Engineering Council of India

7th National Conference

Theme : Engineering Profession - Vision 2020

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Lodhi Road, New Delhi -110003

Proceedings

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Glimpses of the 7th National Conference

"ENGINEERING PROFESSION – VISION 2020"

Dr. Uddesh Kohli presenting Welcome Address

Dr. Baldev Raj delivering Theme Address

Dr. Narendra Jadhav, Member Planning Commission presenting Inaugural Address

Dr. P.R. Swarup delivering Vote of Thanks

Panel Session - Chaired by Shri K.K. Kapila in progress

A View of the Audience

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7th National Conference
on
Engineering Profession – Vision 2020

November 30, 2009

Main Auditorium
SCOPE Complex Lodhi Road, New Delhi

Proceedings

Engineering Council of India
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Programme

Time	Programme	
0830 - 1000 Hrs	Registration	
1000 - 1100 Hrs	Opening Session	
	Welcome Address	Dr. Uddesh Kohli, Chairman, Engineering Council of India (ECI), Chairman Emeritus, Construction Industry Development Council (CIDC)
	Theme Address	Dr. Baldev Raj, Hon. Member, International Committee on NDT, Distinguished Scientist & Director, Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakam, Tamil Nadu
	Inaugural Address by the Chief Guest	Dr. Narendra Jadhav, Member, Planning Commission
	Vote of Thanks	Dr. P.R. Swarup, Director General, Construction Industry Development Council (CIDC) and Senior Vice President, International Council of Consultants (ICC)
1100 - 1130 Hrs	Tea / Coffee	
1130 - 1300 Hrs	Technical Session - I	
	Theme	Engineering Profession Today and Vision for 2020
	Session Chairman	Shri Mahendra Raj, Vice Chairman, ECI & President, Indian Association of Structural Engineers
	Keynote Speaker	Dr. G.P. Karmakar, Professor in Petroleum Engineering, Rajiv Gandhi Institute of Petroleum Technology, Raebareli
		Dr. Abha Kumari, Assistant Professor, Dept. of Biotechnology, Delhi Technological University, Delhi
	Expert Intervention	Shri L. Pugazhenthy, Immediate Past President, IIM and Executive Director, ILZDA
	Discussion	
1300 - 1400 Hrs	Lunch	

1400 - 1530 Hrs	Technical Session- II	
	Theme	Evolution of an Action Plan for Achieving Vision 2020
	Session Chairman	Lt. Gen A. K. Puri, PVSM, AVSM (Retd.), Ex D.G., Border Roads, Chairman, Indian Institution of Bridge Engineers (DSC)
	Keynote Speakers	Prof G.K. Suraish Kumar, Indian Institute of Technology Madras, Chennai
		Shri D.G. Roychowdhury, Dean, Mechanical Sciences, Hindustan Institute of Technology & Science, Padur
		Shri M. L. Batra, Member Secretary, Southern Regional Power Committee, Bangalore
		Prof. Pooja Tripathi, Asst Prof, Indraprstha Engineering College, Ghaziabad
	Discussion	
1530 - 1600 Hrs	Tea / Coffee	
1600 - 1700 Hrs	Concluding Session	
	Theme	Panel Discussions and Recommendations
	Session Chairman	Shri K.K. Kapila, CMD, Intercontinental Consultants & Technocrates Pvt. Ltd. & President, Consulting Engineers Association of India
	Panelist	Shri R. Sampat, Vice President, Indian Institute of Industrial Engineers (IIIE) and Chairman, Delhi Chapter, IIIE
		Dr D.P. Misra, Deputy MD, Jacobs H&G Pvt Ltd, Member, BOG, Engineering Council of India and Past President, Indian Institute of Chemical Engineers
		Dr. O.P. Taneja, Principal, Haryana Engineering College, Jagadhri, Distt. Yamuna Nagar
		Shri J. S. Saluja, M D, SCPL, Senior Vice president, Indian Institution of Plant Engineers and Member Board of Governors, Engineering Council of India
	Discussion and Recommendations	

Introduction

Dr A P J Abdul Kalam, the former President of India, while unfolding his India Vision 2020, identified 5 areas based on India's core competence for integrated action to transform India into a developed country by the year 2020.These include (i) agriculture and food processing, (ii) infrastructure with reliable and quality electric power, (iii) education and healthcare, (iv) information and communication technology (ICT) and (v) critical technologies and strategic industries.

The Planning Commission Committee's Report on India Vision 2020 has identified eight major challenges, namely, (i) a targeted approach to bring millions of families above the poverty line, (ii) generation of nearly ten million of new employment opportunities per annum, especially for those in the lower income groups, (iii) eradication of illiteracy. (iv) a concerted effort to raise primary and secondary enrolment rates and minimize dropouts, (v) improved public health to reduce infant mortality and child malnutrition, (vi) massive investment in power generation, telecommunications and other physical and social infrastructure, (vii) accelerated acquisition of technology capabilities to raise productivity in agriculture, industry and services, and (viii) becoming a more important player in the world economy in terms of both trade and investment.

Whatever scenario we may consider, it is ultimately the human knowledge, skills and capabilities which will meet the challenges and deliver the Developed India 2020 which we all dream about. A world-class education, particularly higher technical education is necessary to develop and access critical technologies and systems. All sectors of our economy would need world-class professional engineers' apart from the other inputs. The important question here is: are we having such engineers today and do we strategies for developing the world-class engineers and technologists who could help in realizing the Vision 2020 for the country?

It is obvious that India will have to convert its base of engineering education into a world-class professional engineering education and training establishment which will provide professional engineers for its economy and to the international market of engineering services. Our engineering education may require a paradigm shift to ensure quality to meet the needs of the economy. In developed countries, professions are regulated in order to ensure that practitioners follow the standards set for the professions. In India, however, in the case of engineering profession, we still have to bring in a statutory regulatory mechanism in position which will meet our own requirements of accountability and professional conduct as well as those to ensure mobility of engineers across borders.

Objective

The 7th National Conference was organized to take a critical look at the requirements and expectations from the engineering profession for meeting the challenges that India would face in 2020; deliberate as to what needs to be done to develop the profession to meet these challenges. A summary action plan was expected to emerge from the deliberations for implementation by the stakeholders. The conference met this objective fully.

Recommendations

1. In India, engineering profession is not yet regulated. India should also regulate its engineering profession as the developed countries and other countries are. For this, the government should bring on the statute the Engineers Act and set up the statutory Council of Engineers without further delay, which will meet the requirements of accountability, professional conduct, ethics and those that will ensure the mobility of Indian engineers for providing the professional services abroad

2. The industry, academia and the government should work together for re engineering the engineering education for achieving the vision 2020.

3. The engineering curricula and its delivery mechanism need to be reformed for producing multi-skilled engineers of quality which the industry needs.

4. There should be one standard curricula for engineering education in all the institutions across the country-IITs, NITs and the other engineering colleges.

5. There should be one common entrance test for engineering education throughout the country which should also include assessment of the aptitude for engineering profession.

6. The current quota policy for admission to engineering colleges is proving counter productive. This policy should be changed; and the merit alone should be the core principle of the policy.

7. During-the-course industrial training should not be confined to mere visits to industrial units, as is the case at present; it should be on industry problems or projects. The training should also be assessed and the credit added to the marks obtained from written examination.

8. There should be a mandatory paid industrial internship for about six months after the course is over. It should also be assessed and the credit of this assessment should be added to the total score-written exam+ during-the-course industrial training +internship. The engineering degree should be given after this. The industry should be compensated for any expenditure that it may incur on this internship via the tax route.

9. The regulatory authority should assess the demand for engineers- discipline-wise and sector-wise from time-to-time as deemed appropriate; it should decide sanctioning of the new engineering colleges after identifying the gap in the demand-supply balance of engineers.

10. There is no synergy in the various efforts that are being made by the various agencies in training the technical workforce. This issue needs to be addressed .

11. Subsidy for developing sustainable technologies including for the energy sector should continue to be available to the R&D sector as a matter of policy till such time it is required.

12. We need to collaborate with the world class foreign universities for the faculty exchange, establishing the research centres, apart from developing the curricula.

13. The industry-faculty exchange should be made a mandatory feature of our engineering education system. Under this system, working engineers and technologists from the industry should go and teach in engineering colleges for some years; and like-wise, the faculty should go and work in the industry for the same period.

14. There is a net shortage in the availability of quality faculty, which is further growing with the accreditation of new engineering colleges. The competent authorities should take suitable measures, as required, to address this issue. This may also include allowing those working engineers and engineer consultants who have created a name for themselves to teach engineering.

15. A working institutional mechanism needs to be set up in the country for training the faculty and also training the trainers and monitor it regularly.

16. The suitability of the current engineering education and training to sustainable development of industries, particularly the energy sector needs to be assessed and if found not suitable, measures should be taken to reform it, as required .

17. The Industrial Training Institutions (ITIs) should be modernised and brought at par in quality with that of similar institutions in the developed countries. This should include the infrastructure, the faculty, the curricula and its delivery mechanism.

18. The present regulatory mechanism of engineering education (AICTE) needs to be made more effective and efficient so that it can deliver what is needed of it - the quality engineering education.

19. We need to create a standing institutional interactive mechanism of the engineering institutions and the industry for making engineering education industry-specific.

20. India should have some national standards for both the basic education and higher technical education, particularly engineering education which should also include concerns for sustainability.

21. There should be a standing mechanism for monitoring whether the standards are being maintained by the engineering institutions across the country; if not, remedial measures should be taken as the earliest, as required. The professional bodies of engineers can jolly well be entrusted with this task.

22. Students exchange programme with foreign universities / professional institutions should be encouraged and supported by the government as a matter of policy through funding the concerned institutions.

Executive Summary

The 7th national conference with the theme: "Vision 2020 -Role of Engineers & Technologists" was organized to take a critical look at the role that engineers and technologists would have to play in realizing the vision 2020 - the status of a developed country for India in that year. It also deliberated on the expectations from engineering profession, and what needs to be done, particularly for further developing the engineering profession for meeting these expectations. Accordingly, the conference looked at the current status of engineering education and training, identified issues which need to be addressed for ensuring the availability of world-class engineers and technologists to the fast growing Indian economy and for trading in the engineering services abroad-opening up of which is round the corner, identified measures that need to be taken to resolve these issues so that these do not become a serious constraint in realizing the higher growth of Indian economy. Particularly, it discussed the quality of engineering education and R&D, the current policy governing admission to engineering courses, sanctioning of new engineering colleges, quality issue of the infrastructure and faculty of a large body of engineering colleges, shortage of the quality faculty, standards of engineering education, up gradation of training institutions of engineer technicians, the current quota policy and entrance test for engineering education, role of consulting engineers and technologist and that of the professional associations of engineers in the required continuing professional development of engineers in the growing economy and suggested measures for bridging the gap, etc,. The conference also looked at the issue of regulation of engineering profession in India, as it is in the developed and many developing countries.

India is today the second fastest growing economy in the world. Our economic policies are now right and we have made our solid commitment for continuing our efforts to maintain the high growth rate of our economy. This is a positive position for us to rely on for taking further steps which we need to take for realizing the vision 2020. We know that it is ultimately the human knowledge and skills which will meet the challenges and deliver the developed India 2020. India is a young country with the average age of its population being around only 24 years. By the year 2020, the average age of India's population will be 27 years. It will still be a young country. When we look at the developed countries, we find that these countries reached to their developed stage when they had also this demographic advantage. This advantage, however, will not make India automatically a developed country; it will depend on the role of education sector including higher technical education. We will have to bring up this sector to the stage of what it is in the developed countries. We will have to match with the developed countries in formal skill development levels of our workforce.

According to the sample survey, 2004-05, only 2 % of our youth have any kind of formal vocational training; 8 % of the youth had some kind of informal on-the-job training. It means that only 10% of our youth has some kind of formal and informal vocational education and training; and 90% of the youth were going to the job market without any kind of formal / informal vocational training. The present position on this remain by and large, the same. This is where our biggest challenge lies. When comparing it with the rest of the world we find, 87 % of the youth of South Korea get formal or

informal vocational training. India is stuck at mere 10 % only. Our gross enrolment ratio (GER) is 11 %; this means that around 89 % of our youth has no access to higher education. We have targeted GER to 15% by the end of the XIth Plan; and then on to 20-23 % by the end of the XIIth Plan. We need to do a lot more. Aggregate deficit of technically trained workforce world-over is estimated to be around 500million people by the year 2022. India can become a reservoir of this work-force provided we act now; and we should act to meet this challenge.

India stands connected globally. This global connectivity has advantages and disadvantages. It works as per the natural law: survival of the fittest. The three pillars of globalization are equity, ethics and ecosystems. A developed civilization rests on three pillars namely wealth generation and management, equity in education and health care and protection of the eco systems. Our future development will have to be sustainable. We need to have consistent policies which are compatible with the global connectivity. We will have to remove deficiencies and bottle necks that are still there in our economy such as, our legal system, governance, infrastructure, health care, education, particularly higher technical education, etc. The global connectivity also demands from us a world-class professional workforce. Particularly, Indian engineers and technologists should be competent to met challenges for developing the next generation technologies and skills to tackle future problems including those which will arise from the world without boundaries and from the concerns arising from maintaining the sustainable world order.

Though, there has been a significant advancement in our engineering and technological knowledge, it has not been at the level at which it has been there in the developed countries. India lags behind the developed countries in the advancements of engineering and technological knowledge due to a variety of factors. Consequently, India has continued to depend on these countries for the latest technologies. It needs to do much more for closing this gap. Obviously, our present engineering education and training system is not as it ought to be in the current global connectivity scenario. This gap can only be bridged inter alia by reforming the engineering education and training for making it in all respects just equivalent to what it is there in the developed countries. Our engineering education may require, therefore, a paradigm shift for ensuring its quality. We must study the engineering education system of the developed countries such as the UK, the US, Germany and some others and compare it with what we have here in India; after this, we should reform the system, as required. Specifically speaking, we will need a well educated and multi-skilled technical workforce in all the three categories-graduate engineers, diploma engineers and engineer technicians. Particularly, we need multi-skilled graduate engineers of a high ethical standards and professionalism. For this, we need multidisciplinary engineering education.

We need, therefore, re-engineering of the engineering curriculum, placing a balanced emphasis on theoretical and practical aspects, as required. The curricula should also include subjects such as economics, statistics, humanities, law; a course on some foreign language should also be included. The industrial training should be a compulsory subject in the curricula; it should not remain confined to visits only, but should be related to some theoretical concepts taught during the delivery of the course and conceptualized through projects undertaken during the industry training; it can also be on some major or minor industrial projects or problems which need knowledge of advanced mathematics and physics; it also needs to be assessed and marks thus obtained should be added to the total score. After

the course is over, there should be a mandatory paid industrial internship for about six months which also should be assessed and credit added to the total credit. Engineering degree should be awarded only after this is done. The industry should be compensated for this via the tax route.

We also need to collaborate with the world - class foreign universities for the faculty exchange and establishing of research centres, apart from developing modern curricula. A Students exchange programme with foreign universities / professional institutions will also be very useful. For this, as a matter of policy, internal support by the government through funding the concerned institutions needs to be considered. The industry, academia and the government should work together for re engineering of the engineering education.

We also need to make the industry-academia exchange a mandatory feature of our engineering education system. Under this system, working engineers and technologists from the industry should go and teach in engineering colleges for some years; and like-wise, the faculty should go and work in the industry for the same period. This could be in one or two spans during their career, as is considered necessary. By this exchange mechanism, we will be able to teach the students what the industry wants and in turn the industry will get engineers that it wants. Besides, for solving the problems that arise in the industry, what we need is to apply real knowledge to actual practical work. This can be done with a continuous interaction between the industry and academia. The industry facing problems, say with the productivity of its operations or for that matter any other problem, should seek guidance from the academicians for resolving these problems. There are many examples before us from the literature that this interaction works for the advantage of both the industry and academia. In India this practice is not there; while as in the western countries including in China, it is there.

There are other issues that we must address; these include shortage and poor quality of the faculty, poor quality of the infrastructure that a large body of engineering colleges has, there are three standards of engineering education - IITs, NITs and the other engineering colleges and admission tests, engineering domain-specific curricula, etc. There should be one standard of engineering education and the bench mark of which should be the IITs. There should be one common entrance test for engineering education throughout the country which should be structured in such a way as would also assess in a student the aptitude for the engineering profession. A major reform of engineering curricula and its delivery mechanism should be carried out, therefore, speedily so that world - class multi-skilled engineers are produced. We should also consider moving out of the present engineering discipline-wise engineering education to multidisciplinary engineering education so that we produce engineers for the industry. Similarly, we need to reform diploma engineering education and the education and training of engineer technicians. We have also the problem with the faculty - both its availability and the quality. Then there is no sound mechanism in position to train the faculty on continuing basis and also monitor this. We should create such a mechanism.

There is a policy in position for opening up new engineering colleges. This policy has failed in ensuring that the new colleges are set up with the quality infrastructure and the faculty as per the standards laid down in this policy. Consequently, we have a large number of engineering colleges without the quality infrastructure and faculty. We need to revisit this policy and take action as required. Immediately,

what we can do is to put on notice all engineering colleges not having the quality infrastructure and the faculty to upgrade their infrastructure and the faculty to the required standards in a given time-frame ; else, they will be asked to close down after meeting the interests of students standing enrolled in these colleges.

While we have many engineer designers and they have been doing an excellent work, particularly in the nuclear, space and defence sectors, we do not have much competence in the country in innovations and basic designs. India still depends on imports for high-end technologies. We still import basic designs. Our rate of innovations is very low when compared with the countries like Japan, The US, Germany, France and so. This is because we are not producing engineers and technologists who are capable of designing technologies from the scratch; nor are we producing competitive innovators. The reason for this lies in the engineering education system itself that we have today. We can catch up with the developed world in producing basic engineering designs with, as stated earlier, reforming the engineering education both at the graduate and at the postgraduate levels and thus making it more practical for producing thinking engineers and technologists with commitment and zeal for their engineering profession and determination to be the best in the world in designing engineering projects, in developing high-end technologies. We also need to reform the regulatory mechanism of engineering education so that it can deliver thinking and committed engineers.

Our engineers and technologists should be able to anticipate future technologies. They should be competent to develop these technologies. Engineering curricula and training programmes should also have, therefore, subjects on technology forecasting, technology development, designing of products and processes, managing innovations, technology management, project management, environment sustainability, etc. From this view point, we will need to have a practical engineering education which also teaches innovations for producing professionals who are capable and competent to develop high - end technologies.

The government should re-visit its policy of selecting the candidates for admission to engineering colleges. The present practice of holding two different tests, one for the general category students and the second for the special category students, is proving counterproductive. The standard of the former test is somewhat higher to that of the later category test. Further, the test for admission to the IITs is comparatively of a very high standard. A new policy needs to be brought in which should provide for one common admission test for engineering colleges for all the categories of students and engineering educational establishments-both of the central and state governments- throughout the country.

The present quota-based reservation policy for admission to engineering courses demerits the merit. This dispensation provides for promoters quota, management quota, reserve quota, capitation fee, etc., which enable students of comparatively low merit to get admission to engineering courses. How can we expect such students to become competent professionals? The merit should not be compromised; it alone should be the criteria for admission to engineering courses. We need to, therefore, do away with the present quota-based reservation policy for admission to engineering courses. There can be some other ways for addressing the social disparities that are still there in our society. One way out could be the government providing full help in educating the children of the vulnerable segments of our society from the school level itself; later on, the students from these classes

can also be provided training by the government for the entrance examination to the professional courses.

We need to have a standing mechanism for monitoring whether the standards are being maintained by the engineering institutions across the country; if not, remedial measures should be taken at the earliest, as required. We need to set up an institution for trainers of the engineering faculty. We also need to create a standing industry-academia interactive mechanism for dealing with the issues of engineering education, remuneration of the faculty, assessing demand for engineers- discipline-wise and sector-wise from time-to-time as deemed appropriate, etc.

There is no failure system in engineering colleges. A student can jolly well complete his / her course even in ten years by allowing him / her to continue taking examinations for subjects or a subject which he / she has not been able to clear in the allowed four years. This practice should not be allowed by the competent regulatory body. At the most, a grace period of just one year can be given for clearing all the subjects and completing all other requirements that may be there for obtaining a degree in engineering.

We are not able to attract competent people to the engineering faculty.Can there be as attractive remuneration package for the faculty as it is there in the industry and management sectors? We need to address this very pertinent question.

We need now quality construction of our projects covering infrastructure, industry, services, etc. Construction Industry, therefore, requires educated and skilled workforce. A formal basic education and skill development training is required for the construction workers. We need diploma engineers and graduate engineers specifically for the construction sector. This calls for a major reform of our current engineering education - both at the diploma and degree stages. Mere a diploma or a degree in mechanical, electrical or civil engineering will not do. We need a diploma or a degree in construction engineering as such. We need to develop suitable curricula for a diploma and a degree in construction engineering. The scope of work of training this large body of the technical workforce is very large.

Construction Industry Development Council (CIDC), which was set up jointly by the Planning Commission and the construction industry in 1996, has set up, as a matter of self financing initiative, about 174 vocational training centres in the country for training workers for the construction industry. This number may look large, but given the share size of the workforce required by the construction industry in our faster growing economy, this number is very small. We need many more such centres. The construction industry needs around 5, 00,000 trained people every year. Though many training schemes have been launched by the central and the state governments, it has been noted that, by and large, the curricula has not been in consonance with the requirements of the industry; trainers have not been available; there has not been any working mechanism in position to train the trainers, apart from the training infrastructure of the training establishments also not being of the required quality. Initiative, however, has been taken by these governments to address these issues. We have got to ensure that there is the synergy in the efforts that are being made by the various agencies so that the implementation of the training programmes is effective, efficient, and as required.

India will have to reduce carbon emissions. The vision 2020 demands it; the Indian engineers and technologists will have to ensure it. Subsidy for developing sustainable technologies including for the energy sector should continue to be available to the R&D sector as a matter of policy till such time it is required.

We need to become aggressive in filing patents and match the advanced countries like Japan, the USA, UK, etc in this. We need to develop the culture of innovations.

In developed countries, engineering profession is regulated in order to ensure that practitioners of the profession follow the standards set for it. In India engineering profession is not yet regulated. This needs to be done by bringing on our statute Engineers Act and set up the statutory body which will meet our requirements of accountability and professional conduct as well as those to ensure mobility of our engineers to provided professional services abroad.

Indian needs to become the Full Member of Washington Accord so that our engineering degrees are recognized internationally. Presently, India is a provisional member of the Washington Accord; and the Ministry of HRD should deal with this matter speedily. It will be only then that India will be able to take part in the multi-billion dollar international market of engineering services.

Opening Session

Dr. Uddesh Kohli

ECI was incorporated in the year 2002 under the Patronship of the Dy Chairman, Planning Commission and since then it took up various programmes under its set objectives for promoting the world-class engineering profession in the country. It also facilitated bringing up of a consensus draft of Engineers Bill for regulating the engineering profession in the country. The draft was submitted to the Ministry of HRD in 2007. The Ministry circulated the draft to the concerned Ministries / Departments of the Government of India for soliciting their comments in September, 2009. ECI also took up programmes as per its set objectives since its incorporations in 2002 including on reforming the engineering education in the country for making it suitable to the current and future needs of the economy. The title of the 7th national conference is vision 2020- which, in other words, means making India a developed country by that year. Engineers and technologists will have a major role to play in realizing this objective. This can only be done inter alia by reforming the engineering education and training for making it in all respects just equivalent to what it is there in the developed countries. This conference will deal with this issue in detail and I am sure that some valuable recommendations will emerge from the conference after in-depth deliberations.

Theme Address : Dr. Baldev Raj

Vision 2020 is, as stated by Dr Uddesh Kohli, India becoming a developed country by 2020. The target year is not quite far from today. So, we have to work hard to get to that stage of our development. We are operating now in a global world and not in isolation of a closed economy - as we were till 1990 when India made a major policy shift in its development and opened up its economy. Thus, India stands connected globally. This global connectivity has advantages and disadvantages. It works as per the natural law: survival of the fittest. The three pillars of globalization are equity, ethics and ecosystems. Our future development will have to be sustainable. A developed civilization rests on three pillars namely wealth generation and management, equity in education and health care and protection of the eco systems. We need to have consistent policies which are compatible with the global connectivity. We have to organize ourselves; we have to remove deficiencies and bottle necks that are still there in our economy such as, our legal system, governance, infrastructure, health care, education, particularly higher technical education, etc. The global connectivity also demands from us a world-class professional workforce. We have to be globally competitive in all our economic activities.

About 75 % of the engineers that we produce are not found employable. It is a well recognized fact today. Why are not they found employable? The answer is that our present engineering education system as a whole is not as it ought to be in the current global connectivity scenario. We have a large number of engineering colleges without the quality infrastructure and faculty. Our polytechnics and industrial training institutions are also in the same category. Our engineering curriculum is not

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Dr. Baldev Raj is the Hon. Member, International Committee on NDT, Distinguished Scientist & Director, Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakam, Tamil Nadu

producing multi -skilled professional engineers. Our diploma engineers and engineer technicians are also in the same boat. We need to produce engineers with thinking capability and not with only the mugging skills- as is generally the case at present. We do not have professional teachers, exceptions here and there notwithstanding. It is also true that it is not that the IITs only produce employable engineers. The basic rule is that if input is good, out put is also going to be good. We need to study what kind of input is going to our rather a large no of engineering colleges which are mostly in the private sector; and if this input is not of the same quality as it is going to the IITs and NITs , we will have to remedy this position. For this, we need to have one common entrance test for admission to all the engineering colleges including the IITs , NITs and the other engineering colleges. This test should also be structured in such as way, as would also access the aptitude for the engineering profession. This innovation will surely tackle this burning issue that we are confronted with today.

We have a number of issues before us to deal with. First issue is that of the availability of faculty and its quality. Second, there is no sound mechanism in position to train the faculty on continuing basis and also monitor this. Third, we need to look at the remuneration that is paid to the faculty and compare it what engineers get in the industry and try to narrow the gap - if found via policy intervention. If it is done, engineers having aptitude for teaching will return to the teaching jobs. Fourth, we must make it mandatory that the minimum qualification for teaching engineering should be a postgraduate degree. Presently, graduate engineers are also recruited by engineering colleges for teaching jobs. This must stop. Fifth, teaching should also be opened up to the practicing engineers. These engineers have practical experience; and by virtue of this, they can as well teach engineering to the students. The academicians should change their mind-set and welcome this. Sixth, there are well known and successful consulting engineers, they can also teach engineering. They should be invited to the faculty. Seventh, there should also be a mandatory rule in our policy for the faculty members to go and work in the industry on a tenure basis in their service career. Short two or three repeat tenures of one-or-two year's duration can be considered for this purpose. By doing so, we can better tackle the issue of quality of our engineering faculty. It will also help in a great measure in developing industry-specific engineering curricula.

India is appreciated in producing objective policy papers, but implementation of what is recommended is generally perceived to be poor. The sustainability issue has come up as a very serious issue; it needs our attention. Whatever we do now, it has got to be sustainable. Engineers and technologists will have a major role to play in the future sustainable development of our economy. It encompasses sustainable energy security, sustainable manufacturing and so on. We have got to ensure sustainable use of all the natural resources. We have got to find technologies for moving away from using non renewable natural resources to using renewable natural resources as inputs for our development. We need to create capacities as the demand is growing with continuous growth of the economy. We need to improve significantly the quality of energy that we generate, identify and develop alternate sustainable fuels, sustainable technologies including for expanding our current capacities not only in the energy sector but also in the manufacturing sector. We will have to ensure affordable health care, education, nutritious food, etc, for all the stakeholders. We will have to ensure that all the stakeholders including our children are made aware about the need to maintain our ecosystem and sustainability of our development. We have got to ensure sustainability of all the actions that we may take in any sphere or area of our economic activity.

We all know that the nature works very much with its own ethics. Being a representative of the nature itself, we humans ought to follow ethics in whatever we think and do. But we do not do so. We should work within a frame work of ethics and morality. It is only then that we will be able to ensure sustainability of our decisions and actions thereof, particularly while pursuing our targets. India, though not polluting the environment as severely as the developed countries have been doing, cannot be complacent in this. It will have to stride for reducing the carbon emissions. The vision 2020 demands it; and the Indian engineers and technologists will have to play a major role in ensuring this. We will have to take advantage of the best technologies that are available and find funds to get these technologies in place as early as possible. At the same time, we need innovation of the current conventional technologies and, therefore, we should also intensify our R&D programmes for this including for making these technologies cost-effective, particularly for harnessing renewable resources for realizing much needed energy security. We should also develop new technologies. We have the policy support available with us for this. We should act now with the determination that it demands. Our engineers and technologists, by reducing carbon emissions, can also generate money through carbon trading. We are not earning much from this area yet. Switzerland and many other countries are earning much more than what we are earning from the carbon trading. Countries producing energy with less emissions of carbon dioxide do it through nuclear energy and using renewable recourses like hydro power. France has about 80 % of nuclear energy; Norway has hydro energy. India will have to do like-wise to reduce the carbon emissions from the energy sector and earn more money through carbon trading. Subsidy for developing sustainable technologies including for the energy sector should continue to be available to the R&D sector as a matter of policy till such time it is required.

Engineers and technologists will also have to ensure energy conservation through innovations, by improving our efficiency of generation and transmission by cutting down the transmission and distribution losses, which are substantial today. We also need to produce quality power. India has emerged as the Nuclear Power Technology country. We are envisaging adding to our power capacity about 40,000 MWe of Nuclear Power in the long-term from our immediate short - time target of 20,000 MWe of nuclear power. It is feasible now that we can as well import reactors with the nuclear deal that has been signed with the US and other countries. In the long-term, we will go for the Thorium-based reactors. India has a large reserves of Thorium. We have also trained workforce and engineers & technologists and other infrastructure in the nuclear sector. This is our strength. We can easily plan to have 100 nuclear reactors in the longer-term. This target is also supported by the Government of India.

Dr. Narendra Jadhav

If we look at the growth of the world economy, we find that since 1945 the US and Japan led this growth till the year 2000.After 2000, the US and Japan as well as the countries of the Western Europe slowed down simultaneously. It was what we call synchronized global slow down. Since 2000, the growth of the world economy is led by the emerging economies: China and India. While China opened up its economy in 1978 without having to face economic crisis first, India faced the economic crisis in 1990; and after this, it made a major policy shift and opened up its economy in 1991. Since then, India has maintained its high growth at 8-9 % annually, except some slowdown witnessed in 2005 because of the

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recession that gripped the US, Japan and the Western Europe. Thus, India became the second fastest growing economy in the world. Our economic policies are now right and we have made our solid commitment for continuing our efforts to maintain the high growth rate of our economy. This is a positive position for us to rely on for taking further steps that we need to take for realizing the vision 2020.

India has a big demographic advantage. In other words, India is a young country with the average age of its population being around only 24 years. By the year 2020, the average age of India's population will be 27 years; it will be 27 years for China, 37 years for the US; and 40 plus years for Japan and some other western European countries. So, even in the year 2020, India will retain this advantage. When we look at the developed countries, we find that these countries reached to their developed stage when they had also this demographic advantage. It, in other words, means that the developed countries attained their developed status when these countries had a large part of their growing population young. India is now at that stage.

We are now concentrating on harnessing this demographic advantage that we have. This demographic advantage, however, will not make India automatically a developed country; it will depend on the role of education sector including higher technical education and formal education and skill development of our workforce at the base level. We will have to bring up this sector to the stage at which it is in the developed countries. Presently, our education sector is not what it ought to have been. It is far from satisfactory.

According to the sample survey, 2004-05, only 2 % of our youth had some formal vocational education and training; 8 % of our youth had some kind of informal on-the-job training. It means that only 10% of our youth had some kind of formal and informal vocational education and training; and 90% of our youth were in the job market without any kind of formal/informal vocational education and training. The picture is not different even today. When comparing it with the rest of the world we find, 87 % of the youth of South Korea get formal or informal vocational education and training. India is stuck at mere 10 % only! Our gross enrolment ratio (GER) is 11 %; this means that around 89 % of our youth has no access to higher education. We have targeted GER at 15% by the end of the XIth Plan (2011-12); and 20-23 % by the end of the XIIth Plan (2016-17). We need to do a lot more. This is where our biggest challenge lies.

There are around 17 departments engaged in the skill development. There is no coordination among them. The Government of India has taken some initiatives on this matter. The National Skill Development Council, National Skill Building Coordination Board and the Skill Development Corporation have been established. Aggregate deficit of technically trained workforce world-over is estimated to be around 500million people by the year 2022. India can become a reservoir of this workforce provided we act now; and we should act to meet this challenge.

Dr. P.R. Swarup

We need now quality construction of our projects covering infrastructure, industry, services, etc. Construction industry, for the development of which Construction Industry Development Council

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(CIDC) setup jointly by the Planning Commission and the Construction Industry, is working for since its incorporation in 1996, therefore, requires educated and skilled workforce. They need a formal basic education and skill development training. These workers mostly come from the lower segments of our society without any kind of formal education and training. The traditional practices that we have been following so far would not do.

The construction industry needs diploma engineers and graduates - specifically educated and trained for the construction sector. Mere a diploma or a degree in mechanical, electrical or civil engineering will not do. Instead, we need a diploma or a degree in construction engineering as such, which will cover the basics of major branches of engineering and of the social sciences including management. We need to create,therefore, a new branch of construction engineering- both diploma and degree. We must take this forward looking step and fast at that.

CIDC has been engaged in training workers for the construction industry including engineer technicians, diploma engineers and graduates. The programmes have also been developed and conducted under a distant mode of education involving the Assam Central University and the IGNOU. But, it has been modest when we look at the technical workforce which is around 17 % of the able bodied citizens of our country, half of which is connected with construction industry and the rest with the core industry including the manufacturing sector.

The scope of work of training this large body of technical workforce is very large. CIDC has set up, as a matter of self financing initiative, about 174 vocational training centres in the country for training workers for the construction industry. It has been able to train around 1,83,000 persons through out India in 2008. The target set for the year 2009 is 3, 00,000 persons. These numbers may look large, but given the natural attrition factor of 5 % in a span of 20 years and around 35 million people employed in the construction industry and taking into account the growth of these numbers as a consequence of the fast growing construction industry, these numbers are minuscule. The construction industry needs around 5, 00,000 trained people every year.

Though many training schemes have been launched by the central and the state governments, it has been noted that, by and large, the curricula has not been in consonance with the requirements of the construction industry; trainers have not been available; there has not been any working mechanism in position to train the trainers. The training infrastructure of the training establishments is also not of the required quality. Initiative, however, has been taken by the government to address these issues. We have got to ensure that there is synergy in the efforts that are being made by the various agencies so that implementation of the training programmes is effective, efficient and as required.

Technical Session - I

Shri Mahendra Raj

It is a well recognized fact that engineers and technologists have and will continue to play a very important role in the development of the country. In realizing the vision 2020, engineers and technologists will have to play a major role.They can play this role very well provided their education and training meet the current and future requirements of the industry and the R&D. This is what we will be looking at in this conference; and the related issues will also come up for discussions in this day - long national conference. I am sure that at the end of the in-depth deliberations, many recommendations will come up including on the regulatory mechanism and policy governing our engineering education and training. This only would load to reforming our engineering education and training, as are required, for enabling us to produce engineers and technologists that our fast growing open economy demands.

Dr G.P. Karmakar

There has been a significant advancement in engineering and technological knowledge. While the developed countries kept in pace with this advancement, India has lagged behind in this due to a variety of factors. Consequently, we remained dependent on technologies on the developed world. Though India has progressed in the field of engineering and technology, it needs to do much more to catch up fully with the developed countries. The vision 2020 is our target for closing the gap that we have in the field of engineering and technology with that of the developed countries. It is well recognized now that our engineering education and training require a major reform. We must deal with this issue speedily. We should also regulate the engineering profession by an act of Parliament, as the other professions are. More so, we need to do it for taking part in the trade in engineering services, opening up of which is round the corner.

When looking at the engineering education system in the developed countries such as the UK and Germany, we find that in the UK, a system of the state universities is taking care of the engineering education and after a student is awarded a degree in engineering he / she joins industry and works there for some time. After that he / she takes another test by virtue of which he / she is given a certificate of a chartered engineer or professional engineer. In Germany, there are two possibilities for becoming an engineer- one is to obtain an engineering degree either by joining a classical university or by joining a Fachhochschule (FH) or a university of applied sciences. The German Act on Higher Education, August, 1998 lays down that (a) both the bachelor and the master degrees must qualify for an engineering profession, (b) the duration of the bachelor's programme can be of 3-4 years, (c) the duration of the masters programme can be of 1-2 years, (d) the total duration of the of the combined bachelors and masters programme must not exceed 5 years and (e) the masters degree from either a university or FH satisfies one of the requirements for admission to a doctoral programme, which is limited to the traditional universities. We can have a look at the other countries also on what is the

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practice in these countries being followed for engineering education and training. We must then take appropriate measures without losing further time to bring our engineering education system at par with that of the developed countries. So, we need to act.

We have some other important issues to deal with. First, we have shortage of teachers. Second, we have a large body of engineering colleges without the quality infrastructure and faculty. Third; we have three standards of engineering education - IITs, NITs and what the other engineering colleges have; we need to have one standard of engineering education and the bench mark of which should be the IITs. Fourth, we need to have one common admission test for engineering education which should also include assessment of the aptitude for engineering profession. Fifth, we need to reform the engineering curricula and its delivery mechanism for producing multi-skilled engineers of quality which the industry needs. We need multidisciplinary approach to the engineering education. Similarly, we need to reform diploma engineering education and the education and training of engineer technicians. We need to address these issues as well.

Dr Abha Kumari

Five sectors have been identified by Dr A P J Abdul Kalam to transform India into a developed country by 2020. These sectors are agriculture and food processing, Infrastructure with reliable and quality electric power, education and healthcare, information and communication technology, etc. All knowledge - based sectors of the Indian economy in the year 2020 will need world class professional engineers, apart from the other inputs. Technologies are advancing at a rapid pace- both due to innovations and applied R&D. Consequently, usage of technology in everyday life is also increasing at a rapid pace. The global warming is generating new problems. According to an US Report, natural forms of energy will be over by 2035 and alternate sources of energy have to be developed. The global warming due to high level of toxic gases in the environment is a serious problem today; this problem needs to be dealt with; while it is receiving a serious attention globally, its complete resolution is still eluding us due to variety of reasons. Among other things, green engineering is required for tackling this problem.

The challenges before us to meet by the year 2020 include a) production 400 million tones of food grains with reduced land use, water, 21st century technologies, b) several well - planned & designed cities with 100 million homes, roads, marketing complexes, industrial units, airports, high speed local transport, connectivity with railways and highways, etc, for population of 10 crore or more, c) capacity to harness several million megawatts of power from hydro / nuclear /solar/ wind and ocean-based resources, d) networking of rivers, oceans across the country, satellite communication capability, sustainable industry, e) provision of affordable healthcare for 1.4 billion people and f) well educated & multi-skilled technical workforce in all the tree categories-graduate engineers, diploma engineers and engineer technicians. Particularly we need multi-disciplinary graduate engineers with designing skills, problem solving skills, critical thinking skills, intellectual creativity and innovation skills, skills of self direction, self - learning, accountability, adaptability, inter- personal collaborative skills, social responsibility, strong analytical skills, ingenuity, creativity, understanding of business management,

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leadership, high ethical standards and professionalism, attributes like dynamism, agility, willingness for continuous professional development for life long learning .

Indian engineers & technologists in the year 2020 should be competent to met challenges including for developing the next generation technologies and skills to tackle future problems including those which will arise from the world without boundaries and from the concerns arising from maintaining the sustainable world order.

We need, therefore, re-engineering of the engineering curriculum placing emphasis on theoretical and practical aspects as required including case-studies from industry problems solved or projects implemented. Emphasis should also be given to the lab courses, subjects related to information and communication, bio-technology, bio-engineering, nano technology, high speed robotics, logistics technology management, project management etc. The engineering curricula should also include subjects such as economics, statistics, humanities, law; a course on some foreign language should also be included. The curricula ultimately should be such as will develop thinking capability and research culture in the students at the graduate level itself.

The industrial training should be a compulsory subject in the curriculum and this training should not remain confined to visits only- as has been the practice so far and continues to be, by and large so, even today. It should be related to some theoretical concepts taught during the delivery of the course and conceptualized through projects undertaken during the industry training. The training can also be on some major or minor industrial projects or problems which need knowledge of advanced mathematics and physics. It also needs to be assessed and marks thus obtained should be added to the total score. After the course is over, there should also be a mandatory paid industrial internship for about six months. The industry should be compensated for this via the tax route.

We need to collaborate with the world class foreign universities for the faculty exchange and establishing of research centres, apart from developing modern curricula. A student exchange programme with foreign universities / professional institutions will also be very useful. For this, as a matter of policy, internal support by the government through funding should be made available to the concerned institutions. The industry, academia and the government should work together for re engineering the engineering education for achieving the vision 2020

Shri L. Pugazhenthy

Vision 2020 is a major land mark for the country to achieve. It implies that by the year 2020, India will be a developed country. The world is talking about it. India has maintained a constant growth of its economy. India will be a country of 1.2 billion people very soon. Among the various issues that we are facing today, the first issue that we need to tackle is that of our population growth. Today, like China, we do not have a standing policy on population in position. We need to have such a policy. We need to take up this issue on priority so that we are able to bring down our population growth to near zero, if not zero, at the earliest possible. Given the resources that India has today and that will be available in future, Indian economy will not be able to absorb high growth of its population and at the same time

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realise its inclusive growth targets. So, we must act now and tackle this very pressing issue. Out of the 1.2 billion people by around a little less than a decade, 800 million people will be of the age group between 25-37 years. Dr Jadav has touched on this point in detail. This will be our demographic advantage to be tapped for what it is worth.

There is a big gap in the development status between urban and rural India. We cannot be called a fully developed country till we fill up this development gap. In a country, when a village and a city are at the same level of development, the country is called a developed country. So, our policy thrust will have to be on removing this urban-rural development gap. Engineers and technologists will have a major role to play in removing this gap. Some of the enabling legislations / policies have already been put in place such as, education for all, rural employment guarantee scheme, etc. Some more such enabling legislations will have to be identified and brought on the statute at the earliest.

It is a well recognized fact now that we need to reform our engineering education and training for making it to meet the current and future requirements of the industry. We need to act on this without further delay. This is very important. We need now multi-skilled engineers and for this India needs to move out of the present engineering domain-specific engineering education to multidisciplinary engineering education. There should be compulsory during-the-course industrial tainting in the curricula which is done on some industrial problem. It will result in the better understanding of the theoretical concepts.

Further, there should be a mandatory paid six months internship with an industrial unit after the main course is over; which should also be assessed and credit thus obtained by a student should be added to the total score- obtained from the written test plus during-the-course industrial training. The engineering degree should be conferred only after that. The industry should be compensated via the tax route for the expenditure that it may incur on this mandatory internship because if it is not made a paid internship, it will mean burdening parents for further six months, which many of them may not be able to afford. The industry will also gain by the work that the students may be asked to do during their internship; it may also help the industry find suitable engineers to fill up the vacancies that it may have. It will be a win- win position for all the stakeholders.

There are other important issues concerning engineering education which we need to deal with speedily. These include the poor quality of faculty and the infrastructure that many engineering colleges have. We need to make the industry-faculty exchange a mandatory feature of our engineering education mechanism. Under this mechanism, working engineers and technologists from the industry should to go and teach in engineering colleges for some years; and like-wise, the faculty should go and work in the industry for the same period. This could be in one or two spans during their career, as is considered necessary. By this exchange mechanism, we will be able to teach the students what the industry wants and in turn the industry will get engineers that it wants.

The other important issue before us is the regulation of engineering profession for which the government should bring on the statute the engineers Act and set up the statutory Council of engineers without further delay. The other issue is India becoming the Full Member of Washington Accord (WA) so that our engineering degrees are recognized internationally. Presently, India is a provisional member of the Washington Accord; and the Ministry of HRD should deal with this matter speedily.

With India becoming the full member of the WA, it will be able to take part in the multi-billion dollar market of the trade in engineering services.

We need to become aggressive in filing patents and match the advanced countries like Japan, the US, UK, etc in this. We need to develop the culture of innovations. Tata's Nano car is an excellent example of an innovation implemented successfully in India. We need many more such innovations including in the manufacturing processes itself and of industrial products across the board. Now that many countries are setting up their design offices in India, it should help the country in a greater measure to develop original designs in which we are miles and miles behind the developed countries.

Shri O.P. Gupta from the Floor

There is a policy in position for opening up new engineering colleges. This policy has failed in ensuring that the new colleges are set up with the quality infrastructure and the faculty as per the standards of this policy. Consequently, we have a large number of engineering colleges without the quality infrastructure and faculty. We need to revisit this policy and take action as required. Immediately what we can do is to give notice to all these engineering colleges to upgrade their infrastructure and the faculty to the required standards in a given time-frame ; else they will be asked to close down. We cannot afford otherwise. The second point that I want to make is that the government should re-visit its policy of selecting the candidates for admission to engineering colleges. The present practice of holding two different tests, one for the general category students and the second for the special category students, is proving counterproductive. The standard of the former test is somewhat higher to that of the later category test. Further, the test for admission to the IITs comparatively is of a very high standard. A new policy needs to be put on the statute which should provide for one common admission test for engineering colleges for all the categories of students and engineering educational establishments-both of the central and state governments- throughout the country The merit should not be compromised for the quotas for admission to engineering colleges. The last point that I want to make is that we need to reform the engineering education for making it meet the current and future needs of the industry.

Shri Agnihotri - Student Delegate from the Floor

I fully agree with what Shri O.P. Gupta has said. Engineers should be multi-skilled. We need today, therefore, multidisciplinary engineering curricula. We need to reform our engineering education. The subjects such as innovation management, technology management and project management should be included in the curricula as the core subjects. We also need to have a re look at the accreditation policy of engineering education and do not sanction new colleges with the poor quality infrastructure and faculty. The existing colleges who have this problem should be directed to up graduate their infrastructure and the faculty in a definite time-frame or else faces de recognition.

A delegate from the Floor

While I agree fully with the points that Shri Agnihotri has made, I think there is a net shortage of the quality faculty in the country. We need to identify measures that need to be taken for meeting this

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shortage. We should consider, as a matter of policy, allowing the working engineers and consulting engineers to teach. The second point that I will like to make is regarding speedy decision by the competent authority on the issue of poor quality infrastructure and faculty that most of the private engineering colleges have. We need to have one standard education in the IITs, NITs and the other private sector engineering colleges. We need to have one common admission test and standard for admission to engineering colleges through out the country. We need to do away with the current quota policy for admission to engineering colleges by making the merit alone the core principle of the policy. We can find other means of addressing the disparity issue among classes. It is proving counter productive by also addressing it via admission to the institutions of higher technical education including engineering education which is in focus here. I also agree that there is an urgent need to reform engineering education and regulate the engineering profession. We also need to reform the delivery mechanism of engineering education with building in it such procedures of delivery as would lead to an element of research in it at the graduate level itself. We need to make teacher: student ratio better in our engineering colleges and lay stress on tutorial - based engineering education.

Dr G.P. Karmakar

While I fully agree with the points that have been made, I think the subjects like innovation management and technology management should be included at the postgraduate stage of engineering education and not at the undergraduate level as it will be difficult to do so because of the size of the current curricula. If, however, we can shorten it, we may consider inclusion of the above cited two subjects at the undergraduate level itself. It will need to be looked into some depth before any decision can be taken in this regard.

There is a shortage of good quality faculty in the country. We need to address this issue. Dr Baldev Raj in his theme address has made some points in this regard; we need to consider these points. We also need very badly a working institutional mechanism for training the faculty, also training the trainers and monitoring it regularly.

Shri L. Pugazhenthy

The points made by Shri Agnihotri are well taken. We need to reform engineering education by giving way to the multidisciplinary engineering education for producing multi- skilled engineers who are in demand toady. Yes, most of the engineering colleges in the private sector need to upgrade their infrastructure and faculty. Having said this, I would like to add that many Indian industrial groups have become multi nationals like Tatas, Mittals, Reliance, Birlas and so on. These groups will also need engineers of global standards for their global operations. For their Indian operations, they will also demand engineers of the global standards - which will force the other Indian companies to demand engineers of the same global standards from the market. In response, India will have to produce engineers of the global standards and, therefore, these engineering colleges will automatically be driven to the wall for upgrading their infrastructure and the faculty as well as the curricula. This is going to be a logical action - reaction chain working in the current globalised economic environment. But, the competent authority should not leave this issue to be sorted out by this action-reaction chain dispensation, but should address these issues urgently and remedy the situation in which we find ourselves today.

Technical Session -II

Lt. Gen A. K. Puri

What is expected from engineers and technologists for India to realise its vision-2020, which has been elaborated as: reaching to the status of a developed country by that year? This is the question that we need to address. In other words, it means that we need to assess what is the current status of engineering profession in India today and what it should be in the year 2020.The other related question is : is the engineering profession in India today at the same level at which it is in the developed countries, if not why it is not so and what needs to be done including from the policy point of view for making it to reach to that position.

Education in general and professional education in particular is one of the core elements of the mechanism which generates speed to the forward movement of a developing economy like that of India towards its goal of reaching to the status of a developed country. While our development plans and policies are in position to speed up this forward movement, we are focusing in this conference on making an assessment of the competitive edge of our engineering education as it is at present in India; identify the grey areas that are there and suggest measures to remove these grey areas including through policy intervention, if considered necessary, for making engineering education as competitive as it is in the developed countries. I am sure that the conference will consider these questions and come out with appropriate answers. Some concerns have already surfaced in the earlier sessions such as the urgent need for the reform of engineering education, poor quality of infrastructure and faculty that many engineering colleges in the private sector have today, shortage of the faculty and sustainability of the future development process and the role engineers and technologists would have to play in addressing these concerns. I am sure, many more issues of concern will emerge in this session and in the following Panel Session and at the end of the day's deliberations, we will get a clear picture on the actions that we should take to address the various issues.

Prof G.K. Suraish Kumar

What are the opportunities and challenges before us for realizing the vision 2020? According to an Indo-US report on India, these are fulfilling global consumer needs in this era of globalisation. Whatever engineering we do, it would have to be sustainable. We will need more knowledgeable and skilled workforce. Engineers will need to develop meaningful and committed leadership skills including for managing unchartered territories - energy and environment. We will need efficiant and sustainable technologies, effective and efficient information system for data management, storage, retirement and transmission, supply chain management and partnerships including between the industry, academia, government, etc. Engineers will need to have skills to manage electronic data interchange, automated systems, water management system, improved forecasting system, process flow - supply, complete automation from start up to shut down - high speed reliable networks of customer and suppliers, etc. Engineers should have strong domain knowledge, a very good

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knowledge on the other engineering subjects and social sciences like economics, statistics and communication, teamwork, analytical skills, designing skills of the relevant engineering systems, etc. We should also take note of the fact that engineering is relevant to agriculture and medicine including clinical engineering. We will have to create an institutional mechanism for training of the engineering faculty including for exposing the faculty to practical aspects. We will have to ensure a better teacher and student ratio, which at present is adverse. Keeping in view all these aspects, we should make efforts to synchronise things.

For solving problems that arise in the industry, what we need is to apply real knowledge to actual practical work. This can be done with a continuous interaction between the industry and academia. The industry, facing problems say with the productivity of its operations or for that matter any other problem, should seek guidance from academicians. There are many examples before us from the literature that this interaction works for the advantage of both the industry and academia. In India this practice is not there; while as it is there in the western countries including China.

Prof. D. G. Roychowdhury

There has been a significant and rapid advancement in technologies across the board since 1980s; and it is continuing at a faster pace even now. As against this, engineering education and training in India have not advanced as rapidly as the technologies have. Globalisation is now a reality and in this era, India cannot afford to let this position remain, as it is. Immediate action is called for to catch up. This implies inter alia bringing in reform in the engineering education, training and engineering practice itself to enable the engineering profession to face the challenge of technological advances. Our engineers and technologists should be able to anticipate future technologies and take appropriate steps to bring in an appropriate response to developing these technologies. We need to make engineering education multidisciplinary so that we produce multi-skilled engineers which are in demand from the industry. Engineering curricula and training programmes should also have subjects on technology development including designing of products and processes, innovation, technology forecasting, technology management, project management, environment sustainability etc. We also need to regulate engineering profession for which we need to bring in on our statute an Engineers Act and set up the statutory council. Engineering profession is already regulated in the developed countries and also in many developing countries including in our immediate neighborhood. A provision on ethics should be included in the Act; and engineers should work with ethics.

Shri M. L. Batra

I will talk about the power sector, which is a fast growing sector in India. We have to build a large power generation capacity, which implies that we need a large number of engineers, diploma engineers and engineer technicians for the power sector who are of quality - professionally- matching with that of the similar workforce in the developed countries. Then we have to keep in view the fact that the new power plants will have to be environmentally sustainable. This means renovating the existing conventional technologies for making these sustainable and setting up more new plants based

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on renewable resources including nuclear power plants. Accordingly, we will need to assess suitability of the current engineering education and training to sustainable development of industries, particularly the energy sector. If it is not found suitable, measures should be taken for making it so.

Availability of skilled workforce for the power sector, particularly engineer technicians, is an important objective to be kept in focus. It has already been recognized that we need to reform our engineering education and training and also create a working institutional mechanism with a continuous monitoring - in a laid - down time- frame inbuilt system in the mechanism itself - for training the faculty. We need to take action without further loss of time on this matter. At the same time, we should also consider training and development of engineer technicians for the power sector so that we create a large pool of professionally competent engineer technicians for the power sector including for taking up jobs abroad-now that this opportunity will also be there before us.

We need to upgrade and modernize the existing Industrial Training Institutions (ITIs), the training curricula and the delivery mechanism. We need to add English language also in the curricula. The major power companies should adopt the ITIs for this purpose. Government of India has taken up some initiative on this matter, but it is not as comprehensive as it should have been. Some initiative has also been taken by both the public and the private sector companies on this matter; it needs to be expanded further.

We need to assess all the categories of workforce that is required for the power generation, transmission and distribution taking it as a whole during the next 15-20 years time period. And then, we should assess the training needs for them; after that we should develop training programmes as required and identify institutions to conduct these programmes. I think that this work can jolly well be entrusted to the Central Electricity Authority of India (CEAI).

Prof. Pooja Tripathi

I would ask one question as an academician: are we producing engineers for the power sector,industry, agriculture and infrastructure sector? I think we are not producing such engineers to day. We are still in the old mould of domain -specific and static engineering education, exceptions apart . We have many challenges to tackle and our engineers have a major role to play in tackling these challenges. These challenges include: depletion of resources, toxic pollution, climate change concerns, loss of bio diversity & ecosystems. Our future development will have to be sustainable. Our industry will not survive if it does not become sustainable. We need sustainable energy security. Our total economic development has to be sustainable. Though India has recognized these issues and policy initiative has been taken to tackle these issues, question still is there and this is: is our basic education and higher technical education such as would enable people, particularly professionals to deal with these pressing concerns? I think no, it is not so.

All professions including engineering profession touches every part of our lives, every sector of our economy. All our professions come up from the basic education. So, we should reform our basic education and its delivery for making it such as would lead to making people conscious of and

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committed to sustainability and in turn will lead to the development of professionals who are equipped education and training-wise and capable professionally to tackle challenges arising from the sustainability concerns. As an academician, we should here focus on engineering education. We need to produce engineers and technologists who can tackle these issues and meet the challenges that are there.

We need to move out of the current domain-specific engineering education to multidisciplinary and industry-specific engineering education & training which may also include subjects from other than engineering branches from the social sciences like management, economics, statistics and communication. We need to move to project-based learning - which implies that we have more practical delivery mechanism of our engineering education, which is based on projects on solving industrial problems. We need to make during -the -course industrial training an essential part of the curricula and assess this training as well. We should introduce six months of a mandatory paid internship with an industrial unit which should also be assessed and the industry should be compensated via the tax route for any expenditure that it may incur on this internship. Engineering profession need to be regulated. It is there in all the developed countries including in some of the developing countries, even in our neighborhood. We shoul encourage multidisciplinary research.

Shri Ashok Kumar Bhatia - Student delegate from the Floor

Less than 10 % of our students have access to higher technical education. A large number of students can get the opportunity for higher technical education if we go for the E-learning mode of delivery of higher technical education. We need to consider, therefore, to create a required infrastructure for it so that those students, who are left out of the main stream process of higher technical education , go far the E-learning mode of education, E-learning enables one to learn much beyond what the traditional approach entails. It simply means learning using information and communication technology. We need to institutionalize E-learning via building up linkages with engineering institutions and universities. With these linkages, we can create virtual class rooms. This technology of delivery of engineering education can be regulated via the distant mode of regulation of engineering education.

A student Delegate from the Floor

We need to make engineering education industry oriented. We need quality faculty which is in short supply today. We need to find out reasons for this and take remedial measures , as are required. This can only be done through the intervention of competent authority in the government. The student faculty ratio should be 15:1. Today it is not so. This can be done only with bringing in more quality faculty into the teaching circuit. We, as a matter of policy, should consider involving working engineers and consulting engineers, who have created a name for themselves, in teaching engineering. This needs a change in the mind-set of our academicians. A large body of engineering colleges, mostly in the private sector, has been sanctioned without a proper quality infrastructure and faculty. We need to address this issue. We have different criteria and standards for admission to IITs, NITs and the other

engineering colleges. We need to have one common criteria and standard for admission to all these institutions.

We should move out of the present theoretical delivery of engineering education to more practical delivery of engineering education. Engineers need to have managerial skills also. So, the engineering curricula should have some compulsory subjects from the management education. Without having some basic knowledge of economics and statistics, engineers cannot handle projects. So, the engineering curricula should also have these subjects. Besides, engineers should have an excellent knowledge of English language. They should also have communication skill, apart from that of drafting of the feasibility studies. Indian engineers will have to be innovative. There is potential in our students for this, we should top the potential. We need to include courses such as innovation management, technology management and project management in the curricula. Such courses are being taught in universities in the UK and the US.

Concluding Session

Panel Discussion and Recommendations

Shri K. K. Kapila

This panel discussion should concentrate on bringing out some concrete and implementable recommendations so that we can pursue the authorities with these recommendations and ensure that there is a definite out come, as is recommended by this conference.

Shri R. Sampath

India needs to lay emphasis on reforming the engineering education for making it multidisciplinary and such as would produce multi- skilled and employable engineers. What needs to be done in this matter has already been covered and discussed in this conference by the previous learned speakers and delegates. From my side, I would recommend that subjects such as, engineering designs, process efficiency, technology management, project management, etc, should be included in the engineering curricula.

Dr. D.P. Misra

We need to have an innovative and practical engineering education. Our engineering education should produce engineers and technologists with skills and knowledge so that these professionals develop basic and high-end technologies and compete in this market internationally. While we have many engineer designers, when it comes to innovations and basic designs, we do not have much competence. We need to create this competence. Second, we should make engineering education such as would produce multi-skilled engineer-managers. Industry needs engineer-managers today. It will imply reforming engineering education, its delivery including bringing in it more practical aspects, a meaningful during -the-course industrial training, a mandatory industrial internship for about six months after the course is over. Both, during -the-course industrial training and post - course internship should be assessed and the score of these two assessments should be added to the score obtained from the written examination. Engineering degree should be given only after that. We need to reform our regulatory mechanism also so that it can deliver what is needed- quality engineering education.

Dr. O.P. Taneja

For realizing the vision 2020 that we have given to ourselves, we need to ensure that our engineers are of international quality. While we have made much progress in the field of our technical education, we

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still lag behind developed countries in the quality of our technical education, particularly engineering education.

We need to bridge the gap that is there. Action for this needs to start from the very admission stage to the engineering courses for which we need to have one standard for all the three types of engineering institutions that we have namely, IITs, NITs and the other large body of engineering colleges in the country . We need to have one common entrance test for engineering education throughout the country. Further, we need upgrading of the infrastructure that is there with a large body of engineering colleges; we need to up grade the quality of their faculty as well. Then we need to do away with the current reservation policy for admission to engineering courses -management quota, capitation fee, promoters quota, reservation for SC,ST and OBCs.There should not be any such quotas. Merit only should prevail for admission to engineering courses. The people from the backward classes can be given full help in educating their children from the school level itself; and these students can also be trained for the entrance examination to engineerinmg courses .

Engineers need communication skills; they need reports presentation skills; they need English writing skills. These skills can better be developed by including the subject on communication in the curricula itself. Similarly every engineer should have some basic knowledge o f economics and statistics. So, they should be taught these subjects during their engineering education. The industry should also come forward for improving the quality of engineering colleges which are in the private sector as a matter of their business policy and strategy. Some universities / institutions are offering M.Tech and PhD courses through correspondence. We cannot get the quality faculty through this mode of higher technical education. This should not be allowed as a matter of regulation by the competent regulatory body.

There is no failure system in engineering colleges. A student can jolly well complete his / her course even in ten years by allowing him / her to continue taking examinations for subjects or a subject in which he / she has not been able to clear in allowed four years. This practice should also not be allowed by the competent regulatory body. At the most a grace period of just one year can be given to clear all the subjects and complete all other requirements for obtaining the degree in engineering.

Shri J. S. Saluja

For realizing the vision 2020, we will need a major overhaul of our engineering education for bringing it at par, if not to take it beyond, with what it is in the developed countries. Both the curricula and the its delivery need to be reformed so that we produce multi-skilled engineers. For this to happen, we also need to have matching quality of the faculty and the matching infrastructure in our engineering educational institutions with that what it is in the developing countries. While to a large extent our IITS and NITs , match the engineering institutions that are there in the developed countries, problem is at our rather a large body of engineering institutions in the private sector. The five national conventions, national conferences and national workshops on the reform of engineering education that the

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Engineering Council of India has organized since 2006 discussed this issue in-depth and the consensus recommendation was that we need to deal with this issue speedily.

I noticed while in Russia in 1988 in connection with my work related to the steel technologies that some of the technologies invented and put to use there were developed by the scientists who had joined research institutions as graduates and worked in these institutions for about 10-20 years and invented some of these technologies. In India, our students first do graduation in engineering, then M.Tech or M.S and then PhD; and after that they join research institutions, but develop no technology as such. In Europe, students first join factories and then after working in these factories, they decide what kind of engineering they should study. Only those students take this route for becoming engineers who like to become engineers and think that they have an aptitude for it. In India, it is the other way round. How and where we need to improve is a question which needs an answer. Today, by and large, we do not teach how to design, how to innovate, how to develop a new technology, how to manage a technology, how to manage innovations. We have got stuck in civil, mechanical, electrical and so on terminologies. All the latest new technologies are imported and we need to call experts to tell us "show how; while know how is a part of the technology transfer process; show how is not. We do not teach our students how technologies work. This is the ground reality. So, all this needs to change; and sooner we come out of this bind, better it would be for us. There is a need for continuous interaction between the engineering institutions and the industry on what to teach. We need to create a standing institutional interactive mechanism of the engineering institutions and the industry for making engineering education industry-specific.

A Delegate from the Floor

How can we upgrade the standard of engineering education, infrastructure and the faculty of a large body of engineering colleges?

Shri K.K. Kapila

It is a very relevant and important question. This question basically addresses our current regulatory set up for higher technical education, particularity engineering education in the country. In other words, it pertains to the current regulatory procedure of sanctioning engineering colleges. The regulatory authority-AICTE in the present case-ought to ascertain and satisfy itself fully before sanctioning a new engineering college whether the proposal of the new engineering college is as per the laid-down bench marks (standards) regarding the infrastructure that is proposed, the quality of faculty that is proposed and the standard of the curricula that is proposed to be taught in the college; and will this curricula produce employable engineers.

Another related question here is: are there any bench marks set by the regulatory authority on these very important parameters of sanctioning new engineering colleges? Experience tells us that while there may be such bench marks in place, these are not followed as such. If these had been followed, we would have not been loaded with a large body of engineering colleges with the poor quality infrastructure and the faculty. This is the ground reality. This implies that we should have some national standards for both the basic education and higher technical education, particularly engineering education which should also include concerns for sustainability. Further, the present

reservation policy for admission to engineering colleges demerits merit. Some of the provisions that are there include capitation fee, promoters quota, management quota, reserved quota, etc. While reserving seats for the students from the backword classes is okay, the better way, which will not demerit merit, will be to facilitate education of the students from these classes and also train them for enterance test to the professional courses, but do not compromise the merit. If students of low merit get admission to engineering courses, how can we expect such students to become competent professionals? Merit alone should be the criteria for admission to engineering courses. There can be some other ways for addressing the social disparities that are still there in our society.

Some minimum standards for the engineering education should be laid down by the AICTE. These standards should be applicable to all the institutions of engineering education -IITs,NITs and the other engineering colleges. We are not able to attract competent people to the teaching profession. We need to address this issue. Can there be as attractive remuneration package for the faculty as it is there in the industry and management sectors? We need to address this very pertinent question. There is a need to have one standard curricula for engineering education in all the institutions across the country-IITs,NITs and the other engineering colleges. There is a need to have one common admission test for admission to engineering education throughout the country. We need to have a standing mechanism for monitoring whether the standards are being maintained by engineering institutions across the country; if not remedial measures should be taken at the earliest, as required. We need to set up an institution for trainers of the engineering faculty.

We also need to create a standing industry-academia interactive mechanism for dealing with the issues of engineering education, remuneration of the faculty, assessing demand for engineers-disciplinewise and sector-wise from time-to-time as deemed appropriate, etc. Finally, we should also consider moving out of the present discipline-wise engineering education to sector-specific or industry-specific engineering education in the country. So that we produce multi-skilled engineers which the industry needs.

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Apeejay Inst. of Tech.
Gr. Noida

132. Ms. Yogita Sharma
Apeejay Inst. Of Tech.
Gr. Noida

133. Mr. Abinash Sandlibigrala
AIT
Gr. Noida

134. Mr. Mudit Kumar
AIT
Gr. Noida

135. Mr. Sujit Kumar Singh
AIT
Gr. Noida

136. Ms. Shruti Saini
CIDC

137. Mr. K. K. Agarwal
K.K.Agarwal & Associates Pvt. Ltd.

138. Mr. Anil Chaddha
CIDC

139. Mr. Anurag Chaturugi

140. Mr. S. L. Gupta
Advisor, CIDC

141. Mr. Hari Om Gupta
Secy., IASE

142. Mr. Rohtash Kumar

143. Mr. Pankaj Kumar

144. Mr. G. S. Valy

145. Mr. Buishbhanlali K.

146. Mr. N. K. Sharma
SCOPE

147. Mr. S. B. Tare
CE, SCOPE

148. Mr. U. K. Gupta
Dir (T), SCOPE

149. Mr. P. N. Sharma

150. Mr. C. P. Akathu

151. Mr. Mansa Ram

152. Mr. Praveen

153. Mr. Gajay Singh

154. Mr. Sunil Choudhary

155. Mr. Jai Prakash

156. Mr. Dharmendra Pal

157. Mr. Hemant Singh

158. Mr. Vikash Mishra

159. Mr. Akbar Ali

160. Mr. Amil Kumen

161. Mr. Vivek Singh

162. Mr. Ashish Kumar

163. Mr. Suhash

164. Mr. Suman Kr. Singh

165. Mr. Satish Kr. Singh

166. Mr. Harbir Singh

167. Mr. Sunil Kr. Gupta

168. Mr. Md. Aslam

169. Mr. Ashok Kumar

170. Mr. Nitin Kumar

171. Mr. Raj Kumar

172. Mr. Akash Tripathi

173. Mr. Ramesh Kumar

174. Mr. Kamaluddin

175. Mr. Subhash Mishra

176. Mr. Satinder Mohan

177. Mr. Dhevinud K. Soni

178. Mr. Suresh Yadav

179. Mr. Saurabh Mishra

180. Mr. Harinath Singh

181. Mr. Devesh Kumar

Engineering Council of India (ECI)

Engineering Council of India (ECI) was established on April 4, 2002 by coming together of a large number of Professional Organizations / Institutions of engineers to work for the advancement of engineering profession in various disciplines and for enhancing the image of engineers in society, by focusing on quality and accountability of engineers and to enable the recognition of expertise of Indian engineers and their mobility at international level in the emerging WTO / GATS environment. It has emerged as a common voice of its member organizations. It is focusing on the following role and tasks.

Tasks

- Representing Member Associations in government and non-government bodies, and interacting on common policy matters relating to engineering profession.
- Working for the setting up of a Statutory Council of Engineers and later interfacing with it, providing support and inputs for developing systems and procedures for the registration of engineers, CPD, code of ethics.
- Facilitating authorization of member associations to register engineers; assisting them in developing internal systems for undertaking registration, CPD, enforcing code of ethics; and providing common forum for CPD to support the member associations.
- Assisting member associations in interaction with academic institutions and regulatory bodies in regard to their examinations, award of degrees etc.
- Providing forum for exchange of information and experience among member associations, coordination, common thinking and views on important matters.
- Helping in the analysis of existing education systems / bodies and making suggestions in order to make the education relevant for the engineering profession and employability.
- Setting up a Resource Centre and Database of Engineers, which can provide necessary information required for the development of the profession.
- Interacting with professional associations / bodies in other countries & international bodies.
- Undertaking and supporting research for the development of the engineering profession.

Engineer's Bill

ECI has facilitated formulation of a conscious draft of the Engineer's Bill for the consideration of the Government of India, which lays down the criteria for the process of registration of Practising Engineers and provide necessary statutory framework for the same. The draft is being processed by the Ministry of Human Resource Development.

Membership

Membership of the ECI is open to societies / organisations of engineers who meet the following requirements :

- having been established statutorily or registered in accordance with law.
- having atleast 100 corporate members
- having existed for at least four years, and
- the accounts being audited annually.

Board of Governors

Chairman

Dr. Uddesh Kohli	Chairman Emeritus Construction Industry Development Council (CIDC)

Vice -Chairman

Mahendra Raj	President Indian Association of Structural Engineers

Treasurer

Chander Verma	President International Council of Consultants

Members

S. Ratnavel	Member Association of Consulting Civil Engineers (India)
P. S. Sundaram	President Broadcast Engineering Society (India)
Dr. Naresh Kumar	Advisor, Head - RDPD Council of Scientific and Industrial Research
P. R. Swarup	Director General Construction Industry Development Council
K. K. Kapila	President Consulting Engineers Association of India
Rajeev Kher	Joint Secretary Dept. of Commerce, Ministry of Commerce and Industry
Prof. C. V. Ramakrishnan	Member Indian National Academy of Engineers
S.K. Vij	President Indian Buildings Congress
D. P. Misra	Past President Indian Institute of Chemical Engineers

Lt. Gen. (Retd.) A. K. Puri ***PVSM, AVSM***	Chairman Indian Institution of Bridge Engineers (DSC)
Cdr. B.M. Bhandarkar	Chairman Indian Institution of Industrial Engineering
J. S. Saluja	Member Indian Institution of Plant Engineers
Dilip Takbhate	President Indian Society for Non Destructive Testing
Niranjan Swarup	Executive Director Indian Society for Trenchless Technology
B. N. Puri	Principal Advisor (Transport) Planning Commission
R.S. Prasad	ADG (Trg) CPWD, Ministry of Urban Development & Poverty Alleviation
Gp. Capt. (Retd.) H.C. Bhatia	Secretary (Admin) The Aeronautical Society of India
Dr. Baldev Raj	Past President The Indian Institute of Metals
Prof. K Rajgopal	Chairman The Institute of Electrical and Electronics Engineers Inc.
Lt. Gen. (Retd.) Ashok Agarwal ***PVSM***	President The Institution of Electronics and Telecommunication Engineers
Ashok K. Sehgal	Member The Institute of Marine Engineers (India)

Executive Committee

Dr. Uddesh Kohli *Chairman, ECI*	Chairman Emeritus Construction Industry Development Council
Mr. Mahendra Raj *Vice Chairman, ECI*	President Indian Association of Structural Engineers
Mr. Chander Verma *Treasurer, ECI*	President International Council of Consultants
	Chairman Construction Industry Development Council
	Chairman Indian Society for Trenchless Technology

Members

Mr. K. K. Kapila	President Consulting Engineers Association of India & Indian Buildings Congress
Mr. P. R. Swarup	Director General Construction Industry Development Council
Lt. Gen. (Retd.) A.K. Puri, PVSM, AVSM	Chairman Indian Institution of Bridge Engineers (DSC)

Invitee

Lt. Gen. (Retd.) Ashok Agarwal, *PVSM*	President The Institution of Electronics and Telecommunication Engineers
Mr. P. N. Shali	Director Engineering Council of India

Office Bearers of
Engineering Council of India

Dr. Uddesh Kohli
Chairman

Mr. Mahendra Raj
Vice Chairman

Mr. Chander Verma
Treasurer

Engineering Council of India

ECI has been formed by coming together of a large number of professional associations / institutes of engineers. The present members are :

1. Association of Consulting Civil Engineers (India)
2. Broadcast Engineering Society (India)
3. Computer Society of India
4. Consultancy Development Centre
5. Construction Industry Development Council
6. Consulting Engineers Association of India
7. Indian Association of Structural Engineers
8. Indian Buildings Congress
9. Indian Concrete Institute
10. Indian Geotechnical Society
11. Indian Institute of Chemical Engineers
12. Indian Institution of Bridge Engineers
13. Indian Institution of Industrial Engineering
14. Indian Institution of Plant Engineers
15. Indian National Group of The IABSE
16. Indian Society for Non Destructive Testing
17. Indian Society for Trenchless Technology
18. Institute of Urban Transport (India)
19. International Council of Consultants
20. Institution of Mechanical Engineers (India)
21. The Aeronautical Society of India
22. The Indian Institute of Metals
23. The Institute of Electrical and Electronics Engineers. Inc.
24. The Institute of Marine Engineers (India)
25. The Institution of Civil Engineers (India)
26. The Institution of Electronics and Telecommunication Engineers
27. The Institution of Surveyors