

Projects worth Rs 425 crore approved by NMCG**Projects worth Rs 425 crore approved by NMCG**

The Executive Committee of National Mission for Clean Ganga in its 4th meeting held here today approved seven projects worth Rs 425 crore in the sector of sewage infrastructure, Ghat development and research.

In sewage sector, three projects each in Uttar Pradesh and Bihar have been approved. For Uttar Pradesh, interception, diversion and STP projects for Unnao, Shuklaganj and Ramnagar have been approved. These three projects aim at creation of sewage treatment capacity of 29 MLD (Unnao- 13 MLD, Shuklaganj- six MLD and Ramnagar- ten MLD) at a total cost of Rs 238.64 crore.

While in Bihar, three projects at Sultanganj, Naugachia and Mokama with total estimated cost of Rs 175 crore have been approved. These three projects will create additional sewage treatment capacity of 27 MLD (Sultanganj- ten MLD, Mokama- eight MLD and Naugachia- nine MLD).

All the six projects will be provided with Operation and Maintenance cost for 15 years by Central government and 100 per cent central assistance. It is also important to mention that Unnao and Sultanganj projects will be taken up under Hybrid Annuity based PPP model in which 60 per cent of the capital cost will be paid to the contractor who has constructed the STP, over a period of 15 years, on the basis of his work performance on the achievement of desired norms of treated waste water.

A research study to understand the non-putrefying properties of river Ganga in both water and sediment was also approved at an estimated cost of Rs 4.96 crore. The study will be an extension of a research carried out by National Environment Engineering Research Institute (NEERI) to identify the special properties of river's waters. This research would focus on finding out the science behind these special properties in order to formulate a strategy to retain these characteristics.

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Government launches e-RaKAM portal for selling agri produce

NEW DELHI: The government today launched a portal, [e-RaKAM](#), to provide a platform to sell agricultural produce.

The portal is a joint initiative by state-run-auctioneer MSTC and Central Warehousing Corporation arm CRWC.

Launching the portal with Steel Minister Chaudhary Birender Singh, Consumer Affairs, Food & Public [Distribution](#) Minister Ram Vilas Paswan said the effort should be to auction 20 lakh tonnes of pulses in the first phase through the platform.

"I personally feel that we should start with auctioning of pulses as we have them in abundance. Twenty lakh tonnes of pulses were lying idle at warehouse and it still has no buyers. E-RaKAM will help us and farmers hugely," Paswan said.

He said initial hurdles will be there as most of the farmers are illiterate and are in bad condition, Paswan said, as per a joint statement issued by MSTC and CRWC. It added that now various crops whose price increases due to rainfall or bad weather conditions, will be managed and get the [market](#).

He said even transport will face initial hurdles that will be sorted out over time.

Steel Minister Singh said, "Our aim is to strengthen the agriculture-oriented Indian [economy](#) and farmers, who play a vital role in national development. I congratulate all for the launch of e-RaKAM."

E-RaKAM is a first-of-its-kind initiative that leverages [technology](#) to connect farmers of the smallest villages to the biggest [markets](#) of the world through internet and e-RaKAM centres.

E-RaKAM is developed by MSTC Limited and supported by marketing & logistics partner CRWC Limited.

E-RaKAM is a digital initiative bringing together the farmers, [FPOs](#), PSUs, civil supplies and buyers on a single platform to ease the selling and buying process of agricultural products.

Under this initiative, e-RaKAM centres are being developed in a phased manner throughout the country to facilitate farmers for online sale of their produce.

The statement said farmers would be paid through e-Payment directly into their bank accounts.

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Cabinet approves MoU between India and BRICs countries to set up BRICS Agriculture Research Platform

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The Union Cabinet chaired by the Prime Minister Shri Narendra Modi has given its ex-post facto approval for a Memorandum of Understanding (MoU) signed among India and various BRICs countries for establishment of the BRICS Agriculture Research Platform (BRICS-ARP).

Background:

During the 7th BRICS Summit held on 9th July 2015 at Ufa in Russia, Prime Minister Shri Modi proposed to establish BRICS Agriculture Research Centre which will be a gift to the entire world. The Centre will promote sustainable agricultural development and poverty alleviation through strategic cooperation in agriculture to provide food security in the BRICS member countries.

In order to further intensify cooperation among BRICS countries in agricultural research policy, science and technology, innovation and capacity building, including technologies for small-holder farming in the BRICS countries, an MoU on establishment of the Agricultural Research Platform was signed by the foreign Ministers of BRICS countries in the 8th BRICS Summit held on 16th October, 2016 at Goa.

BRICS-ARP will be the natural global platform for science-led agriculture-based sustainable development for addressing the issues of world hunger, under-nutrition, poverty and inequality, particularly between farmers' and non-farmers' income, and enhancing agricultural trade, bio-security and climate resilient agriculture.

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Asia Africa Growth Corridor: Chinese daily cautions India, Japan over trade corridor

BEIJING: The [Asia Africa Growth Corridor](#) ([AAGC](#)) sponsored by [India](#) and [Japan](#) is welcome — as long as it does not try to trip China's [Belt](#) and Road initiative, a Chinese newspaper said on Wednesday.

Announced by Indian Prime Minister Narendra Modi in May, the AAGC, essentially a maritime corridor, was seen by some as a counterbalance to the Belt and Road initiative, the state-run Global Times said in a report.

"The new venture, jointly led by India and Japan - two countries that have so far opted not to join the B&R initiative - sets out a vision for the better integration of South Asia, Southeast Asia and East Asia with Africa and Oceania," it said.

The Times said the India-Japan vision indicates an overlap between the AAGC and the [Belt and Road project](#) "and invites controversy over the actual intentions behind the growth corridor.

It goes without saying that India and Japan could feel free to embark on a new connectivity initiative and no one is begging them to join the B&R initiative.

"As long as the AAGC aims to embrace inclusive growth and promote joint prosperity, the corridor should be encouraged.

"But if India and Japan design the corridor to deliberately counterbalance China's B&R, they should think twice before rushing to it because the route of the AAGC has an extensive geographic overlap with the route of the B&R initiative," the report said.

"That's particularly the case, considering that China has already made huge commitments to developing Africa while the India-Japan partnership is only just taking shape.

"If the AAGC aims to squeeze out China's B&R initiative instead of serving as a complement, it actually divides what's supposed to be a united force to forge ahead with inclusive growth in dozens of countries and regions along the route of the B&R initiative.

"India, for its part, should be particularly level-headed and guard against any over-assertive plans that may go awry."

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ASEAN, China adopt framework for crafting code on South China Sea

4 Min Read

MANILA (Reuters) - Foreign ministers of Southeast Asia and China adopted on Sunday a negotiating framework for a code of conduct in the South China Sea, a move they hailed as progress but seen by critics as tactic to buy China time to consolidate its maritime power.

The framework seeks to advance a 2002 Declaration of Conduct (DOC) of Parties in the South China Sea, which has mostly been ignored by claimant states, particularly China, which has built seven manmade islands in disputed waters, three of which are equipped with runways, surface-to-air missiles and radars.

All parties say the framework is only an outline for how the code will be established but critics say the failure to outline as an initial objective the need to make the code legally binding and enforceable, or have a dispute resolution mechanism, raises doubts about how effective the pact will be.

Chinese Foreign Minister Wang Yi said the adoption of the framework created a solid foundation for negotiations that could start this year, if "the situation in the South China Sea is generally stable and on the premise that there is no major interference from outside parties."

He told reporters there had been "really tangible progress" so there was "a need to cherish momentum on the South China Sea".

Signing China up to a legally binding and enforceable code for the strategic waterway has long been a goal for claimant members of the Association of South East Asian Nations (ASEAN), some of which have sparred for years over what they see as China's disregard for their sovereign rights and its blocking of fishermen and energy exploration efforts.

Beijing insists its activities are for defense purposes, in areas it considers its waters. Malaysia, Taiwan, Brunei, Vietnam and the Philippines, however, all claim some or all of the South China Sea and its myriad shoals, reefs and islands.

Some critics and diplomats believe China's sudden interest in the code after 15 years of delays is to drag out the negotiating process to buy time to complete its strategic objectives in the South China Sea, through which more than \$3 billion of ship-borne trade passes annually.

Opponents also say it is being pushed through at a time when the United States, long seen as a crucial buffer against China's maritime assertiveness, is distracted by other issues and providing no real clarity about its security strategy in Asia, thus weakening ASEAN's bargaining position.

The framework has not been made public but a leaked two-page blueprint seen by Reuters is broad and leaves wide scope for disagreement.

It urges a commitment to the "purposes and principles" of the United Nations Convention on the Law of the Sea (UNCLOS) but does not specify adherence to it, for example.

A separate ASEAN document, dated May and seen by Reuters, shows that Vietnam pushed for stronger, more specific text in the framework, wanting mention of a dispute resolution mechanism and respecting "sovereignty, sovereign rights and jurisdiction".

Sovereign rights cover entitlements to fish and extraction of natural resources.

Several ASEAN countries, including Vietnam and the Philippines, have said they still favor making the code legally binding, something experts say China is unlikely to agree to.

Wang said he would not try to anticipate what the code will comprise, but said whatever is signed must be adhered to.

Robespierre Bolivar, foreign ministry spokesman of host Philippines, said the adoption of the framework symbolised the commitment to creating a “substantive and effective” code.

Additional reporting by Manolo Serapio Jr; Writing by Martin Petty; Editing by Muralikumar Anantharaman

All quotes delayed a minimum of 15 minutes. See [here for a complete list](#) of exchanges and delays.

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India and Iran reiterate their commitment for early operationalization of Chabahar Port Shri Nitin Gadkari returns from a two day visit to Teheran

India and Iran reiterate their commitment for early operationalization of Chabahar Port Shri Nitin Gadkari returns from a two day visit to Teheran

Shri Nitin Gadkari, Minister for Shipping and Road Transport & Highways returned to India yesterday after a two day visit to Tehran. He was there to represent the Indian Government at the inauguration and oath taking ceremony of HE Dr. Hassan Rouhani as the President of Iran for a second term, on 5th August, 2017.

In an interaction with Dr. Rouhani, Shri Gadkari conveyed the Indian Prime Minister's greetings and best wishes for a successful tenure to him. He also handed over the letter of felicitations from Prime Minister Shri Narendra Modi extending an invitation to the President of Iran to visit India.

Shri Gadkari later held wide ranging discussions on many issues including India's cooperation in the development of Chabahar Port and proposed rail link between Chabahar & Zahedan. In the meetings, both sides positively assessed the progress in implementation of the decisions taken during the Indian Prime Minister's visit to Iran last year, including the progress of Chabahar Port. Both sides reiterated their commitment to complete and operationalize the Port at the earliest.

Shri Gadkari called on the first Vice President Dr. E. Jahangiri and highlighted the issue of activation of contract of Chabahar Port development and conveyed to him that India Ports Global Limited (IPGL) has finalized procurement of critical equipments such as Rail Mounted Gantry Crane (RMGC), and is close to finalizing orders relating to Rubber Tyre Mobile Crane (RTMC), MT Container Handlers(MTCH), Truck and Tractor Trailers Containers and related equipments. He also conveyed India's readiness to aid Iran in taking up operations in Chabahar Port during the interim period between the actual activation of contract. He requested the Iranian side for an early submission of loan application for Chabahar Port Development to EXIM Bank of India so that the contract agreement between the two countries can be activated. It may be recalled that the Iranian side had requested India to provide upto 150 million dollar credit and had made it a condition for activation of the Chabahar Port contract. The application for loan to EXIM Bank of India is still awaited.

Later Shri Gadkari met Dr. Abbas Akhoundi, the Iranian Minister for Roads and Urban Development, and conveyed to him the latest update on procurement of equipment for the two terminals - multipurpose and container - that are covered under Chabahar Port Agreement. He also requested Dr Akhoundi that in the interest of supporting operations of Chabahar Port, the Iranian side should consider waiving off the condition of submission of loan application as it was taking time. The Iranian side assured that the application shall be presented to EXIM Bank of India early.

The Foreign Investment Promotion and Protection Act (FIPPA) application was also presented by the MD, IPGL to the Iranian authorities in the presence of Shri Gadkari and

Dr Akhouni . India has opened an office of IPGL in Teheran.

In his meeting with Dr Abbas Akhouni Shri Gadkari stressed upon the need for marketing of the Chabahar Port to attract cargo. He said, Iran and India should jointly organize a workshop at Chabahar for this purpose at an early date. Shri Gadkari also emphasized the need to develop rail connectivity from Chabahar to Zahedan, and said that the MoU with India in this regard may be extended. The issue of ratification of the trilateral Transit Agreement between India, Iran and Afghanistan was also discussed. While India and Afghanistan have the agreement, Iran is yet to do the same.

Besides the Minister Shri Nitin Gadkari , the Indian delegation comprised of Dr. Alok Srivastava, Special Secretary, Ministry of Shipping, Shri Saurabh Kumar, Indian Ambassador to Iran, Shri Deepak Mittal, Joint Secretary(PAI), MEA and Shri Raj Gopal Sharma, OSD to Shri Gadkari.

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A gathering crisis: the need for groundwater regulation

The water crisis India faces is of such a magnitude that urgent measures are necessary to address it. Yet, while the crisis is often discussed, law and policy measures to address it remain insufficient. This is partly due to the fact that the primary source of domestic water and irrigation is groundwater but the media and policymakers still and often focus on surface water. This needs to change as water tables have been falling rapidly in many parts of the country, indicating that use generally exceeds replenishment.

One of the underlying reasons for excessive use of groundwater is the legal framework governing access to the resource. This was first introduced in the mid-19th century when judges decided that the easiest way to regulate this 'invisible' substance was to give landowners what amounts to a right to access groundwater found under their land, even if in the process they also used water found under their neighbours' land. Over the following decades, this led to a framework whereby landowners see groundwater as their own and as a resource they can exploit without considering the need to protect and replenish it since there are no immediate consequences for over-exploiting it. Access to a source of groundwater has progressively become a source of power and economic gain. The latter has become increasingly visible in recent decades with the propagation of mechanical pumps, which allows big landowners to sell water to others.

The Union government recognised the need to modernise the regulatory framework for accessing groundwater soon after massive expansion in mechanical pumping led to the realisation that recharge could not keep pace with use. The measures proposed were in keeping with the policy paradigm of the early 1970s when a model Bill was first introduced. It focussed on adding some State-level control over new, additional uses of groundwater but did not address the iniquitous regime giving landowners unlimited control over groundwater. This was only taken up by around a dozen States from the late 1990s onwards. The States that now have groundwater legislation based on the model Bill conceptualised in 1970 have on the whole failed to manage to address the problem of falling water tables due to increasing use. In addition, there is no provision in the existing legal regime to protect and conserve groundwater at the aquifer level. Further, since the legal regime fails to give gram sabhas and panchayats a prevailing say in the regulation of what is essentially a local resource, the present framework remains mostly top-down and is incapable of addressing local situations adequately.

Over the past decade, the situation has become increasingly dire not only in States where water tables are falling but also in those that are less affected by quantity concerns. Indeed, the quality of the water pumped is increasingly becoming cause for concern; thus the worry is about accessing a sufficient amount of groundwater that is not harmful to health. The present legal regime has clearly failed to address the growing multiple crises of groundwater. This has been officially recognised since at least the beginning of this decade, first in the Planning Commission and more recently by the Ministry of Water Resources, River Development & Ganga Rejuvenation. The result is the Groundwater (Sustainable Management) Bill, 2017, which is based on current understandings of groundwater and its links with surface water and on the legal framework as it has evolved since the 19th century.

The Groundwater Bill, 2017 consequently proposes a different regulatory framework from the century-old, outdated, inequitable and environmentally unfriendly legal regime in place. It is based on the recognition of the unitary nature of water, the need for decentralised control over groundwater and the necessity to protect it at aquifer level. The Bill is also based on legal developments that have taken place in the past few decades. This includes the recognition that water is a public trust (in line with the oft-quoted statement that groundwater is a common pool resource), the recognition of the fundamental right to water and the introduction of protection

principles, including the precautionary principle, that are currently absent from water legislation. The Bill also builds on the decentralisation mandate that is already enshrined in general legislation but has not been implemented effectively as far as groundwater is concerned and seeks to give regulatory control over groundwater to local users.

A new regulatory regime for the source of water that provides domestic water to around four-fifths of the population and the overwhelming majority of irrigation is urgently needed. For decades, policymakers behaved like the proverbial ostrich because the 'invisibility' of falling groundwater tables made it possible not to address the problem immediately. In many places, the situation is now so grave that regulatory action is unavoidable. The proposed new regime will benefit the resource, for instance through the introduction of groundwater security plans, and will benefit the overwhelming majority of people through local decision-making. Overall, the increasing crisis of groundwater and the failure of the existing legal regime make it imperative to entrust people directly dependent on the source of water the mandate to use it wisely and to protect it for their own benefit, as well as for future generations.

Prof. Philippe Cullet is Senior Visiting Fellow, Centre for Policy Research, New Delhi and Professor of Environmental Law, SOAS University of London

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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Approval of Industrial Parks in Andhra Pradesh

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Department of Industrial Policy and Promotion (DIPP) under Ministry of Commerce and Industry has approved two projects under 'Modified Industrial Infrastructure Upgradation Scheme (MIUS)' for development of industrial clusters at Hindupur and Bobbili in the respective districts of Anantapur and Vizianagaram of Andhra Pradesh. Details of the projects are given below:

Sl. No.	Name of project	Date of Approval	Rs. in crore		
			Project Cost	Central Grant	Released central grant
1.	Upgradation of Hindupur Growth Centre & IP Gollapuram, Anantapur District	01.03.2016	54.20	14.93	4.48
2.	Upgradation of industrial Growth Centre, Bobbili, Vizianagaram District	01.03.2016	30.61	8.68	2.60

The objective of the above projects is to provide quality and reliable infrastructure to industrial units located in these clusters; specifically these projects aim to provide road network, drainage, power and water supply networks and some other common services like health centres, canteens, crèches, dormitories, parking areas, etc. These projects are likely to be functional by 31st March, 2018.

These projects have employment potential of about 5500 persons (direct) and 8500 persons (indirect).

This information was given by the Commerce and Industry Minister Smt. Nirmala Sitharaman in a written reply in Rajya Sabha today

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It is almost two months since Indian and Chinese soldiers became locked in a standoff at Doklam in the Sikkim Sector. The faceoff was triggered when a team of the People's Liberation Army (PLA) was prevented by Indian troops from extending a class-5 track in the Dolam Plateau area which is part of Bhutanese territory. The Indian Army acted in response to a request from the Royal Bhutan Army under the terms of the 2007 Bilateral Friendship Treaty. Moreover, the PLA's track building is in contravention of the 2012 Agreement between the Special Representatives of India and China, whereby the status quo was required to be maintained in the said area until the resolution of the trijunction in consultation with Bhutan.

Post 1962, there have been numerous border incidences between the Indian and Chinese militaries; Nathu La in 1967 and Sumdorong Chu two decades later. In the recent past too, the Depsang Plateau and the Chumar-Demchok area witnessed face-offs in April 2013 and September 2014, respectively, with the latter intriguingly coinciding with President Xi Jinping's visit to India. Incidentally, the current Chinese incursion in Bhutan happened around the time of Prime Minister Modi's visit to the United States.

Given the opaque Chinese system, deciphering the intent of its Communist leadership poses a real challenge. According to the eminent scholar Derek Bodde, those who deal with China are often bewildered when the actions of its leadership send mixed signals, making clear interpretation extremely difficult. The People's Republic of China (PRC) draws from its ancient thinkers. Its actions are always deliberate, like the moves on a checker board. It is imperative to gain an insight into the Chinese psyche and decode China's strategic calculus in order to effectively cope with its grand designs.

The PRC's assertiveness around its periphery is attributable to its age old belief of a 'subdued neighbourhood' being an essential prerequisite for stability. In his book *On China*, Henry Kissinger has brought out that the PRC perceives itself to be a returning power and does not view exercising influence as unnatural. Alastair Johnson, an expert on Chinese strategic culture, has stated that there is no pacifist bias in the Chinese strategic tradition but only realpolitik. Nations are either friendly or hostile. This is why servile countries such as Pakistan and North Korea are generously rewarded, while those like India or Vietnam which counter China's aggressive behaviour invite its wrath.

Chinese thinking since ancient times advocates mitigating a threat by eliminating it. Thus, during the period 1950-85, the PRC opted to use force eight times. When confronted with a stronger adversary, non-coercive means may be adopted as an interim expedient.

China's grand strategy encompasses three concise objectives: safeguarding sovereignty, maintaining stability, and sustaining economic progress. Any danger to the Communist Party is perceived as an 'existential threat'. Sovereignty implies, besides external non-interference, safeguarding core interests, control of the South China Sea, unification of Taiwan, and integration of claimed territories with the mainland including South Tibet (Arunachal Pradesh). In the pursuit of these vital national interests, the use of force remains an option.

President Xi has emerged as an all-powerful leader. Designated as a 'Core' leader and addressed as 'Chairman' (*Zhuxi*), he is poised to join the league of Mao and Deng. During the forthcoming 19th Party Congress in November, Xi is set to consolidate his grip further. The earlier policy enunciated by Deng that China should "bide time, hide capability and not to claim leadership" has

undergone a visible shift under Xi. Xi's 'China Dream' envisions a 'prosperous and powerful' China restored to its past greatness.

In the Chinese concept of Comprehensive National Power (CNP), hard power is the key component. China's military culture lays immense emphasis on the 'strategic configuration of power', creating a favourable disposition of forces to obviate actual fighting. By exploiting its asymmetric edge to coerce smaller nations, China has effectively pursued the surreptitious strategy of 'fighting and talking concurrently' in order to extend its control over the South China Sea. China's military doctrine of "Local Wars under Informationalised Conditions" envisages short-swift engagements to achieve political objectives. Under President Xi, the PLA is in the process of path breaking transformation to emerge as a modern military in the coming decades.

Internationally, PRC remains a lonely power. It has used diplomacy effectively to exploit differences among the adversaries to its advantage. China's threat assessment perceives the US and Japan to be the prime security concerns, while India is seen as a potential threat. As US and Western countries yield space, China under Xi has pronounced itself as a champion of globalization and sustainable growth to fill the void. Major initiatives like the 'Belt-Road' and 'Maritime Silk Road' have been launched in a quest to shape a Sino-Centric global order.

The PRC's action at Doklam is in consonance with its policy of intimidating smaller neighbours. Apparently, China did not anticipate India to step in. The Communist leadership is infuriated with India for abstaining from its signature projects. New Delhi's growing proximity to Washington and Tokyo has also irked Beijing. Given its focus on the Western Pacific, the mounting tension on the Korean Peninsula, economic imperatives and internal stability concerns in the run-up to the forthcoming Party Congress, China will avoid an armed confrontation with India, despite its rhetoric. However, it will keep up the pressure militarily and pursue aggressive diplomacy to deal with the issue.

The PRC has pursued the policy of delinking complex political issues from economic ones. It enjoys strong trade linkages with the US, Japan and Taiwan, despite serious political differences. Beijing will continue with its policy of marginalising New Delhi politically in international forums, while seeking to avoid a negative economic fallout.

In its efforts to engage China, India has followed a policy of appeasement. And its responses to PRC's misadventures have been in the form of crisis management. To effectively cope with the PRC's hostile attitude, India needs to evolve a pragmatic China policy centred on core national interests. Some essential facets which merit serious consideration are summarised below.

Firstly, given the PRC's policy of asymmetric coercion, India has no option but to narrow the existing CNP gap between the two countries. Developing strategic partnerships, initiatives like 'Indo-Pacific Economic Corridor', 'Act East Policy' and counter balancing strategies are steps in the right direction.

Secondly, national security policy needs clear articulation, based on a realistic threat assessment. Apex organizational structures require streamlining to telescope the decision making process. The current format of military modernization demands a holistic review.

Thirdly, in an era of 'limited wars', a 'joint military doctrine' is a *sine qua non* and 'tri service theatre commands' are prerequisites for synergised application of the war waging potential. In the prevailing scenario, facing the PLA's Western Theatre Command are India's seven Army and Air Force commands, which is a serious lacuna. In short engagements, the timely application of requisite combat power at the point of decision is critical. This calls for creating essential infrastructure on highest priority.

Lastly, the border management mechanism needs to be revamped. A single nodal agency is required to coordinate the functions of the various organs. Operational control astride the Line of Actual Control ought to rest with the Army. A well calibrated response mechanism must be put in place, with disputed vulnerable areas effectively dominated and troops fully prepared to meet any eventuality. Paramilitary Forces deployed for manning the borders require urgent upgrade to match the PLA's Border Regiments.

While many seem to know China, few understand it. In the desperation to engage the PRC, there is a tendency to lose sight of the bigger picture. Given the conflicting interests coupled with unresolved issues, relations between India and China are bound to be marked by contradictions, leading to frequent confrontations. However, through deft diplomacy, differences can be managed. While solutions to vexed problems may not be on the horizon, disputes turning into conflict can be avoided in the larger interest of both nations.

The Chinese are shrewd negotiators with tremendous stamina and penchant to sit across the table, but with equals. India must, therefore, firmly stand its ground and forthrightly safeguard its strategic interests. To deal with China on a level footing, the Indian leadership needs to make pragmatic assessments, possess the courage to accept home truths and display audacity for bold decisions.

The writer has served as Defence Attaché in China, North Korea and Mongolia; commanded a Division in the Eastern Sector; and currently is Professor of International Studies, Aligarh Muslim University.

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India, China to join Indian Ocean exercise

PLA Navy ships, Zhenghe and Weifang, during their visit to Visakhapatnam in 2014. | Photo Credit: [PTI](#)

Despite growing tensions with China, official sources said the Indian Navy would join the People's Liberation Army (PLA) Navy in a maiden maritime search and rescue exercise to be chaired by Bangladesh at the Indian Ocean Naval Symposium (IONS) in November this year.

"Bangladesh, the current Chair, is scheduling a maiden International Maritime Search and Rescue Exercise (IMMSAREX) in November in the Bay of Bengal to be attended by ships and aircraft of the members and observers of the IONS," an official source said.

The IONS is a regional forum of Indian Ocean littoral states, represented by their Navy chiefs, launched by India in February 2008. It presently has 23 members and nine observers.

Conclave of chiefs

The exercise comes at a time of intensifying competition among regional navies for dominance in the Indian Ocean — navies of China and Japan, presently observers, in addition to member states like India, France, Iran and the U.K.

In addition, Bangladesh is also scheduling an "extraordinary conclave of Chiefs," a meeting of chiefs of Navy before it hands over the Chair to Iran next year, the source added.

Under the charter of business adopted in 2014, the grouping has working groups on Humanitarian Assistance and Disaster Relief (HADR), Information Security and Interoperability (IS&I) and anti-piracy now renamed as maritime security.

India has considerably expanded its engagement with countries to further its own interests as well as to check the rapid expansion of Chinese naval forays in the Indian Ocean. Other countries in the region are also engaged in rapid expansion of their military capabilities.

The working group's conferences are held annually and India had chaired the one on HADR in May this year and Pakistan had chaired the meeting on IS&I in July.

Says BJP will campaign against corruption, law and order problems and lack of development work in Himachal Pradesh

The process of holding the requisite Board Meetings and Shareholder Meetings has been completed in phases in September 2017.

Ruben George is staying at Ram Nath Kovind's house at Kalyanpur, near Kanpur

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In South Asia, be the Un-China

As the [stand-off between the Indian and Chinese militaries](#) enters its third month at Doklam, it is not just Bhutan that is keenly anticipating the potential fallout. The entire neighbourhood is watching. There is obvious interest in how the situation plays out and the consequent change in the balance of power between India and China in South Asia. India's other neighbours are likely to take away their own lessons about dealing with their respective "tri-junctions" both real and imagined, on land and in the sea. A Chinese defence official was hoping to press that nerve with India's neighbours when he told a visiting delegation of Indian journalists this week that China could well "enter Kalapani" — an area near Pithoragarh in Uttarakhand that lies along an undefined India-Nepal boundary and a tri-junction with China — or "even Kashmir" with a notional India-China-Pakistan trijunction.

Perhaps, it is for this reason that governments in the region have refused to show their hand in the Doklam conflict. "Nepal will not get dragged into this or that side in the border dispute," Nepal's Deputy Prime Minister Krishna Bahadur Mahara said ahead of a meeting with External Affairs Minister Sushma Swaraj, who had travelled to Kathmandu for the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) regional summit. Chinese Vice Premier Wang Yang will be in Kathmandu next week, and Nepal's Prime Minister Sher Bahadur Deuba in Delhi the week after. Making a similar point while speaking at a conference on public relations this week, a Sri Lankan Minister in Colombo contended that India and China are "both important" to Sri Lanka. Bhutan's Foreign Ministry has stuck to its line, blaming China for violating agreements at Doklam, but not mentioning India. Columnists in the country too are increasingly advocating that Bhutan distance itself from both Indian and Chinese positions.

Is India a good neighbour?

A policy of 'equidistance' for our closest neighbours is a far cry from India's past primacy in the region and something South Block can hardly be sanguine about. Yet, it is a slow path each of the neighbours (minus Bhutan) has taken in the past few years. When the Maldives first turfed private infrastructure group GMR out of its contract to develop Male airport in 2012, few could have imagined the situation today with Chinese companies having bagged contracts to most infrastructure projects. This includes development of a key new island and its link to the capital Male and a 50-year lease to another island for a tourism project.

Similarly, when the then Prime Minister of Nepal K.P. Sharma Oli signed a transit trade treaty and agreement on infrastructure linkages with China in late 2015-2016, Ministry of External Affairs mandarins had brushed it off as a "bluff". Today, China is building a railway to Nepal, opening up Lhasa-Kathmandu road links, and has approved a soft loan of over \$200 million to construct an airport at Pokhara. According to the Investment Board Nepal, at a two-day investment summit in March this year, Chinese investors contributed \$8.2 billion, more than 60% of the foreign direct investment commitments made by the seven countries present.

Sri Lanka's Hambantota port construction project went to the Chinese in 2007 only after India rejected it. Today, China doesn't just own 80% of the port; it has also won practically every infrastructure contract from Hambantota to Colombo. Chinese President Xi Jinping's visit to Bangladesh last October was another such overture, with \$24 billion committed in infrastructure and energy projects. Earlier this year, the largely state-owned Chinese consortium, Himalaya Energy, won a bid for three gas fields in Bangladesh's north-east shoulder from the American company Chevron, which together account for more than half of the country's total gas output.

Even if Pakistan is not counted in this list, it is not hard to see which way India's immediate

neighbours, which are each a part of China's Belt and Road Initiative (BRI), are headed in the next few years. More pointedly, once the investment flows in, it will be that much harder for them to stave off a more strategic presence which China is now more unabashed about.

The crossroads at the Doklam plateau

If one of the aims of the action in Doklam is to save Bhutan from the same fate, then what else must India do to ensure that China doesn't succeed in creating similar space for itself in a country that stood by India in its objections to BRI, and bring its other neighbours back?

To begin with, India must regain its role as a prime mover of the South Asian Association for Regional Cooperation (SAARC), the organisation it abandoned a year ago over its problems with Pakistan. Despite sneers all around, SAARC has survived three decades in spite of its biggest challenge, India-Pakistan tensions. That New Delhi would cancel its attendance at the summit to be held in Pakistan in the wake of the Uri attack, winning support from other countries similarly affected by terrorism such as Bangladesh and Afghanistan, is understandable. But a year later, the fact that there have been no steps taken to restore the SAARC process is unfortunate. This will hurt the South Asian construct and further loosen the bonds that tie all the countries together, thereby making it easier for China to make inroads. It should be remembered that despite China's repeated requests, SAARC was one club it never gained admittance to. For all the Narendra Modi government's promotion of alternate groupings such as South Asia Subregional Economic Cooperation (SASEC), BIMSTEC, the Bangladesh, Bhutan, India, Nepal (BBIN) Initiative and Security and Growth for All in the Region (SAGAR), none will come close to SAARC's comprehensive cogency.

Second, India must recognise that picking sides in the politics of its neighbours makes little difference to China's success there. In Sri Lanka, the Sirisena government hasn't changed course when it comes to China, and despite its protestations that it was saddled with debt by the Rajapaksa regime, it has made no moves to clear that debt while signing up for more. The United Progressive Alliance government made a similar mistake when President Mohamed Nasheed was ousted in the Maldives, only to find that subsequent governments did little to veer away from Chinese influence.

India made its concerns about the then Prime Minister Oli very clear, and was even accused of helping Pushpa Kamal Dahal 'Prachanda' to replace him in 2016, yet Nepal's eager embrace of Chinese infrastructure and trade to develop its difficult terrain has not eased. In Bangladesh too, Prime Minister Sheikh Hasina, who has overseen the closest ties with New Delhi over the past decade, has also forged ahead on ties with China. Should her Awami League lose next year's election, the Bangladesh Nationalist Party will most certainly strengthen the shift towards China. In Bhutan's election, also next year, it is necessary that India picks no side, for nothing could be worse than if the Doklam stand-off becomes an India-versus-China election issue.

Above all, India must recognise that doing better with its neighbours is not about investing more or undue favours. It is about following a policy of mutual interests and of respect, which India is more culturally attuned to than its large rival is. Each of India's neighbours shares more than a geographical context with India. They share history, language, tradition and even cuisine. With the exception of Pakistan, none of them sees itself as a rival to India, or India as inimical to its sovereignty. As an Indian diplomat put it, when dealing with Beijing bilaterally, New Delhi must match China's aggression, and counter its moves with its own. When dealing with China in South Asia, however, India must do exactly the opposite, and not allow itself to be outpaced. In short, India must "be the Un-China".

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India, Russia to hold mega war games in October

In the midst of evolving security situation in the region, India and Russia will hold a mega war game in October involving their armies, navies and the air forces for the first time to further ramp up military ties. The exercise Indra, which will be held in Russia from October 19 to 29, will primarily focus on achieving coordination between forces of the two countries in a tri-services integrated theatre command scenario, military sources said. It will be for the first time India will participate in a tri-services exercise with a foreign country with such a large scale participation by the Navy, the Army and the Air Force, they said.

A total of 350 Indian Army personnel will participate at the mega exercise and the contingent will be led by a major-general rank official. The contingents by the Navy and the IAF will also be sizeable in numbers, the sources said.

The exercise is taking place at a time when India's ties with China have nosedived due to the simmering border dispute and its ties with Pakistan have deteriorated over cross-border terrorism and number of other issues.

The sources said the exercise will take place in three locations in Russia including in mountainous Vladivostok region.

The armies, navies and air forces of Russia are holding bilateral exercises separately but this is for the first time, both the countries will carry out a tri-services exercise.

Russia has been a long-standing defence partner of India and both the countries are now eyeing to further deepen the ties.

During Prime Minister [Narendra Modi](#)'s visit to Russia in June, both countries had decided to "upgrade and intensify" defence cooperation through joint manufacture, co-production and co-development of key military hardware and equipment.

A vision document, issued then had said that both the countries also decided to work towards a qualitatively higher level of military-to-military cooperation.

India has already decided to significantly ramp up its defence capability and has lined up billions of dollars of procurement proposals as part of military modernisation.

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Largest volcanic region on earth lies in Antarctica

Fire and ice:Water warmed by volcanoes in Antarctica. Heat from volcanoes allows plants and animals to survive here.British Antarctic Survey/Australian National University/AFP/PETER CONVEY

The largest volcanic region on Earth — with nearly 100 volcanoes — has been discovered two km below the surface of the vast ice sheet in west Antarctica.

Researchers from the University of Edinburgh in Britain found a staggering 91 previously unknown volcanoes, adding to the 47 others that had been discovered over the previous century of exploring the region.

The height of these newly discovered volcanoes range from 100 to 3,850 metres, with the highest almost as tall as Switzerland's 3,970-metre Eiger mountain.

These active peaks are concentrated in a region known as the west Antarctic rift system — which stretches 3,500 km from Antarctica's Ross ice shelf to the Antarctic peninsula. Geologists say this huge region is likely to dwarf east Africa's volcanic ridge — currently rated as the densest concentration of volcanoes in the world.

Eruption concerns

However, the activity of this range could have worrying consequences, glacier expert Robert Bingham was quoted as saying to *The Guardian*. "If one of these volcanoes were to erupt it could further destabilise west Antarctica's ice sheets."

"Anything that causes the melting of ice, which an eruption certainly would, is likely to speed up the flow of ice into the sea," Mr. Bingham said, adding: "The big question is: how active are these volcanoes? That is something we need to determine as quickly as possible."

The Edinburgh volcano survey, reported in the Geological Society's special publications series, involved studying the underside of the west Antarctica ice sheet for hidden peaks of basalt rock similar to those produced by the region's other volcanoes.

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India moves to revive TAPI gas pipeline

Power point: India wants to secure gas from Galkynysh in Turkmenistan | Photo Credit: [REUTERS](#)

India will host the next steering committee meeting of the proposed 1,814 kilometre-long Turkmenistan-Afghanistan-Pakistan-India (TAPI) gas pipeline, senior officials on both sides confirmed.

The decision was made during the sixth joint Inter-Governmental Committee (IGC) meeting on trade, economic, scientific and technological cooperation.

The meeting was followed by a meeting between visiting Deputy Prime Minister and Foreign Minister of Turkmenistan Rashid Meredov and Minister of State for Petroleum and Natural Gas Dharmendra Pradhan.

“I strongly believe in this project, and this is the position of Turkmenistan,” Mr. Merodov said at a small interaction.

“It is not just a commercial project, but one which will be a good foundation for providing peace and security in the region,” he added.

In Beijing's shadow

Mr. Pradhan said India's commitment to TAPI — first proposed in 1995 — “remains strong”, and Prime Minister Narendra Modi had made the proposal to hold the TAPI steering committee meet in Delhi when he met the Turkmenistan President in Ashgabad last year, which he has now accepted. The last steering committee meeting, scheduled to be held annually, which is supposed to be held took place in April 2016.

Officials told *The Hindu* that the pipeline, that had its ground-breaking ceremony in December 2015, has seen flagging interest since then for a number of reasons. India's effort is to tap Turkmenistan's Galkynysh gasfields, which are the fourth largest in the world.

The move is also an effort by the government to stave off any Chinese interest in the project, given that Turkmenistan is a close partner of China in its Belt and Road initiative across Central Asia, and Beijing is the largest buyer of its gas. Even the Galkynysh gas basin is being developed under a loan from the Chinese Development Bank (CDB).

When asked by *The Hindu* on apprehensions about China's Belt and Road Initiative (BRI), which India has refused to join, affecting India's interests, Mr. Meredov said it was important to have a “united approach” on connectivity and economic cooperation in Eurasia.

“We must be practical in the implementation of strategic economic projects. China has the BRI, we have similar ideas, India has similar ideas,” he explained.

Responding to Indian sovereignty concerns about the China-Pakistan Economic Corridor (CPEC), which passes through Pakistan-occupied Kashmir, Mr. Meredov said Turkmenistan was “open to all economic cooperation, which is how all such projects should be seen. India is and will be one of the most important countries for Turkmenistan.”

Says BJP will campaign against corruption, law and order problems and lack of development work

in Himachal Pradesh

The process of holding the requisite Board Meetings and Shareholder Meetings has been completed in phases in September 2017.

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Cabinet approves completion of balance works of North Koel Reservoir Project**Cabinet approves completion of balance works of North Koel Reservoir Project**

The Union Cabinet chaired by the Prime Minister Shri Narendra Modi today has given its approval to the proposal to complete the balance works of the North Koel Reservoir Project in Jharkhand and Bihar at an estimated expenditure of Rs.1622.27 crore to be incurred during three financial years from the start of the project.

The Cabinet also approved storage of water in dam restricted at lower level than envisaged earlier to reduce the submergence and to protect Betla National Park and Palamau Tiger Reserve.

The project is situated on North Koel river which is a tributary of Sone river finally joining the river Ganga. The North Koel Reservoir is located in the most backward tribal areas in Palamau and Garhwa districts of Jharkhand State. The construction was originally started in the year 1972 and continued till 1993 when it was stopped by the Forest Department, Govt. of Bihar. Since then, the work on dam is at a standstill. The major components of project are: 67.86 m high and 343.33 m long concrete dam called Mandal dam originally intended to store 1160 million cubic metre (MCM) water; 819.6 m long barrage at Mohammadganj, 96 km downstream of the dam; and two canals originating from left and right banks of Mohammadganj Barrage with distributaries system for irrigation. With the new lowered elevation level (EL) of 341 metre, the Mandal dam will now have storage of 190 MCM. The project aims to provide irrigation to 111,521 hectares of land annually in the most backward and drought prone areas of Palamu & Garhwa districts in Jharkhand and Aurangabad & Gaya districts in Bihar. The unfinished project as on date is providing irrigation to 71,720 hectares and completion of this project will provide additional irrigation benefit to the extent of 39,801 hectares. The irrigation potential through this Project in the two States would be as follows:

Total irrigation potential: **1,11, 521 hectares**

Irrigation potential in Bihar: **91,917 hectares**

Irrigation potential in Jharkhand:

19,604 hectares

The total cost of the project as assessed on date is Rs 2391.36 crore. An expenditure amounting to Rs. 769.09 crore has been incurred on the project till date. The Union Cabinet has approved the proposal for completing the balance of the North-Koel reservoir project in Jharkhand & Bihar at an estimated cost of Rs 1622.27 crore during three financial years.

The common components amounting to Rs.1013.11 crore of balance works would be funded by the Central Government as a grant from PMKSY Fund. This would include cost of Net Present Value (NPV) and Compensatory Afforestation (CA) which comes to Rs.607 crore and Rs.43 crore respectively. The Central Government will also fund 60% of the cost of balance works amounting to Rs.365.5 crore (Bihar Rs.318.64 crore and Jharkhand Rs.46.86 crore) from Long Term Irrigation Fund (LTIF) under PMKSY as grant from the States of Bihar and Jharkhand. The States of Bihar and Jharkhand will arrange 40% of remaining cost of balance works amounting to Rs.243.66 crore (Bihar 212.43 crore and Jharkhand 31.23 crore) as loan from LTIF through NABARD at the rate which is not subsidised and is related to market borrowing cost with no interest subvention.

The Cabinet also approved execution of balance works of the project on turnkey basis by M/S WAPCOS Ltd., a CPSU under MoWR, RD & GR as Project Management Consultant (PMC). The execution of the project will be monitored by an Empowered Committee of Government of India headed by CEO NITI Aayog.

AKT/VBA/SH

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New layer of tectonic plates in Earth's mantle discovered

Houston: Scientists have found what appears to be an extra layer of tectonic plates lurking in the Earth's mantle, which may explain a mysterious series of earthquakes in the Pacific.

Jonny Wu of the University of Houston in the US and colleagues believe that the tectonic plates subducted into the Earth's mantle millions of years ago. Tectonic plates are pieces of Earth's crust and uppermost mantle, together referred to as the lithosphere.

The newly discovered plates slid horizontally inside a water-rich layer of the mantle known as the "transition zone," which lies 440-660kms below the surface. These subducted plates appear to travel horizontally for thousands of kilometres at speeds almost as fast as plates move at the surface, researchers said.

The plate movements may explain a mysterious series of very deep, large earthquakes known as the Vityaz earthquakes, which originated in the mantle between Fiji and Australia. Just as in conventional tectonic plates at Earth's surface, the bends and breaks in these subducted plates can generate earthquakes, *The Guardian* reported.

Researchers suggest that the Vityaz earthquakes could be due to the sliding of a subducted plate within the transition zone. "Basically, 90% of Earth's deep seismicity (more than 500km deep) occurs at the Tonga area where we have found our long, flat slab," said Wu.

The finding was made possible by recent advances in seismology, which allowed scientists to generate pictures of Earth's interior using vibrations from natural earthquakes. These seismological pictures can be used to locate subducted tectonic plates lurking within the mantle and then to reconstruct the configuration of plates on Earth's surface millions of years ago.

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Can't Mokedatu be used to address T.N.'s needs, asks SC

The Supreme Court on Thursday asked why the Mokedatu dam project cannot be envisioned as a facility to store excess water from Karnataka, which can be released to Tamil Nadu.

The suggestion was mooted by a three-judge Special Bench, led by Justice Dipak Misra, during the hearing of appeals in the Cauvery case.

The discussion touched upon the Mokedatu project when Karnataka provided statistics of Cauvery water released to Tamil Nadu from 2007, post the tribunal award. Karnataka submitted that except for two drought-ridden years, the water released had never decreased below the 192 tmc ordered by the tribunal.

Tamil Nadu retorted, saying only excess water was released by Karnataka.

'Can be storage facility'

At this point, Karnataka submitted that the Mokedatu dam project could be used as storage facility for excess water, to be released whenever Tamil Nadu required so.

Tamil Nadu indicated that it was agreeable to the proposition, provided that such an arrangement was under the control and supervision of an independent third party. The court also said that it may not be feasible to construct a new dam for storage in Tamil Nadu, and asked both States to put the proposition before the Centre when it begins its arguments in the Cauvery case next week.

In 2015, Karnataka had termed the challenge posed by Tamil Nadu to the construction of Shivasamudram and Mokedatu hydro power projects as "misconceived, obstructive and factually baseless".

The Karnataka government told the Supreme Court that the two reservoirs would neither diminish nor reduce the river's downstream flow.

First instalment, an adaptation of first two chapters, released

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No data from China on Brahmaputra this year

Hinting at China's responsibility for the current spate of floods across the northeastern States, India on Friday said Beijing had not shared any water-related data about the Himalayan rivers in the current year. The Ministry of External Affairs said under an agreement, China had committed to share annual hydrological data with India but the same has not been shared this year.

"There is an existing mechanism named India-China Expert-Level mechanism... started in 2006 to share hydrological data during the flood season for Brahmaputra and Satluj rivers. Under the MoUs, the hydrological data is to be shared between May 15 to October 15 every year but from May 15 till now, we have no data from China. The last meeting of the mechanism was held in April 2016," said Raveesh Kumar, spokesperson of the Ministry of External Affairs.

Cooperation necessary

The spokesperson hinted at the necessity for regional cooperation to control floods and explained that the responsibility of sharing data is with China as it hosts the points of origin of the Brahmaputra and Satluj.

Mr. Kumar also flagged Nepal's role in controlling floods in Bihar, saying External Affairs Minister Sushma Swaraj had discussed the issue with Nepal's Deputy PM.

The spokesperson also addressed the ongoing India-China standoff at Doklam and declined to give a timeline to the standoff adding, "I am not an astrologer and since I am not an astrologer so I will let it pass." He however noted a racially motivated skit that appeared in the Chinese official media earlier in the week and said, "I will not dignify this with an answer."

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India's Exclusive Rights to Explore Polymetallic Nodules from Central Indian Ocean Seabed Basin Extended by Five Years

India's Exclusive Rights to Explore Polymetallic Nodules from Central Indian Ocean Seabed Basin Extended by Five Years

India's exclusive rights to explore polymetallic nodules from seabed in Central Indian Ocean Basin (CIOB) have been extended by five years. These rights are over 75000 sq. km of area in international waters allocated by International Seabed Authority for developmental activities for polymetallic nodules. The estimated polymetallic nodule resource potential is 380 million tonnes, containing 4.7 million tonnes of nickel, 4.29 million tonnes of copper and 0.55 million tonnes of cobalt and 92.59 million tonnes of manganese. This has been approved unanimously in the 23rd session of International Seabed Authority (ISA) concluded on August 18, 2017 at Kingston, Jamaica.

India is the first country to have received the status of a pioneer investor in 1987 and was allocated an exclusive area in Central Indian Ocean Basin by United Nations (UN) for exploration and utilization of nodules. India is one among the top 8-countries/ contractors and is implementing a long-term programme on exploration and utilization of Polymetallic Nodules through Ministry of Earth Sciences. This includes survey and exploration, environmental studies, technology development in mining and extractive metallurgy, in which significant contributions have been made.

While, the extraction of metals from the polymetallic nodules lying at the deep ocean floor is not yet found to be economically viable at this stage, an area of about 7860 square km has been identified in the CIOB for the First Generation Mine Site on the basis of detailed surveys and analysis. Environmental studies for mining of deep-sea polymetallic nodules were also carried out to evaluate the possible impacts of mining on deep-sea environment.

A Remotely Operable Submersible (ROSUB 6000), capable of operating at 6000 m water depth was also developed and tested successfully at a depth of 5289 m. A remotely operable in-situ soil testing equipment was also developed for obtaining detailed geotechnical properties of the mining area at CIOB and tested successfully at 5462 m water depth.

A mining system is under development which has been tested for 500m water depth. Metallurgical process routes for extracting copper, nickel and cobalt from polymetallic nodules have been developed and tested in a demonstration pilot plant set up on semi-continuous basis at Hindustan Zinc Limited, Udaipur with a capacity to process 500 kg nodules per day.

International Seabed Authority (ISA) is a UN body set up to regulate the exploration and exploitation of marine non-living resources of oceans in international waters. India actively contributes to the work of International Seabed Authority. Last year, India was re-elected as a member of Council of ISA. India's nominees on Legal and Technical Commission and Finance Committee of the ISA were also elected last year.

HK/nb

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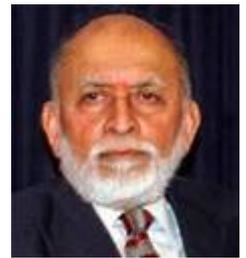
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70 years of Independence

Special Feature – I-Day 2017

India's Atomic Energy Programme



***Dr. M.R. Srinivasan**

India entered the atomic age, more correctly the nuclear age, on 4th August 1956 when Apsara, India's first nuclear reactor, went into operation. This reactor was designed and built by India with the nuclear fuel supplied from the United Kingdom under a lease agreement. Our second reactor for research purposes, CIRUS, was built with cooperation with Canada and went into operation in the early 1960's. The research reactors were platforms for conducting research in neutron physics, studies in the behaviour of materials under neutron irradiation and for production of radio isotopes. The latter are very useful for diagnostics and treatment of various ailments, especially cancer, and also very useful in industrial applications, especially for the purpose of non-destructive testing.

Electricity production using nuclear energy commenced in October 1969 when the two reactors at Tarapur were put into service. The Tarapur Atomic Power Station (TAPS) was built by General Electric of USA and is now in its forty-eighth year of service. Tarapur supplies the lowest cost non-hydro electric power in the country. India's second nuclear power station came up in Rajasthan, near Kota, the first unit of which went into operation in August, 1972. The first two units at Rajasthan were built in collaboration with Canada, who pioneered reactors that could use natural uranium as fuel. They, however, required heavy water, present in extremely small quantities in ordinary water and can be extracted through complex processes.

India's third nuclear power station came up at Kalpakkam, near Chennai. This station was designed and built by India, on its own. All the material and equipment were produced in the country. This was a huge challenge as Indian industry at that time, had no experience in making complex equipment required for nuclear applications. Special materials like nuclear fuel, zirconium components and heavy water production required extensive work in the laboratories of the Bhabha

Atomic Research Centre (BARC). Pilot plants were built and later scaled up to industrial plants. Industry had to be trained in special manufacturing processes and novel quality testing procedures introduced. Thus, when the first unit of the Madras Atomic Power Station (MAPS) started up in July 1983, India joined a small group of countries which could design and build nuclear power units on their own.

Our fourth nuclear power station came up at Narora, on the banks of river Ganga. This site has experienced earthquakes in the vicinity. So we evolved designs capable of withstanding any foreseeable earthquake that could visit the site. We also standardized the design of a 220 MW unit that could be built at a number of sites in the country. The first unit of Narora started up in October 1989. In the next twenty years, India built and commissioned eleven 220 MW units and two 540 MW units, all based on its own technology called 'Pressurised Heavy Water Reactors'. To accomplish this task, India also built up a strong heavy water production capability and fuel production, including mining of uranium in Jharkhand. Indian industry was mobilized to produce the entire range of equipment and materials to support the nuclear power programme.

Since India was keen to augment the nuclear capacity rapidly, it entered into a collaboration with the former Soviet Union in 1988 to build two 1000 MW reactor power units using enriched uranium as fuel. Due to the implosion of the Soviet Union in 1990 and the economic difficulties India faced at the time, the Indo-Russian project was put on the back burner. In 1998, India and Russia decided to embark on this project, and work at site commenced in 2003. When the commissioning activities on the first unit were in progress, the accident in Fukushima, Japan, occurred in March 2011. This triggered a strong opposition to the project amongst people living in the neighborhood. It took considerable time and patient explaining to inform the public at large about the safety features at Kudankulam and also how the site conditions there were completely different from those at the Japanese site. The first unit at Kudankulam went into operation in 2014 and the second in 2016.

India now has twenty-one reactor units in service. The first unit at Rajasthan supplied by Canada has been out of service due to some equipment deficiencies. The other units with a total capacity of 6700 MW have been operating reliably. The plant load factor for the five years from 2011 to 2016 has been about 78%. The nuclear power units have been supplying power at Rs. 2 to Rs. 3.50 per kwh (Kilowatt hour). In fact the cost of power from Tarapur has been less than Rs. 1/kwh. For Kudankulam units 1 and 2, it is about Rs. 4 per kwh.

The cost of installing Indian designed and built nuclear power unit is about Rs. 16.5 crores/MW. For the Russian reactors, the cost is about Rs. 22 crores/MW. Since the fuelling cost of the Russian reactors is lower than those of the Indian reactors, both of them produce power at about Rs. 5/kwh. This cost, when escalated to the time horizon of 2023-24, will come to about Rs. 6.5 per kwh. Coal based power in regions far away from coalfields would cost more in the same time horizon. Solar power for recent projects costs about Rs. **2.5/kwh**, but an expenditure of Rs. 2 /kwh is needed to connect the solar units to the grid system, taking the total cost to **Rs. 4.5/kwh**.

India signed cooperation agreements with the USA and France in 2008 and they provided for building nuclear power units designed in these countries to be set up in India. Negotiations have been going on from then on. However, the leading nuclear power plant builder in the US, namely Westinghouse filed for bankruptcy a few months ago. AREVA of France lost a lot of money on their nuclear fuel business following the Fukushima accident. The French government allocated the nuclear reactor business to their national electric utility, Electricite' de France. There is considerable uncertainty, therefore, with regard to cooperation with USA and France.

Given this scenario, the Government of India decided to build ten India designed 700 MW Pressurized Heavy Water Reactors in June 2017. The Nuclear Power Corporation had scaled up the 540 MW size units to 700 MW and started work, two at Kakrapara (Units 3 and 4) and two at Rajasthan (Units 7 and 8). This is one of the biggest single commitments in nuclear power, after the Fukushima accident of 2011. This programme will provide Indian industry with sustained workload for a period of a decade and establish India firmly as an important player in this field.

Work has commenced on Units 3, 4, 5 and 6 at Kudankulam. Russia has offered to build six 1200 MW units at a second site to be identified by India. As a parallel activity, India has designed the 'Indian Pressurised Water Reactor' of 900 MW capacity, using enriched uranium as fuel. Work on two such units may be taken up soon, to be followed thereafter by series building. At Kalpakkam, the Prototype Fast Breeder Reactor of 500 MW is in the process of commission. Two reactors of 600 MW of similar design may follow. The Bhabha Atomic Research Centre has completed the design of a 300 MW reactor called 'Advanced Thermal Reactor' which would use thorium. Our long term plans to use thorium depend on fast reactors and thorium based systems.

Not elaborated in this article are activities in the field of research, reprocessing of spent fuel, development of accelerators and so forth. The department of Atomic Energy has been actively engaged in supplying radio isotopes to hospital and industry, in the use of radiation technologies for preventing spoilage of marine foods, spices and for enhancing the shelf life of onions, mangoes and other food articles, as well as in sterilization of medical products.

We may thus foresee, in the decades ahead, nuclear energy making an important contribution as carbon-free energy, and nuclear technologies offering benign solutions in enhancing the quality of life of our people.

**The author is Former Chairman and presently Member, Atomic Energy Commission.*

Views expressed in the article are author's personal.

(The feature has been contributed by PIB Chennai)

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70 years of Independence

Special Feature – I-Day 2017

Self reliance in food – Green and White revolution

With special reference to North East India



*Dr. Prarthana Rajkumari

This is an era of 'Partivartan' – time for some revolutionary changes! Our Prime Minister Mr. Narendra Modi has started campaigning for a multicolour revolution referring to a second green revolution with protein-rich pulses, a white revolution with cattle and livestock, a saffron 'energy' revolution with solar energy, and a blue revolution on clean water and the welfare of the fishermen. Among these, Green and White Revolution have already influenced the live of the Indian to a great extent. As far as food security is concerned, India cannot compromise on food self-sufficiency and there has to be a number of short-term as well as long-term initiatives to be taken. Shri Modi's attention to the sufferings of farmers during election campaign has raised a lot of hope among the under-privileged community.

Green Revolution was aimed to increase the production of food-grains that resulted in a drastic reduction in imports. Because of this Green Revolution we are now self-sufficient in food-grains and have sufficient stock in the central pool and sometimes in a position to export food-grains also. Green Revolution brought a large scale farm mechanisation which created demand for different types of machines and requisite for chemical fertilizers, pesticides, insecticides, weedicides, etc. also increased considerable. Subsequently, an agro based industry has come up creating a large number of employments in the country.

It seems that North East, though rich in natural resources, has lagged behind since Independence. Prime Minister said that the second Green Revolution should start from the East and if that happens, it will begin from Assam. Accordingly, the Ministry of Agriculture has included Assam in the list of eastern states to be covered by the second Green Revolution. Among the eastern states, Assam has received the best performance award for National Food Security Mission (NFSM) – rice in 13 NFSM districts. The mission aims to increase the production and productivity of rice.

With so much water, fertile land and hardworking farmers North East has the potential to contribute immensely in achieving the target of doubling the farmers' income by the year 2022. As the Prime Minister laid the foundation stone of Indian Agricultural Research Institute (IARI) in Gogamukh, Assam, it can be expected that it will impact the entire region in a positive way and agriculture needs will be developed in line with the requirements of the 21st century. Farmers will get benefitted from the changing technology as well.

The North East can excel in the field of organic farming as well. Diverse agro-climatic conditions, varied soil types and abundant rainfall have endowed the region with promising horticulture and value added products that can be marketed within the country and abroad. The diverse agro-climatic situations in the region offer excellent scope for growing different horticultural crop groups like fruits, vegetables, spices, medicinal and aromatic plants. A wide range of tropical, sub-tropical and temperate fruits such as lemon, mandarin, pineapple, passion fruit, banana, ginger, turmeric, and vegetables, both indigenous and exotic, are grown in the region. In terms of its contribution to the national production, the region accounts for about 5.1% (fruits) and 4.5% for vegetables.

Moreover, a unique advantage the region has that it is gifted with suitable agro climatic condition very different from rest of country due to its climatic diversity, meandering altitudes and production of varied crop groups. In fact, the uniqueness of North Eastern market is that one can enjoy fresh off-season crop groups in one state from the neighbouring states where its season has just started due to this climatic diversity.

White Revolution is the concerted efforts on a cooperative level to increase milk supply through which Indian Dairy Industry has grown to the extent that milk output has not only topped the world, but also represents sustained growth in the availability of milk and milk products. The dairy sector is now the largest contributor in the agricultural sector to the nation's GDP.

National Dairy Development Board (NDDB) formed in 1965 to promote, plan and organise dairy development through cooperatives launched Operation Flood in 1970 which is considered to be the world's largest dairy development programme. Under this programme professionals were employed for marketing and application, and science and technology to link the rural producers with urban consumers.

But if we talk about North East India, consumption of milk and milk products is much lower due to divergent food habit and less availability of milk. Assam is the largest producer of milk followed by Tripura. In recent times a notable increase in milk production is seen in Tripura mainly due to improvement in milk breed. Prompt financial assistance from government and constructive motivation in form of training engrossed the state to become successful in this field.

The country's market leader, Amul, has started operations in the state giving a tough competition to the West Assam Milk Producers' Cooperative Union Limited (Wamul) that sells its products under the brand name Purabi, which has become a household name and has met with some success in recent years. According to Economic Survey of Assam, the Dairy Development Department has been focussing on increasing milk production as well as creating processing facilities for economic uplift of rural dairy farmers.

To make the country self-reliant in agriculture and food security, instead of providing a particular amount of food grains every month, the focus should be on making the villages take care of their own needs which may help in removing hunger in the long term. Strategic planning and implementation is necessary to develop agriculture and make region marginally, if not significantly, surplus in food production by integrating research, extension and education duly supported by a time bound reforms in land tenure system in each state.

**Author is Assistant Professor in College of Agriculture, Dhuburi, Assam.*

Views expressed in the article are author's personal.

(This feature has been contributed by PIB Guwahati)

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India's Exclusive Rights to Explore Polymetallic Nodules from Central Indian Ocean Seabed Basin Extended by Five Years

India's Exclusive Rights to Explore Polymetallic Nodules from Central Indian Ocean Seabed Basin Extended by Five Years

India's exclusive rights to explore polymetallic nodules from seabed in Central Indian Ocean Basin (CIOB) have been extended by five years. These rights are over 75000 sq. km of area in international waters allocated by International Seabed Authority for developmental activities for polymetallic nodules. The estimated polymetallic nodule resource potential is 380 million tonnes, containing 4.7 million tonnes of nickel, 4.29 million tonnes of copper and 0.55 million tonnes of cobalt and 92.59 million tonnes of manganese. This has been approved unanimously in the 23rd session of International Seabed Authority (ISA) concluded on August 18, 2017 at Kingston, Jamaica.

India is the first country to have received the status of a pioneer investor in 1987 and was allocated an exclusive area in Central Indian Ocean Basin by United Nations (UN) for exploration and utilization of nodules. India is one among the top 8-countries/ contractors and is implementing a long-term programme on exploration and utilization of Polymetallic Nodules through Ministry of Earth Sciences. This includes survey and exploration, environmental studies, technology development in mining and extractive metallurgy, in which significant contributions have been made.

While, the extraction of metals from the polymetallic nodules lying at the deep ocean floor is not yet found to be economically viable at this stage, an area of about 7860 square km has been identified in the CIOB for the First Generation Mine Site on the basis of detailed surveys and analysis. Environmental studies for mining of deep-sea polymetallic nodules were also carried out to evaluate the possible impacts of mining on deep-sea environment.

A Remotely Operable Submersible (ROSUB 6000), capable of operating at 6000 m water depth was also developed and tested successfully at a depth of 5289 m. A remotely operable in-situ soil testing equipment was also developed for obtaining detailed geotechnical properties of the mining area at CIOB and tested successfully at 5462 m water depth.

A mining system is under development which has been tested for 500m water depth. Metallurgical process routes for extracting copper, nickel and cobalt from polymetallic nodules have been developed and tested in a demonstration pilot plant set up on semi-continuous basis at Hindustan Zinc Limited, Udaipur with a capacity to process 500 kg nodules per day.

International Seabed Authority (ISA) is a UN body set up to regulate the exploration and exploitation of marine non-living resources of oceans in international waters. India actively contributes to the work of International Seabed Authority. Last year, India was re-elected as a member of Council of ISA. India's nominees on Legal and Technical Commission and Finance Committee of the ISA were also elected last year.

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Cabinet approves MoU between India and Nepal for laying down implementation arrangement for construction of a new Bridge over Mechi River at Indo-Nepal border**Cabinet approves MoU between India and Nepal for laying down implementation arrangement for construction of a new Bridge over Mechi River at Indo-Nepal border**

The Union Cabinet chaired by Prime Minister Shri Narendra Modi today approved a Memorandum of Understanding (MoU) to be signed between India and Nepal for laying down implementation arrangement on Cost sharing, Schedules and Safeguard issues for starting construction of a new Bridge over Mechi River at Indo-Nepal border.

The estimated cost of construction of the bridge is Rs. 158.65 crore, which would be funded by Government of India through ADB loan. The new bridge is part of up-gradation of the Kakarvitta (Nepal) to Panitanki Bypass (India) on NH 327B covering a length of 1500 meters including a 6 lane approach road of 825 meters. Mechi Bridge is the ending point of Asian Highway 02 in India leading to Nepal and provides critical connectivity to Nepal.

The construction of the bridge will improve regional connectivity and has potential to strengthen cross border trade between both the countries and cementing ties by strengthening industrial, social and cultural exchanges.

National Highway and Infrastructure Development Corporation (NHIDCL) under Ministry of Road Transport & Highways has been designated as the implementing agency for this project. DPR for this project has been prepared and alignment of bridge has been finalized in consultation with Government of Nepal.

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The importance of data in smart cities

During the London 2012 Olympics the Transport for London (TfL) network needed to manage 18 million local journeys made by spectators. One can only imagine the volume of data generated during this time; the data and analytics, mostly from the games, was utilized by TfL to predict the number of people who were likely to use public transport during that time, in order to ensure that the system was running effectively.

With the evolution of technology changing the way we live and work, it is only a matter of time before governments around the world upgrade their infrastructure to offer citizens efficient services through smart cities, where enormous amounts of data moves within complex information supply chains.

Yet, smart cities are not about constantly introducing new technologies. Data sources are everywhere around us, ranging from smart phones and computers, to Global Positioning System (GPS) and social media sites. Effective analysis and utilization of this data is going to be a key factor for success in the smart cities initiative, by making the data available in one place through a framework that is clean, well labelled and allows better processing and consumption.

This global trend of rapid urbanization that makes a strong case for smart cities, is also reflected in India. The government's Make in India initiative states that investments of approximately \$1.2 trillion will be required over the next 20 years across transportation, energy, and public security to build smart infrastructure. Besides the government and industry, participation of start-ups and citizens is cardinal in closing the last mile and feedback loop in this process, morphing the 3Ps of Public Private Partnership into the 4Ps (Participative PPP). This necessitates the involvement of citizens, enabling smart decisions on deploying solutions, implementing reforms, and designing post-project structures that make smart city developments sustainable.

One way to increase data collection and citizen participation at the grass-root level is to have an artificial intelligence (AI) system that is flexible and adaptive. In a country where we are short of nearly 500,000 doctors, based on the World Health Organization (WHO) norm of 1:1000 population, AI-based healthcare systems can study past patient data and medical records, process data quickly, and even help doctors detect dormant signs of diseases that may manifest later.

The Indian government is already increasingly collecting data in machine-readable forms, and as technologies reach a level where they can rival any human in a real-time and cost-effective way, AI can help in grievance redressal, law and order, and health and education. From that point of view, there are opportunities for AI to be more deeply ingrained across the Make in India, Skill India, and Digital India programmes.

Even so, there are two concerns here, the first being the need for effective utilization of the existing data. According to Gartner, the lack of a holistic, framework-based approach and a viable revenue model are stalling large-scale smart city projects in India. The framework-based approach takes into consideration the current state of the physical and IT infrastructure of the city, the city's challenges, the citizens' needs, and the existing capabilities of the city machinery to deliver critical services. This helps identify the gaps in various hardware, software, network, connectivity, security and information management infrastructure that must be bridged to implement a scalable, future-proof and cost-effective smart city service delivery infrastructure.

The second key consideration that needs to be taken into account is the fact that for the smart cities initiative to take off successfully, massive amounts of data will need to be monitored. Not

only will this data be in the public domain, it will also be in the personal domain. This, naturally, brings up the question of security and privacy—indicating a need for stringent regulations to ensure data security.

It is true that there is no set template that can address all the questions being raised; the need of the hour is to effectively analyse the current state of the infrastructure and identify need gaps, encourage citizens to become more active participants in the smart city design, and build a culture of innovation and collaboration that will help realize the vision of a smart city.

Prakash Mallya is managing director of the sales and marketing group at Intel Technology India Pvt Ltd.

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A new score in waste management

Rich source Cotton stalks are first treated to breakdown the complex organic polymers present in it. | Photo Credit: [K Ananthan](#)

Scientists from CSIR's National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram have been able to turn waste into wealth. They have produced ethanol from discarded cotton-stalks by using a combination of chemical and biological techniques. India has about 9.4 million hectares under cotton cultivation and every hectare generates 2 million tonnes of cotton stalk wastes. The results were published in *Bioresource Technology*.

The stalks were first treated with an acid, alkali and different enzymes to breakdown the complex organic polymers of the stalk. "The agro-residues are tough in nature and we need chemical pre-treatment to break down the complex structure of the stalk," explains Meera Christopher, research scholar at NIIST and first author of the paper.

The acid helps to remove hemicellulose, a polymer of the cell wall and the alkali extracts lignin, a binding matrix in the cell wall, made of complex phenolics. These treatments expose cellulose, the major component made of glucose to the action of enzymes.

The cellulose was further treated using enzymes to convert it into glucose.

Fermentation

To convert the glucose into ethanol, fermentation using a novel yeast strain was carried out. "We isolated the yeast-*Saccharomyces cerevisiae*-RRP-03N, from a rotting wild fruit we found in the Silent Valley National Park in Palakkad, Kerala. In spite of several inhibitors of microbial growth produced during chemical treatment, the yeast performed better than distiller's yeast strains in fermenting the cotton stalk hydrolysate," says Dr. Rajeev K Sukumaran, Head of the Biofuels and Biorefineries Section, at NIIST and the corresponding author of the paper.

The yeast showed a glucose conversion efficiency of 76% and the entire glucose was utilised by the yeast in just 24 hours and converted into alcohol. This performance was superior to any other organism reported for fermentation of cotton stalk. The final alcohol obtained can be made to fuel grade bioethanol (>99% purity), after distillation and dehydration using molecular sieves, which is an existing technology practised in the distilleries.

Bioethanol

Bioethanol has a number of advantages over conventional fuels as it comes from a renewable resource. It is mandatory to blend 10% ethanol with petrol. Bioethanol presently in use is obtained by fermentation of sugar cane molasses which is a byproduct of sugar production, and has food value. Most of this first generation ethanol finds its way into consumer applications, primarily as liquor. Converting the agro-residues to ethanol reduces the food vs fuel competition," explains Meera.

Further studies should be carried out for commercial viability and large-scale production.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Study linking temperature, farm suicides challenged

Some academics have challenged a recent study that said that “temperature during India’s main agricultural-growing season has a strong positive effect on annual suicide rates”.

The paper, titled “Climate change and agricultural suicides in India” and authored by Tamma A. Carleton, has been published in the *PNAS* journal (Proceedings of the National Academy Sciences of the United States).

The study had used State-level data from 1967 to 2013 to suggest that an increase in temperature by a degree Celsius a day can cause 70 suicides.

The evidence, it said, leads to the conclusion that crop damage by extreme temperatures leads to economic hardship and suicide.

In a press note, T. Jayaraman and Kamal Kumar Murari of the Tata Institute of Social Sciences and Madhura Swaminathan of Indian Statistical Institute said they considered these claims to be baseless. “These claims are a consequence of the uncritical use of data, bad assumptions, flawed analysis and unacceptable neglect of the existing literature on global warming and Indian agriculture as well as farmer suicides,” they said.

Wrong premise

The academics noted that the author incorrectly used suicide data, wrongly identified extreme temperatures for crop production, took only kharif as the relevant agricultural season to consider extreme temperatures, and wrongly identified the relevant crops.

As a result, the meaning of the correlation that the author claimed to find between extreme temperatures and suicides was unclear.

They said the paper used State-level data on suicides, both urban and rural. “How can urban suicides be included in an analysis of agricultural suicides,” they asked.

The paper ignored the fact that the suicide data, taken from the National Crime Records Bureau, had separated farmer suicides from those of other occupational categories only after 1995.

The author did not analyse individual crops but only considered a few such as rice, wheat, sorghum, sugar, maize and millet.

Cotton, closely associated with farmer suicides, was a notable omission as are a host of other cash crops. The author also ignored the Rabi season.

The paper considered temperatures above 20 degrees Celsius as extreme temperatures.

This was flatly contradicted by what was known of the temperature dependence of crop production, the academics noted.

Jaggi Vasudev’s Rally for Rivers claims they will, but this is not based on the most nuanced science

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Ocean forecasting system unveiled

The Indian National Centre for Ocean Information Services (INCOIS) of the Ministry of Earth Sciences here inaugurated the Ocean Forecasting System for Comoros, Madagascar, and Mozambique at the third Ministerial Meeting of Regional Integrated Multi-Hazard Early Warning System for Asia and Africa (RIMES), held at Port Moresby, Papua New Guinea, on Friday.

The ocean forecast and early warning information on high wave, currents, winds, tides, sub-surface ocean conditions cater to users like fishermen, coastal population, tourism sector, coastal defence officials, marine police, port authorities, research institutions and offshore industries of these countries.

Safety at sea

These ocean services are aimed towards safety at the sea.

The system would offer oil spill advisory services, high wave alerts, port warnings, forecast along the ship routes in addition to tsunami and storm surge warnings and help in search and rescue operations.

New system launched

M. Rajeevan, Secretary, Ministry of Earth Sciences, and Chair, RIMES Council, launched the system for operational use in the presence of David Grimms, President of World Meteorological Organization (WMO); Wesley Nukund, Minister for Disaster Management, Papua New Guinea; Soulaïmana Kaambi, Deputy Minister, Comoros; Abdullahi Majeed, Minister of Disaster Management, Maldives; Anura Priyadharshana Yapa Yapa, Minister of Disaster Management, Sri Lanka; Subbaiah, Director of RIMES; Balakrishnan Nair, Head, ISG, INCOIS and Director General of Metrology and Disaster Management of 48 countries of Indian and Pacific Ocean region.

The INCOIS has already been providing these operational services to the Maldives, Sri Lanka and Seychelles.

The Ministerial council and the WMO lauded and placed on record the initiatives of INCOIS/India in providing the ocean forecast and early warning services to the Indian Ocean countries and taking a leadership in ocean services in the Indian Ocean region.

Real-time data

“The Ocean Forecast System developed for the Indian Ocean countries and the real-time data from their territories also help to improve the ocean forecast and early warning system for the Indian coast too,” said Balakrishnan Nair, Head, Ocean Science and Information Services, Hyderabad.

Wave surge (*kallkadal*) and coastal flooding that occurred from July 28 to August 3 in 2016 along Kerala and West Bengal were well predicted and real-time data from Seychelles were highly beneficial for predicting these incidents, as many of these remotely forced waves originated from the southern and western Indian Ocean, he added.

The ocean forecast and early warning services were most essential for safe navigation and operations at sea and the blue economic growth of many of these Indian Ocean rim countries and island nations.

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Why does the 2022 target for rooftop solar seem ambitious?

The government has set itself a target of 100 GW of solar power by 2022, of which 60 GW is to come from utilities and 40 GW from rooftop solar installations. While the 60 GW target seems achievable, the country is lagging behind on the target set for rooftop solar.

What is rooftop solar?

Rooftop solar installations — as opposed to large-scale solar power generation plants — can be installed on the roofs of buildings. As such, they fall under two brackets: commercial and residential. This simply has to do with whether the solar panels are being installed on top of commercial buildings or residential complexes.

What are the benefits?

Rooftop solar provides companies and residential areas the option of an alternative source of electricity to that provided by the grid. While the main benefit of this is to the environment, since it reduces the dependence on fossil-fuel generated electricity, solar power can also augment the grid supply in places where it is erratic.

Rooftop solar also has the great benefit of being able to provide electricity to those areas that are not yet connected to the grid — remote locations and areas where the terrain makes it difficult to set up power stations and lay power lines.

What is the potential for rooftop solar in India?

The Ministry of New and Renewable Energy has pegged the market potential for rooftop solar at 124 GW. However, only 1,247 MW of capacity had been installed as of December 31, 2016. That is a little more than 3% of the target for 2022, and 1% of the potential.

Why is it not being adopted widely?

One of the major problems with rooftop solar — and what affects solar energy generation in general — is the variability in supply. Not only can the efficiency of the solar panels vary on any given day depending on how bright the sunlight is, but the solar panels also produce no electricity during the night. Arguably, night is when off-grid locations most need alternative sources of electricity.

The solution to this is storage. Storage technology for electricity, however, is still underdeveloped and storage solutions are expensive. So, while some companies will be able to afford storage solutions for the solar energy they produce, most residential customers will find the cost of installing both rooftop solar panels and storage facilities prohibitive. Residential areas also come with the associated issues of use restrictions of the roof — if the roof is being used for solar generation, then it cannot be used for anything else.

Another major reason why rooftop solar is not becoming popular is that the current electricity tariff structure renders it an unviable option.

Many states have adopted a net metering policy, which allows disaggregated power producers to sell excess electricity to the grid. However, the subsidised tariffs charged to residential customers undermine the economic viability of installing rooftop solar panels. The potential profit simply does not outweigh the costs.

That said, imports of cheap solar panels are continuously placing a downward pressure on prices and so this scenario could change in the future. Commercial applications of rooftop solar are already viable in most states.

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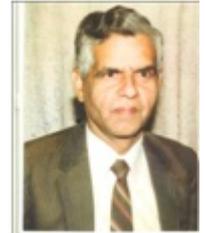
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70 years of Independence

Special Feature – I-Day 2017

Swift Surge Forward in Tourism sector



***O P Sharma**

Alongside rapid strides on other spheres, the Tourism sector in India now is surging forward; swiftly and surely. Gradually, our country with rich cultural heritage, dotted with many spots with nature's bounty and charms, sublime environs and numerous other attractions, pilgrimage places depicted as "Incredible India" is gaining popularity for its destinations. Tourist traffic is attaining new heights with this sector in top gear and still moving ahead to gradually tap its vast potential. Our nation is carving out its due share and status in the global tourism industry.

Tourism, a pivotal sector as a driver of social integration and economic development, is growing at impressive pace in recent years. Domestic travels for pilgrimages, business and varied other factors, is as old as our society. While there were just 17, 000 inbound tourists on the eve of our Independence, presently the figure for tourist traffic has shot up very significantly. But keeping in view the high potential, there is more scope for giving further boost to India's tourism industry. Due to some tangible bold initiatives and promotional schemes taken by the present regime, this sector will certainly go up carving out its due share in the global tourism and travel sphere.

Ever since achievement of Independence, keeping in view the vital importance of tourism, concrete policies and elaborate plans have been implemented in a phased manner with the result that steadily there has been growth and development in tourist trade. More sustained endeavors are required to secure larger share in global tour and travel sectors.

Latest figures indicate that tourism generated 14.02 lakh crore (US\$220 billion) or 9.6 per cent of the nation's GDP in 2016 and supported 40.343 million jobs, which is 9.3 per cent of its total employment. This sector is predicted to grow at an annual rate of 6.8 per cent to 28.49 lakh crore (US\$440 billion) by 2027, which is 10 per cent of our GDP. To quote an instance, India's medical tourism estimated to be worth US\$3 billion, which is projected to grow further to \$7–8 billion by 2020. It is pertinent to point out that in 2014 nearly 184, 300 foreign patients traveled to India to for medical treatment. About 88.90 lakh foreign tourists arrived in India in 2016 as compared to 80.27 lakh during the previous year, recording a growth of 10.7 per cent. Domestic tourist visitors numbered nearly 1,036.35 million in 2012, an increase of 16.5 per cent from 2011. Pilgrim-tourism too is registering ever-increasing numbers every year. The Prime Minister,

Narendra Modi has underscored need for involvement of youth power in projection and promotion of tourism industry.

As per the report of World Economic Forum on global travel and tourism, India ranks 40th out of 136 nations across the globe. Now with the present Government's emphasis on improvement of roads network, high-speed railway and air services, higher hotel accommodation, business opportunities, cashless payment system, clean environ and liberalized visa system and suitable human resources, the tourist traffic is expected to further grow up swiftly.

The Union Ministry of Tourism and all the States have to work as partners for working on suitably- designed national policies and plans for sustained growth of tourism. Visa policy has been rightly liberalized and vigorous world-wide campaign of "Incredible India" is yielding encouraging results. It is envisaged to give a further fillip to tourism sector and upgrade India's status in the global tourist traffic. E-tourist visa facility extended to over 150 countries and UDAN scheme among others, will go a long way in promoting domestic and foreign tourism.

There are well-designed tour packages and tourist-cum-pilgrim-circuits to suit all sorts of visitors. The Indian tourism and hospitality industry is key driver of growth among the services sector. Tourism is also a potentially large employment generator besides being a significant source of foreign exchange for the country. Every citizen has to abide by spirit of "Aatithi Devo Bhava" (every tourist is our honoured guest) and act as voluntary ambassador of tourism to attract more tourists.

India's rising middle class and increasing disposable incomes has continued to support the growth of domestic and outbound tourism. Domestic Tourist Visits (DTVs) has grown by 15.5 per cent year-on-year to nearly 1.65 billion during 2016. Foreign visitors have significantly gone up and India's foreign exchange earnings (FEEs) have through tourism increased by 32 per cent and touched US\$ 2.278 billion in April, 2017. India is expected to move up five spots to be ranked among the top five business travel market globally by 2030, as business travel spending in the country is expected to treble until 2030 from US\$ 30 billion in 2015. Foreign Tourist Arrivals (FTA) in India have witnessed an impressive growth in the last three years. During April, 2017, it stood at 7.40 lakh compared to 5.99 lakh in April 2016 and 5.42 lakh in April 2015. There has been a significant rise in Non-Residential Indians (NRI) travelling to India as well.

In the Union Budget 2017-18, more initiatives have been taken to give a boost to the tourism and hospitality sector by setting up five special tourism zones, special pilgrimage or tourism trains and worldwide launch of Incredible India campaign among others.

The Union Tourism Ministry and State Governments, Private sector, NGOs and each citizen must jointly put in their best to realize the country's full tourism potential and take lot of more innovative initiatives to make India a global tourism hub.

The concerted and innovative initiatives will certainly give further impetus to both domestic

and foreign tourism to realize India's full potential for positive results to emerge as a major player in the world tourism industry.

**Author is Jammu-based free-lance journalist.*

Views expressed in the article are author's personal.

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MNRE & GIZ Signs Agreement to Improve Framework Conditions for Grid Integration of Renewable Energies

MNRE & GIZ Signs Agreement to Improve Framework Conditions for Grid Integration of Renewable Energies

The Ministry of New and Renewable Energy (MNRE), Government of India and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH India on behalf of the Government of the Federal Republic of Germany signed an agreement on technical cooperation under the “Indo-German Energy Programme – Green Energy Corridors (IGEN-GEC)” here today . The main objective of this programme component is to improve the sector framework and conditions for grid integration of renewable energies.

In the distinguished presence of Minister of State (IC) for Power, Coal, New & Renewable Energy and Mines Shri Piyush Goyal and the German Ambassador to India, H.E. Dr. Martin Ney, the agreement was signed by Dr. Wolfgang Hannig, Country Director, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH India and Mr. A.N. Sharan, Joint Secretary, Ministry of New and Renewable Energy (MNRE).

Speaking on the occasion, Shri Goyal said “ am delighted that this relationship between GIZ and India will result in improve market mechanisms and regulations, help us train manpower, to ensure grid stability & integration of renewables into grid and ensure safer & secure grid and a grid which can take cyber challenges” . Shri Goyal further added that Germany is a very reliable partner country and has been supporting India in achieving its goal for sustainable development through bilateral cooperation for almost six decade now.

Dr. Ney added “When in July 2012 Power Grid Corporation of India submitted a comprehensive and well elaborated “Transmission Plan for Envisaged Renewable Capacity” to MNRE it paved the way for India’s ambitious goals to transform its power system by significantly increasing the share of renewable energies in the energy mix. Also in Germany’s “Energiewende” the evacuation and grid integration of renewable energy plays a pivotal role with major technological and fiscal challenges. Both the countries have very constructive dialogue under the Indo-German Energy Forum (IGEF).

Being committed to this objective, GIZ and MNRE will work on improving market mechanisms and regulations for integration of Renewable Energies; advancing technical and institutional conditions in specified target states, regions and on a national level; adding human capacities to handle systemic (strategic, managerial, financial, technical) Renewable Energies integration in an efficient and effective manner.

The IGEN-GEC programme is commissioned by the Federal Ministry for Economic Cooperation

and Development (BMZ) and jointly implemented by Ministry of New and Renewable Resources (MNRE), Ministry of Power (MoP), Government of India and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). This programme component supports the implementation of the Renewable Energy Management Centre (REMCs), Green Energy Corridors scheme of the Government of India which is a prerequisite for large scale grid integration of renewable energy thus contributing to achieve the 175 GW target of the Government of India for renewable energy generation capacity by 2022.

Based on the Indo-German Consultations held on 11th April 2013 in Berlin, both countries confirmed collaboration on the Green Energy Corridors. In the subsequent bilateral development cooperation negotiations, it was agreed that Germany will provide concessional loans of up to 1 billion Euros through KfW (German Development Bank) and up to 10 million Euros under technical assistance in forecasting, balancing, market design, network management and demand side energy efficiency, implemented by GIZ. These contributions have been further increased in 2015 and 2016 by concessional loans up to 400 million Euros for transmission infrastructure and up to 7 million Euros for training activities in the photovoltaic solar rooftop sector and energy efficiency in residential buildings under technical assistance through GIZ.

It was added that India & Germany will further benefit each other in the journey towards sustainable development. Economic growth and a cleaner world with successful continuation of cooperation & fruitful exchange.

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70 years of Independence

Special Feature – I-Day 2017

HARNESSING INLAND WATERWAYS FOR GREENER ECONOMY AND INCLUSIVE GROWTH



***Archana Datta Mukhopadhyay**

A sound and efficient transport infrastructure is the key to boosting economic growth and in turn, to alleviating poverty and promoting sustainable development. Inland water transport system ensures both, by way of providing access, mobility and connectivity and generating employment at the grassroots with lesser environmental footprint and cost.

In our civilization, rivers have played a crucial role as a mode of transport in carrying people and goods. Even in the present era, many countries depend heavily on inland water transport, especially for large and bulky cargo.

India is a land of rivers. It has 7500-km long coastline with approximately 14,500 kms of navigable waterways. This offers a huge potential for developing a cheaper and greener mode of transport. But only a very small percentage of trade is currently being carried out through these waterways and coastlines. Coastal shipping accounts for only 6 % and inland water transport for about 0.4% of trade.

Nearly 60 % of goods today travel by congested roads 25 % by rail networks. This slows down the movement of cargo, adds to uncertainties, increases the costs of trade, and leaves deep environmental footprints. It has been found that logistics costs in India account for about 18 percent of the country's GDP, which is much higher than China, USA, UK and many other countries. This makes Indian goods costlier and hence less competitive. As per World Bank analysis, the cost of transport of one tonne of freight over a km by road is Rs 2.28, by rail Rs 1.41

and Rs 1.19 for waterways. So logistics costs in the country can be brought down considerably by transporting more and more goods by waterways.

In this era of energy crisis, waterways have been found to be a fuel efficient, environment friendly and cost effective mode of transport, besides having the capacity to ease pressure on rail and road sectors. Inland Waterways Authority of India (IWAI), which came up in October 1986, acts as the nodal agency for optimum utilization of the vast untapped potential of our inland waterways.

The National Waterways Act, 2016, was an important watershed in the direction of developing the untapped potential of our inland waterways. Under the Act, 111 inland waterways across twenty four states have been declared as National Waterways (NWs). IWAI will be taking up projects for developing these waterways as environment friendly and sustainable modes of transport.

The first of such projects is the World Bank aided Jal Vikas Marg project on River Ganga, or the National Waterways 1. The objective of the project is to develop the stretch of river between Allahabad and Haldia to make it navigable for vessels with 1,500-2,000 tonne dead weight capacity. This is close to the carrying capacity of a goods train. For this, the project will develop a navigational channel of 2.2 to 3.0 meters depth and 35- 45 metre width. Multi-modal terminals are being constructed at Varanasi, Haldia, and Sahibganj, besides a Navigational Lock at Farakka. Modern systems of river information, training and conservancy works, night navigation facilities, and other modern facilities like channel marking, navigational lock, etc. are being developed to for efficient and safe movement of vessels. Phase-I of the project covers the Haldia—Varanasi stretch of the river. Once operational, the waterway will form part of a larger multi-modal transport network having linkage with the Eastern Dedicated Rail Freight Corridor and also with the area's existing network of highways. The cargo from the Gangetic states of Bihar and Uttar Pradesh now takes circuitous land routes to reach the sea ports of Mumbai in Maharashtra and Kandla in Gujarat. The development of NW1 will help these states to send some of their freight to the Kolkata-Haldia complex, thus making the movement of freight more reliable with less logistical costs.

A joint venture is afoot with Thompson Design Group, Boston (USA) and Infrastructure Architecture Lab of Massachusetts Institute of Technology, to identify the best locations for construction of 18 ferry terminals in six cities, namely, Allahabad, Varanasi, Patna, Munger, Kolkata and Haldia on NW1. The feasibility study takes into account the capacity of freight and passenger movements of each city with a view to integrating these terminals with the existing transportation networks and facilities of each city.

The NW1 has the future of emerging as the leading logistical artery for the entire northern India, which passes through one of India's most densely populated areas and resource-rich regions, and generates an estimated 40 percent of India's traded goods. The region's teeming markets also attract goods from other parts of the country. The network of a water- road-rail link will help the

region's industries and manufacturing units to have a seamless flow of goods to markets in India and abroad. Further, it will also give wider market access to the farmers of this agriculturally-rich Gangetic plain.

Since the river Ganga occupies a special place in the social, cultural and environmental milieu of our country, the Inland Waterways Authority of India (IWAI) follows the principles of 'working with nature' to protect the river's diverse fauna and aquatic biodiversity. For this, minimum dredging is being undertaken for passage of large barges carrying up to 2,000 tonnes of cargo. In places where large shoals and islands exist, temporary structures of natural materials like bamboo are only used to channelize the water. IWAI is also ensuring that water traffic does not impact the two aquatic wildlife sanctuaries that fall along this stretch of the river -- the Kashi Turtle Sanctuary at Varanasi and the Vikramshila Dolphin Sanctuary at Bhagalpur.

IWAI is in the process of developing thirty seven more NWs in the next three years. Ro-Ro transportation has started between Dhubri and Hatsingamari and slipway facilities are being constructed at Pandu on River Brahmaputra, or NW-2. Normal development works are ongoing on NW-3. The development of NW-4 (Kakinada- Puducherry Canal along with Krishna & Godavari Rivers), NW- 5 (East Coast Canal with Brahmani & Mahanadi Delta), NW-16 (Barak), NW-37 (Gandak), NW-40 (Ghagra) and NW-58 (Kosi) also are in progress.

While developing the waterways, the legal framework governing inland waterways vessels is also being revamped. A new Bill is on the anvil to amend the century old inland Vessels Act, 1917, in keeping with needs of the modern inland water transport and the required legal framework. The 2017 Bill addresses the existing lacunae regarding variation of standards of inland vessels across the states. As per the Draft Bill, Central Government would be the nodal authority to stipulate uniformly applicable standards and measures for safe navigation of inland Vessels.

Once fully operational, the integrated system of water-road and rail network will herald a new era of inclusive growth and green economy in India.

**Archana Datta is a former civil servant. She was Director General (News), AIR and Doordarshan.*

Views expressed in the article are author's personal.

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Harvey makes landfall in Louisiana

At sea: A home surrounded by flood waters in Houston; and, right, the Interstate 10 highway, which was closed due to flooding. AP David J. Phillip

After pouring record rains on Texas, Tropical Storm Harvey made a second landfall on Wednesday to strike Louisiana, a State that still bears deep scars from 2005's Hurricane Katrina.

The second hit comes five days after the monster storm slammed onshore as a Category Four hurricane, pummeling the U.S. Gulf coast with torrential rains that turned neighbourhoods into lakes in America's fourth largest city, Houston.

Harvey made its second landfall just west of the town of Cameron, the National Hurricane Center said, with "flooding rains" drenching parts of southeastern Texas and neighbouring southwestern Louisiana.

Louisiana residents braced for Harvey's ferocious maximum sustained winds nearing 45 miles (72 km) per hour, with forecasters predicting another five to 10 inches (13 to 25 cm) of rain could pour on the region.

They expected Harvey will gradually weaken to a tropical depression by Wednesday night, meaning maximum sustained winds should slow. But low-lying New Orleans was still girding for the storm, just a day after the 12-year anniversary of Katrina, which ravaged the vulnerable city famous for its jazz music and cuisine.

The New Orleans branch of the National Weather Service said a heavy rain threat remained over southeast Louisiana and southern Mississippi through Thursday, when relatively drier weather is finally slated to arrive. One night prior to the second landfall, New Orleans Mayor Mitch Landrieu tweeted to "remind #NOLA that we are not yet in the clear", urging residents to "remain vigilant and cautious".

In Texas emergency crews were still struggling to reach hundreds of stranded people in a massive round-the-clock rescue operation — but the National Weather Service tweeted that weather conditions there were to at last improve. The storm had transformed roads into rivers in America's fourth-largest city, driving more than 8,000 people into emergency shelters.

Houstonians woke up on Wednesday from a night-time curfew declared by Mayor Sylvester Turner aimed at aiding search efforts and thwarting potential looting in the flood-ravaged city. U.S. media reports indicated the death toll could have risen to 30, and authorities feared confirming more once the worst had past and search teams could again travel roads.

Six million impacted

The National Weather Service said over six million Texans have been impacted by 30 inches or more of rain since Friday.

President Donald Trump toured the Harvey disaster zone in Texas on Tuesday.

The National Weather Service tweeted that Harvey appears to have broken a U.S. record for most rain from a single tropical cyclone, with nearly 52 inches (132 cm) recorded in the town of Cedar Bayou.

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Managing embankments

Life had come to a standstill in the [Ganga-Brahmaputra floodplains](#) where large tracts of land were reeling under floods. Everywhere there were submerged houses, broken bridges, and wasted railway tracks. The fury of the waters in the Kishanganj and Katihar districts of Bihar had cut off the road and rail services in north Bengal, and consequently Northeast India's connectivity by rail with the rest of India. On such occasions, schools routinely turn into relief centres and schoolchildren are forced to take a "flood vacation". Access to water and sanitation is difficult. Open defecation is common, and the use of contaminated water leads to a peak in water-borne diseases. Agricultural land is either covered with sand or remains waterlogged.

Further accentuating the misery is the failure of embankments — the gold standard for flood protection. An embankment is an uplifted earthen structure constructed along the river channel to artificially reduce the size of the floodplains by constricting floodwaters to a narrow stretch. The land outside the embankment is supposed to be safe from floods. However, embankment breach resulting in flooding the "safe" areas is routine. We need a paradigm shift in the way these embankments are managed. It is important to involve the community that is close to the embankment in its management. Only then can we break the build-and-forget mentality that currently rules the bureaucracy.

Bihar floods: when home is a highway

Our study of over 100 villages in the Ganga-Brahmaputra floodplains found that villages in these areas are exposed to diverse water-related hazards depending on their location vis-a-vis an embankment. Those located inside the embankment are vulnerable to floods and riverbank erosion, and those outside, in the "safe" areas, are prone to extended periods of inundation. This takes place when the construction of an embankment causes the drainage lines to be blocked, the regulators in the embankments become dysfunctional, or when there is a backflow of the larger river in spate. The people in these "safe" areas suffer from a perennial fear of embankment breach, which is not entirely unfounded. In Bihar in 2008, there was a colossal embankment breach in the Kosi river basin. This year too, in parts of Assam, Bihar and West Bengal breaches have caused flooding. Only in a few cases have newly constructed embankments been able to protect villages located outside them from floods. Despite this, in flood-prone areas with no embankments, people still articulate the need for embankments.

Till now, embankments have been managed by irrigation or flood-control departments. However, the communities near the embankments are best positioned to take care of them. The responsibility of embankment management could be devolved to the community, while the ownership right resides with the state. But this task of decentralisation will not be easy when society is fractured along the lines of caste, class, and religion. We must remember then that disaster is non-discriminatory and affects all.

To incentivise collective action from the community, the state has to create an enabling institutional environment. The community-based organisations (embankment management committees) should be empowered to earn revenue from the embankments through levying tolls (as most embankments are also used as roads), and undertake plantation activities (and sale of the harvest). In areas where villages exist both inside and outside the embankment, their interests conflict. In such cases, efforts could be made to ensure that the former has a greater share of the revenue. This will dissuade them from causing a breach. While the irrigation or flood-control departments might issue tenders for periodic maintenance activity, the committees could act as a partner to partly implement the same, or act as a monitoring agency. Payment to contractors could be conditioned upon a joint inspection by the irrigation department and the embankment

management committees.

Promoting decentralised management systems is yet to be tested for embankment management, even as participatory irrigation and joint forest management are established practices. But if the past teaches us something, it is that build-and-forget cannot be an option for embankments. If we have to shift from reactive flood protection to year-round flood governance, we must design ways of embankment management in flood-prone areas. Participatory embankment management could be the way forward.

Nirmalya Choudhury is a Consultant for Tata Education and Development Trust, and member of the research team at Centre for Development and Research, Pune

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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Powering aspirational India

How much electricity is needed by India? To answer this, one approach is to follow a top-down econometric model whereby one examines growth in the economy, looks at the relationship between [economic growth and energy requirements](#), and incorporates influence of technological and policy changes exogenously. The alternative is a bottom-up approach, whereby one estimates demand based on equipment saturations, efficiencies and usage.

A simple method is to look around and draw conclusions. As per data for 2014 published by the International Energy Agency, average global per capita electricity consumption is 3030 kWh (kWh is colloquially known as a unit). The corresponding figure for India is about 805 units, and for developed countries of the OECD, it is 8,028. A majority of the OECD countries are in the temperate climate zone. Therefore, let us examine the scene around India: the corresponding figure for Singapore is 8,844, for Malaysia 4,646 and for Thailand 2,566. The projected global average per capita consumption by the middle of the century is 7,500 units. We can use this data to set a target which India can aim at.

An emphasis on energy conservation and improvement in energy efficiency of industry and household gadgets will help in reducing electricity consumption, but bringing it down to below 5,000 units per annum to enjoy a standard of living enjoyed by citizens of OECD countries seems difficult. Assuming India's population by the middle of century will be about 1.6 billion and transmission and distribution losses will come down to the lowest technically feasible value of about 7%, India must plan to generate about 8,600 Billion Units (BU) to provide 5,000 units per capita per annum to its citizens.

Many don't have power in 'power-surplus India'

The cumulative average growth rate of electricity generation in India for the period 2006-07 to 2015-16 was close to 6%. In 2016-17 generation by utilities was 1,242 BU. Data for generation from non-utilities is not yet available, but one can assume it to be around the same as in 2015-16, i.e. 168 BU. The total generation was thus 1,410 BU. Assuming a population of 1.3 billion, it translates to a per capita generation of 1,100 units. Thus, electricity generation projected for 2050 is six times the total generation in 2016-17 and in terms of per capita generation, it is about 4.5 times. India has a long way to go.

The target of per capita availability of 5,000 units per annum is very modest because of several reasons. The percentage share of electricity in total energy consumption is increasing. As per estimates by the International Atomic Energy Agency, this share was 34.8% in 2015 for Middle East and South Asia, and is projected to increase to 52% in 2050. The Government of India has announced policy initiatives such as electricity and housing for all, accelerated infrastructure development, Make in India, electrification of transport, etc. which call for more electricity and on a reliable basis.

Many have opined that we should return to a frugal way of living and consume less electricity. Can one expect the young in India to do that when electricity consumption is continuously rising elsewhere in the world? Aspirational India has a desire to work and live in air-conditioned spaces, reduce the drudgery of home work by using electrical appliances, entertain itself by deploying the best theatre system, commute in comfort in non-polluting transport and so on. Once basic amenities are available, an ordinary Indian will become an aspirational Indian.

Human lives have become more productive because of electrical lighting and indoor climate control. Indoor heating for climate control increased productivity in countries in colder regions of

the world and air-conditioning is doing that now in tropical countries, including India.

Given this backdrop, we must maximise the use of low-carbon energy sources, i.e. hydropower, variable renewable energy (VRE), and nuclear power. Last year hydroelectricity generation was 122 BU; exploiting the additional potential will take time.

A NITI Aayog report says India's solar and wind energy potential is greater than 750 GW and 302 GW respectively. Assuming a load factor of 20%, this could generate 1,840 BU. All these numbers are rough estimates, but make it clear that the total possible generation from hydropower and VRE can at best be about a quarter of the projected requirement of 8,600 BU.

Wherefrom will India get the rest of electricity? The share of electricity generated by nuclear power must be ramped up as soon as possible and large investments must be made in research and development in electricity storage technologies to derive full benefit from VRE sources. Until installed capacity based on low-carbon sources picks up, fossil fuels have to continue playing their role. Recent moves such as the Cabinet nod to the construction of 10 indigenous pressurised heavy water reactors, taking further steps for the construction of units 3-6 at Kudankulam, and completing all steps towards operationalisation of the nuclear cooperation agreement with Japan are all steps in the right direction.

R.B. Grover is Homi Bhabha Chair, Department of Atomic Energy and a Member of the Atomic Energy Commission

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