

# Indo-U.S. Science and Technology Forum Connect

Newsletter

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IUSSTF

Indo-US Science and Technology Forum

Clean Energy

**ENERGY DISTRIBUTION AND STORAGE SYSTEMS**

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## FROM THE EDITOR-IN-CHIEF'S DESK

India and the United States of America have a long history of commitment and partnership towards addressing climate change. As climate action and clean energy leaders, the two nations share an ambitious vision to rapidly deploy clean energy at scale, build economic prosperity, and help achieve global climate goals.

The recent historic visit of Prime Minister Narendra Modi to the U.S. in June 2023 underscored the strengthening clean energy bilateral cooperation with many new joint initiatives and partnerships announced in their joint statement. In August this year, the two countries launched the U.S.-India Renewable Energy Technology Action Platform (RETAP) under the Strategic Clean Energy Partnership, one of the focus areas of which is energy storage.

At the 28<sup>th</sup> Conference of Parties concluded recently in Dubai, India and the U.S. held strong ground on their commitments towards meeting common energy goals. The two largest democracies announced investing up to \$1 billion in the India Green Transition Fund, a private credit fund poised to accelerate the development and deployment of clean energy transition projects in India through investments in solar, energy storage, and e-mobility.

In alignment with the strategic priorities of the two nations, the Indo-U.S. Science and Technology Forum (IUSSTF) has been leading programs and initiatives in the field of clean energy. Through this edition of Connect, IUSSTF is proud to bring you the success of one of its key initiatives – the **Joint Clean Energy Research and Development Centre (JCERDC) – Phase II**. The **U.S.-India collaborative for smart diStribution System wIth SStorage (UI-ASSIST)** under JCERDC – II addressed essential issues related to the adoption and deployment of active distribution networks, integrating distributed energy resources including storage in the network as well as the microgrid level. The spectrum of accomplishments under the project encompasses development of unique lab test beds, state-of-the-art tools and products, field demonstration pilots in both urban and rural settings, 185 publications in international journals, 4 patents, development of knowledge products, and workforce development and capacity building.

Every issue of Connect celebrates scientists and entrepreneurs from the Indo-U.S. scientific community who have embarked on a journey of discovery and innovation to address some of the pressing challenges and accelerate progress in meeting the clean energy goals. This issue presents key projects with a focus on **clean technologies for sustainable energy storage**, funded under the **Technology-based Energy Solutions: Innovations for Net Zero** initiative of United States-India Science and Technology Endowment Fund (USISTEF), in partnership with Social Alpha. In addition, the stories shed light on how the initiative is contributing to strengthen the U.S.-India Strategic Clean Energy Partnership 2030.

As a first step towards contributing to one of the Indo-U.S. national priorities – the **U.S.- India Initiative on Critical and Emerging Technology** – IUSSTF is pleased to share the launch of a Special Call under USISTEF focusing on the **co-development and commercialization of quantum and artificial intelligence technologies**.

I hope you find this issue insightful and inspiring and take the opportunity to extend warm wishes for a very happy, healthy, and prosperous 2024.

**Dr. Nisha Mendiratta**  
Executive Director, IUSSTF



U.S.-India collaborative for smart distribution System with Storage (UI-ASSIST)

# SMART GRIDS AND ENERGY STORAGE

**A** collaborative smart grid research component would allow both India and the United States to explore and analyse the concept of microgrids to enable optimal integration and utilization of Distributed Energy Resources (DER), including distributed generation, electric vehicles, storage, and demand response. It would work synergistically with the smart grid research program to explore the contributions of storage to enhanced grid resilience, reliability, efficiency, and performance. The UI-ASSIST project addresses essential issues related to the adoption and deployment of active distribution networks, integrating distributed energy resources including storage in the network as well as microgrid level.



response with DERs. U.S.-India federated Testbed was the first of a kind testbed where data is transferred at such a large distance, and it studied the performance of the co-simulation with respect to the data rate.

- iii. WSU, WVU, and IITR collaborated in developing the **federated cyber-physical simulation testbed** to validate various control and cyber-resilient approaches for microgrids connected distribution systems.

### STATE-OF-THE-ART TOOLS AND PRODUCTS

Multiple **state-of-the-art tools and products** were developed in the project including CP-SyNet Tool, cyber and physical systems resiliency assessment tools, "CP-SAM and RTRMOD/RPIA", real time resiliency monitoring against adverse weather events "RT-RMS", distribution-PMU based anomaly and event detection tool "D-SyncAED", microgrid protection, reliability and transactive control framework, retail market models, solar PV forecasting web-tool, behind-the-meter load estimation tool, power amplifier prototype, micro PMU utilizing NAVIC GPS signal and ADMS tools.

- i. An **ADMS** is a sophisticated software-based automation platform meticulously designed to oversee and optimize modern active Electric Distribution Network (EDNs) efficiently, securely, and reliably. Development of the ADMS functions and the associated platform development, as part of UI-ASSIST, has been the first indigenous and inhouse development by IIT Kanpur and Synergy Systems & Solutions Ltd., which has been integrated with the urban, semi-urban, and rural field pilots in Kanpur for testing the

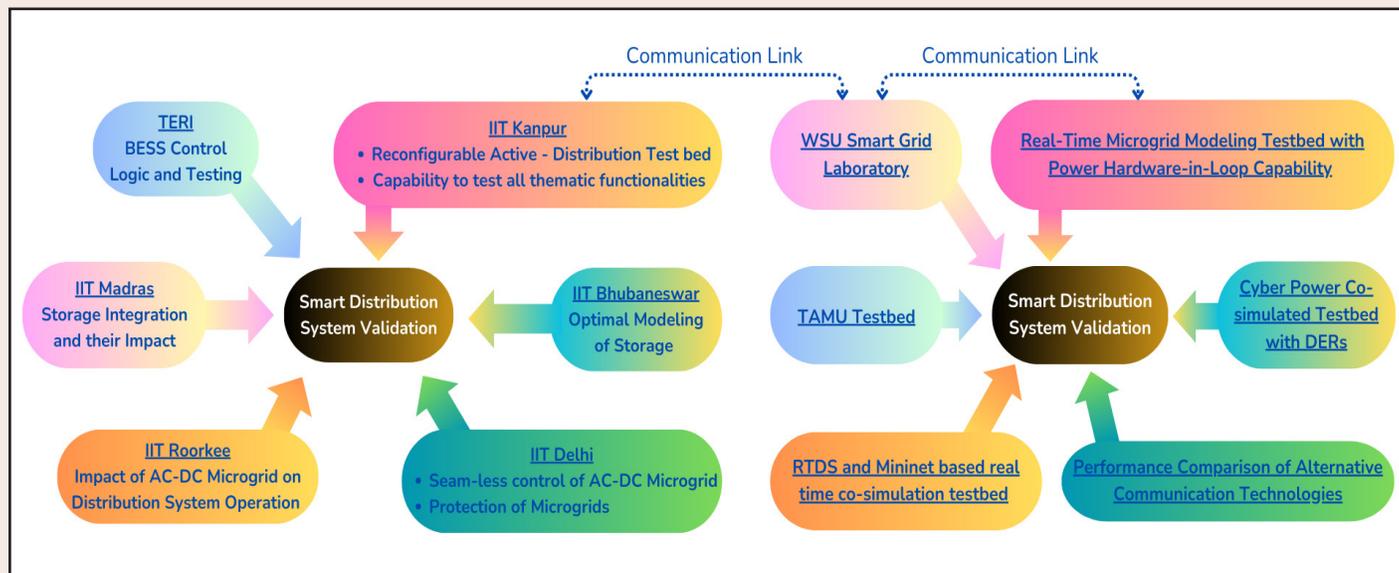
real-time efficacy of the developed system on practical real-life pilots. The research efforts as part of ADMS development have delved deeply into pivotal areas, such as load forecasting and profiling, solar and wind forecasting and system inertia monitoring and enhancement, Distribution System State Estimation (DSSE), Volt-VAR Optimization (VVO), Demand Response (DR) with optimal operation of DERs, Network Reconfiguration (NR), accompanied by substantial progress in setting up TSO/ DSO coordination frameworks.

- ii **Micro-PMU Development:** A micro-PMU measures the time-synchronized magnitude and phase angle of distribution grid voltage and current. A micro-PMU generally offers higher accuracy (TVE < 0.01%) and a high reporting rate (120 measurement reports per second) compared to transmission grade PMU. Accurate data from micro-PMU enable system analytics to determine the exact sequence of events that have led to islands or a major blackout.

### FIELD DEMONSTRATION PILOTS

A proof of Smart Distribution System concepts were developed in this project and validated through implementation of the **ten field demonstration pilots**, five each in India and in U.S. under rural, semi-urban and urban settings. These pilots have clearly shown technical merits in terms of increased reliability of supply, and provide 24x7 access to quality electricity supply, in addition to significantly reducing carbon footprint. The Indian pilots are as follows:

- i **Rural Field Pilot by IIT Kanpur, DVVNL, & Shramik Bharti Foundation:** With the assistance of IIT Kanpur



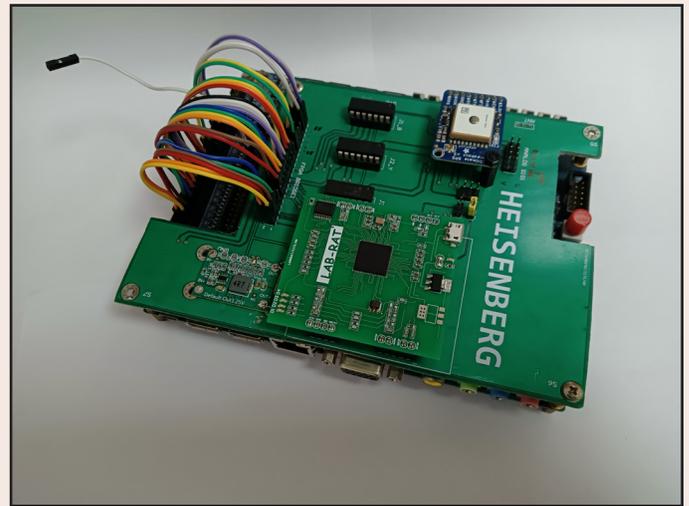
UI-ASSIST Lab Pilots

(IITK), Dakshinanchal Vidyut Vitran Nigam Limited (DVVNL) and Shramik Bharti Foundation (SBF), two unelectrified hamlets of Harnoo village the “Chhabba Niwada” and “Bargadiya Purwa,” 45 km north of IITK campus were electrified and transitioned to clean and sustainable energy sources, primarily solar power. This shift not only illuminated the villages but also brought numerous benefits, including improved education, a higher standard of living, and economic opportunities for various sectors. To address the limitations of solar power during nighttime and unfavourable weather conditions, a hybrid biomass system for generating electricity has been implemented in Kanpur. This initiative, supported by IITK, SBF and the local village, utilizes cow dung to generate electricity. The generated electricity is used for various purposes, including lighting houses. Additionally, the project yields organic fertilizer and introduces standalone solar water pumps for agricultural irrigation, reducing dependence on grid electricity and diesel-powered pumps. This emphasizes the need to replicate such renewable energy projects in thousands of villages to ensure widespread access to sustainable energy and its associated benefits.

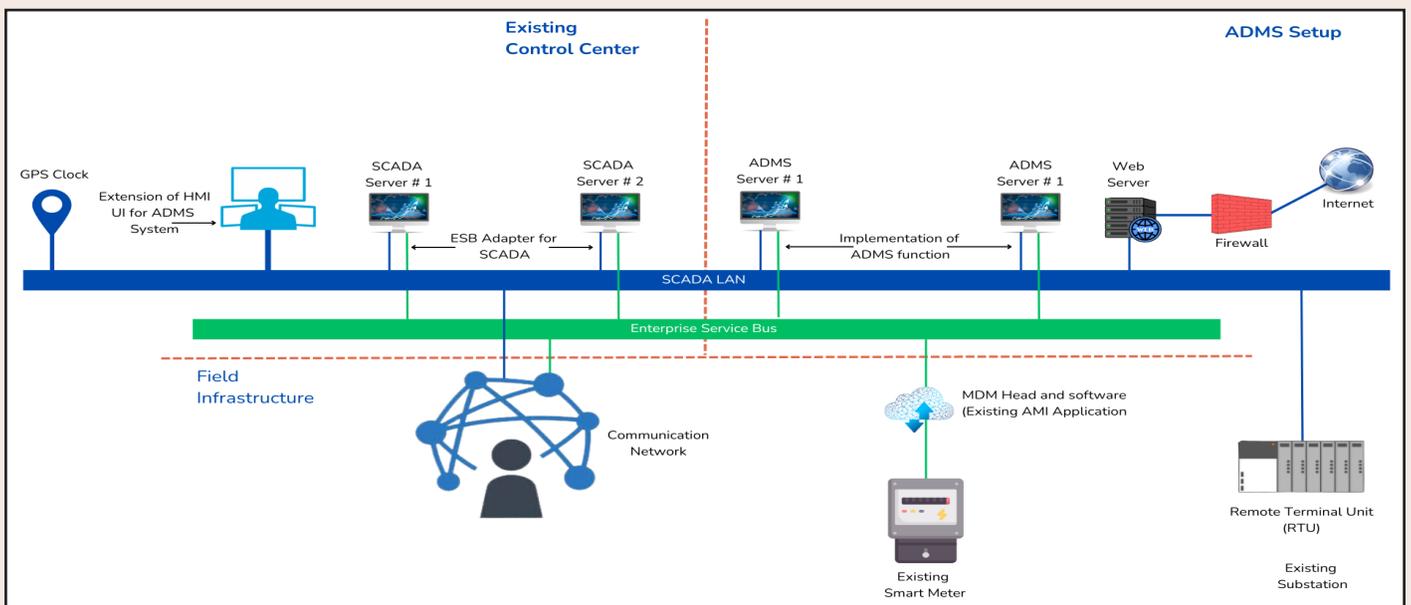
- ii **Semi-urban field pilot by IIT Kanpur:** This pilot has rooftop PVs in residential lanes 32 and 33 in IIT Kanpur campus, Li-ion battery energy storage system (BESS), and an hybrid inverter system of adequate power rating of both lanes. The integration of rooftop PVs, Li-ion battery storage, and an inverter system controlled by a hybrid inverter controller represents a sophisticated approach to decentralized energy generation.

This system not only optimizes energy efficiency but also provides a sustainable solution for power supply. As we move towards a future dominated by renewable energy, such innovative configurations pave the way for more reliable and environment-friendly energy systems. The careful consideration of load management, grid independence, and safety measures ensures the successful implementation of these advanced technologies in real-world applications.

- iii **Urban field pilots:** An urban pilot has been installed at the faculty residence towers C&D at the IIT Kanpur Campus. Three-phase smart meters, 25kW SPV, and hybrid inverter, along with a 50kWh battery are installed at the two faculty residence



Micro-PMU



Advanced Distribution Management System (ADMS)

towers and in case of a power failure and non-availability of Solar PV output, the BESS will feed the common area lighting and lift loads.

**Social impacts** of such smart distribution system pilots have been established through extensive pre- and post-installation surveys. These clearly demonstrate social upliftment, specifically in the Kanpur rural pilot in terms of enhanced agricultural yields due to provision of solar irrigation pumps and quality manure from the biomass plant installed in one of the hamlets, enhancing children's education and local employment due to continuous power supply and setting of local cottage industries.

### TRANSFORMING THE INDIAN POWER SECTOR - DSOS: NEED FRAMEWORKS, AND REGULATORY CONSIDERATIONS

A detailed study of the existing DSO models, need and status of distribution system management for different utilities has been utilized to bring out DSO whitepaper which is particularly relevant for its implementation

in Indian context. The paper was launched during the Industry Oriented Stakeholder Workshop on Green Powered Future on 8 May 2023 at MNIT Jaipur. This has been jointly developed by teams at IIT Delhi, TERI and IIT Kanpur under the UI-ASSIST project.

### WORKFORCE DEVELOPMENT

A large number of capacity building and skill development workshops and training programs were conducted for utilities, industries, researchers, and technicians. Future workforce development was achieved by involving a significant number of students, introducing new courses and conducting several webinars.

### MANPOWER TRAINED IN THE SMART GRID AREA

- i. 207 Research staff, 118 Students, 214 Professionals, 35 ITI training workshops
- ii. Ph.D: 48 (38 continuing); M.Tech/MSR: 20 (12 continuing)



Smart grid field pilot at the Bargadiya Purwa village



Biomass system at the Bargadiya Purwa village



Solar PV set up at the Chhabba Niwada village



EV Charging station at Type2 community, IIT Kanpur campus

### PUBLICATIONS AND PATENTS

- i. International Journals: 185
- ii. Conference Proceedings: 244
- iii. 4 Patents

### COMPENDIUM

The consortium also published a compendium provides the overview of technological achievements, on lab developments and implementation, and other highlights

of the UI-ASSIST project focused on developing Smart Distribution Systems during the workshop on **"DER Integrated Smart Distribution Systems: Learnings from Indo-U.S. Project"** during 26-27 September 2023.

UI-ASSIST is an excellent example of a strong and highly motivated collaborative activity for both India and the U.S. The journey of executing the UI-ASSIST project has been an enriching and a reverberating experience for the partnering institutes, funding agencies and the experts who have monitored the project. The consortium



Urban Pilot Setup: a) Rooftop Solar PV installed being visited by the PMC; b) SMART GRID - Faculty Block D, IIT Kanpur Campus Complex



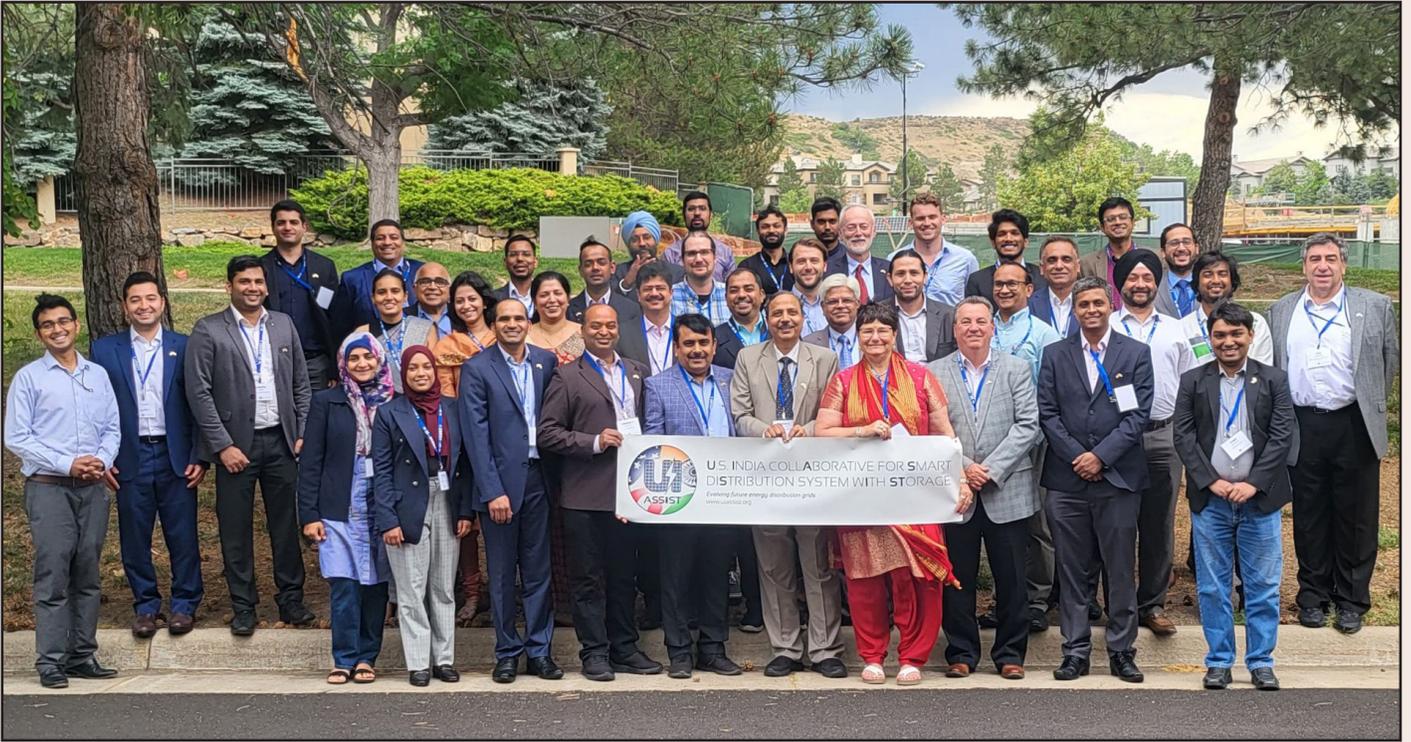
The Village Community interacting with the Project Monitoring Committee

management has been truly commendable in terms of the regular skype/web meetings, webinars, joint meetings, researchers/students' exchange visits organized. The first joint Indo-U.S. meeting was organized in Portland, OR, U.S. during 2-3 August 2018 . The second meeting was held in Spokane, WA, U.S. during 12-13 June 2019, and the

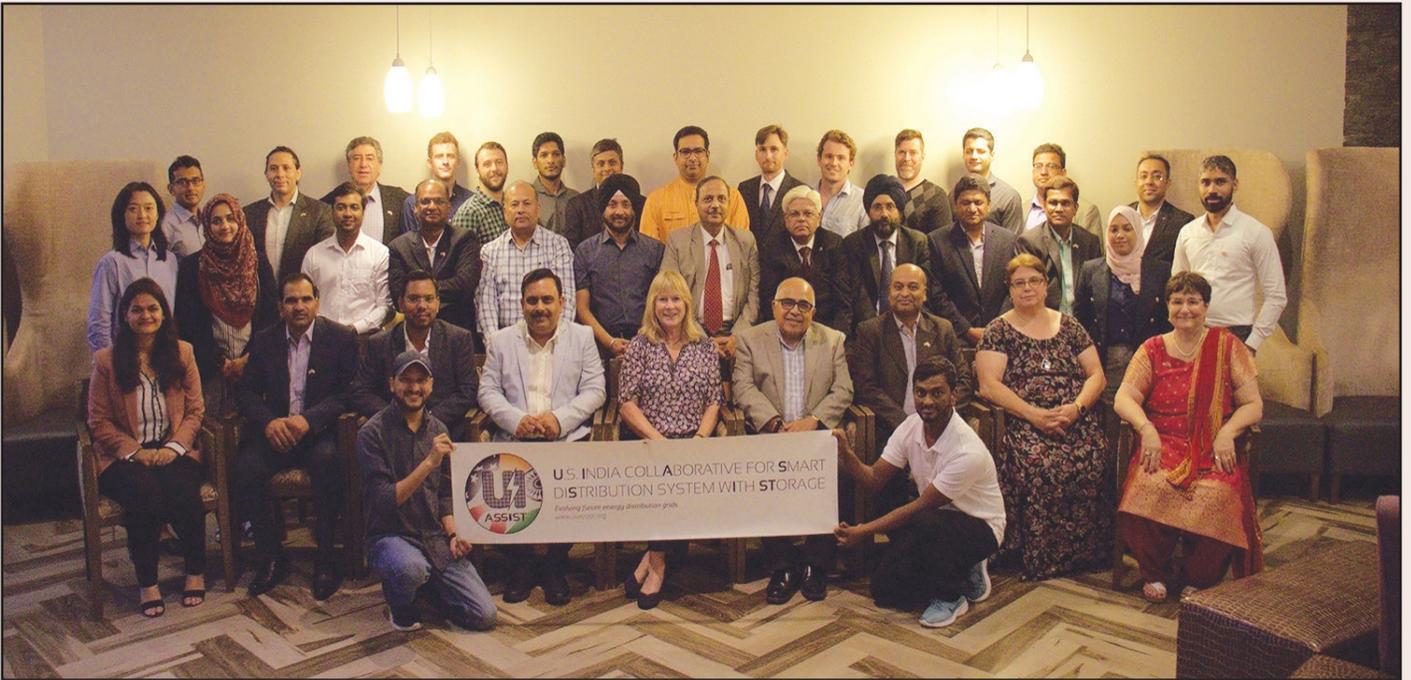
third was held in New Delhi, India during 18-19 December 2019. The following years the consortium held its joint meetings virtually due to COVID-19 and after three years, the researchers from the United States and India came together in person for the sixth UI-ASSIST 2022 Progress Meeting from 13 -15 July 2022 at Golden, Colorado.



Dr. Noel Schulz (U.S. Lead PI, Washington State University, Pullman) and Merrill Smith (U.S. Department of Energy) visiting the Rural pilot



Sixth UI-ASSIST Progress Meeting held from 13 -15 July 2022 at Golden, Colorado



The UI-ASSIST Progress Meeting held from 12 – 14 July 2023 in Orlando, Florida

The UI-ASSIST workshop on “DER Integrated Smart Distribution Systems: Learnings from Indo-U.S. Project” during 26-27 September 2023. The objective was to familiarize the participants from power utilities, industries, regulatory organization, load dispatch centres, and R&D organizations with different operational, regulatory,

reliability, and security challenges that need to be addressed in deploying renewable and storage integrated smart active distribution systems. The experience gained through R&D activities and pilot deployments under the UI-ASSIST project were shared by the consortia partners from India as well as U.S.

In summary, the UI-ASSIST team provided unique perspectives, skills and knowledge that helped in understanding the big picture for clean energy opportunities and challenges, national and international similarities and differences, entire process from R&D to Field Demonstrations of smart distribution system concepts. Interactions across multiple sectors of technical community many new collaboration partnerships within and across two countries.

It is envisaged that the UI-ASSIST team, built across utilities, industry, research labs and academia from the two countries, will serve as technical leaders of today and tomorrow in clean energy and sustainable smart distribution systems development. The R&D outcomes and key learnings from the implementations in the UI-ASSIST project will enhance the awareness of all the stakeholders and pave the way for wider adoption of Smart Distribution System concepts by the utilities and system integrators. ●



Pictures from the 'DER Integrated Smart Distribution Systems: Learnings from Indo-U.S. Project' workshop held on 26-27 September 2023

GREEN  
ENERGY



# SUSTAINABLE ANODE MATERIALS FOR BATTERIES

Indigenous Battery Materials from Recycled Graphite and Biomass

**L**ithium Ion Batteries (LIBs) are pivotal in applications ranging from renewable energy storage to consumer electronics with single largest application being – Electric Vehicles. There is a great interest on part of the Government of India in developing a domestic lithium-ion battery manufacturing ecosystem. Production of the lithium-ion battery will depend heavily on an expanding supply of critical materials for which significant manufacturing infrastructure does not exist, especially from domestic sources of downstream raw materials. Graphite is one of the largest components of LIBs. Present sources and methods used to produce graphite are both non-sustainable and polluting. It thus becomes a big challenge to make available sustainable battery materials for a cleaner and greener energy future. An endeavor to produce battery materials from recycled graphite and biomass ingeniously is a welcoming step. The project team aims to develop a commercially viable process for producing high-performance Lithium-ion battery anode materials.

The global transition to clean energy and sustainable technologies is being propelled by advancements in lithium-ion battery (LIB) technology. LIBs are pivotal in applications ranging from electric vehicles and renewable energy storage to consumer electronics. However, it is estimated that by 2029, around 108 GWh of LIB battery capacity will be at its 'end of life', creating the challenge of waste along with large new demand for replacements. While non-LIB alternatives are also being developed (none in commercial use yet), none of them are applicable to the single largest application for LIBs – Electric Vehicles. With this large, expected increase in the need for new LIB capacity, the race is on to explore alternative battery technologies, focusing on sustainability, resource availability, and improved performance for a greener and more sustainable energy future.

One of the largest components of LIBs is graphite – used for the anode. The existing sources and methods used to produce it are both non-sustainable and polluting. As the demand for anode graphite is expected to grow significantly (an additional 6 – 7 million tons/year needed by 2025), the industry concerns are now related to raw material availability, supply chain sustainability, and the environmental impact of production processes. Given this scenario, it is imperative that new renewable, sustainable and non-polluting methods of graphite production are developed.

### OBJECTIVE

In a world where clean energy and sustainability have taken center stage, a collaborative effort between **Vinod Nair from Farad Power Inc.**, a U.S.-based company, and **Smruti Prakash Barik from Attero Recycling Pvt. Ltd.**, an Indian company, is making remarkable strides in pursuing sustainable battery materials. Their project, '**Indigenous Battery Materials from Recycled Graphite and Biomass**,' garnered support from the USISTEF – IUSSTF in 2023, further solidifying their commitment to a cleaner and greener energy future.

The project revolves around one central mission - **to develop advanced materials from waste streams - for use in Lithium-ion batteries.**

Specifically, the project aims to jointly develop a lithium-ion battery (LIB) anode material by combining recycled

graphite anode material with substantially sustainably sourced carbon-silicon materials derived from agricultural waste. Further, the objective is to validate a waste-derived precursor approach to developing a domestic supply chain for a critical component of LIBs, thereby reducing the country's dependence on imported battery materials. The primary objectives designed under the study are outlined below.

- Lead the preparation and testing of the proposed LIB composite anode material and synthesize the innovative carbon-silicon (C/Si) composite from agricultural waste extracts.
- Provide recycled graphite materials for the composite LIB anode by extracting graphite from spent LIBs and refining it to make it suitable for use in the LIB composite anode.

### STRATEGY AND POTENTIAL OUTCOMES

The USISTEF Ignition Grant is funding the development of an innovative approach to synthesize high-performing LIB anode materials from waste streams.

Using agricultural waste and LIB waste respectively, Farad Power has developed a carbonized C/Si composite and Attero has come up with a recycled graphite which needs a final processing step to make them high-performing battery grade anode materials. However, both have very complementary properties, and combining them - at this stage - into a graphite-C/Si composite eliminates the need for further processing.

Currently, both companies are synthesizing and characterizing their individual components, prior to combining them and testing the composite in 'end-user' LIB anode application. Processing equipment like high-temperature furnaces, hydro-pyrometallurgy and filtration systems, along with high-resolution testing instruments are being utilized to synthesize and evaluate the quality and performance of graphite-C/Si composite anodes. This final evaluation, expected by the end of the project will represent a significant step towards advancing LIB anode technology globally, as no other research team other team – anywhere in the world – is working on the development of high-performing LIB anode materials from such diverse waste streams.



The Research Setup



Pilot plant facilities at Attero, India.



Laboratory facilities at Farad Power, Inc. USA.

The potential impact of this project extends far beyond the laboratory. It aligns with India's ambitious goal of achieving a sustainable, domestic supply chain for a high-performing LIB anode material. It also eliminates the use of harsh chemicals and pollutants that are endemic to the current methods of graphite production. For example, no poisonous NO<sub>x</sub> or SO<sub>x</sub> pollutants are generated by this process, fostering a cleaner manufacturing environment. The project, therefore, endeavors to revolutionize the Indian LIB materials manufacturing industry - enabling domestic supply chains and reducing the harmful effects of harsh and polluting manufacturing processes.

**LEVERAGING INDO-U.S. PARTNERSHIPS THROUGH IUSSTF**

As the world strives to inch towards a cleaner and greener future, this project sets an inspiring example of the role of Indo-U.S. bilateral collaboration in shaping the energy landscape. The Farad Power Inc. team, led by Vinod Nair, brings materials science, carbon chemistry, and sustainable technology expertise and is leading the development of carbon composites from agricultural waste extracts. The company has developed battery-grade carbons from agricultural waste-derived furan chemicals like furfuraldehyde. Sugarcane bagasse, corn cob and rice straw are all excellent sources for the extraction of this aldehyde, that is then carbonized using patented methods. These waste-derived sources are also mixed with specialized additives to produce high-performing carbon/silicon (C/Si) composites for LIB applications. In this project, they are the driving force behind the innovation of C/Si composite anodes.

Attero's team, under the leadership of Smrutiprakash Barik, specializes in electronic waste recycling and graphite extraction from spent LIBs. Their contribution is pivotal in ensuring a sustainable source of materials. Attero has developed patented recycling technology to extract graphite from spent LIBs and has set up pilot plants to do this. Both companies have already secured more than 20 granted patents – combined – on their respective technologies, and now, with the support received from IUSSTF, have put together an innovative approach to co-develop an innovative LIB anode material. ●



Vinod Nair, PhD



Shantanu Mitra, PhD



Elton Cairns, PhD



Ron Turi



Sudhinda Tatti, PhD

The Farad Power Inc. Team

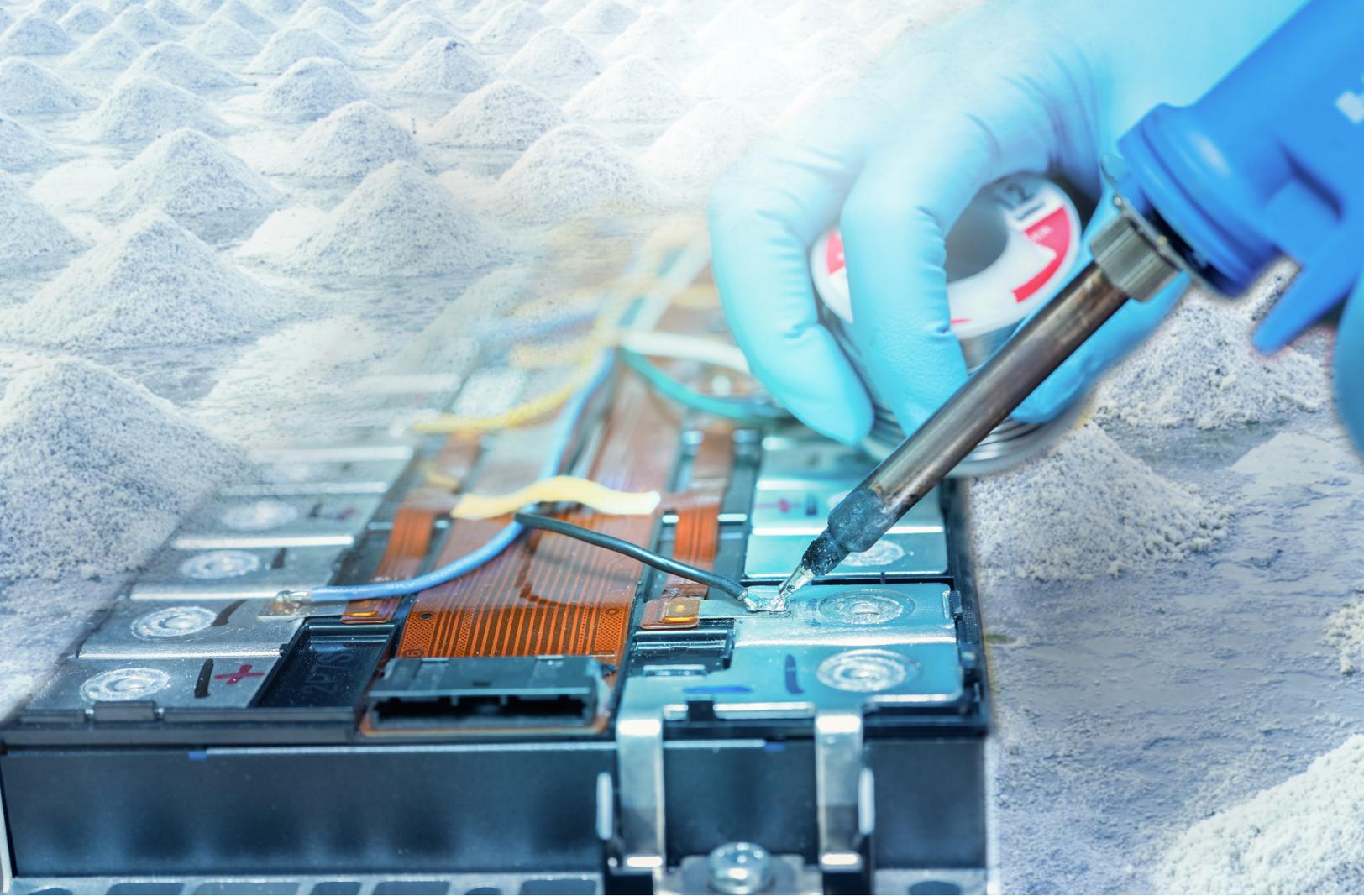


The Attero Team

## CONTRIBUTONS TO THE U.S.-INDIA STRATEGIC ENERGY PARTNERSHIP

The collaborative effort between Farad Power Inc. and Attero is contributing to the Indo-U.S. Strategic Energy Partnership by championing sustainability while reducing carbon emissions, promoting local manufacturing, and ensuring the responsible use of resources. This collaboration sets a precedent for future sustainable battery material production developments, supporting clean energy and climate change goals.

The story of this project is one of innovation, collaboration, and commitment to a greener future. It's a story that intertwines the efforts of two companies on opposite sides of the globe, working together to shape a more sustainable and cleaner energy landscape for all.



# RECHARGEABLE SODIUM-ION BATTERY

Rechargeable Sodium-ion Battery for Sustainable Energy Storage

**C**limate change, carbon emission and pollution are imparting tectonic shift towards usage of renewable and clean energy. The 'energy harvesting and storage' are the key components for the sustainable transition. The global energy storage market is approaching USD 100 billion at a CAGR of 13%. The demand for rechargeable batteries in India is projected to increase more rapidly at a CAGR of 35% by 2025. Currently, Li-ion batteries have monopoly in the energy storage market for consumer electronics, electric mobility and to some extent stationary applications. However, limited and disproportionately distributed Lithium, Cobalt, Nickel reserves, concentrated component manufacturing capabilities, national energy security, fire safety, climate impact of excessive mining and human right violations at some mining sites are serious concerns about Li-ion technology.

## OBJECTIVE

To address the above issues, **Dr. Vilas Shelke** and **Dr. Manjusha Shelke** at the **Rechargion Energy Pvt. Ltd., Pune** and **Prof. P. A. Ajayan** at the **Rice University, Houston**, with support from USISTEF, are steering efforts towards development of a contemporary technology based on sodium ion chemistry. The team is aiming to provide an alternative solution with comparable or better energy density, cycle life, safety profile, charging speed and cost effectiveness. Their technology is based on abundantly available sodium and is free from disproportionately mined lithium or cobalt usage. Inherently, low thermal runaway provides much needed safety against the fire hazards. Sustainability, Scalability, Suitability, Safety, Speed and Self-reliance are the 'Six S' features of sodium-ion battery.

A fully optimized, validated, scalable pouch cell with high energy density, cycle life and safety, at low cost is a disruptive proposition for electric mobility and stationary storage. The primary focus of this project is **translational research to take laboratory scale prototype of the sodium-ion battery to a commercially viable product.**

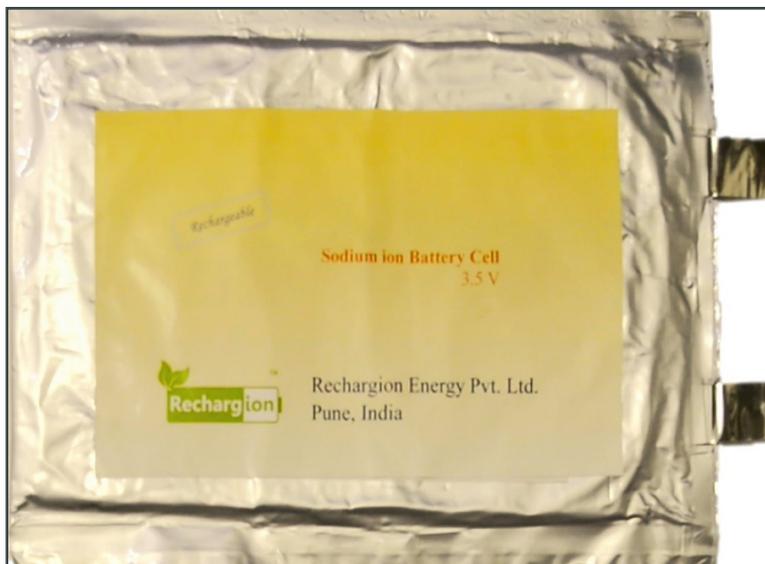
## STRATEGY AND POTENTIAL OUTCOMES

So far, the team has scaled up hard carbon anode and sodium compound cathode materials synthesis to few hundred-gram batches and fabricated the first-generation pilot-scale prototype pouch cell battery. The 1.2 Ah, 3.5 V cell has typical energy density of 146 Wh/kg and cycle life

beyond 1000. The end-product emerging from the project would be a customizable pouch cell with 4-10 Ah capacity, 150 Wh/kg energy density and 5000 cycle life. The team is setting up a pilot plant suitable for 10-20 cell fabrication per day. These cells will be optimized for optimum performance and then used for safety testing, validation, and certification at the Automotive Research Association of India, Pune. The primary target market is electric 2/3 wheeler mobility and stationary storage.

## LEVERAGING INDO-US PARTNERSHIPS THROUGH IUSSTF

The project team presents a classic case of strengthened Indo-U.S. partnership over the years. Both the partners on the Indian side, **Dr. Vilas and Dr. Manjusha Shelke have been a beneficiary of the Indo-U.S. Science and Technology Forum Fellowships in the year 2008 and 2013**, respectively. Dr. Manjusha began working on carbon-based materials - an essential component for the energy storage devices like supercapacitors and rechargeable batteries - during her fellowship tenure with Prof. Ajayan at Rice University Houston, where the foundation stone for this ever-growing Indo-U.S. partnership was laid. After her return to India, she established the 'Energy Storage Devices' research group at CSIR-National Chemical Laboratory, Pune. Prof. Ajayan, who is an eminent expert in energy storage devices across various chemistries, has constantly mentored and guided the Indian team for achieving academic excellence. His group has, over the years, worked on creation of new designs for battery, improving the



Electrode materials and Pouch cell for Sodium-ion rechargeable battery

energy capacity of electrode materials, improving stability and cycling, creation of 3D nanostructured systems for thin film battery, creation of organic (green) electrodes, etc. The ongoing work captures all the aspects of new formats for electrochemical energy storage for real time applications. A wide range of expertise and experimental facilities required for energy storage research are available in this group. Further, the project leaders have complimentary Physics, Chemistry and Nanoengineering backgrounds.



**Dr. Vilas Shelke**



**Dr. Manjusha Shelke**



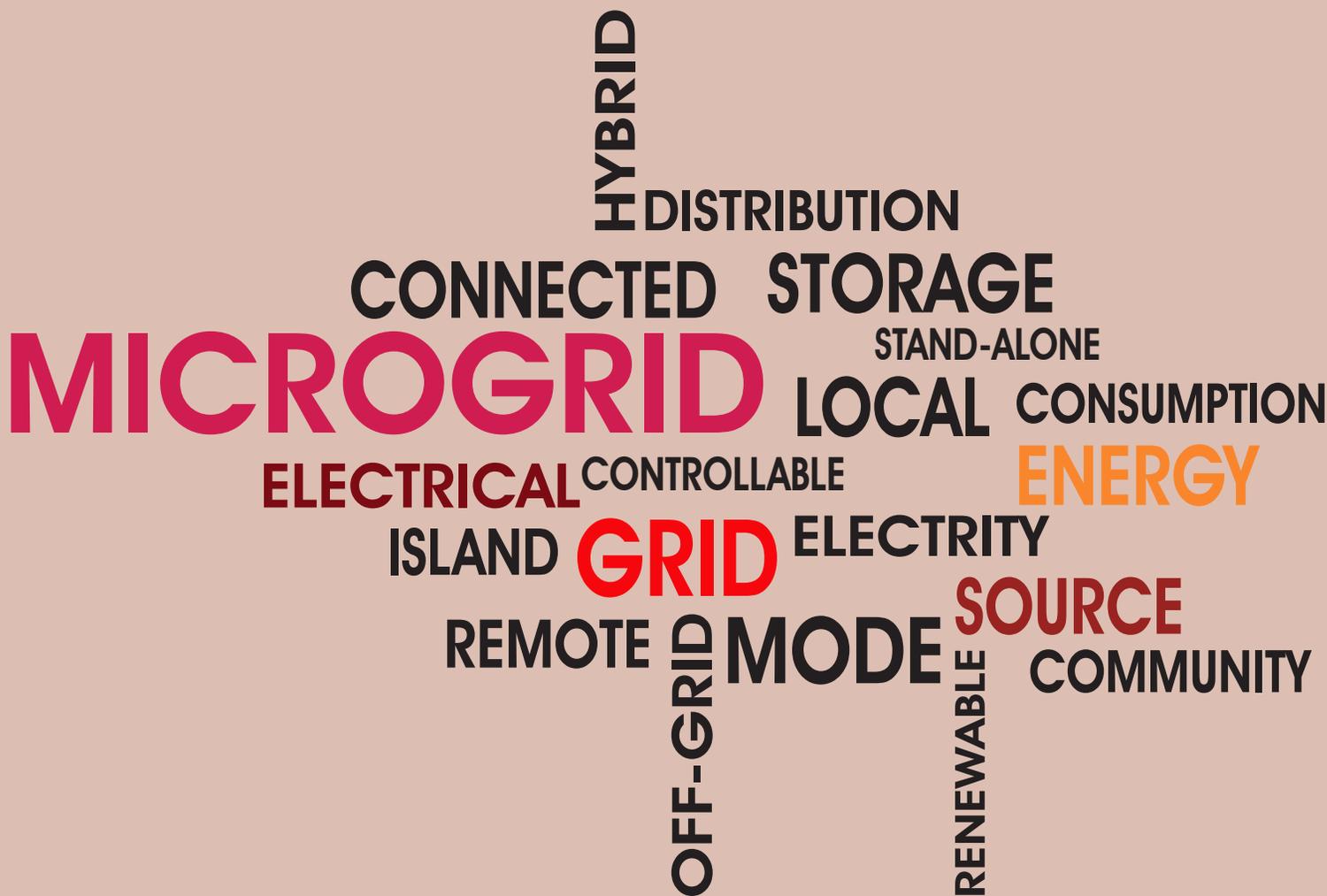
**Prof. P. A. Ajayan**

The innovations and novelties of battery technology are mainly associated with anode and cathode materials. New materials exhibit good performance at laboratory scale but often underperform at pilot or manufacturing scale. The role of the Indian partners is to scale-up the material synthesis to few hundred-gram batch size

and maintain the quantity as well as quality of battery grade materials. The optimization process involves several characterisation techniques and data analysis. Nevertheless, the application of high quality electrode materials in cell fabrication is not simple and straight forward. The real challenge is to control the whole set of cell fabrication parameters like slurry coating process, adhesion, thickness, viscosity, humidity, temperature, roll-to-roll coating speed, calendaring, number of layers, contact resistance, electrolyte composition and many others. At this juncture, the expertise and experience of the U.S. group are the vital accessories. They have the potential to interpret and analyse the experimental data and contribute million-dollar feedback for improvement of the process. The group would pitch in to cross-examine the data with their advanced facility. During the first visit of Prof Ajayan to India in August 2023, a detailed plan for the pilot scale facility was outlined and the technical specifications and necessary customization of equipment were confirmed. The Indian team received valuable inputs for improvement of performance of the first-generation pilot-scale prototype that was attempted using the IIT Bombay facility. The teams are committed to strengthen their collaboration for achieving objectives and driving outcomes under the project. ●

### CONTRIBUTONS TO THE U.S.-INDIA STRATEGIC ENERGY PARTNERSHIP

A real-time deployment of comprehensively developed energy storage technology is indispensable to achieve the clean energy and climate change goals. The U.S.-India Climate and Clean Energy Agenda 2030 and Strategic Clean Energy Partnership advocate reducing the consumption of fossil fuels, reducing greenhouse gas emissions, and minimizing impacts to the climate. Both the countries are committed to promote investment, trade, technology tie-ups, R&D collaborations, etc across the entire value chain. This project has been envisaged with that outcome in mind. The final product and commercialisation strategy is set for the global market. The project team's Indo-U.S. academia-industry partnership is the first step towards increasing their global footprint. They believe worldwide mobility will be driven and the neighbourhoods will be lightened by the sodium ion batteries in near future.



# EMPOWERING THE RURAL RENEWABLE MICROGRIDS

Commercializing ZincGel Battery

**R**enewable microgrids in rural areas generate electricity by utilizing solar energy but this results in intermittent electricity generation. Energy storage is thus required to overcome intermittent supply. One of the most critical and expensive components for this purpose are their batteries. The need of the hour is thus developing unique energy storage technology using raw materials that are abundantly available globally and are non-toxic and non-flammable, providing an ideal replacement for Li-ion-based solution and other existing batteries.

Electrification is a challenge in rural areas where it is infeasible or uneconomical for the electricity grid infrastructure to be connected or where the infrastructure is unable to provide high quality power. This problem is frequently solved using diesel generators or renewable microgrids – the latter generate electricity by utilizing solar energy for the local community. Renewable microgrids represent a scaled-down version of the challenge facing renewable integration broadly – that of intermittent electricity generation. Unlike fossil fuels, electricity from renewable energy can be generated only when the sun shines or the wind blows, and often, it isn't needed at that moment. To bridge this gap between when electricity is generated and when it is required, energy storage is needed.

One of the most critical and expensive components of renewable microgrids is their batteries. Currently, lead-acid is the preferred battery due to its low cost and ease of maintenance. However, lead-acid technology is energy-inefficient and has severe performance constraints. Lithium-ion, on the other hand, is a great technology which is well suited to space-constrained applications such as consumer electronics and electric vehicles but isn't well suited to stationary energy storage due to performance, life, safety, and sustainability limitations. In recent years, new technologies such as flow and metal-air batteries have emerged on the back of efficient and safer conventional chemistries. However, these new technologies often lack a balance among sustainability, performance and cost as well.



A diesel generator at one of the selected sites



Current renewable microgrids use lead acid batteries, limiting performance and life

## OBJECTIVE

The project aims at deploying a revolutionary new battery technology, ZincGel, to Tata Power Renewable Microgrids and validating its performance in partnership with the Indian Institute of Technology, Kanpur. ZincGel is a unique energy storage technology developed by the project team using raw materials that are abundantly available globally and are non-toxic and non-flammable. This offers a significant cost advantage due to 90% energy efficiency, thermal stability, and a life span of 10 years, thereby providing an ideal replacement for Li-ion-based solution and other existing batteries.



ZincGel batteries

## STRATEGY AND POTENTIAL OUTCOMES

The deployment of the battery technology is planned to be achieved in three phases –Phase 1 aims at customizing the technology, laying the technical groundwork, and demonstrating small-scale deployment; Phase 2 objectives encompass integration and deployment of the battery system; and Phase 3 involves monitoring and troubleshooting of the system.

In September 2023, the project team concluded the Phase 1 of the deployment with completion of the customization plan for ZincGel/subsystems, baseline setting, advanced prototyping of ZincGel and demonstration of a scaled-down version. The scaled-down version, a 5kWh system, uses off-the-shelf subsystems, matching the available inverter voltage and integrating with a smart EMS (Energy Management System) which optimizes energy usage and enables cost savings for the operator. Further integration, testing and deployment are currently underway.

Once accomplished, the project will be a full commercial-scale battery bank powering around 100 rural households with clean energy. It will demonstrate the commercial viability of ZincGel as a battery technology and make the economics of renewable microgrids more compelling. ZincGel would provide stronger technical performance - in terms of charge/discharge speed and life cycles - at a significantly lower levelized cost than Lithium-ion while ensuring safety - no fire risk - and sustainability - through use of abundantly available materials and easy recycling. Furthermore, ZincGel's unique chemistry would allow it to handle power surges without impacting battery health, thereby significantly improving the usefulness and viability of renewable microgrids.



Scaled-down demonstration of ZincGel



Offgrid Energy Labs and Tata Power Renewables Microgrid teams visit a pilot site

Delivering electricity to communities thus far entirely deprived of it using renewable microgrids would have a colossal impact on their quality of life. ZincGel enables this by reducing the cost of batteries and providing power in circumstances other batteries struggle with, all while safeguarding human health and ensuring sustainability.

### LEVERAGING INDO-U.S. PARTNERSHIPS THROUGH IUSSTF

The Indo-U.S. collaboration supported by IUSSTF has been instrumental in bringing together project partners with complementary strengths to meet project objectives and

drive outcomes. Offgrid Energy Labs, a U.S. domiciled company, has developed and manufactured the ZincGel technology and is primarily responsible for the deployment. Tata Power, one of India's largest utilities, has been seeking cost-effective and sustainable energy storage systems for grid-scale applications and has deep knowledge and expertise across the electricity value chain; the Tata Power Renewable Microgrid subsidiary has deployed hundreds of renewable microgrids in India and ZincGel is being deployed at some of these sites. The Indian Institute of Technology Kanpur is globally acclaimed in education and research in science and technology; and is well positioned to test and validate the outcomes of the project. ●



Offgrid Energy Labs and Tata Power Renewable Microgrid teams next to a conventional lead acid system

## CONTRIBUTIONS TO THE U.S.-INDIA STRATEGIC ENERGY PARTNERSHIP

ZincGel battery technology contributes to the Indo-U.S. clean energy strategic partnership by enabling key objectives. The renewable energy pillar of the partnership requires not only renewable energy generation but also, critically, energy storage. While renewable generation is the most cost-effective way of generating energy, storage – both grid-scale and other stationary energy storage - is a key bottleneck to scaling it.

The renewable microgrids project validates the technical and commercial viability of the technology but it is just the beginning. ZincGel is designed to enable grid-scale renewables integration by providing stronger technical performance more economically and sustainably than existing solutions. This allows for firm, dispatchable power and enables strengthening of the power grid to ensure reliable, affordable, and resilient clean energy supply. By demonstrating that ZincGel is a safe, commercially viable and scalable solution, we come one step closer to achieving a clean energy future.

In the current geopolitical climate, energy independence is more important than ever and that extends to critical energy infrastructure. Lithium-ion poses geopolitical risk since its raw material value chain is highly concentrated in a few countries whereas all ZincGel input materials are available in both India and the U.S., and its manufacturing equipment can be sourced from dozens of countries, allowing the two nations to eliminate import dependency.

# CALLS 2024



## IUSSTF-VITERBI PROGRAM (Research Internship 2024)

The Indo-US Science and Technology Forum (IUSSTF) and The Viterbi School of Engineering, University of Southern California (USC) have partnered to support the IUSSTF-Viterbi Program. This program provides opportunities to Indian students to undertake research internship at the Viterbi School of Engineering in summer 2024 for a period of 8 weeks.



### The IUSSTF-Viterbi Program is envisaged to:

- Provide an opportunity to the best and brightest Indian students to gain exposure and access to world class research facilities in the Viterbi School.
- Promote research and capacity building in front line areas of engineering and technology.
- Encourage outstanding students to take up research as career.
- Pave the way for the next generation engineers from India to interact with American peers, thus help building long-term R&D linkages and collaborations.

### Eligibility:

- Indian students currently pursuing a Bachelors or Masters degree at recognized institutions of higher education in India.
- Open to students of Electrical Engineering, Electronics & Communication Engineering, Computer Sciences and Computational Sciences.

### Scholarship includes:

- Airfare
- Stipend (to cover contingencies including network access, equipments, computing facilities etc)
- Accommodation

For applications and guidelines please visit: [www.iusstf.org](http://www.iusstf.org)

For program information contact:

Indo-US Science and Technology Forum (IUSSTF)  
12, Hailey Road, Fulbright House  
New Delhi-110001  
E-mail: [viterbi-india@iusstf.org](mailto:viterbi-india@iusstf.org)

USC Viterbi School of Engineering  
University of Southern California  
Los Angeles, CA 90089  
E-mail: [raghu@usc.edu](mailto:raghu@usc.edu)

APPLICATION DEADLINE : 15 November 2023



## KHORANA Program for SCHOLARS

The Department of Biotechnology (DBT), Government of India, the Indo-U.S. Science and Technology Forum (IUSSTF) and WINStep Forward (WSF) have partnered to support the prestigious Khorana Program for Scholars named in honor of Dr. Har Gobind Khorana, who won the Nobel Prize in 1968 for his work on deciphering the genetic code.

The Khorana Program provides opportunities to Indian students to get research exposure at leading U.S. universities over Summer 2024 for a period of 10-12 weeks.

### Program Objectives:

- To provide exposure to world class scientific research facilities.
- Nurture the next generation of scientists and technologists to build long term R&D collaborations.
- Enable post-graduate students to pursue higher education and research-based careers.
- Promote capacity building in frontline areas of biotechnology and bio-quantitative sciences.

### Eligibility:

- Pre-final year students enrolled in B.Tech., M. Tech., MSc., B.E., M.E., M.S., Integrated B.S-M.S., B.Sc., B.V.Sc., M.V.Sc., B. Pharm., M. Pharm., MBBS., and Master in Medical Science and Technology (MMST) at recognized institutions of higher education in India in Biotechnology and allied areas are eligible to apply.
- First Year, Final Year and Ph.D. students are NOT eligible to apply.

### Scholarship includes:

- Stipend
- Airfare
- Health Insurance

For additional program information, please visit [www.iusstf.org](http://www.iusstf.org)

For program information contact:

Indo-U.S. Science and Technology Forum (IUSSTF)  
12 Hailey Road, Fulbright House,  
New Delhi - 110 001  
E-mail: [scholar@iusstf.org](mailto:scholar@iusstf.org)

Application Deadline : 31 October 2023

IUSSTF thanks all applicants for an overwhelming response.

# IUSSTF WELCOMES THE NEW LEADERSHIP



Dr. Nisha Mendiratta took up the charge as Executive Director of IUSSTF on November 17, 2023. Earlier, she served as an Advisor/Scientist G at the Department of Science and Technology, Ministry of Science and Technology, Government of India, while spearheading two important scientific divisions - Women in Science and Engineering (WISE-KIRAN) and the Climate Change Program (CCP).



**Dr. Nisha Mendiratta** was greeted by **Dr. Abhay Karandikar**, Secretary, Department of Science and Technology, Government of India and Indian Co-Chair of the Governing Board of IUSSTF during their discussion on various avenues for advancing Indo-U.S. strategic partnership in science, technology, and innovation on November 22, 2023.

The first month has been a whirlwind with Dr. Mendiratta networking with dignitaries and key stakeholders of IUSSTF.



On November 28, 2023, **Dr. Nisha Mendiratta** interacted with **Mr. Eric Garcetti**, U.S. Ambassador to India to set the stage for significant Indo-U.S. science and technology collaborations during her forthcoming tenure at IUSSTF.



On December 4, 2023, **Dr. Nisha Mendiratta** met **Dr. Rajesh Gokhale**, Secretary, Department of Biotechnology (DBT), Government of India to discuss the programs executed through DBT-IUSSTF partnership and strengthen the long-standing ties in upcoming priority areas under biotechnology.



**Dr. Nisha Mendiratta** highlighted the need for establishing virtual startup networks to foster Indo-U.S. R&D collaboration in biotechnology during the Plenary Session on the Biotech Ecosystem: Views from Key Opinion Leaders at the **Global Bio India 2023** on December 4, 2023.



**Dr. Nisha Mendiratta** had an engaging discussion on the goals and ambitions of the prestigious United States-India Science and Technology Fund (USISTEF) program with the USISTEF Co-Chairs, **Dr. S.K. Varshney** (Indian Co-Chair) & **Mr. Drew Schufletowski** (U.S. Co-Chair) on December 7, 2023.

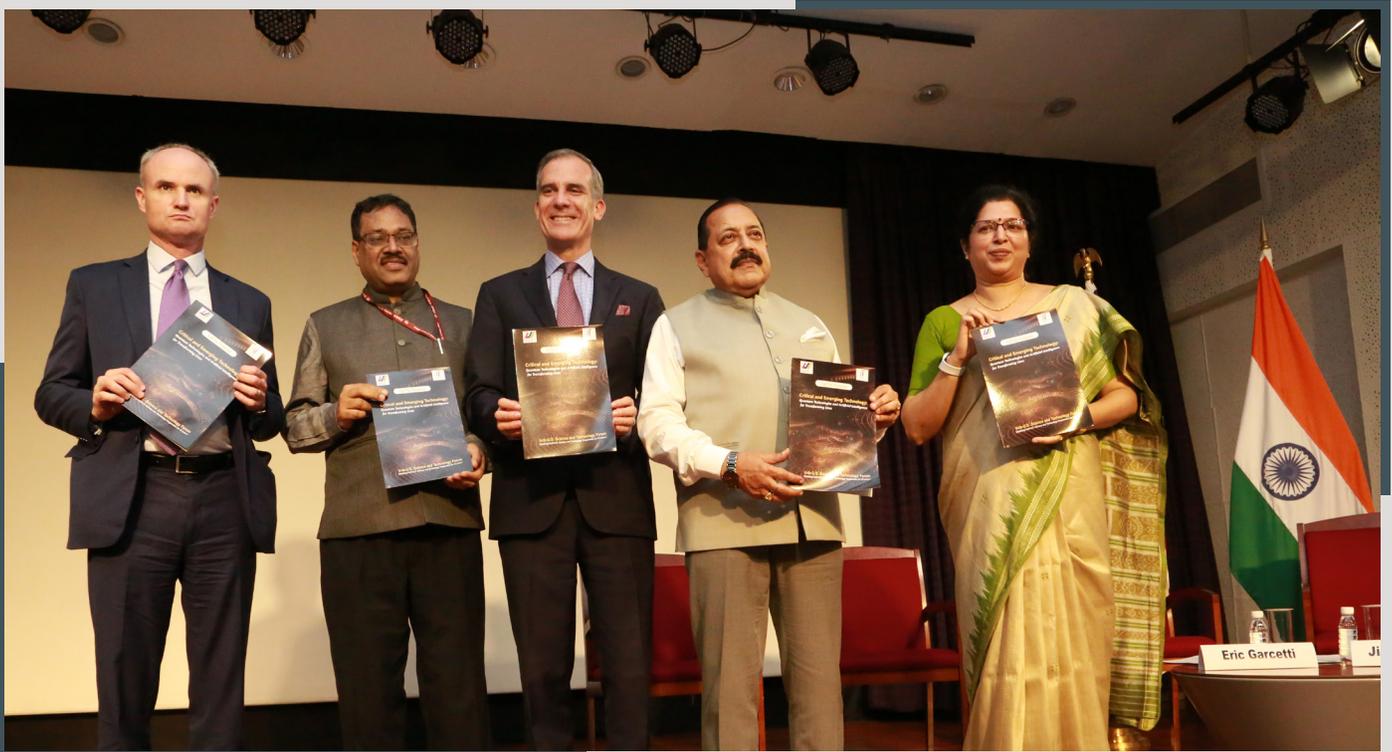
Launch of Call for Proposals

# CRITICAL AND EMERGING TECHNOLOGY: QUANTUM TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE FOR TRANSFORMING LIVES

India and the United States are building a comprehensive roadmap for partnership in crucial areas of mutual interest while emphasizing the importance of leveraging complementary strengths and addressing critical challenges. The U.S.-India initiative on Critical and Emerging Technology (iCET) was launched in May 2022 to strengthen links between the innovation ecosystems of both the nations and enhance bilateral technology cooperation.

On June 22, 2023, Hon'ble Prime Minister Shri Narendra Modi and President Joseph R. Biden, Jr., in their joint statement, welcomed the launch of a \$2 million grant program under the U.S.-India Science and Technology Endowment Fund (USISTEF) for the joint development and commercialization of Artificial Intelligence (AI) and quantum technologies.

In pursuance of the announcement by the leaders, the Indo-U.S. Science and Technology Forum - Secretariat for the USISTEF, designed a special call for proposal on "Critical and Emerging Technology: Quantum Technologies and Artificial Intelligence for Transforming Lives."



Launch of Call for Proposals: the Brochure

On July 12, 2023, **Dr. Jitendra Singh**, Hon'ble Minister of State (Independent Charge) for Science and Technology; and Minister of State for Prime Minister's Office; Personnel, Public Grievances and Pensions; Department of Atomic Energy; and Department of Space, Government of India and **Mr. Eric Garcetti**, U.S. Ambassador to India in the presence of USISTEF Co-Chairs, **Dr. Sanjeev Varshney**, Advisor and Head

(International Cooperation Division), Department of Science and Technology (DST), Government of India and **Mr. Drew Schufletowski**, Minister-Counselor for Economic Affairs, Environment, Science and Technology, U.S. Embassy, New Delhi formally launched the special call for proposal on "**Critical and Emerging Technology: Quantum Technologies and Artificial Intelligence for Transforming Lives**" at the American Centre, New Delhi.



Dr. Jitendra Singh

*"It gives me immense satisfaction to see that both the Indian and U.S. sides having positioned themselves quickly to implement the decision of the two leaders. I am confident that USISTEF would serve the Sustainable Development Goals through sustainable startups and strengthen Indo-U.S. strategic ties. This is a new chapter in the AI (America – India) technology relations in the AI (Artificial Intelligence) era."*



Mr. Eric Garcetti

*"As we look ahead, the Endowment Fund will foster linkages between U.S. and Indian innovation ecosystems, innovators, and entrepreneurs to develop technologies that not only will further our bilateral priorities but will define the future of technology and its impact globally."*



Dr. S.K. Varshney

*"USISTEF has a mandate of empowering citizens through innovations that benefit society at large. USISTEF is a great platform to implement a public-private partnership model and how it could contribute to the cause of binational iCET."*



Mr. Drew Schufletowski

*"Finding ways to promote, sustain, and disseminate the benefits of innovation is a top priority for our two governments – as is the need to work with the private sector to ensure that appropriate incentives for innovation are created and respected."*

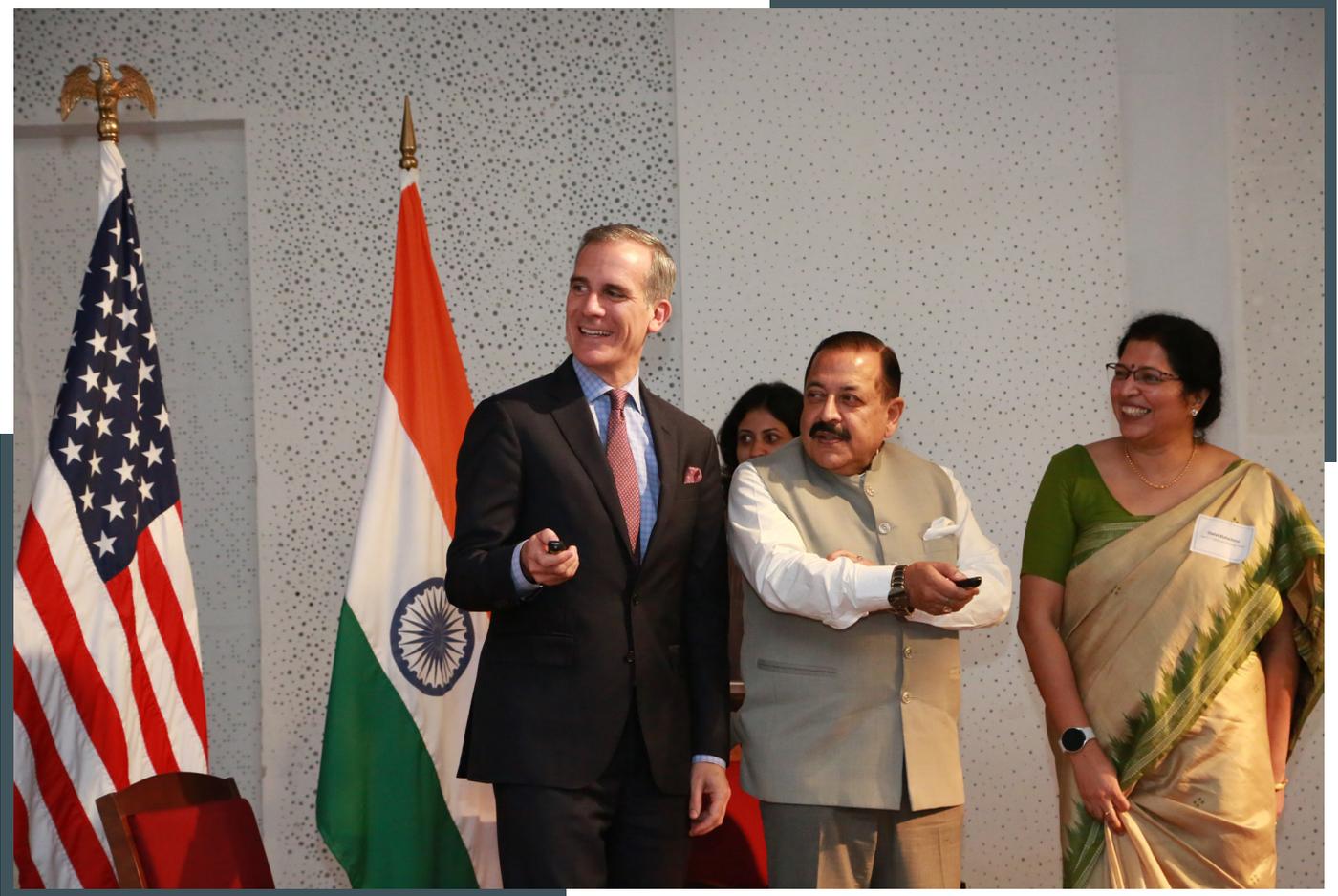


Dr. Chaitali Bhattacharya

*"For Indo-U.S. Science and Technology Forum, today is another milestone moment. IUSSTF is very proud to announce the welcoming of a \$2million grant program under USISTEF by President Biden and PM Modi for the joint innovation and commercialization of Quantum and AI technologies."*

The launch event observed participation of key representatives from the DST, Government of India; the Embassy of United States of America in India; Quantum and

Artificial Intelligence experts from industry and academia; Endowment fund awardees; and potential applicants of the award.



Digital launch of Call for Proposals

During the event, select USISTEF awardees demonstrated products/ prototypes developed by them. The exhibits garnered huge interest and appreciation from the dignitaries during their visit to the stalls and interaction with the awardees. The products/ technologies showcased during the event were NeoBreathe Newborn Resuscitation System, JaipurBelt™, Continent Ostomy Management Device, Low-Cost Anti-Counterfeiting Labels, MIRACLE Dialysis - Wearable Alternate Kidney, ArmAble - An Interactive Arm Training Rehabilitation Device, Lab-on-a-strip (LOS): Towards Multi-analyte Screen Printed Biosensor Strips, and Paediatric Postural Support Wheelchair.

As part of the event, a panel discussion was organized with a focus on **"The New U.S.-India Partnership Call: Essence, Expected Outcomes, and Deliverables."** The discussion brought key industry and academic representatives from IBM, Microsoft India, QpiAI, QNu Labs, Bharat Innovation Fund, and IIIT Delhi on a common platform to deliberate on the strengths and complementarities of the Indo-U.S. Quantum and AI landscape, and how the same could be capitalized to foster technology co-development and commercialization for advancing societal impact.

Quantum computing is a rapidly emerging technology with an estimated market size of \$9B-\$93B by 2040 when the potential Quantum technology market size is estimated at \$106B. The discussion commenced with understanding the span of Quantum domain beyond Quantum Computing.

**Mr. Somshubhro Pal Choudhury**, Partner, Bharat Innovation Fund, who was moderating the session, shared that the scope of the domain extends to quantum communication, quantum sensing and metrology, quantum cryptography, quantum algorithms, quantum imaging and quantum simulation, to name a few. On similar lines, McKinsey & Company has estimated Quantum communications and Quantum sensing as the major contributors to the \$106B market figure.

Attempting to shed light on the state of maturity of these fields from technology and market adoption standpoints, **Mr. L. V. Subramaniam (Venkat)**, IBM's India Quantum Leader said, "Quantum has a remarkable capability to bring huge impact, in finance, logistics, drug discovery, etc. In five years from now, businesses will be taking exponential

advantage through quantum in terms of solving some of the biggest problems."

Talking of the state of affairs in AI, with a focus on healthcare in India, **Dr. Tavpritesh Sethi**, Associate Professor, Computational Biology and Founding Head, Centre of Excellence in Healthcare, Indraprastha Institute of Information Technology, Delhi emphasized on the fast-changing landscape in the post-COVID era that is witnessing technology adoption like never before. With this and the opportunity rooted in India's diversity, demography, and heterogeneity, the healthcare practitioners are now more than willing to come up with use cases that could be solved using AI.

Steering the discussions to focus on the Indo-U.S. Quantum-AI innovation and regulatory corridor, **Mr. Ashutosh**



Paediatric Postural Support Wheelchair



Continent Ostomy Management Device



Multi-analyte Screen Printed Biosensor Strips



JaipurBell™ - Belt System for Body Support



Low Cost, Anti Counterfeiting Labels



MIRACLE Dialysis-Wearable Alternate Kidney



ArmAble: An Arm Training Rehabilitation Device



Rechargeable Sodium Battery for Energy Storage



Integrated Neonatal Resuscitation Solution

**Chadha**, Group Director, Government Affairs and Public Policy, Microsoft India explained that such a much-needed corridor could, for instance, enable startups have a safe place to experiment, create solutions with no regulatory barrier, and have a potential market opportunity either within the two countries or in a third geography. He added, "U.S.-India partnership is for global good. Together the two countries can achieve things which have the potential to solve big problems of the world." He further highlighted the possibility of a regulatory sandbox, starting with agriculture, health, climate change, education, privacy and security as these issues are universal.

Comparing and contrasting academia-industry ecosystems on the two sides, **Mr. Subramaniam** reinforced that India has a rich talent which needs to be trained and channelized while U.S. has capital and more industrial maturity. As a result, many U.S. companies are willing to invest in new and upcoming technologies. He added, "USISTEF is an incredible platform that brings together such talent with use case maturity in U.S., an excellent amalgamation to foster technology co-development and commercialization."

Furthermore, India has successfully established as a provider of building blocks for Quantum and AI

applications, for instance, for the largest drug company here, India is putting together the IT infrastructure on a quantum computer, providing hardware to the only two Quantum cryptography industries in the U.S., etc. **Mr. Sunil Gupta**, Co-Founder and CEO, QNu Labs, Bengaluru exclaimed, "Quantum software and services in India have evolved as per the need from providing protection to critical infrastructure in border areas to providing access in remote areas during COVID. This provides the go-to-market for India in the U.S."

The discussions culminated in understanding the status quo regarding trustworthy and explainable AI systems and opportunities in place for Indo-U.S. innovation ecosystems. **Dr. Sethi** opined that the definition of trustworthy and explainable AI systems is quite fuzzy and varies from one research group to another. He feels the need to collaborate in a domain-specific manner and to come up with guidelines applicable to that domain. Expressing agreement on this, **Mr. Chadha** remarked, "At this point of time, India and the U.S. could figure out the right definition and framework on how to look at trustworthy, explainable, AI systems. It is imperative to have governance of AI in place, to put humans back in control." ●



Panel Discussion on The New U.S. - India Partnership Call: Essence, Expected Outcomes, and Deliverables

JCERDC Workshop

# DER INTEGRATED SMART DISTRIBUTION SYSTEMS: LEARNINGS FROM INDO-U.S. PROJECT

A dissemination workshop on **Distributed Energy Resource (DER) Integrated Smart Distribution Systems: Learnings from Indo-U.S. Project** was held on **September 26-27, 2023**, at the **IIT Kanpur Outreach Centre, Noida**. The workshop was organised by the consortium of the **UI-ASSIST: U.S.-India collaborative for Smart Distribution System with Storage** project, jointly funded by the United States Department of Energy (**DOE**), and Department of Science and Technology (**DST**), Government of India and implemented by the Indo-U.S. Science and Technology Forum (**IUSSTF**) under the Joint Clean Energy Research and Development Centre (**JCERDC**) Program.

The workshop served as a platform for about 60 participants from power utilities, industries, regulatory organizations, load dispatch centres, and R&D organizations to understand different operational, regulatory, reliability, and security challenges that need to be addressed in deploying renewable and storage integrated smart active distribution systems. The knowledge gained through R&D activities and pilot deployments under the joint project was shared with the participants present in the workshop.

The engaging and dynamic sessions by the Indian and U.S. team members on the research undertaken under the UI-ASSIST project provided insights into important learnings from the outcomes of the project, recommendations, and the way forward on various components of the smart active distribution networks. Specifically, these sessions focused on the challenges of integrating DERs into distribution grids; energy storage system modelling, sizing, siting, and optimal charge/discharge control when integrated with the distribution grid; microgrid control and protection; Advanced Distribution Management System (ADMS) platform development; active distribution network management and cybersecurity and infrastructure, Distribution System Operator (DSO), field deployment, and social and regulatory issues.

In addition to providing an insight into the Research and Development (R&D) outcomes accomplished under the project, the sessions presented the experts and stakeholders with an opportunity to appreciate the consortium's work in developing the synthetic benchmark systems representing evolving microgrids and future distribution networks, the setting up of the six laboratory testbeds each in India and the U.S. to test and validate the



Participants at the workshop



Panel Discussion: Pathways to roll out smart distribution systems

R&D concepts through offline/ online simulations, and the demonstration of evolving microgrid and advanced distribution system concepts through the demonstration pilot setups in rural, semiurban and urban settings.

In addition to the above, a panel discussion on **"Pathways to roll out smart distribution systems"** was held. The panel discussed the current setup, requirements for the future and the challenges to transmission from the existing system and possible resolutions for both countries. The closing session of the workshop allowed the participants to appreciate the journey of the consortium members,

funding agencies and the experts from 2017 to 2023 in bringing together many academicians, industrialist and professionals working around smart grids and energy storage and their contributions to the future deployments.

The consortium also released a compendium summarizing the key **outcomes and deliverables of the UI-ASSIST project** resulting from six years of efforts of 31 consortia organizations from India and the U.S. The compendium presents the technical accomplishments, laboratory and field level deployments, and other key highlights of the project. ●



Compendium launch at the workshop



# GIVING WINGS TO TALENT

**USSTF is committed to nurture contacts between scientists and students from India and the United States to address the need for human resource development and capacity building in science and technology through visitation programs such as 'IUSSTF-Viterbi Program' and 'Khorana Program for Scholars.'** It has been unambiguously demonstrated that providing students and young scientists with an exposure to cutting-edge scientific research experiences at a formative stage not only broadens their intellectual horizons but also leads to increased engagements in scientific and technological research careers. In this section of Connect, we bring to you the experiences and learnings of some of our young interns and fellows of the 2023 cohort in their own words!

# IUSSTF - VITERBI PROGRAM



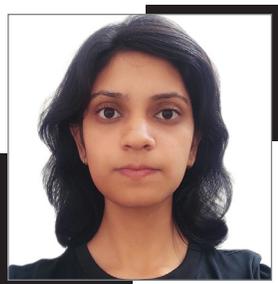
**APURBA PRASAD PADHY**  
Indian Institute of Technology  
Roorkee

Thinking back on my experience with the IUSSTF – Viterbi Internship, it was quite a journey. My research endeavours under the guidance of Prof. Peter Beerel allowed me to leverage my past experiences in FPGA-based implementation and Spiking Neural Networks (SNNs). The interdisciplinary nature of the project provided a comprehensive understanding of cutting-edge applications in the field. Beyond the laboratory, the program stood out in connecting me with people who shared similar goals and thoughts but came from different places and institutions in India, thereby giving a peek into different non-academic

cultures from institutions back in India.

The program wasn't just about work; it was a mix of experiences. Weekends turned into mini-adventures as we explored new places together. We did everyday stuff like grocery shopping and cooking as a team, facing challenges and making memories.

As the program concluded, it left me with a repository of cherished memories and invaluable lessons of life. The bonds formed with my co-interns, coupled with the experiences of navigating through unfamiliar territories, instilled a profound sense of independence.



**SAUMYA PANDA**  
International Institute of Information  
Technology  
Bhubneshwar

I wanted to share a glimpse of my incredible experience this summer during the IUSSTF-Viterbi internship program at University of Southern California (USC). From the moment I learned about my selection, I was elated and couldn't wait to embark on this journey. Navigating the visa process was a bit of a concern initially, but thanks to the efficient support from IUSSTF, we were given priority slots and everything proceeded smoothly.

Workwise, I had the opportunity to collaborate closely with my prospective Ph.D. mentor on enhancing code-generation models with Large Language Models (LLMs), which allowed me to delve into cutting-edge technologies and contribute to AI research.

One of the highlights of this internship was the people I got to know. Through orientation and regular meetings, I had the pleasure of making new friends. Together, after our work hours, we explored the vibrant city of LA, where we were constantly surprised by the ever-changing weather – from chilly winds in May to scorching sun in July.

The impromptu trips we embarked on were both thrilling and nerve-wracking, adding an extra layer of adventure to our stay. Overall, this experience has been nothing short of amazing, and I wouldn't trade it for anything else.



# KHORANA PROGRAM FOR SCHOLARS

During my internship under the Khorana Program for Scholars at the University of Nebraska-Lincoln, I worked with Dr. Saurav Das on soil health. My research, focused on soil organic matter dynamics using advanced statistical tools like ANOVA and PCA, led to the development of a hierarchical land classification system for comparative soil health studies. The experience honed my skills in R-programming, meta-analysis, and ArcGIS, thereby helping me grow professionally. During the internship period, I attended the International Millet Conference 2023 which helped me network with several esteemed specialists working in the

agriculture domain. My time in Nebraska granted me insights into American rural landscapes and large-scale industrial farming in the Midwest – the American Breadbasket. Besides my work, I explored several national parks and historical landmarks, including the Rocky Mountain National Park and Mount Rushmore in the Black Hills. These visits underscored the vastness of the world and the myriad experiences I've yet to encounter. The internship was instrumental in my personal and professional development and will be invaluable as I pursue further academic challenges, particularly a Ph.D. from a prestigious institution.



**JITUL BORA**  
Assam Agricultural University  
Jorhat

Leaving behind the comforts of my homeland, I embarked on a three-month journey to the United States. My destination was the Department of Biochemistry and Molecular Biophysics at the Kansas State University. At the heart of my journey was my host mentor, Dr. Om Prakash. Under his mentorship, I learned to express my ideas in a more refined and scientific manner, a skill that will prove invaluable in my academic journey. The people I met in the laboratory weren't just colleagues; they became a family away from home. With them, I found camaraderie, celebrated diversity, and learned that science transcends borders.

One of the highlights of my experience was the vibrant work culture in the

United States. The emphasis on creativity, innovation, and collaboration was infectious. I felt encouraged to ask questions, challenge assumptions, and explore new horizons. Throughout my internship, I had the privilege of presenting my work during weekly lab meetings. Week by week, I witnessed improvement in my ability to express complex ideas succinctly and confidently. It was a testament to the nurturing environment of the lab and the support of my peers and mentor.

As I look back on my Khorana Program journey, I am filled with gratitude. It was a voyage of self-discovery, resilience, and personal growth that enriched my life in ways I could never have imagined!



**APRAJITA JHA**  
KIIT School of Biotechnology  
Bhubaneswar

# Adiós 2023!



**The IUSSTF family wishes all its valued readers a prosperous 2024!**

Let us commemorate the dawn of another year in the long-standing Indo-U.S. friendship in science, technology, and innovation.