

## **Summary of the discussions of the Twenty sixth meeting of Scientific Advisory Committee to Cabinet (SAC-C) held on 7<sup>th</sup> June, 2013 at Vigyan Bhawan Annexe, New Delhi**

The agenda of the meeting and list of participants are at Annexure I and Annexure II, respectively.

### **M26 A1& A2 Opening Remarks**

**Dr. R. Chidambaram**, Chairman SAC-C welcomed all the members and initiated the proceedings of the meeting. Introducing the agenda items he said that INSPIRE is evolving into a successful programme and this office had played a role in development of the scheme. An important feature of the scheme is an assured career for 5 years after Ph.D. Dr. Ramasami will make a presentation on the progress the scheme has made.

Touching upon the Global University Ranking, he informed about the recent National Policy dialogue on “Universities Ranking, Research Evaluation & Research Funding” organised by the Planning Commission and MHRD with the support of British Council, TIMES Higher Education and Thomson Reuters. Analysing the reasons why Indian Universities are not in top 200 rankings, Dr. Chidambaram said that the university ranking of a country, in his opinion is correlated with per capita GDP. University rankings also change with time. He said when India was prosperous Nalanda flourished and must have been high in university rankings if such an exercise had been done then. In Germany, University of Gottingen produced 45 Nobel Laureates in the 19<sup>th</sup> and early 20<sup>th</sup> centuries, but today its ranking is below 150. He also felt that the global university rankings are based on the perspective of developed countries, but we should surely put in all necessary efforts to improve the quality of research and teaching in our university system. Nevertheless in the QS World University ranking for engineering courses, three IITs figured in top 50. He also touched upon the freedom of academic institutions and expressed his views in support of the newly introduced 4-year course for undergraduate programme of Delhi University.

Utilization of waste is a topic that our office and SAC-C is concerned for some time. In fact, this office had encouraged the setting up of automotive waste utilization centre at Chennai with the help of Department of Heavy Industries,

Ministry of Heavy Industries and Public Enterprises. Another important waste is plastics and we shall have a presentation from Dr. M.O. Garg, Director, CSIR-IIP, Dehradun on “waste plastics to fuels”.

He highlighted the importance of batteries and their widespread use in daily life. With the launch of the electric mobility vehicle programme, and the Government thrust on renewable energy, the usage of batteries is likely to go up manifold. Unfortunately the research efforts in the country in this important area are far below the desired levels. He informed that the Office of PSA had recently organised a brainstorming meeting on “energy storage devices” and working towards a report with specific recommendations on various kinds of batteries. Prof. A.K. Shukla, IISc., Bangalore will make a presentation on the R&D issues related to batteries and ultra-capacitors.

He informed the members that Sh. Ajay Chaudhari is unable to make it to the meeting due to health reasons and the presentation on Micro-electronics shall be taken up in the next meeting.

Before concluding his initial remarks, he talked about the need for risk perception & risk communication in science. For India to become a knowledge based developed economy, it will be imperative to have a stomach for risk-taking in research and country should learn to be first introducer of new advanced technologies. Any new introduction is always associated with some risks and we have the capability to ensure safety. Proven technology, unless subjected to continuous evolutionary improvements, is often a synonym for an obsolete technology.

He then took up the action taken report and explained the actions taken on the decisions that have emerged from the last SAC-C meeting. He then invited Dr. Ramasami to make his presentation on the success of INSPIRE Programme.

### **M26 A3 INSPIRE: Scheme for Attraction of Talent for Scientific Research – Dr. T. Ramasami, Secretary, DST**

Initiating the presentation **Dr. Ramasami** gave a brief background to the origins of the scheme. He said that during the preparation of XI FYP under the chairmanship of PSA, majority of the members lamented about lack of attraction for science as career for talented young people in this country and the need for reviving interest in basic sciences was strongly felt. The DST scheme for Innovation in Scientific Pursuit for Inspired Research (INSPIRE) was

emerged in this context. He informed the members that even NSF had created a similar scheme and named INSPIRE on the lines of Indian scheme, speaks well about DST initiative. He said that unless assured career opportunity is created from the beginning, people choosing science stream is difficult. He then discussed the INSPIRE scheme in detail. The scheme has 5 components starting with 10-15 year age group (1 million awards in schools), science camps for the age group of 16-17 years, scholarships for higher education (10,000 scholarships in Maths, Physics, Chemistry and Life Science for the age group of 17-22 Years), fellowships for 1<sup>st</sup> rank holders in any branch of science for the age group of 22-27 yrs.), faculty scheme along with research grant. The INSPIRE scheme was announced by Prime Minister in 2008 Science Congress and the evidence for success of the scheme has started to emerge.

He mentioned that it was heartening to note that for awards at the school level all 28 states & 7 union territories are enrolled. So far 9 lakh awards were given and the target of 1 million will be achieved with in the financial year. The gender ratio is 47.6 female and 52.4 male. There is no reservation in the scheme, yet there is proportional representation with 15.5% SC and 9% ST. Two exhibitions were conducted at national level in Delhi with participation of 1800 people. These two exhibitions resulted in 212 provisional patents from the children of 10-15 age groups. A large number of these entries are focussed on application to local problems. Continuing the presentation, he said that for internship scheme more than 700 science camps were organised at different levels and 1.6 lakh people participated. The provision is for 50,000, but this number had already been crossed. The scheme component had been able to attract about 50 noble laureates and 3500 mentors. As far as the scholarships are concerned, he said that the first three years had not been good and the number joined is very small. A slight change affected in the scheme showed better results and improved performance. Accordingly, those who have admitted into a 5 year integrated course of IISERs and other similar notified institutes are fully covered under the scheme (with proper checks and balances). Moving on to the top 1% performance based component, he informed the members that in the first year only 480 availed the offer out of eligible 7500 students. DST has now enrolled the state boards as partners and requested them to send the eligibility of scholarship letter along with the mark sheet to all eligible candidates. Out of the 73000 eligible this year, about 14050 have availed the scholarship and 22% of those availed are from Mathematics stream. He highlighted the case of Kumaou University, Uttarakhand where all 71 eligible students availed INSPIRE

scholarship. He further said that over 60% of the scholarship holders hail from small towns. In the Fellowship component of the scheme, 1406 scholarships are released to top rankers for Ph.D directly without NET and 60% of them are girls. He mentioned that as a result of the scheme Ph.D output in agriculture sciences increased significantly. He explained the Faculty scheme in great detail. He said that in this scheme known as Faculty Award, about 1000 positions are available every year and their salary matches an Assistant Professor of IIT. It has both vertical and lateral entry opportunities. The vertical entry of faculty will take some more time. The lateral entry has taken off and it is in three modes. These are: (i) IITs, IISERs and IISc can follow their own rigorous method of selection and propose to DST for Faculty Award (ii) Other Institutes can follow a method suggested by DST and select candidates for award and (iii) DST enrolled INSA as a partner for shortlisting and selection of candidates through an Apex committee. So far about 550 awards were granted. The scheme is able to attract several Indians staying abroad to come back and relocate.

Concluding the presentation, he said that it is still a short period to assess the success of the scheme, but it is already showing positive trends. The details of the presentation are at Appendix 'A'.

This was followed by a detailed discussion and members shared the following views

- **Dr. Krishan Lal** said that implementation of the INSPIRE Faculty Scheme had been an effective exercise which is being managed by 8 committees working very zealously. Number of people applying from outside India has increased and for the interviews skype, video conferencing with NKN facilities are being used. He gladly mentioned that till now the committee had not missed any deadline. As a point of concern, he stated that in some universities the package at the entry level is lower than INSPIRE fellowship leading to their absorption in the university a problem.
- **Dr. Pratibha Jolly** said that it had been a truly inspiring experience to attend the science camps. Projects across the country are of very high level and these will certainly have an impact on society. She felt that inspire internships review meeting in Pune every year is an eye opening. There appeared to be a sharp contrast between the camps organised in

metros and other parts of country. There is a need to analyse this sharp contrast to the success rate across the country.

She then discussed the issues of University & Institutes not welcoming the faculty awardees. She mentioned that UGC Research Scientist awards as an example. She said that these were very good with salaries of similar scale with the advantage that the person can work in any area of his/her interest, set up needed facilities and work passionately. Such individual may find community led opposition because these positions are considered as back door entry to claim a permanent position. Thus the UGC scheme was great, but fell into lot of trouble. After a while the awardee also starts asking whether he will be absorbed or not? We need to take care of such problems in Faculty award scheme of INSPIRE.

- **Dr.Sikka** said that his experience of addressing the students in the Inspire Science Camp in Rajasthan was very stimulating. He enquired about the budget of the scheme. To which, Dr. Ramasami informed that DST budget for current year is Rs.2100 Crore and department wishes to invest about 10% of its budget on INSPIRE.
- **Dr. Milan Sanyal** congratulated Dr. Ramasami for the success of INSPIRE Scheme. He enquired whether there is any legal implication in recruitment into the INSPIRE scheme. Dr. Ramasami informed that INSPIRE faculty award is a fellowship and not a permanent position and there are no legal implications. **Dr. Sanyal** suggested that after 2<sup>nd</sup> & 4<sup>th</sup> year there should be a report of the candidate performance and movement of individual to other organization should be allowed during the period of fellowship.
- **Dr. Joshi** too agreed with the suggestion and said that the candidates should be freely allowed to apply to other positions and even apply for additional projects other than the start-up grant.
- **Dr.Raghavan** observed that INSPIRE is a phenomenal example of how an agency implements the concepts being discussed. Other point he highlighted was the opening of bottom of pyramid with INSPIRE scheme in higher education and people from far locations now have an opportunity to pursue higher education.
- **Dr.R.Chidambaram** appreciated the massive effort of DST in implementing the Programme with zeal and great deal of attention to detail. He also mentioned about the programme of gifted children

sponsored by the PSA's Office. He then invited Dr. M.O. Garg to make his presentation.

#### **M26 A4 Waste Plastics to Fuels – Dr. M. O. Garg, Director, CSIR-IIP, Dehradun**

**Dr. M.O.Garg** made a presentation on waste plastics to fuels and chemicals. Presenting the world scenario he said that out of about 280 million tonnes of waste plastics generated every year, only 130 million tonnes are recycled while rest is littered and uncollected. In India ~56 lakh TPA waste plastics are generated and only 60% is recycled. He said that according to the waste plastics management hierarchy reuse & recycling is environment friendly while land filling & energy recovery are hazardous to environment. He then discussed the world scenario of mechanical & chemical methods of recycling the plastics. In chemical recycling of waste polyolefin (PE & PP) thermal process and thermo catalytic process were elaborated. He then shared the IIP's initiatives of converting waste plastics to value added products. The concept of idea started in 2003 and proof of concept emerged in 2006. Thereafter lab scale studies were carried out (2006-2008), with the objective of development of process by screening of different catalysts and process optimization for conversion of waste plastics (PE & PP) and low polymer wax (LPW) into value added hydrocarbons i.e. gasoline, diesel, aromatics. These experiments led to obtaining of automotive grade fuel. The scale up studies were carried out in a pilot-plant designed & tailor made by IIP in collaboration with GAIL in 2009-12. During this period lab scale results were revalidated, scalable data was generated and the fuel performance was tested and exclusive production of either gasoline or diesel or aromatics along with LPG from polyolefin waste (eg HDPE, LDPE & PP etc.) was experimented. The fuel performance was found to be at par with commercial automotive grade fuel and it met most of Euro specifications with low carbonaceous residue. He further said that the process is simple, pollution free and completely environment friendly. He said that by this process 60% of plastic waste can be safely treated.

Concluding his presentation, **Dr. Garg** requested SAC-C support to set up demo units (10 TPD) along with State Transport Corporation (STC) in diesel mode where the diesel (with a price of Rs.45/- per litre) may be completely consumed by STC. The details of his presentation are at Appendix 'B'.

During subsequent discussion, the following points emerged:

- **Dr. P. Ghosh** observed that 10 TPD capacity will be low to realize economies of scale. The technology needs to go through the sensitivity analysis i.e at which optimum scale the technology becomes viable. So that the costs could be firmed up and designs could be developed for that level. The product needs clearance from petroleum sector to scale up. STC may or may not be interested in setting up the plant. He suggested involving large major companies in oil sector on board. The oil companies may partner with IIP pilot scale technology and take it to commercialization. The tax benefits for this kind of fuel may be persuaded simultaneously.
- **Dr.Yogeswara Rao** said that to collect waste plastic & transport to a distant plant may defeat the very purpose. The idea should be to put smaller plants near to urban centres where the collection of plastic becomes easier and transport costs are minimized.
- **Dr. Ramamurthy** gave the comparative study of garbage in Hyderabad & Vienna. The garbage production in whole of Vienna is much higher than Hyderabad but the utilization of garbage is much higher in Vienna and there is no aggregation of garbage. The waste plants operate regionally in small scale than bigger plants with minimum shifting of garbage. He suggested handling this problem locally at ward level as this is not an industrial but a social problem.
- **Dr. Devang Khakar** appreciated the technology developed and refined by IIP. He said that the economics include not only the manufacturing part but also the collection & transportation. Smaller plants with regional distribution will be more viable.
- **Dr. Chidambaram** wanted to know what is the capital cost of a 10TPD plant and whether green chemistry is followed & any toxic effluents produced?

**Dr. Garg** replied that economy of scale is the other way round. As we go up in capacity, pay back is much lower i.e. the typical chemical engg. principles. The cost of a 10TPD plant is Rs.19 Cr. He said it's important that the fuel produced may not go into the secondary market of adulteration as it is better than Euro III standards. Thus the organization, where the plant may be set up should have 100% captive consumption and that would be ideal.

*The committee appreciated the efforts of the IIP on waste plastics to fuels initiative. After further deliberations SAC-C recommended that a small*

*committee including Dr. T. Ramasami, Dr. Devang Khakkar, and Dr. Yogeswara Rao may be constituted to look into the technology details to take the best step forward and suggest further course of action.*

Initiating the next agenda item **Dr. Chidambaram** highlighted the areas where energy storage is important e.g. electric mobility platform and (intermittent) renewable energy. He shared that in S&T report of XI plan, Office of PSA had suggested that hybrid vehicles are more suitable for India. And in electric vehicles batteries play an important role. Besides renewable energy is intermittent and batteries are needed to either store, release or hybridize with other energy sources. Organizations such as Department of space & DRDO need batteries for their own use. In mobiles and computers small Li-ion batteries are required. He mentioned that when President Obama started the innovation hubs, one of them was indeed on energy storage devices anchored by Argonne National Laboratory. He informed the committee that the Office of PSA recently had a brainstorming session on energy storage devices where experts from IISc, ARCI, DRDO, DoS, CECRI-CSIR, DHI and industry etc. participated in day long deliberations. A status cum roadmap report is being prepared on the subject. He then invited Prof. A.K. Shukla to make his presentation.

**M26 A5 Energy Storage Devices: Batteries & Ultra Capacitors – Prof. A. K. Shukla, IISc, Bangalore**

**Prof. A.K.Sukla** made a detailed presentation. He said that energy services are crucial to human wellbeing and to a country's economic development. And for the storage of energy batteries and ultra-capacitors are critical. For a successful battery system apart from electrode materials, cost & availability of material is important. He elaborated on the conventional and newer technologies, characteristics of good storage batteries & type of batteries. He discussed in detail the various types of batteries. He opined that lead-acid batteries are the most used category due to its reliability & high recyclability. He also discussed about the advantages and disadvantages of other batteries e.g. rechargeable Li-ion batteries, Fe-based batteries, namely Fe-Air, Ni-Fe etc. Availability of Li-sources in the country, cost & safety issues is a concern. He urged increased efforts in R&D on Pb-Acid, Fe-based & Li-Accumulators as well as Human Resource Development in this crucial area. He further recommended setting up of centres of Excellence on these three battery systems at three locations for sustained activity. The details of his presentation are at Appendix 'C'.

During subsequent discussion, the following points emerged:

- **Dr. Chidambaram** shared that the groups as decided after the brainstorming session on energy storage devices will write the specific chapters of the report with specific recommendations to academia, industry & govt. Then the draft report shall be discussed among a larger group of experts and refined. At that stage, he would like to bring it to the SAC-C for its suggestions and recommendations.
- **Dr. Ramasami** said that internationally a large percentage of the Research and developments in this sector are taking up in the industry, i.e closer to applications. By initiating the programmes far away from the market, we will be aging the process. Therefore there is a need to come with a different model which is not conventional. Lateral entry into technology platform had to be thought of. Partnerships must be in a mission mode with specific end deliverables. Programmes like electric mobility must be given priority for this area. Technology acquisition from abroad has to be encouraged and internal capabilities must be synergised. CECRI, Karikudi is a complete institute having all the facilities for electrochemical systems with application oriented programmes and needs to be encouraged to take up such programmes in a mission mode. In a long supply chain, centres of excellence (CoE) will be fine, but for application development CoEs may not be the right approach. He suggested building technology platforms in 4-5 critical areas, setting benchmarks and pooling all the resources to strengthen these areas.
- **Dr. Chidambaram** said that obviously for speeding up the process, we must have international collaboration. He informed that Argonne National Laboratory is interested in collaborating with India and PSA's office is working on this. He further said that whilst CECRI has the capability, there are other labs like ISRO which also have necessary expertise in the batteries' area. For long term sustainability, it may still be necessary to look at CoEs.
- **Dr. Vijay Ragavan** appreciated the presentation and opined that knowledge share and development is necessary, but is a long process. There is a need to leap-frog in this area. He cited the example of Reva car and Mahindras and said that Mahindra's got into electric car segment after purchasing Reva. It had raised lot of interesting R&D problems on batteries. For example, in automotive and space sector requires high quality energy battery which can rapidly be recharged. R&D

organisations and industry could be pushed to create an industry proximal structure which may take care of low hanging fruits, while one develops through a variety of ways the higher end batteries.

- **Dr. Chidambaram** said that DRDO had started a project at IIT, Kharghapur on Li-ion batteries. There is a need to build up capability in all types of batteries. He gave the example of CAREL for strengthening the electronic hardware field where half a dozen applications were identified & for each of these, interactive meetings with industry were organised to chalk out the future course of action.
- **Dr. Sanyal** said that the science part in batteries is not yet over. There is still good scope to improve or bringing out a new battery system. The other part is known technology and known science and taking it to the industry. We need to have both.
- **Prof. SV Raghavan** said that listening to various people on different forums, one thing comes out clearly that the country has distributed strength and not a critical mass for solving a major problem. Many of these institutes are NKN connected and we can bring them together for wider synergy. What are the grand challenges in the batteries' field and who are to be connected, it is necessary to determine. INSA may take lead in this area.
- **Dr. Joshi** commented that industry involvement is important. Without their involvement any amount of research is not going to help.
- **Dr. Yogeswara Rao** said that battery manufactures are different from battery users. Automobile manufacturers, such as Maruti, TATAs and Mahindras are users and source their requirement from other manufactures. In the country only few players are into manufacturing of batteries and that to only into Pb-acid batteries. There is not much research taking place in this area among the public funded institutes. There is a need to build the base both for R&D including manpower development and manufacturing.
- **Dr. Ramasami** said that the programme should be a demand driven one rather than supply driven. We seem to be mostly on supply driven system.

*At the end of deliberations SAC-C recommended that the groups as decided after the brainstorming session on energy storage devices will prepare the report with specific recommendations for interventions as*

*appropriate. After refining the report in consultation with experts, the final recommendations may be placed before SAC-C.*

The agenda item M26 A6 CAREL and Translational Research-Role of Nano, Proto and Mega Fabs- by Sh. Ajai Chowdhri, Founder HCL was not presented due to health reasons.

**Dr. Chidambaram** brought up Risk Perception as an off-agenda item for discussion. He informed the members that he had been having discussions with Dr. Ramamurty on this subject so that NIAS can take up this problem. He then discussed the various concepts of risk perception: familiar risk, (what he called) self-satisfying risk, technological risk, (what he called) transferred familiarity which can help in risk perception etc.

- **Dr. Raghavan** opined that the immediate relevance of risk perception is in the realm of clinical trials & technology in agriculture, in addition to the broad value of communicating scientific data & analysis to people. He said that on the assumption that the regulatory systems of other developed countries are more robust and well established, the data on trials and risk assessment is transferred which in the long run may lead to adverse consequences. Weak regulatory policies and poor communication from our side may aggravate the problem. The other issue is propagation of an activism with a sense of nativity and legal systemic failures.
- **Dr. P.Ghosh** commented that every regulatory authority must set up a continuous monitoring mechanism for possible manifestation of risk and its evaluation. There is well established literature on risk communication regarding how a human being perceives risk for large proximate spectacular events. These events may have a much higher perception of risk than the events which are occurring continuously with higher value of aggregate risk. For example the number of deaths per billion watt hours in nuclear power is far less than from coal plants. Risk perception may also be due to the way in which risk has been communicated. Thus appropriate risk evaluation & risk communication are important for any new technology.
- **Dr. R.B.Singh** shared his view about the inappropriate risk assessment communication aspect of GM crops in media. He informed the committee that on appeal of few NGOs & other organizations Supreme Court gave a 10 year moratorium, for testing of GM crops. Responding to the order all

stakeholders after conducting a brainstorming session submitted a policy report to Supreme Court on lack of evidence or any adverse effect on consumption of GM crops. He strongly felt that such events were the consequence of failure in proper science communication.

- **Dr. Ramamurthy** noted that misinformation has started interfering in the decision making process of the government and regulatory agencies. Many countries have a programme on risk communication, risk analysis, and risk management which do not exist in our country. Large number of research papers are available in literature and we may invest in studying some of these things and recognise this as a part of science.
- **Dr. Chidambaram** agreed that risk communication is a part of science communication and may be taken up as an agenda item in next SAC-C. In the context of new advanced technologies science communication should not focus only on risk perception, risk management but take a holistic view.

*The Committee felt that it is an important issue and nation has to take appropriate steps in right earnest.*

The meeting ended with a vote of thanks to the Chair.

## **LIST OF PARTICIPANTS**

1. Dr. R. Chidambaram
2. Prof. Devang Khakhar
3. Dr. B. K. Gairola
4. Prof. S.K. Joshi
5. Prof. Milan K. Sanyal
6. Dr. Pratibha Jolly
7. Dr. Prodipto Ghosh
8. Dr. M.S. Raghunathan
9. Dr. V.S. Ramamurthy
10. Dr. S.K. Sikka
11. Dr Tessa Thomas
12. Prof. Vijayalakshmi Ravindranath
13. Dr. K.Vijayraghavan
14. Dr. J.S. Yadav
15. Dr. Krishan Lal
16. Prof. A. K Shukla
17. Dr. T. Ramasami
18. Prof. R. B Singh
19. Dr. M.O. Garg
20. Dr. Sanat Kumar
21. Dr. S. M. nanoti
22. Shri Sanjeev Chawla
23. Prof. S.V. Raghavan
24. Dr. D.Yogeswara Rao
25. Shri Neeraj Sinha
26. Dr. Manju Gerard