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RECOMMENDATIONS

Challenges of Engineering for Sustainable 10% Growth and Beyond

To become an economic power, technology and economy needs to be considered in an integrated manner rather than as separate entities. The engineering community will have to support the nation in acquiring economic leadership and progress to achieve India's vision of attaining the status of a 'developed nation' by 2020. The economic development of India with a double-digit growth rate presents an enormous challenge and consequently presents an equally enormous opportunity to our engineers.

Engineering in Agriculture for Economic Progress

Agriculture is a way of life of Indians. Agriculture supports 65-70 per cent of population for their livelihood. Poor growth rate in agriculture is an issue to be looked into. Agriculture has to grow beyond 4% if the nation is to grow at a rate of 10%. Following recommendations have been made.

- There should be mechanization of agriculture for development and optimal utilization of natural resources leading to higher productivity and reduced cost of production.
- Engineering inputs for modernization of production and post production agriculture is a must.
- Proper blend of conventional and renewable energy technologies in agriculture & irrigation should be applied.
- Energy conservation in agriculture, irrigation and post-production agriculture be given utmost importance.
- Agro-based technologies specific to NE Region should be developed.
- Steps should be taken for application of Information Technology in a big way for communication between farmers and scientific institutions for dissemination of information.

Education for Engineering in Present Context

Access to engineering education in India is not adequate because of uneven distribution of technical institutions. Skilled technical manpower will be required in a large scale to meet our challenges for attaining 10% growth. Quality of technical education has to be improved. As such recommendations are as follows :

- States with low capacity technical education should increase capacity.
- Quality of technical education is to be improved – introduction of continuous evaluation, credit and grading system should be given importance.
- To enhance scope of technical education in State like Assam, Technical University should be established.
- Upgradation of Polytechnics should be stressed.

- As establishment of Technical Institution will attract more Industry because of availability of locally employable persons, due thought should be given for that.

Application of R&D for Competitiveness

There is an urgent need for a strong R&D base to provide the foundation for growth in industry, science & technology and agriculture and also to sustain it in global competitive environment through continuous innovations. Lack of attention/ investment in the R&D by the industries has made the career in R&D less attractive and the potential research talents have switched over to other jobs. This has made a crisis in availability of manpower for R&D. The seminar deliberated on these core issues involved under the sub theme and recommended as follows:

- Since R&D is the key for long term development and its sustainability in global competitiveness, industries should give topmost priority and importance to R&D within their organization and establish adequate infrastructure. Stress should be on advance planning for R&D for future technologies based on global market.
- Investment in R&D do not yield immediate returns in terms of productivity or growth, but its long term returns are likely to be significant and manifold. Industries should realize this vital fact and make more investment in R&D for their own business interest.
- Competent and capable manpower in R&D are assets for the industry and the country. Their services should be suitably remunerated to make the career in R&D more attractive to the prospective talents.
- There should be more research collaborations between Engineering Institutes and industries.
- Career in R & D to be made more attractive – Industry Oriented R & D, better compensation to R & D personnel and engineering teachers.

Exploration & Exploitation of Natural Energy Resources

Energy is the basic input required to fuel economic growth. To make the energy available in utilizable & sustainable form to commensurate with the double digit growth of economy envisaged is a challenge. The depleting fossil fuel reserves and environmental issues involved in utilizing such resources, slow pace of development of hydro-power resources, existing gap between supply & demand position, status of development of technology for utilization of new and renewable energy resources are some of the issues deliberated upon in the Seminar to evolve the strategy for exploration & exploitation of natural energy resources and following recommendations were made.

- Government should come out with a comprehensive long term energy policy to meet the future energy demand in consideration of all the issues involved in exploration and exploitation of energy resources.
- Under the present energy scenario, India cannot afford to keep its huge hydro-power potential - which is clean and renewable, unutilized. Feasible hydro-power projects need to be taken up in phased manner addressing the concerned environmental issues judiciously. Priority should be given for taking up of run-of-river schemes and underground/ tunneling hydro-projects posing lesser environmental problems.
- To avoid inordinate delays in execution of hydro-projects generally experienced in India, "Accelerated construction model" should be adopted to ensure speedy execution of such projects.

- More emphasis should be given to utilize the new and renewable energy resources like solar, wind, bio-mass etc. under decentralized system. Major thrust is necessary to develop technology requiring lesser capital investment which will certainly boost up utilization of such resources.
- Use of new energy resources like Coal-Bed-Methane, Gas hydrates, Hydrogen, Ocean thermal energy etc. need to be taken up with right earnest.
- While use of coal cannot be avoided, cleaner and efficient technologies should be developed / adopted for utilizing coal in power generation.
- Development of bio-diesel could certainly curb the demand of crude oil in transport sector. Development of bio-diesel and plantation of bio-diesel feedstock plants should be taken up in a big way with due consideration of the environmental angle. This would not only bridge the supply and demand gap, but could also provide employment to thousands of people.
- Energy conservation measures in domestic, industrial, agricultural and commercial sectors should be pursued more vigorously.

Transport System for Uniform Development

Transport sector is a pivot around which the entire economy and social growth of a network revolves. It is a tough challenge to the engineering community. Modernization of existing transport infrastructure, creation of new sustainable transport system as well as proper maintenance of created assets deliberated upon in the seminar to evolve the strategy for attainment of high economic and social growth. Issues to be looked into in the transport sector are capacity constraints – heavy congestion in rail corridors, roadways, urban transportation, airports and ports, lack of proper maintenance, road connectivity to rural areas, and absence of quality management system in rural road sector. Recommendations made are as follows:

- Government should come out with a comprehensive long term policy to meet the basic socio-economic needs of masses where transport sector plays vital role.
- Transport sector revamping requires massive investment, as such government should encourage public private partnership.
- Government should prioritize implementation of government sponsored/externally aided projects to remove the regional imbalance.
- Government should formulate such proposals to attract private sector participation to earn additional revenues through commercial exploitation of huge untapped assets particularly in railway department. Government should also take steps for capacity augmentation of existing facilities.
- A proven quality management system, especially in rural road sector, adequate institutional arrangement and effective utilization of vast human resources shall be established to get the desired result.
- Adequate steps which have bearing on the quality, sustainability, transparency, accountability and above all conforming to customers' requirement should be taken.
- Government should encourage involvement of stakeholders at the stage of execution in the monitoring the quality.

Rural Urban Interface for Equitable Development

One of the biggest barriers in achieving the double-digit growth rate is India's 700 million strong rural population in about 600,000 villages. The rural economy needs significant help to approach this aspired growth rate. If India has to progress, there is little doubt that India's villages have to progress, too. Transforming Rural India is a challenge that should focus the engineering community. Following recommendations were made.

- For providing urban facilities in rural areas they must be provided
 - Physical Connectivity: Road, Transport.
 - Power connectivity.
 - Electronic Connectivity: Communication Networks.
 - Knowledge Connectivity – educational institutions.
 - Market Connectivity – first hand information on market conditions.
- Location specific models should be developed. Commercially viable business models where Govt. is not a funder but an enabler - for empowering people with access to computing and the internet – for getting new ideas, learning new skills, information on markets, new agricultural techniques, new government initiatives – *Knowledge connectivity and Market Connectivity*.

Conservation and Management of Water

Water is a critical entry point for a better tomorrow. Though abundantly available, freshwater, which we use for drinking, daily needs, sanitation, irrigation and industries, has become a rare commodity, and is threatened due to misuse, mismanagement, over- exploitation and pollution & contamination. Other issues in water management are insufficient and inefficient exploitation of water resources and need for development of watershed areas of Northeast. Following recommendations were made.

- Development of location specific Integrated Watershed management Systems in a sustainable, rational, efficient and equitable way through extensive soil conservation, catchment area treatment, preservation of forest and increasing the forest cover and the construction of Check Dams should be promoted.
- A well-developed water resources information system through space technology such as remote sensing with GIS and GPS should be developed for proper water resource development and management. New technology for Laboratory simulations and modeling studies for analysis, planning and management of wide range of problems related with the use of water should promoted with international collaboration, support, linkages with research and academic institutions
- An integrated, multidisciplinary approach is needed to evolve permanent flood mitigation and erosion control measure for Brahmaputra and Barak valley. Water Resources Development should not narrowly focus on hydropower, but consider a holistic multi-sector development approach. An umbrella organization for water resources management needs to be formed that would serve as a nodal organisation. To empower such a nodal organization, appropriate laws should be enacted. Since bulk of the country's hydropower resources is located in the North-

Eastern regions, harnessing these resources should be accorded priority adhering to National Water Policy 2002 to boost economic growth of the nation.

- In order to ensure a better quality of life for everyone, now and for generations to come it is essential to focus attention on the key environmental issues involving Land, forest, biodiversity, surface water, rivers, wetlands, ground water contamination, C-N-P loading, urbanization impacts, industrial pollution, GHG emissions and climate change. These issues are even more complex in case of North-Eastern region due to its vast water availability and unique topography and therefore, needs to combine ecological, social and economic concerns, so that they can offer business opportunities for corporate sector that can improve the lives of the people.
- There is an utmost requirement of filling the knowledge gaps, tackling root causes taking an integrated approach, and for mobilizing action. More integrated science & technology for solutions and better forecasting tools are very much essential. The water quantity/quality monitoring system should be strengthened and proper assessment is needed to consolidate knowledge.

Disaster Management & Rebuilding

Throughout the history, human lives and property have been repeatedly destroyed or damaged by natural disasters. Major causes and influencing factors for increased vulnerability to disasters are inadequate physical infrastructure, environmental degradation, poor management, inappropriate territorial occupation and land use, concentration of population in hazard prone areas. The above causes are directly influenced by pressure of chronic poverty, social and economic exclusion, rapid urbanization, inadequate planning, weak administrative set up, climate change and climate variability as well as lack of adoption of scientific and engineering advancements.

Major issues discussed were – Relief, Rehabilitation, Reconstruction, Mitigation and Preparedness. Following recommendations were made.

- There is need for institutionalization of systems for training and capacity building for proper disaster risk mitigation. The network of disaster management information should be strengthened with better sharing of knowledge between government, NGO's/ CBO's and other stakeholders involved in disaster management.
- Focus should be laid in generation of awareness at all levels for disaster management and risk mitigation and research should be oriented to develop technologies for disaster resistant and cost effective housing.
- There should be standards and risk management of disasters.

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