Countries with surplus credits can sell the same to those with quantified emission limitation and reduction commitments under the Kyoto Protocol. Developed countries that have exceeded the levels can either cut down emissions, or borrow/buy carbon credits from developing countries. A company has two ways to reduce emissions. One, it can reduce GHGs by adopting a new technology or improving upon the existing one to attain new norms for emission of gases. Or it can tie up with developing nations and help them set up a new technology that is eco-friendly, thereby helping the developing country or its companies 'earn' credits.

Addressing climate change is not a simple task. To protect ourselves, our economy and our land from the adverse effects of climate change, we must reduce emissions of carbon dioxide and other GHGs. To achieve this goal, the concept of Clean Development Mechanism (CDM) has come into vogue as a part of the Kyoto Protocol. India signed and ratified the Kyoto Protocol in August 2002, and has emerged as a world leader in the reduction of GHGs by adopting CDMs in the past few years. According to a report on the National Action Plan for operationalizing CDM by the Planning Commission, Govt of India, the total CO_2-equivalent emissions in 1990 were 1,001,352 Gg (Gigagrams), approximately 3% of the global emissions. If India can capture a 10% share of the global CDM market, annual CER revenues to the country could range from US$ 10 to 300 million (assuming that CDM is used to meet 10–50% of the global demand for GHG emission reduction of roughly 1 billion tonnes CO_2, and prices range from US$ 3.5 to 5.5 per tonne of CO_2). Carbon, like any other commodity, has begun to be traded on India's Multi Commodity Exchange (MCX) since the last fortnight. MCX has become the first exchange in Asia to trade carbon credits.

In his inaugural address at the International Workshop on 'R&D Challenges in Carbon Capture and Storage Technology for Sustainable Energy Future', R. V. Shahi (Ministry of Power) suggested greater initiatives to research on carbon capture and storage technology and R&D challenges to be met for building scientific strengths in the Indian context[2].

India has generated approximately 30 million carbon credits and approximately 140 million in run, the second highest transacted volume in the world. India's carbon market is growing faster than the information technology, biotechnology and BPO sectors, as 850 projects with a huge investment of Rs 650,000 million are in the pipeline. According to the Prime Minister's Council on Climate Change[3], the revenue from 200 projects is estimated to be Rs 97 billion till 2012.

Although awareness about carbon credit trading is yet to pick up fully in India, those who are well-informed about the opportunities are gearing up to cash in on it in a big way.

1. Reddy, B. S. and Assenza, G. B., *Curr. Sci.*, 2009, **97**(1), 50–62.
2. Goel, M., *Curr. Sci.*, 2007, **92**(9), 1201–1202.
3. *Beyond Market*, 2009, **1**(21), 18–19.

SHARAD BISSA*
A. BOHRA

Department of Biotechnology,
Mahila PG Mahavidyalaya,
Jodhpur 342 009, India
**e-mail: bissasharad@yahoo.co.in*

Revising India's water policy: need for a process

Late in May 2010, the Prime Minister's Climate Council approved a National Water Mission for India, as part of the broader task of preparing the nation to adapt to climate change. This news is welcome and timely. One important goal of the Mission is to have a revised National Water Policy approved by 2013. This goal is commendable.

Included among the Mission's objectives are: ensuring equitable distribution both across and within states through integrated resource development and management, a comprehensive database in public domain, public participation through promotion of citizen–state interaction, and integrated basin-wide management and enactment of state-wide legislation through persuasion. These well-considered objectives, upon reflection, reveal the need for a process that will guide policy revision.

On the one hand, integrated resource development, basin-wide management and a comprehensive database in public domain require that the best available scientific knowledge of water and natural resource systems must lie at the core of the policy. On the other hand, ensuring equitable distribution both across and within states, public participation through citizen–state interaction, and enactment of state-wide legislation through persuasion involve human factors that lie beyond science. Integrated water management entails fundamental questions about ownership of surface water and groundwater that have to be managed together for long-term sustainability. Thus, for a national water policy to be credible, scientific knowledge and human factors must harmonize in unprecedented ways towards a common purpose. The challenge is to harness science knowledge with human values. Ultimately, policy has to be made based on social judgement. Yet, such social judgement cannot be credible without comprehending what the best available knowledge has to say about availability of the vital resource.

If this premise is reasonable, the logical next step in revising India's National Water Policy would be to pay particular attention to the process that will guide the task of revision. Although water is used locally, the principles by which 'integrated' management can be achieved must be uniformly applicable throughout the country so as to unite it. For this reason, the authority for the process needs to emerge from the highest levels of the Indian Union. In India, water is indeed a state subject. Yet, considering the special attributes of water as a natural phenomenon, the Union Government's role is a profoundly philosophical one, giving

direction and stability to an equitable sharing and beneficial use of a vital resource.

Three years is a short time. One would hope that the momentum on a National Water Policy will be maintained by taking the indispensable first step of defining and setting up a process that will facilitate a harmonious coming together of science and policy. The daunting task will test the skills, talents and creativity of the best Indian minds from the humanities to the sciences. In a technological world that is in transition from a mindset of exploiting nature to one of adaptation, India has an opportunity to provide world leadership in water and natural resources management.

T. N. NARASIMHAN

Materials Science and Engineering, Environmental Science, Policy and Management,
210 Hearst Memorial Mining Building, University of California,
Berkeley, CA 94720-1760, USA
e-mail: tnnarasimhan@LBL.gov

Socio-legal aspects of earthquake prediction

The subject of earthquake prediction has been undergoing several transient stages. Initially it was almost an outcast subject, then it became a non-scientific subject. At this stage statistical probabilistic values of earthquake occurrences were considered seriously. But these were for medium to long-range forecast on time-scale. At present it is almost on the verge of partial acceptance as a branch of earth sciences. It is hoped that within the next few years it would attain the status of a fully acceptable branch of geosciences. The most vital point is all these efforts of prediction is invariably aiming at saving human lives during destructive earthquakes. At present, there is no official or administrative mechanism to issue any alert or warning signal about the imminent earthquake. This could be one of the reasons for the high death toll during the recent Bhuj (2001), Andaman (2004) and Kashmir (2005) earthquakes.

With this background it would interesting to examine the scenario in Italy. On 6 April 2009 a magnitude 6.3 earthquake occurred at L'Aquila, Italy, killing 308 persons, leaving 1600 injured and more than 65,000 homeless[1]. Prior to this, a magnitude 4.0 earthquake had occurred on 30 March 2009 in the region and there was public apprehension. The official Italian agency for disaster management visited the site on 31 March 2009 and it was officially announced that there is no danger of any further earthquakes. But the deadly earthquake occurred within six days with heavy loss. The affected people requested a local lawyer to file a case of manslaughter against the expert committee. L'Aquila Chief Prosecutor, Alfredo Rossini, told the Italian press on 3 June 2010 that after examining the rules, regulations and acts, he was left with no choice but to proceed with an investigation and that his office had now gathered enough information to indict the individuals named for manslaughter and a case has been filed.

It needs to be noted that Italy has a historical track of prosecuting scientists. Galileo, the famous astronomer, was called to Rome for punitive legal action in 1633 for stating that the sun was at the centre of the planetary system. It is hoped that there will not be any torturing of Italian scientists in the present case.

In USA, the possible occurrence of an earthquake, popularly known as the Parkfield earthquake, was announced in 1984. But it did not occur for more than two decades. After the failure of the Parkfield earthquake prediction, the Government reduced grants for earthquake prediction research.

There are similar cases in India about earthquake prediction. Before the occurrence of M 6.3 Latur earthquake on 29 September 1993, it was announced by India Meteorological Department (official agency to study earthquakes), that there will not be any earthquake and people need not have any apprehensions. But the earthquake occurred within a week and resulted in a death toll of about 10,000 lives.

There is the case of a Chennai geologist who had predicted that Dibrugarh town in Assam would experience a large-magnitude earthquake (7–8 on the Richter scale) on 8 September 2006 at 0821 h (IST). The earthquake did not occur, and the people of Dibrugarh as well as the administration were relieved.

It needs to be noted that the occurrence of the Bhuj (2001) earthquake was accurately predicted astrologically by Ambalal Patel. He had written in November 2000 in a Gujarati newspaper that Gujarat would experience a destructive earthquake during 24–26 January 2001. He was arrested two days before the earthquake for creating panic and fear psychosis, but was released immediately after the earthquake.

With the above background it would be interesting to examine the present seismic scenario in the country. The Northwest Himalayan region consisting of Himachal Pradesh and Uttarakhand is heading for a large-magnitude earthquake according to several studies[2–5]. NE India has been identified as one of the 10 most vulnerable seismic areas in the world. There are various legal provisions in the National Disaster Management Authority (NDMA) and various State Disaster Management Acts about prediction and false prediction of earthquakes.

The present Indian seismic scenario could be summarized as follows.

(a) Scientifically accepted observations indicate that large-magnitude earthquakes are expected in NW and NE Himalayan regions.

(b) There is no provision of the issue of any alert or warning system about an imminent large-magnitude earthquake in the NDMA Act.

(c) A number of scientists are doing research in earthquake prediction and the Ministry of Earth Sciences has established a multiparameter laboratory in Uttarakhand with a view to predicting earthquakes.

(d) Traditional reliable seismic precursors such as abnormal animal and human behaviours are not accepted, because the