Summary Record of Discussion of the Fifteenth Meeting of Scientific Advisory Committee to the Cabinet (SAC-C) held on 13th August 2008, at Vigyan Bhawan Annexe, New Delhi.

The fifteenth meeting of the Scientific Advisory Committee to the Cabinet (SAC-C) was held on 13th August 2008 under the Chairmanship of **Dr. R. Chidambaram**, Principal Scientific Adviser to the Government of India (PSA to GOI) and Chairman, SAC-C.

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

M15A1 Opening remarks by the Principal Scientific Adviser to the Government of India & Chairman, SAC-C.

At the outset, the Chairman welcomed members of the Scientific Advisory Committee to the Cabinet (SAC-C). Thereafter, he gave a background of the proposal of the Working Group on Cross Disciplinary Technology Areas. The details of 'Cross Disciplinary Technology Areas' are contained in Chapter 8 of The Steering Committee on Science and Technology for Eleventh Five Year Plan (2007-12) (http://www.psa.gov.in). This report was prepared by the Apex Committee constituted by the Planning Commission under his Chairmanship.

M15A2 On Implementation of the proposal of the Working Group on Cross Disciplinary Technology Areas as finalized in the Eleventh Plan Project Proposal.

Dr. Baldev Raj, Distinguished Scientist & Director, Indira Gandhi Centre for Atomic Research, gave a presentation on Cross Disciplinary Technology areas based on the Steering Committee Report. He mentioned that the report has identified eleven S&T areas under the umbrella of Cross Disciplinary Technology Areas.

It was clarified that as per terms and conditions of the Planning Commission, only areas allotted to various scientific departments as identified in Government of India (Allocation of Business) Rules, 1961, amended from time to time, were considered by the Steering Committee. These Cross Disciplinary Technology areas include Desalination and Water Purification Technologies, Nutrition, Health care (Medical diagnostics, Medical devices, Vaccines), Advanced Computing, Advanced Manufacturing, Robotics and Automation, Combustion Research, Sensors & Integrated Systems, Distributed Sensors and Networks, Security Technologies, Advanced Functional Materials.

He further gave the details of implementation mechanism of recommendations for inculcating the culture of translating the scientific knowledge to practical gains. The main features of implementation mechanism are (1) Establishment of research parks to facilitate to act as the hub for interfacing of universities, R&D centres and industries, (2) Constitution of empowered panel of experts, with financial control, that can suggest and implement mid-course corrections to the programme, to facilitate and exploit breakthroughs in R&D, (3) There is a need to have an education system which integrates Science, Engineering and Medicine (4) For areas such as Desalination and Nutrition, Public-Private Partnerships must be encouraged, (5) Need for adequate legislations to ensure progress in some of the cross-disciplinary technology areas, wherever necessary, (6) Need for an autonomous regulatory authority in the area of Medical instruments, (7) India is on the threshold as a hub for clinical trials, especially for vaccines. This must be exploited. (8) In several of the cross-disciplinary technology areas, collaborative ventures with Scientists and Technologists of Indian origin abroad, and foreign institutions of repute should be actively encouraged.

This will pave the way for crucial inputs both by way of science and technology and work practices that will help us to leap frog in the development of science based technologies. The identification of the

collaborating scientists and institutions will be carried out when the detailed proposals are submitted.

After detailed deliberations, SAC-C opined that when a technology area is cross disciplinary it is likely that more than one Department of the Government can fund R&D projects in that area. To avoid duplication and to assure adequate dissemination of information and knowledge among the institutions and scientists working in such an area, it is recommended that a single Oversight Committee of experts will assess, recommend for funding and review R&D projects in that area. While all the concerned Departments will be represented in that committee, there will be one nodal Department. Funding can come, as agreed upon, from various Departments but there will be no further technical review of the projects from individual departments. While this does not prevent individual departments from taking up additional R&D projects, this will be done after taking fully into account the projects funded by the multi-Departmental Oversight Committee. Depending on the nature of the technology area and the level of development in the country, the character of the R&D project could include directed basic research, pre-competitive applied research, specific time-bound product-oriented research and development. The latter may also transform into mission mode, wherever appropriate.

An Apex Committee for the technology area may also be formed to lay down the road map for each technology area. Generally, this will be before the Oversight Committee is formed; in some cases, two Committees function simultaneously for some time. Alternatively, the Apex Committee in some cases, can itself function as the Oversight Committee.

M15A3 On Revitalizing R&D on Natural Disasters and their Management including Relevance to Climate Change Threat.

Climate change is an additional stress to the existing climate variability and is projected to increase the natural disasters manifest in

the adverse impacts relating to storms, floods, heavy precipitation, and extreme heat events. Department of Science and Technology (DST) in its presentation while explaining the significance of the climate change in the context of natural disasters and need of understanding and forewarning capabilities supporting better management on disaster. A reference was also made to various programmes of Ministry of Earth Sciences and Ministry of Science and Technology and their linkages with National Action Plan on climate Change was also given.

It was mentioned that the initiatives of Ministry of Environment & Forest include issues related to impact, vulnerability and adaptation to climate change pursuant to India's Second National Communication to the United Nations Framework Convention on Climate Change. The presentation pointed out that the Ministry, at the time of preparation of India's Initial National Communication, had developed a network of institutions which had undertaken studies on impacts of climate change on key economic sectors, such as water, agriculture, natural ecosystems, coastal zones, infrastructure, including assessment of extreme events such as cyclones, storms and heavy precipitation as many as 36 research teams were constituted.

As a follow up action of recommendations of Second National Communication, the Ministry has also launched studies on impacts and vulnerability to and adaptation to projected climate change building on the earlier work. This work is highly relevant to the subject of discussion in so far as the research and development on natural disasters and their management including relevance to climate change threat is concerned.

The key thematic areas for research & knowledge generation identified by DST in its presentation include revitalizing R&D in Natural Disasters include understanding climate change, Climate science (including observations & modeling), Hydrology, glaciology and water resources, Climate-society linkages in key sectors and regions including issues of vulnerability & adaptation, Ecosystems (including forests,

biodiversity and carbon sinks), Agriculture (mitigation and adaptation), Health, Water resources, Disaster management, Technology priorities for adaptation and mitigation, Advanced fossil, Renewable, Transport (fuels, vehicles and transport systems), Energy intensive industries (ferrous, non-ferrous, cement, petrochemicals), Construction and buildings (including urban infrastructure).

The above key thematic areas of research are likely to improve regional and global modeling capability. Thus, the assessment of vulnerability applying regional and global modeling would give a better assessment of vulnerability and help in adoption of full range of technology ranging from traditional knowledge to frontier science. Technologies for disaster management and mitigation could be identified and grouped sectorwise. The primary sectors may be agriculture, agricultural biotechnology and plant genomics, health including disease surveillance, including prevalence as a result of environmental change including new treatments etc. The development of appropriate technologies to improve the efficiency of water usage for multiple uses and may also play an important role in the disaster mitigation and management.

The Ministry of Environment and Forest endorsed the view expressed in the presentation by DST and further added that the efforts should also be made to examine linkages among water resources, agriculture, food security and livelihoods; human health and climatic extreme events; forests and natural ecosystem and livelihoods. This would help in quantifying significance and relevance for the various Missions envisaged under the National Action Plan for Climate Change released by the Hon'ble Prime Minister on June 30, 2008. Therefore, it is imperative to revitalize R&D on disaster mitigation and management also to address issues relating to climate change. For this purpose, institutions under ICAR, CSIR, universities, Government departments, Ministries and Non-Governmental Organizations countrywide may, therefore, should be fully involved. These institutions have the technical capacity to respond to concerns of climate change and can serve as vehicle for advancing work in

the management of natural disasters. SAC-C appreciated action taken by DST, Ministry of Environment and Forest and suggested to monitor the progress more effectively and keep SAC-C informed.

M15A4 Exploring possibilities for semiconductor industries in India.

A presentation on exploring possibilities for semiconductor industries in India was made by Department of Information Technology (DIT). In the presentation, the Global and Indian Scenario of the Electronics and Semiconductor market was presented. India becoming an important source of chip design destination was highlighted.

DIT's programme in the area of semiconductors has primarily been through i) Research and Development in Nano-technology ii) Human Resource Development in the area of VLSI design & related software and iii) Policy initiatives for Manufacturing - Special Incentive Package Scheme (SIPS) to encourage investment for setting up of semiconductor fabrication and micro and other nano technology manufacturing industries.

The approach in the Nano-technology had been to create networked multidisciplinary centers for research in nano-electronics (at IIT Bombay and IISc Bangalore) and nanometrology (NPL Delhi) at the national level and fund small/medium level research projects in specific areas, such as nanomaterials, nanodevices, carbon nano tubes, nanosystems etc. With a vision to make India high-end VLSI design destination and target around US$1B (Rs. 5000 Crore) turnover by 2010 (15-20% of the global share), DIT initiated the Special Manpower Development Programme in VLSI design & related software (phase-II) in March 2005. During the last three academic years (2005-06, 2006-07 and 2007-08) 3344, 3832 and 4021 manpower at various levels (BE/ME/PhD) have been generated.

The semiconductor industry and other high tech industries are characterized by specific constraints that challenge their viability. These are highly capital intensive and have to deal with constantly changing technology. It, therefore, becomes imperative on the part of the

Government to create a conducive environment for manufacturing and offer a package of incentives, comparable with other countries to attract global investments into the manufacturing sector as well as help bridge the viability gap due to lack of adequate infrastructure and eco-system. With this in view, DIT initiated the Special Incentive Package Scheme (SIPS) to encourage setting up semiconductor fabrication and other micro and nano technology manufacturing industry in India in March 2007 (Guidelines for SIPS were issued on September 2007). Under this scheme, capital subsidy in the form of investment grant or equity is provided to investors. This scheme is open for all Semiconductor and ecosystem units, namely, displays including Liquid Crystal Displays (LCD), Organic Light Emitting Diodes (OLED), Plasma Display Panels (PDP), and other emerging displays; storage devices; solar cells; Photovoltaics; other advanced micro and nano technology products; assembly and test of all the above products.

The scheme is open up to 31st March 2010. There is a ceiling on the number of units, which could be considered under SIPS viz. 2 to 3 fab units and 10 eco-system units. The units become eligible for capital subsidy subject to Threshold Net Present Value (NPV) of investments, which is Rs. 2,500 crore and above in case of fab units and Rs. 1,000 crore and above in case of ecosystem units.

The committee was informed that till date, 13 proposals amounting to a total investment of Rs. 1,31,915.38 crores (in 10 years) have been received (one for semiconductor fab, one for TFT-LCD panel and eleven in the area of solar photovoltaic). DIT has set up a panel of technical experts to evaluate the proposals. The committee was provided with the list of the companies that have applied under SIPS. It was also indicated that manufacture of polysilicon is covered under the SIPS policy and four investors have already applied for manufacture of polysilicon along with solar photovoltaic.

Dr. J. Vasi, Deputy Director, Indian Institute of Technology, Bombay, in this context appreciated the steps taken by DIT for Special Incentive Package Scheme for Semiconductor Manufacturing" in March 2007, and particularly the guidelines issued in September 2007 in DIT. He mentioned that the proposals received so far, are mainly in the field of photovoltaics and suggested that some of the interest evinced in 2005-2006 by early potential manufacturers has got transformed from chip fabrication to photovoltaic device and module fabrication. While this represents a shift from the original intent of having chip manufacturing in India, we should see it as a necessary market-driven force. There are three important reasons why it is entirely appropriate for India to go into semiconductor photovoltaic device fabrication in a big way.

First, the cost of setting up a semiconductor photovoltaic fabrication unit is much less – perhaps 20% of the cost of a chip-manufacturing foundry, which can touch $ 5 billion. This makes it more attractive to investors. We should see this as an initial vestment, which if successful, will create a suitable ecosystem in which a larger investment can more realistically be made. In other words, investment in photovoltaic today will lead to investment in chip manufacturing tomorrow.

Secondly, with increasing emphasis on clean energy world-wide, photovoltaic today is an extremely important area in its own right. It probably is at the same point in its growth curve that chip manufacturing was at in the 1970's and 1980's. This is clear from enormous attention that photovoltaic is receiving from venture capitalists all over the world.

Thirdly, seeing the market forces at work in the direction of photovoltaic, it is important to harness these effectively and therefore support photovoltaic manufacturing, but only where it involves semiconductor processing (and not just say, making modules from ready wafers).

Another important concern if India is to flourish in the area of semiconductor manufacturing is the shortage of available trained

manpower for manning the industries and doing research. Ministry of Human Resource Development (MHRD) should be brought into the loop to fund programmes in these areas, similar to the synergistic collaboration between the various Departments of Government of India dealing with energy and MHRD during the 1980's, which led to a profusion of trained VLSI engineers, who seeded the VLSI industry.

After detailed deliberations, SAC-C recommended that a committee be constituted under the Chairmanship of Dr. J. Vasi, Indian Institute of Technology (IIT), Mumbai, with members drawn from Ministry of Human Resource Development (MHRD), Department of Information Technology (DIT), Indian Institute of Science (IISc), Central Electronics Engineering Research Institute, Pilani (CEERI) and some selected industries, DST as a nodal department to look into the various aspects of exploring the possibilities for semiconductor Industries in India, in global context which is governed by the market forces. Semiconductors play a significant role in advanced computing, remote sensing (RS), geographic information (GIS), global position system (GPS), simulation modeling etc. and serves as a cost effective tool for collection of information relating to natural resources (soil, land, water crops) over large areas for their efficient monitoring and management and much wider use of sensors in the filed agriculture, health, security and surveillance etc. For this purpose, the semiconductor industry would also require manpower with the proposed investment coming in, an integrated view about manpower development.

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

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Annexure-I

Fifteenth Meeting of the Scientific Advisory Committee to the Cabinet (SAC-C)

Date : 13th August 2008
Time : 10.30 A.M.
Venue : Committee Room 'A', Vigyan Bhawan Annexe, New Delhi.

AGENDA

M15A1 Opening remarks by the Principal Scientific Adviser to the Government of India & Chairman, SAC-C.

M15A2 On Implementation of the proposal of the Working Group on Cross Disciplinary Technology Areas as finalized in the Eleventh Plan Project Proposal.

M15A3 On Revitalizing R&D on Natural Disasters and their Management including Relevance to Climate Change Threat.

M15A4 Exploring possibilities for semiconductor industries in India.

M15A5 Any other item with the permission of the Chair.

M15A6 Concluding remarks by the Chair

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Annexure-II

List of participants of the Fifteenth Meeting of Scientific Advisory Committee to Cabinet (SAC-C) held on 13th August 2008, at Vigyan Bhawan Annexe, New Delhi

Sr. No.	Name, Designation and Organization	Status
1.	Dr. R. Chidambaram, Principal Scientific Adviser to the Government of India, Vigyan Bhavan Annexe, Maulana Azad Road, New Delhi – 110011	Chairman
2.	Dr. M.S. Ananth, Director, Indian Institute of Technology Madras, I.I.T. Post Office, Chennai – 600036.	Member
3.	Dr. Mustansir Barma, Director, Tata Institute of Fundamental Research (TIFR), Homi Bhabha Road, Navy Nagar, Colaba, Mumbai – 400005.	Member
4.	Dr. (Mrs.) K.A. Dinshaw, Director, Tata Memorial Centre, Dr. E. Borges Road, Parel, Mumbai – 400 012	Member
5.	Dr. B. K. Gairola, Director General, National Informatics Centre, Department of Information Technology, Ministry of Communications and Information Technology, A-Block, CGO Complex, Lodhi Road, New Delhi – 110003	Member
6.	Dr. Rohini M. Godbole, Centre for High Energy Physics, Indian Institute of Science, Bangalore – 560 012	Member
7.	Dr. Baldev Raj, Distinguished Scientist & Director, Indira Gandhi Centre for Atomic Research, Kalpakkam – 603102, Tamil Nadu.	Member
8.	Prof. Vijayalakshmi Ravindranath, Director, National Brain Research Centre, NH - 8, Nainwal Mode, Manesar, Gurgaon – 122050 (Haryana).	Member
9.	Dr. Panjab Singh, Foundation for advancement of agriculture & Rural Development, Saraswati Kunj, Narainpur (Dafi), Varanasi – 221005.	Member
10.	Dr. V. Sumantran, Scientific Consultant, Office of the Principal Scientific Adviser to the Government of India, Door 7/1, Valli Ammai Aachi Road, Kotturpuram, Chennai – 600 085.	Member
11.	Dr. V. K. Saraswat, Distinguished Scientist & Chief Controller R&D (MSS), Defence Research and Development Organization, Ministry of Defence, Room No. 503, 5th Floor, DRDO Bhawan, New Delhi – 110011.	Member
12.	Prof. Pramod Tandon, Vice Chancellor, Northeastern Hill University, Shillong – 793022.	Member
13.	Dr. Juzer Vasi, Deputy Director, Indian Institute of Technology, Bombay, Powai, Mumbai – 400076	Member
14.	Dr. Mangla Rai, Secretary, Department of Agricultural Research & Education, Room No.105, 1st Floor, Krishi Bhawan, New Delhi – 110 001.	Member
15.	Dr. Samir K. Brahmachari, Secretary, DSIR & DG, CSIR, Anusandhan Bhawan, Rafi Marg, New Delhi – 110 001.	Member
16.	Dr. T. Ramasami, Secretary, Department of Science & Technology, Technology Bhawan, New Mehrauli Road, New Delhi – 110 016.	Member
17.	Prof. R.A. Yadav, Chairman, All India Council for Technical Education (AICTE), 7th Floor, Chandralok Building, Janpath, New Delhi-110001.	Member
18	Prof. M. Vijayan, President, Indian National Science Academy, 2, Bahadur Shah Zafar Marg, New Delhi –110 002.	Member
19.	Dr. P.S. Goel, President, Indian National Academy of Engineering, Ministry of Earth Sciences, Mahasagar Bhawan, block-12, CGO complex, Lodhi Road, New Delhi 110003	Member

20	Dr. Ashok Mishra, President, National Academy of Sciences (Allahabad), National Academy of Sciences, India, 5, Lajpatrai Road, New Katra, Allahabad - 211 002.	Member
21.	Prof. S.K. Thorat, Chairman, University Grants Commission, Bahadur Shah Zafar Marg, New Delhi – 110 002.	Member
22	Dr. S.K. Sikka, Scientific Secretary, Office of the Principal Scientific Adviser to Government of India, Vigyan Bhavan Annexe, Maulana Azad Road, New Delhi – 110011	Member-Secretary
23	Sh. Vijai Sharma, Secretary, Ministry of Environment and Forests, Paryavaran Bhavan, CGO Complex, Lodhi Road, New Delhi – 110003.	Invitee
24	Sh. Jainder Singh, Secretary, Department of Information Technology, Electronics Niketan, 6, CGO, Complex, New Delhi – 110003.	Invitee
25	Sh. K.V.S.S. Prasad Rao, Chairman, National Technical Research Organization, J-16, Hauz Khas, Aurobindo Marg, New Delhi – 110016.	Invitee
26	Dr. S.K. Bhattacharya, Additional Director General, Indian Council of Medical Research, Ansari Nagar, New Delhi.	Invitee
27	Sh. S. Chatterjee, Adviser, Office of the Principal Scientific Adviser to Government of India, Vigyan Bhavan Annexe, Maulana Azad Road, New Delhi – 110011	Invitee
28	Dr. R.P. Gupta, Scientist, Office of the Principal Scientific Adviser to Government of India, Vigyan Bhavan Annexe, Maulana Azad Road, New Delhi – 110011	Invitee
29	Sh. Neeraj Sinha, Scientist, Office of the Principal Scientific Adviser to Government of India, Vigyan Bhavan Annexe, Maulana Azad Road, New Delhi – 110011	Invitee
30	Dr. Ketaki Bapat, Scientist, Office of the Principal Scientific Adviser to Government of India, Vigyan Bhavan Annexe, Maulana Azad Road, New Delhi – 110011	Invitee