hopefully we are able to continue working together to find solutions. We also look at research innovations and trying to bring science and policy together, so that a common language is developed and research outcomes could be implemented as well.

HighNoon started because there was a major concern what was happening to the glaciers and especially the impact of the melt of the glaciers with consequently the effects on the water resources. It was not clear how fast the glaciers were melting hence a glacier inventory was needed. Within a few weeks an article in Science will be published regarding this issue (Jeff Kargel et al). The relevant data on

the melt of glaciers will also be made available. We hope that our inventory will be improved/extended in the coming years.

We welcome the open data policy of the India Government because climate change is a typical topic that goes outside state boundaries. Not only the glaciers were changing, but also the monsoon. To do research to monsoon changes we run regional climate models (RCM). Climate models have a typical resolution of 200x200 km. With regional climate models we go to 25 x 25 km. That is important because an average grid cell cannot accommodate the mountain chains and peaks. High Resolution models can better appreciate the topography. With the rain on the right spot, you know better what happens with the river. We tried to establish what rainwater is available at which part of the catchment and at which part of the year.

In the headwater of the river, the contribution of the glacier is more important; while downstream the contribution of the monsoon is much more important. However, climate change is not the only parameter but the socio-economic developments also contribute to changes. Water availability and water demand need to be matched and therefore it must be clear which sector will use (need) which water and at what point in time. Stakeholders were engaged in this process, to come up with adaptation options that both suit the policy at state level and local priorities. There are a couple of ideas come out there that could be taken up for implementation. To start with pilots first, and to scale up in due course of time.

On behalf of the HighNoon project team, I would like to thank all the people who were involved in HighNoon in one way or another. Within these three years, it was not only science, but we also got good friends for which we are very grateful.

## HighNoon findings and results

Presentation on HighNoon approach and results by Mr Eddy Moors

Presented slides are available on HighNoon website: <http://www.eu-highnoon.org>

The developed GIS indicator is available on: <http://gisserver.civil.iitd.ac.in/HighNoon/HighNoon.aspx>

Recommendations put forward:

- 5 day forecast, seasonal forecast – this could become available within the next 5 years and could be considered as a good implementable option.
- Regional cooperation on glacier research by including larger benchmark glaciers.
- Extremes may be used as a proxy to assess future events, as a preparation for the future.
- Water demand is with administrative boundaries but water availability is at physical boundaries. This must be taken into account. Ganga project is a good initiative which will hopefully be translated to the sub-basins. A good way to come up with integrated solutions for climate change adaptation.
- Election time is every four to five years. However a longer term perspective is important to address today's and tomorrow's problems.

Questions / remarks / comments from the audience:

- Q: have mitigations options (in a broader perception) also been looked at?
- A: in HighNoon we did not look at the GHG emissions. The agriculture part of the project could be linked to mitigation of GHG. Mitigation as trying to prevent problems is also a sort of an adaptation measure. Although it depends on the situation.
- Q: is the high resolution RCM model available?  
A: not yet but we are trying to make it available. It is a huge data set, which we have to get hosted somewhere. We may make a subset available and give people access. Alternative is to bring people in contact with the producers of the data.
- Q: referring to social adaptation, because water is for free in India, may cause problems. If you can create an incentive in the use of water, what will be the effects?

- A: to improve the water use efficiency is a possible option. A long term programme is required in which schooling is very important. A possibility could be for domestic water use that a limited amount is free available (create access for all) and for higher use a water pricing system could be used. However, the social part is not something you can do in e.g. 3 years' and discussions are needed because the public should be willing to implement it. You cannot force it top-down.
- Q: Another option is to recirculate water for as well the domestic use as for industrial purposes. Do you have any idea how much water could be recirculated?  
A: it is good to look at the big cities as you need a lot of water, and recycling has good opportunities. Not only water is scarce, also nutrients are scarce. You may wish to extract nutrients, and even create energy there.
  - Q: Industrialization and quality of water. Is, and if so, in what way is the quality of water studied?  
A: the water quality was not studied in HighNoon, but hopefully it will be picked up because in some parts of India the Arsenic in groundwater is a real issue as well as the effluents in industry. Partly the knowledge is there but the implementation is lacking. People may need to look at what barriers are there for treatment plants?

## **Documentary on stakeholder participation**

A video is demonstrated and can be downloaded from: <http://www.eu-highnoon.org>

## **Session on Research on Climate Change Adaptation**

Chair: Prof Ashvin Gosain (Head, Civil Eng. Department, IIT-Delhi)

Reflection by:

Dr Richard Harding (Research Director, Centre for Ecology and Hydrology, UK),

Dr Akhilesh Gupta (Advisor, Department Science and Technology)

Mr Christian Siderius (senior researcher ALTERRA).

Presentations on the identified research gaps.

Presentation by Christian Siderius

Presented slides are available on HighNoon website: <http://www.eu-highnoon.org>

Recommendations to put forward:

- Only limited stakeholder driven adaptation plans could be made and there is still a lot of work to do. However, the state action plans for adaptation are being developed and both IITD and TERI are very much involved in that. Many governmental rules and procedures must be taken into account.
- An estimation of cost effectiveness, the cross sector impact on water quantity, water quality and socio-economy, and adaptive capacity need more time to elaborate
- It is recommended to look more at seasonality and inter-annual variability. Move away from analysing averages and measure and analyse more extremes. People get gradually used to the change, but the extremes are driven to adaptation. A comparison of different adaptation approaches is also needed.
- We do not only need benchmark glaciers, we also need benchmark catchments.
- Development of climate services. A portal such as [www.climate-adapt.eu](http://www.climate-adapt.eu) for India to exchange good practises and to develop climate services is recommended. In adaptation strategies integration is important. Not only climate change but also land-use change (also driven by other issues) is an important issue.

We are now trying to get the picture of the available water resource and demand on district level and bringing it to the basin level. Unless you bring the baseline into the picture, you cannot oversee the

issue and take measures. We need research for that, in water resources, but also interconnections with agriculture and energy. As people have had access to the resources for 100s of years changes cannot be made overnight.

#### Presentation by Dr Richard Harding

I was at the meeting 'Climate under Pressure' and we were talking about the perfect storm: increasing population, 10 billion by 2050. In India that means a 1000 more cities by 2050, that is rather a sobering thought. We have increasing consumption due to increasing wealth and aspirations, and on top of that we have climate change. We will have to abandon the idea of 2 degrees climate change. The most likely outcome is an increase of 3 degrees, and possibly even 5 degrees. We can adapt most probably to 3 degrees, but not to 5 degrees. Adaptation and mitigation are essential for civilization to survive. Internationally negotiations are stalled now. There is no replacement for the Kyoto Protocol. What we have to look at, the only hope on the horizon, that national policies will achieve something. This is why projects like HighNoon, involving a range of stakeholders, are very important. We have to consider both the adaptation and mitigation agendas. And scientists have to think how stakeholders can be informed. HighNoon has done this very effectively by working with stakeholders at various levels.

#### Recommendations to put forward

- HighNoon illustrates that it has to come from a two way process. People's perception and priorities are not the same at different levels. As scientists we have to consider how we transfer knowledge, about glacier inventories for instance, and how we translate that into advices and information for the general population.
- Looking forward: water remains central to the climate debate and probably the whole resource debate to the future. We need to look carefully to water models for current and future needs. We have inadequate climate models. Better data and better sharing of data are desperately needed.
- It is the extremes that society notes. We have to look very carefully at our models. On the 5 day scale we improved remarkably in the last few decades.
- Influence on pollution on food. Europe study available on ozone background. Nitrous oxides and black carbon – there is a real opportunity for mitigation methane and black carbon emissions. Many of these pollutants have a regional impact on the climate.
- We need to look at coupled systems: land surface, climate change, in order to perspire what might happen to the Indian monsoon in the future. Ultimately we need to look at local and regional solutions.
- Research needs to feed into innovation and things that help society. We should think strongly how science can contribute to innovative solutions that can bring society forward to face the future.

#### Presentation by Mr Aklilesh Gupta

Presented slides are available on HighNoon website: <http://www.eu-highnoon.org>

All research should be collated, when we made the national communication. However, much research is done in laboratories and not often enough scientists go to the society.

On climate change and human health is not much clarity (yet). Some institutes and universities are working on it. We had several rounds of discussions in the country with different groups. Critical areas are how temperature and humidity bring changes in human health (e.g. malaria). Extend and duration and incidence in new areas, should have been impacted by climate parameters. Some studies are already done, but still there is not yet enough clarity on drivers of the changes taking place. It could be from variability or are there some consistent changes? We have a national coordinator from the ICMR and to collaborate with other modellers a group of 30 scientists has been formed.

To strengthen the S&T capacity and to break down barriers eight (8) national missions on climate change were adopted and 15 new centres of excellences will be formed. Two centres of excellence were established in Bombay (IIT, Bombay – climate change studies centre ) and in Hyderabad (ICRISAT – research for plant protection).

Big challenges are foreseen in working together by 5 knowledge networks on science, adaptation, mitigation, climate change impact on water and human health. There are also national plans to sustain the Himalayan Ecosystem.

Questions / remarks / comments from the audience :

- Q: agreement that science results have to reach society and the involvement of the private sector is mentioned. Can an example be given how the private sector could be involved.

Answers:

- People from the hydropower companies came to Kathmandu meeting, early February 2012 with questions about the water intake for the future, and need to know what are the best locations. Scientists are not much focussed yet on the value of their data, so there is not much connection yet.
- The participation of the people collecting data are taking the action: e.g. water resources. However, they are acting on it independently without knowing what others do. Strategic is to develop a knowledge base and keep on updating the knowledge base. Every project collects information and analyses it, but when the project is finished it is finished. It should be a kind of NSDI. We need the most up-to-date information that can be used in new developments. These matters need to be addressed systematically. The researchers have to participate to manage and maintain the resources and by adding the data. We are very poor of evaluating the impact of our actions. We should bring that into focus. Actual implementation is part of the next session, but this is a research agenda as well.
- Q: India has the best engineers and scientists to work on historic data. Uncertainty in climate projections remain in the coming 5 to 10 years. One of the big areas of research is, how to limit uncertainty. What would be the approaches, what would be the techniques?  
Answers:
  - Rainfall pattern as a whole did not change too much, but when you look at the state level scenario, there you see increases and decreases hence we still need to do more.
  - We have many uncertainties: in the data, the climate models, the water models etc. There is a need to reduce uncertainty but we will always have uncertainties and the society at large needs to accept that. Sometimes we do not even know in which direction we are changing. It is worth investing in resilient systems which can manage the change.
  - We need to follow the initiative of the Water Mission – we stated we want a saving of 20% – , which is an enormous resources. Though we are not very certain about the future, but it will help us to face the future.
- Q: Where does the state level action meet the local action?  
Answer: To start at state level was quite a challenge. What we did – national level institutions capacity was mapped – was to encourage states to make the same level for themselves. Of course it should be complementary to the national level. Eventually the idea is that whatever knowledge comes to the state level, they should benefit from it, and do the dissemination down the line. In the state action plan, that mechanism is already build in.
- Q: giving the matter that adaptation requires different disciplinary inputs, how are we going to plan for adaptation?  
Answer: Dept. of S&T does not have institutes of their own, so it works with others in two way: some wanted to do a big programme, so they are assisted. But to break the solo's, we identified components. In order to bring synergies, we encourage each institute to be involved in at least one component. Also a barrier is public/private. Is it a perceived barrier, we are trying to address there?
- Q: Variability across the states was noted. Now how to choose adaptation. What is the government strategy how to differentiate between adaptation and mal-adaptation? Is there a kind of guidelines?  
Answers:
  - Science can be done centrally. Adaptation needs to be done locally. That is why, unless we involve state government, we cannot do it. Finance mechanism has not been established.
  - If the combined wish-list of all the states is too long and there is nothing left for the river itself,

than there has to be a mechanism in place. That is where there is a research agenda. The researchers can find the solutions. Adaptation has to be sent through a level of scrutiny.

- The availability of data is the main issue. If you bring the data in a common forum, it will help the researchers to improve the work on climate change.

- The data will be available freely, but not free! There are different protocols: sharing of data with government, with researchers, with public. What is going to be ensured? If the policy is there, it does not mean that it is available tomorrow! We have a mind-set that if we get something than we also lose something.

- Q: How do you have your projections on the local level? What scale can be used? Can a district be used for a local city?

Answer: It is often not really worth downscaling. Anything what we can get down to 25 km, gives sufficient detail on the climate site. How that will impact the area, you need to see, but you do not need to downscale further.

The most important outcomes from this session are:

1. Research agenda and fragmented research. How can research be put in a manner that it is more integrated, and less fragmented?  
E.g. adaptation questions have to be properly answered. What are the linkages between water-agriculture-energy etc? Fragmented research can be overcome by having interactions between the domains. Researchers should work across the domains in order to address adaptation and enhance integrated networks. That domain has to be created.
2. The weak link between science and policy is an important point. But also how does the research have to be disseminated? Policy makers have to be in line with the requirement and have to take the society along. Society is the first group to benefit from science, even before it comes to the policy makers. If it is not acceptable for society, it should not go to the policy maker.
3. The absence of partnership in the private sector. Regarding e.g. water, people are afraid that water may become unaffordable, once the private sector comes in. Society should be involved in the public/private partnership and how that should be dealt with.
4. Temperature changes in combination with urbanization is also an important issue. You may wish to change the design of housing and cities. This needs a 30 year lead time before you can implement these changes.

## **Session on Implementation of adaptation**

Co-chairs: Dr Annemarie Groot (senior researcher ALTERRA) and Mrs Suruchi Bhadwal (Associate Director, Earth Science and Climate Change Division, TERI).

Reflection by:

Dr D.K. Das (Agro-meteorologist, Department of Agriculture, Government of West Bengal),

Dr Debal Ray (Chief Environment Officer, Department of Environment, Govt. of West-Bengal)

Mr Ashok Kharya (Director, Ministry of Water Resources)

Short presentations on climate change adaptation implementation initiatives of involved departments.

### Presentation by Dr D.K. Das

The question is how knowledge can be disseminated in such a way that it is understandable for as well politicians and the local population. At this moment there are three research projects, funded by the government in agricultural field on climate change, and one project on coastal region. There is also a smaller project about a tool for meteorological information for the function of agricultural information. The department also contributed in a National Action Plan for Climate Change that is initiated by the government of India.

In the HighNoon project we are also beneficiaries as this project is going on in the Kansabati river basin project. The soils in this area are not very good and the farming community is very poor. There is also

not enough water available. In this situation the expectation is that HighNoon will definitely help us for the mitigation of climate change.

#### Presentation by Dr Debal Ray

A final draft of a state action plan of climate change, containing a vulnerability assessment of the city of Kolkata has been prepared, but not yet submitted. The assessment was part of a 4 coastal cities study of ADB and World Bank. Prof Gosain (IITD) did the hydrological modelling for the cities. It was very surprising that the outcomes taught us that we are not that vulnerable as we thought we would be.

#### Presentation by Ms Suruchi Bhadwal

Suruchi Bhadwal is the team leader for the study on coastal region. This is very important study for West Bengal, as we are experiencing very high intensity of cyclonic events in the region. Climate change in rural areas in India is going on in our state. Positive work have been done in the field. Embankments in the Sundarbans are very important and breaches are occurring every year. It is a difficult issue because there are many diversification of livelihood options in these areas. Climate proofing of existing programmes is also on-going.

To communicate proper adaptation options with the community we are using folk theatre and puppets in the rural areas. It attracts people and make things better understandable. Although not yet done we intend to communicate also by radio. We plan to implement some easy recommendations of the state action plan, using the money. Some are low hanging fruits. One big climate change vulnerability assessment for one city is on-going.

#### Presentation by Dr Ashok Kharya

Besides the already presented 8 missions of the Ministry by Mr Gupta, there is also a national action plan for climate change from the Central Government with 5 goals under the water mission. The basin level is integrated in water resources management with discussions up to panchayat level (local self-governments) in one case. Also NGO's are invited to participate in one session. When the drafting part is over, a meeting with the Water Council Board will be arranged. The ultimate goal is that the government approved the to be taken adaptive measures. But the first goal is a comprehensive data base.

More info on: <http://www.india-wris.nrsc.gov.in/>

A very important goal is to increase water saving with 20%. 80% of the water is consumed by irrigation in agriculture. There is high scope for water saving. The ministry is listing and analyses projects of the last 10 years to take lessons for future projects.

Presentations on potential implementation example:

1. The use of seasonal and weather forecasts by Dr Ashok Mishra (Assistant Professor, IIT Kharagpur)
2. Adaptive strategies for the hydropower sector by Dr David Collins (Professor, University of Salford)

#### Presentation by Dr Ashok Mishra

Presented slides are available on HighNoon website: <http://www.eu-highnoon.org>

The research conclusion is that a large variability in rainfall (amount and distribution) already exists. The researchers looked at several adaptation options.

Adaptation option 1:

Use of seasonal forecast produced using GCM to improve crop management. This delivers an enhanced average economic return of crop by 2.8 % (may go up to 11.4% with ideal forecast.

Adaptation option 2:

Use of weather forecast (1-5 days) based on previous years to improve water use efficiency

The main findings are:

- 17-60% reduction in irrigation water application when 5-day perfect rainfall forecasts are used (sustained yield)

- Using rainfall forecasts showed 30% more saving of irrigation water under future climate with intense showers and prolonged dry periods.

But: both options need rigorous field tests before implementation is feasible and an important part of these tests are a cost benefit analyses.

Comments of the panel members:

Dr D.K. Das: we have delineated 5 aspects – crop based, soil, water, land use and science based. In this area the water scarcity is large and farmers are only interested in growing rice and the required water availability. Another aspects is that 92.5% of the farms are small. Diversification in e.g. to grow millet or multiple crop seasons are recommended. Other techniques such as raised bed planting, zero tillage are also introduced. However farmers are, so far, not very interested to adapt. We are trying to map the region, according to the suitability of the weather, and for the particular crop adaptation techniques recently introduced in this area.

Dr Mishra adds that not all farmers can directly take this information. Some who can, may adapt and process it and can provide it to other farmers An attractive strategy for farmers is very welcome.

Mr Ray stresses that the first adaptation option in West Bengal should be to stop the cultivation of rice in winter because a huge amount of water is drawn from the underground. For short term gain but for the long term adaptation is sacrificed.

Presentation by Dr David Collins.

Presented slides are available on HighNoon website: <http://www.eu-highnoon.org>

The discharge will change due to melting and variations in runoff from precipitations and this needs to be known for building new hydropower plants (dam dimensions). Records in Himalaya are not long enough to documents variability in runoff and glacier mass to predict the volume of water.

Dams in Europe were built in 1960s based on good data sets of 1940s and 1950s. Dams (lakes) were not filling as quick as they could have done because of cooler years in the 1970s. Then 1990s and 2000s became warmer, and filling of the dams were picked up again. Dams are with a short planning season a long term asset use.

Ice blocks with the same volume, may not melt at the same speed. The one with the long side on the ground melts quicker than the one with the short side on the ground. Structures build in the 1970s, were designed in 1960s. The diurnal range of discharge changed and during the day it overtops the structure. An alternative is to move the whole lot upstream, and piping it downstream.

Climate services means how to translate from a climate feature as a mode and to pinpoint the place where to build structure. Also in the agriculture sector. People will become climate service specialists.

Questions / remarks / comments from the audience:

- Dr Kharya: this kind of information is useful input for developers of hydropower stations.
- Q; How is it seen from the perspective of drinking water?  
A: If there is storage we (Dr Kharma) don't go for diurnal variation. We plan accordingly to the policy and the variation between the seasons on a year to year basis are already build in.
- Q: What is the tipping point of the discharge? When will it increase and when start to decrease?  
A: Difficult to decide because i) it depends where you are in the basin and ii) the volume of ice must be known. The eastern part e.g. will take more time than the western part.
- Q: If we forecast correctly, the yield can be increased. What is the case with indigenous knowledge? And what is the dimension of an Integrated Development case?  
A: Integrated Development and Management is considered. Here we have not tested these directly in the field but it is already tested and approved by the government. Our idea was how to use the information we are developing. Can we use it directly or not. Integrated management is useful, but we have tested information independently.
- Q: What could be other possible adaptation option for hydro power other than reservoir or structures?

A: Adaptation options for hydropower are fairly limited. Water can be taken when it is available; you can't design higher or lower flows. In the end, the trade-off in hydropower is between financial risk and being efficient in capturing the water (which may be expensive).

- The practitioners are missing here because local players can make or break adaptation. For a report on Sundarban NGO's and community people were working closely together to give excellent results as far as adaptation is concerned. We need as scientists to be learning from the ground. Science – policy – and practitioners need to work together.

Mrs Suruchi Bhadwal concludes that we had excellent examples of what is already happening in the departments and departments are taking into account the effects of climate change.

We had discussions on the water mission and its ambition goals. The example of Dr Mishra gives scope for enhancing water use efficiency though it is still at an experimental stage.

There are lot of uncertainties in the hydropower example. Most power is from power plants, and not from hydropower. We will need to look into clean power development.

In all examples there is a need to link science – policy – practice.

## **Closing session**

Summary and key recommendations by Dr Prodipto Gosh (Distinguished Fellow, TERI)

Presented slides are available on HighNoon website: <http://www.eu-highnoon.org>

These presented recommendations are in line with the national Indian action plan on climate change and no climate change action stands by itself. Action plan on water resources and agriculture go to the hearth of where this workshop is about.

Vote of thanks by Mr Eddy Moors.

What we learned in the HighNoon project, is that if you want to implement adaptive measures, you should have good awareness raising – and people should be willing and able to implement. We need a next generation that learned more about these things, and that will be the scientists of the future. The presence of the HighNoon Spring School participants is remarked in this regard.

Many thanks to Dr Ghosh for these useful recommendations. All participants are thanked for their participation and their valuable input during this day. Also many thanks to the TERI team for a well-organized seminar.

## Citations from the meeting

- “Temperatures in the mountains are notably higher in the mountains of India than 50 years ago in my childhood” (Dr R.K. Pachauri)
- “Can scientists bring solutions? Research needs to feed into innovation and things that help society. We should think strongly how science can contribute to innovative solutions that can bring society forward to face the future” (Dr R.J. Harding)
- “Take society along in research. The society is the first recipient to have benefit from the science, even before it comes to the policy makers. If it is not acceptable for the society, it should not go to the policy maker.” (Prof A.K. Gosain)
- “HighNoon illustrates that it has to come from a two way process. People’s perception and priorities are not the same at different levels. As scientists we have to consider how we transfer knowledge, about glacier inventories for instance, and how we translate that into advice and information for the general public” (Dr R.J. Harding).
- “In all state action plans, what is missing is the practitioners. We need as scientists to be learning from the ground through partnerships. Local players can make or break adaptation (Dr Aditi Kapoor, social science researcher)
- “We have to look more at seasonality and inter-annual variability. Move away from analysing averages to analysing extremes. People get gradually used to the change, but it are the extremes that drive adaptation” (Mr C. Siderius)

**ANNEX 1**  
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