



TIFAC Welcomes Executive Director



Dr. Pradeep Srivastava

He is a Graduate in Pharmaceutical Engineering (IIT, BHU) and M Tech & PhD in Biochemical Engineering from IIT BHU, and also a Professor at the School of Biochemical Engineering, IIT, BHU, Varanasi since 2003. Dr. Srivastava has an impressive track record of about more than 25 years as an academician and in industry.

He is in Board of Directors of OCFI India, Editorial Board of several National & International Journals and Fellow at Institution of Engineers.

He has been visiting Scholar to University of Sydney. He has served as Visiting Professor at University of Pune (2001-2003), IIM-Lucknow and several other institutes.

He is also a scientific expert in chemistry and chemical Sciences at Indian Patent Office. His research activities have resulted in more than 100 over reviewed International / National Publications & Proceedings. He has to his credit over 15 Patents.

For more info visit our website www.tifac.org.in

33rd TIFAC Foundation Day Celebrated

TIFAC celebrated its 33rd Foundation Day on February 10, 2020. The year 2020 was very special to TIFAC as it recognized and celebrated the realization of TIFAC's document on Technology Vision 2020 prepared in the year 1995. TIFAC on this occasion revisited memory lanes with luminaries of the Science and Technology establishments in the country by engaging in discussions on Vision for India beyond 2020.



Dr.V.K.Saraswat, Chairman TIFAC

It is pertinent to remember and revisit TIFAC journey where it brought together thousands of academic, researchers and industry experts as well as stakeholders from the state & central governments to build a vision for a developed India under the leadership of former President Dr.A.P.J. Abdul Kalam, the then Chairman-TIFAC. The Technology Vision 2020 document was the first mega technology vision exercise in India which led to a set of 25 documents, including sixteen technology areas and one on driving forces & impediments. In more than 25 years of its service to the nation, it has delivered a number of technology assessment and foresight reports.

Dr. Y.S. Rajan delivered the Foundation Day lecture and shared TIFAC's experience of preparing and implementing TV2020. He had also discussed genesis of other programmes of TIFAC.

TIFAC Activities :

- 52nd TIFAC Council Meeting held on 28th January, 2020 at TIFAC
- 33rd TIFAC Foundation Day celebrated on 10th February, 2020 at TIFAC
- BHUVAN Jaivoorja web-portal launched during 33rd TIFAC Day
- Three Reports Released during 33rd TIFAC Day
- PFC-TIFAC celebrated The International Women's Day & WOS-C 10th Batch received certificates from Prof. Ashutosh Sharma, Secretary DST on 8th March, 2020 at TIFAC
- TIFAC IIASA MoU Signed on 19th March 2020 at New Delhi

Launch of Web portal “Bhuvan Jaivoorja”

<https://bhuvan-app1.nrsc.gov.in/bioenergy/home>

The geo web portal, named BHUVAN Jaivoorja, is an effective tool to assess the availability of biomass and land resources along with logistics support from user defined fetch area, was launched on February 10, 2020 by Dr.V.K.Saraswat, Hon'ble Member S&T, NITI Aayog and Chairman-TIFAC.

The portal would facilitate planning/establishment of tailor made biofuel / biomass plants for better utilization of surplus biomass resources.



Geo-spatial web portal 'BHUVAN Jaivoorja' was launched by Dr. V.K.Saraswat, Hon'ble Member S&T, NITI Aayog & Chairman-TIFAC

Bioenergy could be a possible answer to today's energy challenge. The abundantly available biomass resources can contribute towards sustainable, reduction in fossil fuel imports, employment generation and improving rural economies. Biomass meets around 10% of the world's primary energy demand.

Numerous policy measures are put in place to keep pace with these developments in the country. The Union Cabinet of India has approved a new National Policy on Biofuels in 2018, promoting production and use of biofuels.

It is imperative to ensure the adequate and consistent supplies of preferred feedstock for bioenergy production at reasonable prices and towards estimating accurate surplus crop-residues generated in the country.

In this context, TIFAC partnered with IARI and published earlier a study titled '*Estimation of surplus crop residues in India for biofuels production*' which was released in October 2018.

The study covered state-wise, district-wise estimation of available residual biomass, surplus residues and the report is now available at TIFAC website. The study quantified the generation of surplus crop biomass covering 662 districts and the 11 major crops, identified for the purpose, generate about **683 million tons (MT)** of total dry biomass with total annual surplus crop residue to be ~ **178 MT**.

Further, towards achieving a finer detail in biomass assessment value chain, TIFAC along with National Remote Sensing Centre (NRSC), Hyderabad estimated residual biomass with their energy potential on PAN India basis.

The web geo portal developed, is an interactive tool that provides access to maps and information on existing and potential biomass resources, industry locations, infrastructure and other key data.

The district- wise estimated surplus biomass assessed by IARI was used to disaggregate at 1km grid level to produce spatial map of surplus biomass and bioenergy potential for four major crops namely **rice, wheat, sugarcane and cotton**.

The geo-spatial layers are web hosted along with relevant other thematic layer and the spatial query module has also been developed for the users. The portal has a video tutorial to guide the users. This portal is also linked to TIFAC website.

It is expected that the spatial study would provide policymakers and industry developers with information on the surplus availability of biomass crop residues and energy potential in India for power/heat generation and transportation fuels production.

Release of Technology Vision 2035 Technology Road Map on Water Sector

Technology Vision 2035 document, released by Hon'ble Prime Minister of India in January 2016, forecasted that delivery of clean and potable water to each house hold would still remain as one of the greatest challenge in 2035. This is primarily because the average annual per capita water availability is decreasing due to increase in demand; in 2011 it was 1816 cubic meters which may further go down to 1367 cubic meters in 2031. Therefore, "assured and fit for purpose water supply for all by 2035" becomes the main coordinate based on which the technology roadmap of water has been framed.

The roadmap has identified seven key challenges, starting from augmentation of water availability to large scale monitoring and surveillance of water bodies which need holistic solutions. Hence, overall objectives are "Developing and rolling out innovative and sustainable water solutions to achieve "more from less for more" with freedom from water-borne diseases, cleaner water bodies etc.

To address all the challenges in the years to come, the roadmap focused on the technology needs for the water sector in short, medium and long term time scale. The thrust areas for R&D, ranging from remote sensing of water reserves to smart sensing for quality, energy efficient desalination to precision agriculture, effluent management and many more. Global collaboration, coupled with technology acquisition and indigenization, will be a key component of the overall strategy.

This technology roadmap was released on the occasion of 34th TIFAC Foundation day held on 10th February 2020 by Dr.V.K.Saraswat in the gracious presence of Prof. Ashutosh Sharma, Secretary-DST, Dr Y S Rajan, Former Executive Director, TIFAC and Dr P S Goel, Former Secretary, Ministry of Earth Sciences.



Technology Vision 2035: Technology Roadmap on Water Sector released by the dignitaries

KEY CHALLENGES

1. Augmenting water availability by all affordable and viable means
2. Addressing the challenges of water quality
3. Developing and implementing en masse technologies that help achieve the mission of "more crop per drop"
4. Managing wastewater
5. Desalination, especially in the context of India's long coastline
6. Mitigating uncertainties
7. Large scale monitoring and surveillance of all kinds of water bodies using sensor networks and remote sensing technologies

ENABLING TECHNOLOGY PLATFORM

- a. Biotechnology in the context of water
- b. Development of indigenous membrane technology
- c. Polishing Technologies
- d. Technologies for Residue Management
- e. Remote Sensing
- f. Arresting problems at source
- g. Cascading water through multiple applications before discharge
- h. Sensors and ICT as a Technology
- i. Modeling and Simulation

MISSION MODE PROJECTS

- a. Healthy rivers and their sustenance
- b. Responsible Care of Water in Agriculture:
- c. Creation of reliable and up-to-date interactive databases on water
- d. Better preparedness through Early warning Systems
- e. Computation of Water footprints of major agricultural crops, industrial processes and services
- f. Undesired Run-off Control
- g. Seawater and waste water as sources of usable water
- h. Retain as well as remove

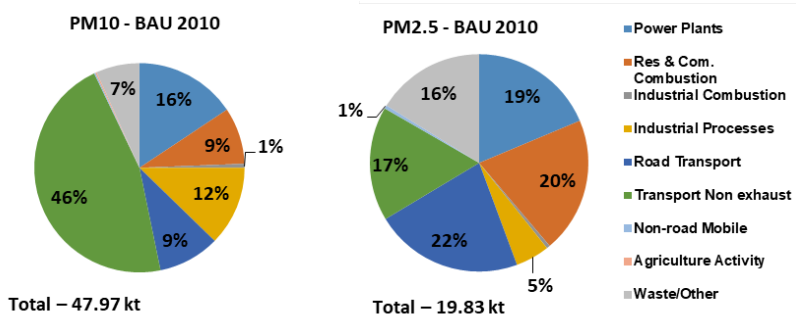
TIFAC-NEERI-IIASA Study

Development and Application of the Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS)-City Model for Indian Cities



Report was released by Dr.V.K.Saraswat, Chairman TIFAC along with other dignitaries on 10th February, 2020

The Current levels of particulate matter (PM_{2.5}) in India exceed the World Health Organization guideline of 10 μ g/m³ by more than a factor of four. The National Ambient Air Quality Standards (NAAQS) of the Indian government set a permissible limit of annual PM_{2.5} concentrations of 40 μ g/m³ (CPCB, 2012), which is exceeded widely in India. Since long, the Indian authorities have imposed regulations on important emission sources that should lead to significant improvements in ambient air quality and eventually to compliance with the Indian air quality standards and international guidelines.



Different planning/policies towards implementation for various sources are considered under various scenarios such as: *Business as Usual (BAU)*, - based on current legislations, *Advanced Control Technology (ACT)*, - based on better efficiency equipments, *Maximum Technically Feasible Reduction (MFR)* - based on better control for maximum achievable control, and *Low Carbon or Clean Fuel Scenario (CFS)* - by use of cleaner fuel/technology. It is found that, despite the large size of Delhi NCT with currently about 18 million inhabitants, only about 40 percent of (population-weighted exposure to) PM_{2.5} originates from local emission sources (at traffic hot spots, the

GAINS model is a scientific tool developed by IIASA Austria to explore cost-effective emission control strategies that simultaneously tackle local air quality and greenhouse gases (GHGs). GAINS estimates historic emissions of 10 air pollutants and 6 GHGs for each country/region based on data from international energy and industrial statistics, emission inventories and on data provided by countries themselves. It assesses emissions on a medium-term time horizon, with projections being specified in five-year intervals through the year 2050 under various scenarios. For user-specified packages of measures, GAINS calculates resulting effects on ambient air quality (fine particles, ground-level ozone, deposition of sulphur and nitrogen), and the subsequent impacts on human health and ecosystems.

The 2010 emission inventory estimated from GAINS model for fine particulates PM₁₀ and PM_{2.5} or Delhi city indicates that transport non exhaust (road dust) is major of PM₁₀ while power plant, road transport and residential/commercial sector forms the major source of PM_{2.5}.

share increases to about 55 percent). Approximately, 60 percent of PM_{2.5} in ambient air in Delhi is transported into the city from outside. The analysis demonstrates that effective improvement of Delhi's air quality requires collaboration with neighbouring States and must involve sources that are less relevant in industrialized countries. At the same time, many of the policy interventions will have multiple co-benefits on development targets in Delhi and its neighbouring States. These modelling tools used are applicable to other urban areas and fast growing metropolitan zones in the emerging Asian regions.

TIFAC – ISEC - IIASA Study

Conservation of Agro-biodiversity and Ecosystem Management : A study in Indian Agro-climatic Zones



Report was released by Dr.V.K. Saraswat, Chairman-TIFAC along with other dignitaries on 10th February, 2020.

With growing population and need for economic growth, the demand of land for various purposes is continuously increasing. This has resulted in rampant use of resources in a non-sustainable manner thereby exerting immense pressure on our planet. This could cause short and long-term changes to biodiversity along with the loss of specific diverse species and resource depletion which is likely to impact sustenance of life and climatic variations affecting agricultural crop productivity.

An attempt has been made in the study to create a foundation to conserve available biodiversity and encourage sustainable agricultural practices across different regions in various agro-climatic zones of Karnataka. The study indicated that the tradition of conserving the traditional seed varieties was no more a habit of farmers. When subsidy on hybrid varieties was provided, more farmers preferred to buy seeds rather than store their seeds.

The study highlighted how traditional landraces managed to survive in a few regions while were totally lost from other regions. It also highlighted how a few varieties managed to survive over a time while others ceased to exist. A definite shift in cropping pattern was observed in the study region. This shift can be attributed to more economic benefits from the newly introduced crops when compared with the traditional crops. For instance, it was observed in the study area that the pomegranate was cultivated because of promising economic benefits.

However, the provisioning of services from pomegranate fields are lower than that obtained from the fields under main crop cultivation. Hence, much deeper research was required for sustainable production of economically important crops for achieving sustainable ecological development with livelihood enhancement.

The results of the study emphasized the need of such studies across the country to create a library of traditional landraces in the country, conserve landraces that have managed to exist over time, devise means by which lost landraces can be restored, and suggest policy level interventions to the government ensuring the sustenance of traditional landraces. For land use related studies mixed approaches or methods could be more meaningful wherein a strong ground data assemblage with remote sensing data could provide higher accuracy information compared with the survey-based method generally followed by the researchers or the government agencies.

In addition, the Indian government organizations, research and teaching institutions need to prioritize the use of remote sensing as a tool in conducting the field research. This could ensure an efficient utilisation of space technology for generating accurate data. The state remote sensing agencies need to make thematic data affordable to government organisations and institutions as part of facilitating better research outcomes.

Important aspects highlighted in the report :

- Protect and improve soil health;
- Indiscriminate use of fertilizers by farmers affect local soil health directly and local water resources indirectly;
- Awareness camps be conducted on other aspects like conservation of local resources with specific emphasis on water conservation;
- Pressure on water resources is increasing;
- Need to create check and balance on water utilization;
- Increased pest attacks on crop residue to extensive mono-cropping in most regions,
- Need to promote integrated pest management instead of the current practice of use of pesticides.

Making India Non- Fossil Fuel Based Economy : A Panel Discussion

Experts discussed India's future energy resource options on TIFAC foundation day. Dr.V.K. Saraswat, member S&T NITI Aayog & Chairman TIFAC, Prof. Ashutosh Sharma, Secretary DST.

The panel of experts that came together for a discussion organised on the occasion of 33rd Foundation Day of TIFAC deliberated on the clean energy resource options that are available for the country and are expected to dominate the energy sector in future and strategies to migrate to a non-fossil fuel-based economy.

Dr.V.K.Saraswat, Chairman TIFAC, and Member, NITI Aayog, pointed out that as far as non-fossil fuel are concerned, coal is the main ingredient for energy. He added that if coal is going to be the main energy source, technology is required for clean coal technology.

The discussions were inspired by the Technology Vision 2035, which has identified 'Making Indian Economy Non-Fossil Fuel Based' as a Grand Challenge.

Dr. Saraswat also highlighted the other sources of energy and said that bioenergy is emerging in a big way because we are a large biomass producer. India also has huge geothermal resources, particularly in the Himalayan region.

The current use of this resource in India very low, but institutes and industry are working on this technology. "Hydrogen economy will also come up, but we have to solve the problems of technology in hydrogen storage, transportation, and production economically," he added. The International Energy Agency (IEA) declared 2019 as a critical year for Hydrogen and further stated that it has a key role in clean, secure, and affordable energy.

Professor Ashutosh Sharma, Secretary Department of Science and Technology said that India has coal, but it does not have other resources such as petroleum and gas and hence we need to figure out how to improve use of coal in terms of emission, pollution control, power generation efficiency, advanced ultra-supercritical technology, gasification of coal and such forward-looking solutions. "The other options are fusion technologies, which will be the ultimate problem solvers. There is already a big fusion reactor in our solar system, Sun. So, we can make use of solar energy in all different forms," Prof Sharma pointed out. He also mentioned that in the future, the major issue in renewable would be storage in order to use that energy when we need it, and we need to work on it. We don't have lithium either, so we should try storage without dependency on lithium.



Panelists: Sh R.Saha, Dr.Y.S.Rajan, Dr.V.K.Saraswat, Prof.Ashutosh Sharma, Dr. P.S.Goel & Sh Santanu Chowdhury

MoU Signed with IIASA



Recognizing the mutual benefits of scientific collaboration in a broad field of activities of global concern and interest, Technology Information, Forecasting, and Assessment Council (TIFAC), an autonomous body under the Department of Science and Technology (Govt. of India) has entered into the MoU with International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria as a full member. TIFAC would represent India as National Member Organization on the IIASA Governing Council.

The objective of the MoU is to obtain India's membership in IIASA and create a favorable conditions for joint research and collaborations in developing models, scenarios and tools on various socio-economic sectors as stated in the objectives for determined period, implementation of joint activity results in the India & International Institute for Applied Systems Analysis (IIASA) and exchange of ideas, information and technologies for joint use by both Parties.

Collaboration between the Parties within the frames of the MoU will be fulfilled by means of the following:

- Indian scientists will work at IIASA on issues of mutual concern and interest on the Institute's research agenda and programs.
- IIASA will organize several relevant activities in India (e.g., workshops, conferences, seminars, etc.) on the issues of mutual interest on ongoing research activities at the Institute.
- Indian scientists will participate in scientific events at IIASA or events organized by IIASA outside India/Austria (e.g., workshops, conferences, seminars, etc.), in accordance to mutual concerns and interests.
- There would be exchange of scientific and other information between IIASA and TIFAC.

- Short-term stays, seasonal contracts, sabbaticals, and full- and part-time assignments would provide a range of opportunities for Indian researchers to work at IIASA and develop more productive and impactful partnerships.

The MoU was signed by Prof. Pradeep Srivastava, Executive Director, TIFAC on behalf of the Indian side and Albert van Jaarsveld, Director General and Chief Executive Officer, IIASA on behalf of the IIASA side on 19th March, 2020.

"I am confident that our membership of IIASA will facilitate increased scientific cooperation and exchange of ideas, information, and technologies that will benefit both India and IIASA in our joint efforts to address the challenges the world faces on national and global levels today," commented Vijay Kumar Saraswat, Chair of the TIFAC Governing Council and member of NITI Aayog.

As IIASA gives preference to researchers from its member countries, Indian membership of IIASA will also provide many new opportunities for Indian scientists, including participation in the institute's capacity building activities such as the flagship Young Scientists Summer Program (YSSP), IIASA Postdoctoral Programs, IIASA Science Communication Fellowship, and academic training workshops. These activities will help Indian researchers develop interdisciplinary research skills, as well as forge international research relationships.

The following research areas have been identified for future collaboration as offering the greatest potential for India's membership of IIASA considering addressing interests of policymakers and researchers in India :

- *Digital India and the Sustainable Development Goals*
- *India's National Clean Air Action Program*
- *Disaster and Climate Resilience in the Indian Subcontinent*
- *India Energy Model*
- *NEXUS - An Integrated Solution to Water, Energy, Land and Ecosystem Security*

Recognising 25 years of Service @ TIFAC

Sh. Tanikella Chandrasekhar, B.E.(Chem.), M.Tech (Biotech), joined TIFAC in August, 1995 and under the great leadership of Dr. APJ Abdul Kalam, the then Chairman, TIFAC, he successfully completed his 1st assignment of "Technology Vision for India upto 2020" in August, 1996. He later coordinated realisation & implementation of Programmes and Projects under 6 major Technology Vision 2020 Projects in Mission Mode. As Head, PFC he revived the WOS-C (KIRAN-IPR) and spearheaded IP valuation of models during the initial 3 years of the launch of the DST-INSPIRE programme. He also shouldered several responsibilities as Registrar, Vigilance Officer & supervised accounts.



Shri T. Chandrasekhar, Scientist-F being felicitated by Dr.V.K. Saraswat, Chairman TIFAC along with other dignitaries, with a certificate of appreciation.

Exhibition : Srijan technologies demonstrated

Innovative products developed with technologies scaled up under TIFAC-SIDBI Technology Innovation Programme (Srijan) were demonstrated during the TIFAC Annual Day Programme held on 10.02.2020. Dr. V.K. Saraswat, Hon'ble Member-NITI Aayog and Chairman-TIFAC inaugurated the exhibition.



Dignitaries saw the live demonstration of technologies and interacted with innovators of the technologies.

Technologies Demonstrated:

- Automatic Table Top Dosamatic machine by M/s. Mukunda Foods Technologies Pvt. Ltd. Bangalore
- Ceramic Membrane based water filtration system by M/s. Need Innovation, Kolkata
- Single release liner with two face stock applicator for label & packaging industry by M/s. HassleFree Technologies, Gr. Noida
- Polymer membrane based UF water filtration technology by M/s. Technorbitol Pvt. Ltd., Kanpur
- Inertial navigation system for defence and industrial applications by M/s. Aeron System Pvt. Ltd., Pune
- Bio-fertilizer & other value added products from sea weeds by M/s. Aquagri Products Pvt. Ltd., New Delhi
- Non-invasive technology for measuring haemoglobin, bilirubin of blood by M/s. EzeRx Pvt. Ltd., Kolkata

TECHNOLOGY INFORMATION, FORECASTING AND ASSESSMENT COUNCIL

An autonomous body of Department of Science & Technology,
Government of India

Vishwakarma Bhawan, A-Wing, Shaheed Jeet Singh Marg,
New Delhi-110016 INDIA

T: +91+42525808, 42525710 | F: +91-11-26961158 | Email: ed@tifac.org.in
fb : <http://www.facebook.com/tifac.dst.india> | www.tifac.org.in

Designed & Edited

By TIFAC News Team

T. Chandrasekhar
Jancy .A
Rahul Kumar