

International Conference
on
Hydropower
for
Sustainable Development

Summary Proceedings of all sessions

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INDEX

Inaugural session 3
TECHNICAL SESSION – I: Policies and Financial Options 4
TECHNICAL SESSION – II: Hydrology, Floods and Sediment Management 6
TECHNICAL SESSION – III: Recent Trends in Hydro Generating Equipment 7
TECHNICAL SESSION – IV: Micro Hydro and Ultra Low Head 8
TECHNICAL SESSION – V: Geological and Seismological Surprises in Hydropower Development and Mitigation 9
TECHNICAL SESSION – VI: Environmental and Socio Issues and Relevance in Hydropower Development	... 11
TECHNICAL SESSION – VII: Challenges in Hydropower Development	... 13
TECHNICAL SESSION – VIII: Impact of 2014 Disaster on Hydropower Development	... 15
Concluding session	... 16

INAUGURAL SESSION

After lighting of the lamp by the Chief Guest and other dignitaries, Dr. Arun Kumar – the organising Secretary -welcomed all on behalf of the organising committee. Giving a background of the conference, he mentioned that the idea and concept of the conference was proposed by the government of Uttarakhand to bring together experts, consultants, government departments, developers, industry and others to discuss the various issues in hydropower development.

Dr. U.K.Pawar, Secretary Power, Government of Uttarakhand welcomed all the participants, with a special welcome to the Chief Guest, whom he described as a source of inspiration for organising the conference. He mentioned that though the Chief Minister could not make it to the event due to some unavoidable circumstances, he has conveyed his best wishes for the same. He also mentioned that hydropower is the natural first choice for providing clean energy for development at minimum cost to environment.

Mr. Simon Howard from the International Hydropower Association gave a brief overview of hydropower development globally. He mentioned that globally fossil fuels account for 78% of the energy produced, while hydropower constitutes 77% of the remaining 22%. He also mentioned the huge growth of hydropower in China and South America.

Dr. Praveen Saxena from Ministry of New and Renewable energy mentioned that we are going through the dullest period in the growth of hydropower and that we should find ways to revive this sector. He also mentioned how the study by the Department of Science and Technology showed that Hydropower plants were not responsible for the Uttarakhand disaster of June 2013.

Mr.I.K.Pande, Advisor to the Chief Minister, Uttarakhand, said that hydropower in the state had a chequered history and notions about it range from unreasonable to absurd. He advocated a scientific and logical debate on the issue. According to him, local issues are more relevant and cannot be wished away and that agitations to sabotage hydropower are not in the national interest.

Dr.S.P.Gupta, Deputy Director, IIT, Roorkee, welcomed all participants on behalf of the IIT and mentioned that the Institute had been working proactively in the field of renewable energy.

Mr. N. Ravishankar, Chief Secretary, Uttarakhand and the Chief Guest of the Inaugural session, in his inaugural address mentioned that we have to realise that we hold the earth in

the form of a trust for the future generations and hence the importance of sustainable development. He also said that the whole issue of development vs. Environmental protection should be seen with the lens of our current scenarios when we have evolved and moved from industrial to post industrial age. According to him, water is very significant for life and forests for sustainability of life, while legislation is a creation of human mind and we have become our own villains for sustainable development. Mentioning the role played by the Tehri dam in mitigating the disaster of June 2013, he said that the choice between large dams and small hydropower plants should be site specific. He also called for synergising the development of small hydropower with local people's participation and advised to carry forward the debate through the conference.

In the end Mr. Ashish Joshi proposed a vote of thanks.

TECHNICAL SESSION – I: Policies and Financial Options

In all seven (7) presentations were made in this session chaired by Mr. C. S. Sharma, Member, UERC.

Mr. Simon Howard in his presentation "Progress with the Hydropower Sustainability Assessment Protocol" discussed a methodological framework to assess the sustainability of a particular hydropower project at all the stages of its development. He described a protocol which graded the project on different attributes to describe its sustainability. To facilitate awareness and participation of local communities, ownership of the protocol shall be in the hands of the governmental nodal agencies or associated NGOs rather than the project developer. Following the protocol, would lead to a better delivery and de-risking of the project, facilitating decision making at the key stages of project development.

Mr. Shukla in his presentation "Hydropower development in India" pointed out the major causes for slow and sluggish development of a hydro project in India. Getting clearances for environment and forest is one major concern which has led to the private parties getting disinterested in the hydro sector. MoEFCC (erstwhile MoEF) should develop strict timelines for clearances, private developers should come up with multi-purpose hydro projects so as to increase local community participation in order to make the project socially viable.

Mr. Ranjith Narayanasamy in his presentation "Small Hydro Development Building Positive Relationship with First Nations Stakeholders-Outlook from Saskatchewan, Canada" described a 50MW run-of-river project, Tazi Twe, which had an Equity ownership of a local community in Saskatchewan, Canada. An Early contractor involvement (ECI) strategy was

adopted with training & placement facilities for local community thereby facilitating involvement of local people to reduce social issues. Use of radio tagging of fishes and EIA of the project was also carried out to evolve sustainability.

Mr. Sandeep Singhal in “Policies, Development and Priorities of Hydropower Projects for Sustainable Development” discussed in detail issues related to Rehabilitation & Resettlement by Uttarakhand while developing a hydro power project. Reimbursement of the right price of land and 3rd party insurance to the project affected people, both directly & indirectly, were the key issues presented and addressed. He also emphasized on post commissioning environmental studies (soil erosion) and suggested that such studies can be carried out by organizations like NHPC, etc.

Mr. Atle Harby’s presentation “Hydro Power for energy storage and balancing renewable” talked of storage schemes of hydro power as the largest energy storage facility available worldwide. He forecasted renewable energy gap to be balanced through the CEDREN case study. He suggested building up of reservoirs for renewable energy balancing and their multi-purpose use accounting for uncertain future.

Mr. Arun Sharma presented significant issues that need to be effectively addressed for sustainable development of hydropower in his presentation “Challenges and Issues of Small Hydro Power”. He pointed out the weak areas of land transfer, poor infrastructure and grid connection facilities, local and panchayat issues that hinder hydro power developments in Uttarakhand. No implementation agreement, thorough revision of FRA 2006 (Forest rights), shortening of PPA tenures from 10 years, disaster funding/insurance against disaster, tax exemption on a few notable points were some recommendations given to address the aforementioned issues.

Mr. B.K. Bhatt introduced the various steps taken by the MNRE to promote development of shp in a planned and effective manner and also to improve reliability & quality of projects in his presentation “Small Hydro Programme in India”. State wise details of shp projects with their installed capacity and no. of the projects under implementation was presented. Incentive schemes provided by MNRE for activities of R&D, human resource development, DPR preparation, R&M of old SHP were also described.

TECHNICAL SESSION – II: Hydrology, Floods and Sediment Management

Seven (7) presentations were made in this session chaired by Dr. P.K. Pande and co-chaired by Dr. T. Staubli.

Prof. P.K. Pande in “Sediment Management in Hydropower Plants – An Overview” presented an overview of the sediment problems in storage and run of river schemes. Methods for estimation of reservoir sedimentation, flushing of reservoirs, vortex chamber sediment extractors and design of settling basins were described in brief. Mitigation measures for the sediment problem were also discussed.

Mr. Tom Jacobson presented a new technology for sediment removal from settling basins in “Sedicon Sluicers as Effective Method of Sediment Removal from Desilting Tanks and Chambers”. The sluicers consist of a slotted pipe with holes at the bottom and it was claimed that it has no movable parts, gravity is the driving force and sediment deposits of any thickness can be removed.

Mr. T. Hies in his presentation “Analysis of Multi-Frequency Backscattering Signals for Sediment Concentration Measurements” described the determination of sediment concentration and particle size measurements of non cohesive sediments using multi frequency acoustic back scattering. It was reported that a wide range of parameters viz. sediment concentrations ranging from 0 to 50g/l and particle size from 20 to 20000 µm could be covered.

In his presentation “A Field Study of Hydro-Abrasive Erosion in the Swiss ALPS”, Prof. Thomas Staubli described the measurement of Pelton turbine erosion using a 3D scanning technique with a camera and a projector. Quantitative analysis of the erosion, splitter height reduction and width increase can be made. Volumes lost on the splitters can also be determined through 3D views.

In “Prospects of Developing Pumped Storage Projects Utilising the Reservoir of Existing Hydropower Project in the State of Uttarakhand” , Mr. R. Chalisgaonkar presented the pre-feasibility study of having a pumped storage plant with the existing Ichhari dam as the lower reservoir and constructing an upper reservoir which will permit generation of 52.30MW power with 500m gross head at a cost of about 162.5 crores and highlighted the need for using more existing reservoirs to install pump storage plants.

Prof. B.K. Gandhi in “An Accelerated Erosion Wear Test Rig for High Impact Velocities” described a new test rig for determining erosion wear. Results with the same for variation of weight loss and comparison using two coating materials were presented.

Mr. Anant K. Rai described the development of a test rig in “Developing a Test Rig to Measure Hydro-Abrasive Erosion in Pelton Turbine” which uses the 3D scanning technique to measure the erosion.

TECHNICAL SESSION – III: Recent Trends in Hydro Generating Equipment

In all seven (7) presentations were made in this session chaired by Mr. R.N. Misra, CMD, SJVN and co-chaired by Mr. P.K. Shukla, CEA.

Mr. D.V. Karandikar in “HVOF Coatings to Combat Hydro Abrasive Erosion”, introduced a new coating powder SXH 80/8X, with which the life of the project can increase 3 – 4 times as observed in actual plant conditions. A case study of Baragaon project was presented and details of a small Pelton fully coated needle with robot were given. There were no cracks in the coating process. Laser photographic method to optimize coating through uni graphics was also described. Coating thickness (between 250 and 350 μm) can be guaranteed due to high end technologies.

Mr. David Norta described a hydrokinetic turbine with oscillating foil and the use of polyurethane for making the same in “Using Polyurethane to Reduce the Production Cost of Hydrokinetic Turbine Foil”. The various components of the system were described. The turbine can work at low velocities of the order of 2.0 to 2.6m/s.

Mr Mukesh Mangla in “Innovative Approach to Minimise Silt Erosion in Hydro Turbines” presented a technique used by BHEL to develop Francis turbine with less effect of silt. The Francis turbine profile was hydraulically re-designed with help of CFD software without much loss in efficiency. Numerical analysis provided a detailed understanding of silt erosion and reliable qualitative assessment of the same.

Mr. CK Jain in “Innovative Design Features of Turbines for Hydro Projects Located in Himalayan Region”, informed about different facilities available with Alstom to mitigate silt related issues in turbine and other components of hydropower plant. A compact draft tube design was presented. Details of a thrust bearing supported on cone which in turn is supported on head covers to balance load and reduce distance between turbine and generator were presented. This in turn reduces the vibration. Replacement of inlet valve with ring gate valves is suggested to obtain higher efficiency. Information about other facilities like compact draft tube design with circular draft tubes and hooped Pelton runners to reduce mechanical stresses was provided.

Dr. Vishnu Prasad in “Numerical Simulation for effect of Splitters on Performance of ELBOW Draft Tube”, presented the use of splitters in draft tube at different locations to

improve the efficiency of turbine. No advantage of splitter was found at rated conditions. The part load characteristics of Francis turbine is found to improve with use of splitters.

Mr. Pankaj Kulshrestha explained the mechanism of silt erosion in detail in his presentation “Silt erosion”. Erosion occurring factors due to silt in the various hydro-mechanical & civil equipment like Francis & Pelton turbine, etc. were discussed in detail.

TECHNICAL SESSION – IV: Micro Hydro and Ultra Low Head

Six (6) presentations were made in this session chaired by Dr Harald Richter, Programme Head, IGEN-RE, GIZ, Delhi and co-chaired by Dr. RP Saini, AHEC IIT Roorkee.

Mr. Udit Tiwari in “Hydrokinetic Energy for Enlightening the Future of Rural Communities in Uttarakhand” presented a technology where power is entirely dependent on velocity. The set-up consists of a horizontal axis turbine of zero head in stream. The possibility of using this technology for upper Ganga basin in Uttarakhand is presented. The technology is fish friendly and easily scalable. The idea of hybridizing the turbine with photo voltaic was also presented.

Mr. F. Tokihiko in “Sustainable Hydropower toward Community Development: A Case Study of Japanese Rural Area”, presented a unique approach at local level for socio-economic development using shp as a development tool. Different approaches to sort out the problems of local people with energy production using shp was presented and argued that this development would be sustainable. Case study of shp Haki (10 kW) was presented which was developed with help of locals and for the benefits of locals.

Mr. A. Swarnkar presented a new product named stream driver in “An Innovative Solution for Harnessing Low Head Small Hydro Potential”, which taps low head potential. It has unique water lubricated bearing and there is no need of active generator cooling in it. It has water lubricated sleeve bearings and is eco-friendly due to oil free technology. It has standardized modular design with application range of 550 kW – 150 kW and is non/self-regulated machine whose assembly, operation and services are easy.

Mr. Y. Watanabe talked of the R&D facility at local manufacturing unit in Japan in “Re-Build up Small Scale Hydropower Technologies in Japan by Local Industrial Power”, with the case study of Shiraito. Two different types of turbines were studied. The system worked in both grid and off grid applications with automatic switching depending upon the requirements.

Mr. Abhishek Pandey shared the idea of UREDA which is a three party agreement comprising of a technique for development of green energy technology in “A Green Energy Initiative with Community Participation in Micro/Mini Hydro Power Projects”. A case study was presented where a village energy committee (VEC), AHEC and UREDA were involved. The issues faced during execution, planning of VECs development and tariff fixation in accordance with the utility rates were presented. It is shown that MHP act as an effective means of livelihood for rural communities.

Mr. Kashinath Valpai’s presentation “Identifying Policy Inter-Linkages for The Ultra-Low-Head Micro Hydropower Sector Development towards Low Carbon Energy Technology Deployment in India”, stressed on the need for development of policies in the ULH-MHP sector and their inter linkages. He shared that holistic understanding of the ULH-MHP sector development activities could be provided. He also informed about the importance of close operation at federal and state level for development of ULH-MHP projects.

TECHNICAL SESSION – V: Geological and Seismological Surprises in Hydropower Development and Mitigation

This session comprised of two (2) presentations chaired by Mr. D. K. Sharma, Chairman & Managing Director, HP Power Corp. Ltd., Shimla and a panel discussion.

The presentation “Challenging Sites & Hydro Tunnelling Choice of Technologies and Contract Implications” by Mr. Harald discussed various design, constructional and contractual challenges that are encountered during hydro tunneling process. The need for design simulations was stressed. Threshold values of the significant parameters of tunneling process must be known. Tunneling process should follow in a pre-defined direction, to timely assess the rates of tunneling progress stage-by-stage. Regular and timely monitoring of the tunneling process in accordance to the cost paid for the same is necessary. Geotechnical baseline report and risk management plan should go hand in hand and should be a part of any contract document. Assessment of continuous risks and vulnerabilities is suggested. ‘Pre-construction’ and ‘In-construction’ investigation measures should identify and outline suggestions for mandatory contract language that might be implemented to improve early stage site investigation and implementation of results.

In “Sustainable Development of Hydro Power- Key Solutions to Challenges & Perceptions for Successful Implementation”, Mr. Amit Gupta notified about the Indian energy supply and demand short fall and expressed the significance of hydro power as the banks of water &

energy security. Hydropower was regarded as an effective tool to combat the wrath of climate change like famine, glacier melting, etc. Widespread criticism due socio-environmental issues of dams has been slowing up the pace of hp development in India. Issues/challenges and solutions for super saturation, sedimentation, ecological , extraction of methane gas from dams, installation of fish ladders, basin-wide coordinated approach, fish friendly turbines, erosion upstream, participation of local community were discussed. “7M” Model which addresses technical, infrastructural, financial and policy issues are should be encouraged for addressing the challenges of HP.

Panel Discussion

During the panel discussion Mr. RN Mishra argued that while technical capabilities are available with the developers of India but still events of failure persist during the implementation stage of a HP project. Issues of Contractual and Project management were also highlighted which included improper support to the tunnel, blasting pattern, short – pitting, mucking, non performing contracts on both sides etc. Rampur project of 400 MW in HP was quoted which had least contractual problems. Contractor should be paid in time.

Mr. B.C.K. Mishra mentioned the Chamera project where with active integration of international FIs such as World Bank, ADB, etc, contracts now are developed in a much better manner than before. He also discussed two tunnelling experiences and opined that generally the designer is very conservative to save money on excavation and thus, steep slope is provided which encounters steep failures. Technologies are, however available to support poorest of poor rock conditions but one has to have patience to deal with rocks and follow the rules of tunnelling and boring.

Mr. S.P. Bansal talked of the problems faced in the 4.2 km head race tunnel of Manali and the remedies such as drainage holes and sandbag packing followed by grouting with micro-fine cement/polyurethane. He also stressed the need for right equipment of tunnelling process.

Mr. Arun Sharma opined that most of the developers are neglecting geological survey: because failures, if they occur are regarded as due to flooding and other disasters. Designing small hydro components for geological surprises is a need. Studies at different mountain regions are needed to understand the geology and this information must be provided by the government to the developer as shp developers cannot afford such detailed Survey and Investigations.

Mr. Tiewson said that while the ecology of Meghalaya is much better than the Himalayan region but geological surprises are not uncommon. He mentioned cases where the outlet of the tunnel was good but inside a shear zone was running parallel for about 50m which cost a lot of money to take care of or where water started entering the tunnel in a 50m stretch and the tunnel collapsed. Such geological surprises make the projects very costly.

Dr. G.C.S. Gaur mentioned that every project has geo surprises and mentioned the case of a 2.1 km long tunnel where after progressing 10m excavation had to be stopped. Survey & Investigation should be very effective and worst scenarios can be avoided.

TECHNICAL SESSION – VI: Environmental and Socio Issues and Relevance in Hydropower Development

The session was addressed by three (3) speakers and had three presentations. The session was chaired by Dr. R.S. Tolia, Former Chief Secretary and Commissioner Information and co-chaired by Mr. B. K. Bhatt, Director (SHP), MNRE, New Delhi.

Dr. R.S.Tolia in his Chairman's remarks said that hydropower is now at its most challenging period in India. In mountain states, most of the rivers flow down and account for a high potential of hydropower. Use of water, both consumptive and non-consumptive, is crucial and of strategic importance due to sharing of rivers with other neighbouring nations.

Dr. Chandra Bhushan in his address stressed on environmental implications of small hydro projects citing examples of shp projects of Karnataka, Uttarakhand and Uttar Pradesh. Ecological studies are not extensive in India. This is a gap that needs to be filled very quickly, failure of which can increase already existing problems of land intrusion, human-animal conflict, and increase in rainfall. Much detailed discussions are need for criteria of distance between two projects, length of river that can be affected by tunnel or dam, and concept of ecological flow. He stressed that environment protection agencies are not against HP but stress on the importance of ecological and environmental surveys and investigations.

Dr. Anil Joshi stressed on how and why local community participation is important for a successful implementation of a HP project. Local community can accumulate and build up an organization of themselves, for development of a HP project. Financial back-up by Financial Institutions like NABARD, etc and technical back-up by Educational Institutions like IIT Roorkee, etc. is very much important. Proper training and placements should be provided to

them and make them active stakeholders of the project. Interlinking of rivers conceptually draws water from surplus river streams, but a village just 50m away doesn't have adequate water supply if a canal is built.

Mr. Awdesh Kaushal said that hydropower since its inception has always been faced with numerous challenges. Quoting statements of Hon'ble courts of the nation, Mr. Kaushal stressed on the importance of HP to the civilization and its implications on employment and electricity that shouldn't be over looked by the environmental NGOs. Environment saving organizations file litigations and petitions in courts right from the start of a HP project, regardless of the ownership, private, central or state. This cause unnecessary burden on the developer and final cost of the project goes up. He advocated a strong and effective public hearing of all such litigations and cases.

The presentation on "Hydro Power Development in Arunachal Pradesh- Issues" by Dr.S.K. Singal discussed major issues of development of HP projects in Arunachal Pradesh. These included the absence of proper and effective bankable DPRs, not having proper allocated agencies for Survey & Investigations of various aspects and very poor hydrological surveys. Discharge measurements are not done properly. Further there is no proper estimation of design floods or muck disposal plan. Geographical issues of rugged terrain, thick vegetation cover, poor and difficult motorable roads is also a concern. Such issues should be addressed as quickly as possible for tapping of much awaited potential in the state.

In "Revenue Enhancement from Multi Unit Hydropower Plant" Dr. Saroj Rangnekar presented a mathematical methodology to enhance the overall revenue of a multi-unit HP plant. Two major objectives of meeting constant load demand and release of constant quantity of water were addressed. This was achieved through minimization of working discharge for a given load dispatch and maximize the generation during release of obligatory quantity of water. The method developed was simulated to Indira sagar HP project on Narmada river and the results showed additional revenue at a tariff of INR 5/- per kWh.

"Performance Study of Kotabagh Micro Hydropower Project of Uttarakhand" by Mr. Jyothi Prasad talked of one broken sluice out of two, choked trash rack screens, poor maintenance and disturbed flow of water to forebay due to which sufficient power can't be generated. Top cover screen was broken and the welder was not ready to take up the job due to access problem. Good and timely preventive maintenance shall reduce the regular breakdowns and increase the life and productivity of equipment. Also, proper training to the operator was necessary

TECHNICAL SESSION – VII: Challenges in Hydropower Development

Six (6) presentations were made in this session chaired by Dr Sharad Singh Negi, Addl. Director General (Forests), MoEF&CC, Delhi and co-chaired by Dr. S. K. Singal, AHEC IIT Roorkee.

In “Environmental Design of Hydropower: Research within Centre for Environmental Design of Renewable Energy”, Mr. Atle Harby shared the results of ongoing research of developing environmental design of HP. Ecology and development of HP go hand in hand. Basics about ecology with proper knowledge of hydrology of the stream must be known. Variation of environment with the flow changes in the stream is important. Mitigation measures include fishways, fish screens to avoid it coming into turbines, constructing habitats in combination with compensation flows, weirs, diverters and riffles, substrate changes, etc must maintain good ecological status. Hydro peaking in downstream is also a problem. One needs to justify the water release seasonally (summer & winter). Solution is to grow fish with relatively less effects on fish when stranding is provided. Accumulated effect of all SHPs should be taken into consideration.

Mr. Stephen Sparke in “Hydropower for Sustainable Development – Social Aspects”, discussed experiences of Theun-Hinboun expansion project (RoR to dam based) in Laos. On the basis of such experiences, measures in order to maintain environmental and social sustainability were outlined. Measures of less or minimal environment hampering during construction, reforestation, legal status of catch for maintaining environmental sustainability were outlined. Social sustainable measures include application of interactive extension teams on all of R&R area, long term institutional development through water user groups and village funds, external support from government and private organizations, on-the-job training of local farmers and regular supervision of the project.

The presentation “Concept of Keystone Species and Assessment of Flows (Himalayan Segment-Ganga River)” by Prof. R.P. Mathur related to the fish in the Himalayan stretch of river Ganga including the two headstream’s Bhagirathi and Alaknanda. Trouts constituting characteristic fish group represented by nine species of genera Schizothorax and Schizothoracchys of which Schizothorax richardsonii (snow trout) have been identified as the keystone species. The flows are drivers of biodiversity. The water requirement has been computed on the basis of depth of water required at riffle sheath by keystone species during

lean period for migration, breeding and spawning and at monsoon season. E-flow recommendations for key stone species were presented.

The talk “Institutional & Policy Framework for a Sustainable Environmental Flow regime for Development of Hydropower Sector in India” by Mr. Tapas Paul presented the concept to map the institutions which govern the e-flow regimes which could apply to a river in India located in an inter-state basin. Institutional weaknesses and gaps and, the risks that need to be mitigated during HP project implementation were discussed. Evolving scenario and current initiatives on e-flows with examples from projects of Uttaranchal & H.P. were presented. An e-flow regime beneficial to the river management in India addressing current and future uncertainties related to development of HP in Himalayan landscape was discussed. Suggestions include basin level planning and coordination, use of regional planning tools to plan and prioritize basin level hydropower program (important with state’s perspective), initiation of extensive capacity building and real-time monitoring program (‘Wild River’ program), framework for cost sharing and benefit sharing mechanism.

“Public Perception and Environment Mitigation of Hydro Power for Sustainable Development” by Mr. A.B. Garg mentioned that regardless of the size of a HP plant, every project encounters public opposition at some phase of its overall life. Litigation cases (PILs) against Tehri and Narmada projects were highlighted. Environmental issues & its management plan (EMP), comprehensive EIA plan and suggestions with considerations for integrated full life-cycle approach and quality environmental management were discussed. Social impact assessment (SIA) plan should be developed for hassle free development. There is need of integrated basin wise management and benefit-sharing commitment by the govt. and the developer to share the monetary and non-monetary benefits. Efficient inter-governmental coordination is required to reduce unpredictability.

“Advanced technologies in construction of hydropower projects” by Mr. Pankaj Punetha gave results of numerical modelling of the project on Mangdechhu river of Bhutan. The project is of 720 mw, 733 m gross head making it a high head project. The project encountered geological problems. Permeation grouting and technique of cut off wall emplacement was adopted. Result of such an adoption was faster dam construction though costs were marginally high. Comparison of vertical displacement from model results and instrumentation data during excavation were presented.

TECHNICAL SESSION – VIII: Impact of 2014 Disaster on Hydropower Development

Six (6) presentations were made in this session chaired by Mr. Indu K Pande, Former CS & Advisor, Govt of Uttarakhand.

Mr. Zahoor Ahmad Chat in “Facing the Flood Fury -Overtopping of Dam of 900 MW Baglihar HEP in J&K- A Case History” presented the case study of 900 MW BAGLIHAR HEP dam presented where the flood issues during construction is handled by puncturing the main dam and construction of sluices to pass the discharge. He mentioned that in view of current scenario of climatological changes, high unpredictable instantaneous discharges led to adverse flooding of the construction site. Need of risk management, planning and analysis with the option of increasing their diversion discharges to handle unpredictable floods are required. The slopes near intakes of Diversion Tunnels are most severely affected during floods so extra measures in form of protecting these areas are required.

Mr. Dweependra Nath Kalita in “Assessment of High Flood Discharge in A Post-Flood Scenario- a Case Study from Uttarakhand” emphasized on developing a new approach to calculate uncertainty in flood calculation. The approach included use of near real-time current rainfall data by the Tropical Rainfall Measuring Mission (TRMM) and advances in GIS technology along with traditional approach of historical data analysis. The flood assessment approach is applied for under-construction Singoli-Bhatwari Hydro Electric Project in Uttarakhand.

In “Sustainable Development of Small Hydropower Plant: Case Study of Aleo SHP (3 MW) and Aleo-II SHP (4.8 MW)” Mr. AK Goel mentioned that practices like avoiding deep excavation, no muck disposal by balancing cutting and filling and no blasting allow sustainable development of SHP in short period of time without causing any damage to the local environment and community. Case study of ALEO SHP (3 MW) AND ALEO-II SHP (4.8 MW) have been presented.

Mr. Alok Choubey in “Mitigation of Hydro Project Development Risk - Insurance Need” Provided insights into major risks (likely) for project development, mitigation measures for identified risks through Insurance covers wherever applicable and scope of various commercially available insurance covers in perspective of hydropower. Risks during construction stage of hydropower project development can be mitigated by taking various Insurance covers available commercially. A well elaborated insurance policy with proper Add-on covers is required with experienced insurance company to handle insurable losses. It

is important to identify the risks and make a risk comprehensive register and seek assistance of an expert insurance broker.

Mr. Sanchit Saran Agarwal's presentation "Uncertainties in Sustainable Development of Hydropower Projects in Uttarakhand (India)" highlighted the importance of sustainable development and risk & uncertainty management in the context of hydropower projects. The concept of fuzzy importance index was introduced for decision making under uncertainty in hydropower development. It was stated that such an exercise should be adopted in the pre planning stage rather than in post planning stage.

Mr. Sandeep Singhal in "UJVNL Exposure" described the adverse effects of a multi-day cloud burst centred in Uttarakhand on hydro power stations. The loss of generation amounted to the tune of 383 MUs and the financial loss was 131.78 crores besides loss of material, structures and power house. Maneri bhali – I,II, Chilla; Kaliganga –I,II and Madhyamaheshwar had financial loss of 11.67 crores. The restoration time required will be 2 – 3 years while 3 large and 2 SHPs have been restored. SHPs have suffered severe damage and will take time for restoration. Temporary and permanent measure to remove debris and restore the works were presented. Preventive steps such as study of river basins and course correction, formation of disaster management at corporate and site level and hourly monitoring of discharge should be undertaken.

CONCLUDING SESSION

Dr. Arun Kumar – organizing secretary of the conference gave concluding remarks with a brief review of all the sessions and brief on the three-day event. Draft recommendations covering all the presentations and technical sessions, were presented by him. The recommendations were discussed by each panellist and some members from the audience and later were adopted by the house.

Mr Asheesh Joshi read the message from Mr Harish Rawat, Chief Minister of Uttarakhand who could not attend the session due to sudden demise of his Cabinet Colleague. Chief Minister mentioned that in, Uttarakhand state Government is working consistently and diligently to harness the major resource of the state, hydropower of about 27,000 MW with due concern to environment in accordance with the prevalent guiding principles for sustainable development. The slow pace attributable to many factors like remoteness, hurdles in clearances and land acquisition, poor planning and project management etc. has suffered a major set back due to natural disaster in June 2013. There were demands from many quarters to stop all the projects on Alaknanda, Bhagirathi and many other rivers and the most of the

projects had come to a grinding halt despite significant investments have been made. And more so, when many of these projects received environmental and forest clearances after rigorous due diligence. He mentioned that he saw no reason as to why doubt should be raised at this stage. This has become a great cause of concern for the state Government. He strongly feel that the state cannot be self-sustaining without development of hydropower. Its people cannot be fed without development of incessant renewable resource for revenue and livelihood. When the whole world is marching towards development, people of this state cannot be left behind for their right to have an improved quality of life.

The sessions was Chaired by Mr Deepak Sanan, Additional Chief Secretary, Himachal Pradesh Govt. who shared his experience about the hydropower sector in Himachal Pradesh. The panellists were Mr Indu K Pande, Former Chief Secretary & Advisor to Chief Minister, Govt of Uttarakhand, Dr R S Tolia, Former Chief Secretary and Commissioner Information state commission and Chair Professor at Doon University, Mr Atle Harby, Centre for Environmental Design of Renewable Energy, Trondheim, Norway, Dr N P Singh, Advisor, MNRE New Delhi, Prof S P Gupta, IIT Roorkee, Mr Asheesh Joshi, Director UREDA and Mr Sandeep Singhal, Director (Projects) UJVNL. Mr Sanan called upon the regulators to look at the hydro power as one of the sustainable energy and creat a conducive environment by offering the encouraging market. Sh Sandeep Singhal proposed a vote of thanks to all participants, Governments, foreign delegates, sponsors, exhibitors, paper presenters, , AHEC-IIT Roorkee, hotel management for making the conference a high successful event.