



# CENTERED

## ANNUAL REPORT

STEP<sup>®</sup>  
CENTRE FOR STUDY OF  
SCIENCE, TECHNOLOGY & POLICY

| 2021-22





*“We can’t change the direction of the wind, but  
we can adjust the sails.”*

– An Indian proverb





## Note from the Chairman



**Dr V S Arunachalam**

*CSTEP continues to pursue work in areas that promise sustainable futures. We have developed ideas in Climate, Air Pollution, Green Energy Transition, and AI and Digital Platforms and are engaging in Strategic areas such as hydrogen, technology assessment, and solar charging of electric vehicles. The research shows significant promise as India transitions from fossil fuels to renewable energy.*

*We have seeded various initiatives in these areas and will broaden them across the country. CSTEP's work has received wide recognition, with our researchers participating in various Government Task Forces and Committees. We have provided valuable inputs to COP26 negotiations and the R&D policy for the state of Karnataka, among others.*

*This has caught the attention of domestic philanthropists who have started supporting CSTEP's work, underlining the commitment of local entities and institutions to support projects of national importance. I am also delighted at the recent collaborative successes with domestic and foreign funders.*

*This year is proving to be successful in transforming society through indigenous technologies for public use. We continue to be concerned about the total dependence on foreign technologies and use every opportunity to explore/develop indigenous technologies (in keeping with the vision of Atmanirbhar Bharat).*

*Through the pandemic, CSTEP has managed to function successfully with a hybrid working model despite the challenges. Many of our researchers are now adept at handling work from remote places and collaborate seamlessly with colleagues. We would like to integrate elements of the hybrid model into the work culture.*

*The coming years show significant promise as we work on harnessing the power of technology, especially the ones that are locally developed. Innumerable challenges are bound to come up, but we are confident of resolving them successfully.*







## From the ED's Desk



**Dr Jai Asundi**

*What a rollercoaster the year 2021 was! While we started well with the promise of a vaccine, we weren't spared the brunt of the COVID19 pandemic. Through multiple infections, lockdowns, and spiralling delays in our projects due to the inability to travel, it was yet another challenging year. Amid this uncertainty, it became imperative to stay "centered".*

*Dubbed internally as the "year of consolidation", we spent our time and effort on building the necessary internal governance structure, processes, and capacity-building exercises to ensure that we emerge much stronger at the end of this period. We consolidated our work along the main themes of India's energy transition, creating a sustainable future, improving air quality, and enabling digital transformation. These are the critical problems India faces today. Building the necessary evidence base and analysis tools are essential for us to deliberate on the potential solutions for such complex problems. I believe that my teams are up for the challenge. The projects developed are a testament to the innovativeness, resolve, and thought leadership of our research groups. The support functions like HR, Finance, Communications, and IT stepped up to the challenge in the volatile and uncertain environment to make sure nothing went amiss.*

*Through the year, Special Advisor Dr Dipankar Banerjee and the Committee of Directors (comprising Dr Bellarmine and Mr Munish Sapra) have been a source of immense support to me as we successfully navigated key challenges such as FCRA renewal, raising core grants, tightening controls, etc. Our funders have stood beside us steadfast through these hard times and I am grateful for the same.*

*While we are wary of predicting what the future holds, we feel more confident about making plans for the coming year. In the year gone by, researchers continued to develop new ideas, finding mention for their work in public documents, and at times winning accolades for their work. In the coming year, as we focus on creating impact, we will put more effort into improving the quality of our work and engagements. I see this as a necessary step to establishing thought leadership in our chosen areas. The rigour associated with cutting-edge data/analysis will need to be adopted by all. At the same time, I see the need to develop deep collaborations with other institutions/entities so that we can leverage each other's capabilities for lasting and widespread impact.*

*With the magnitude of challenges and the promise of innovative solutions that lie ahead, I hope we have your support as we work towards a sustainable, secure, and inclusive society.*



## Board of Directors



Dr V S Arunachalam  
Former Scientific Advisor to  
Raksha Mantri (1982-92),  
Padma Vibhushan



Shri Suresh Prabhu  
Indian Member of Parliament and  
Former Sherpa to G7 & G20 Summits;  
former Minister of Environment &  
Forests, Govt. of India



Shri Prafull Anubhai  
Educationist and  
corporate advisor



Prof. Dipankar Banerjee  
Former Chief Controller -  
R&D, DRDO,  
Padma Shri



Shri Rajat Gupta  
Senior Partner,  
McKinsey & Company



Ms Soumya Rajan  
Founder, MD & CEO,  
Waterfield Advisors



Dr Jai Asundi  
Executive Director,  
CSTEP

# Funders

## Domestic

Jamsetji Tata Trust

Narotam Sekhsaria Foundation

Rohini and Nandan Nilekani Philanthropies

Shakti Sustainable Energy Foundation  
(SSEF)

Shri Sivasubramaniya Nadar Educational  
and Charitable Trust

WIPRO

Government of India

Government of Karnataka

Government of Andhra Pradesh

## International

Bill & Melinda Gates Foundation

Bloomberg Philanthropies

British High Commission

Children's Investment Fund Foundation  
(CIFF)

Climate Parliament

European Climate Foundation

European Union

German Corporation for International  
Cooperation (GIZ)

Good Energies Foundation

IBM

International Development Research  
Centre (IDRC)

MacArthur Foundation

Google LLC

Environmental Defense Fund

Next Generation Infrastructures

Oak Foundation

Overseas Development Institute

SED Fund

The Global Green Growth Institute

The World Bank

United Nations Democracy Fund (UNDEF)

United Nations Development Programme  
(UNDP)

United States-India Educational Foundation  
(USIEF)

William and Flora Hewlett Foundation

Agence Francaise Developpement

New Venture Fund



## Collaborations

### Government Institutions

Bangalore Electricity Supply Company Limited (BESCOM)

Bureau of Energy Efficiency (BEE)

Central Power Research Institute

Chamundeshwari Electricity Supply Corporation (CHESCOM/CESC)

Defence Research and Development Organisation (DRDO)

Department of Defence

Department of Science & Technology (DST)

Government of Karnataka

Gulbarga Electricity Supply Company Limited (GESCOM)

Hubli Electricity Supply Company (HESCOM)

Karnataka Electricity Regulatory Commission (KERC)

Ministry of Environment, Forest and Climate Change

Ministry of New and Renewable Energy (MNRE)

NITI Aayog

Planning Commission

Power Finance Corporation

Society for Elimination of Rural Poverty (SERP)

The Indo-U.S. Science and Technology Forum (IUSSTF)

University Grants Commission (UGC)

### Collaborations

Asian Institute of Technology

BRAC University

Carnegie Mellon University

Centre for Policy Dialogue (CPD), Bangladesh

CEPT University

Clean Air Task Force

Council on Energy, Environment and Water (CEEW)

Ecole Polytechnique Federale de Lausanne (EPFL)

Forge Accelerator, Coimbatore

Indian Institute of Science (IISc)

Indian Institute of Technology Bombay (IIT Bombay)

Indian Institute of Technology, Kanpur (IIT Kanpur)

Institute for Social and Economic Change

Institute for Social and Environmental Transition-Nepal (ISET-Nepal)

Integrated Research and Action for Development (IRADe)

International Institute of Information Technology Bangalore (IIIT-B)

M.S. Ramaiah University of Applied Sciences

Pacific Northwest National Laboratory (PNNL)

PLR Chambers

RAND Corporation

Royal Society of Netherlands

Shell India

St. John's Institutions

The Energy and Resources Institute (TERI)

The University of British Columbia

The University of Texas

University of Agricultural Sciences, Bangalore

University of Pennsylvania

University of Washington

Urban Emissions



CSTEP Executive Director Dr Jai Asundi was invited to be a part of the task force set up by the Chief Minister of Karnataka for framing the Research, Development, and Innovation Policy for the state

CSTEP was among the select few think tanks invited by Shri Bhupender Yadav, the Union Minister for Environment, Forest and Climate Change, to discuss climate change issues prior to COP26



CSTEP was among the 35 think tanks invited by NITI Aayog to discuss ways to revive the economy in the wake of the pandemic

## Honour Roll



CSTEP is a member of the NITI Aayog constituted 'India Climate and Energy Modelling Forum'



Bhawna Welturkar, Manager, Communications Design, was one of the Mentors of Change under NITI Aayog's Tinkerpreneur programme





# Secure & Sustainable Future



Unveiled the Sustainable Alternative Futures for India (SAFARI) model, which provides an analytical framework to identify sustainable long-term development strategies for India



The SAFARI model was used for modelling the ethanol demand scenarios by NITI Aayog for their report 'Roadmap for Ethanol Blending in India 2020-2025' and also used to validate scenarios in NITI Aayog's Vision 2035 document



The SAFARI work was presented at COP26 at IDFC pavilion and also at the IIASA systems analysis in Eurasia conference



Published district-level climate atlases for the southern, central, western and eastern states of India to map risks and climate hazards. These are being used in the State Action Plans on Climate Change in Kerala and Manipur



CSTEP conducted training programmes on vulnerability assessment for officials from various state government departments





As an Institute of Repute (IoR) under the National Clean Air Programme (NCAP) of the Ministry of Environment, Forest and Climate Change (MoEFCC), we organised a workshop to guide other IoRs on data collection, handling, and storage for their emission inventory studies



The Centre for Air Pollution Studies (CAPS) signed an MoU with the Karnataka State Pollution Control Board (KSPCB) and Bruhat Bengaluru Mahanagara Palike (BBMP) for the successful implementation of NCAP in Bengaluru



The third edition of the India Clean Air Summit (ICAS) explored the theme 'Clean Air for Healthy Living'

The CAPS team has been training pollution control board officials in Jharkhand, Punjab, and Karnataka on the development and use of emission inventories



**Clean Air for All**




S R Bommai, the Chief Minister of Karnataka, released our Source Apportionment and Emission Inventory study reports for Bengaluru



Published the findings of our study on 'Satellite-Based Mapping and the Quantification of PM2.5 in India'





Completed a study to support Karnataka Power Transmission Corporation Limited (KPTCL) on building transmission infrastructure to include more renewables and suggested measures to strengthen the state transmission network to accommodate future demand

CSTEP was chosen as the knowledge partner for the Bangalore Electricity Supply Company (BESCOM) for projects at the national and state levels



Currently, CSTEP is engaged in developing a roadmap for the Karnataka power sector for 2032



CSTEP is engaged in mapping the solar potential of different cities in Madhya Pradesh using drones



Published a study on the need for a differential pricing mechanism for pumped-hydro energy storage in India



Signed an MoU with the Transmission Corporation of Andhra Pradesh for high-impact research projects in the state





CSTEP is currently developing a study to identify opportunities for decarbonisation in the MSME manufacturing sector



Organised a webinar on the 'Role of Pumped-Hydro Energy Storage in the Indian Grid'



Conducted a webinar on 'Rooftop Solar: A Catalyst for Achieving Net-Zero Emissions'



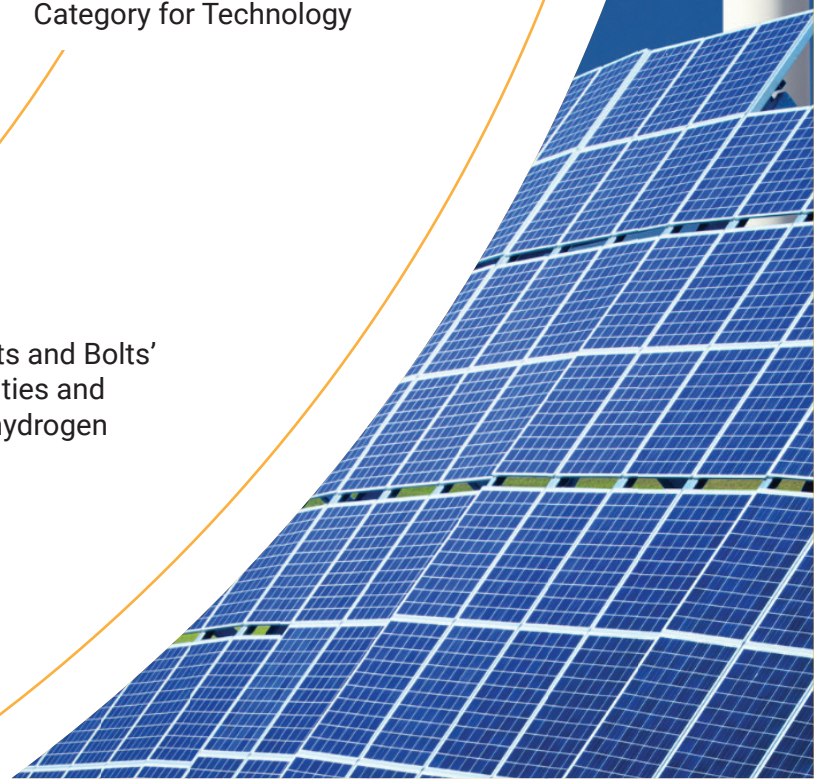
Co-hosted a webinar with the International Energy Agency (IEA) on the future of 'Hydro Power in India'



The pilot study on Solar-PV Integration, where CSTEP was the knowledge partner for BESCO, won the SKOCH Award in the Silver Category for Technology



Organised 'H<sub>2</sub> – The Nuts and Bolts' to explore the opportunities and challenges for a green hydrogen economy in India







The SNEHA NRC app, designed by CSTEP, is being used in all the 33 District Nutritional Rehabilitation Centres, or NRCs, in Karnataka. The app aids in managing the rehabilitation of children suffering from acute malnourishment



Our digital survey platform Sameekshe enabled the Department of Health and Family Welfare and the Department of Women and Child Development of the Government of Karnataka to conduct an integrated health and family survey



Sameekshe enabled the recording of data of over 1 crore individuals in Karnataka



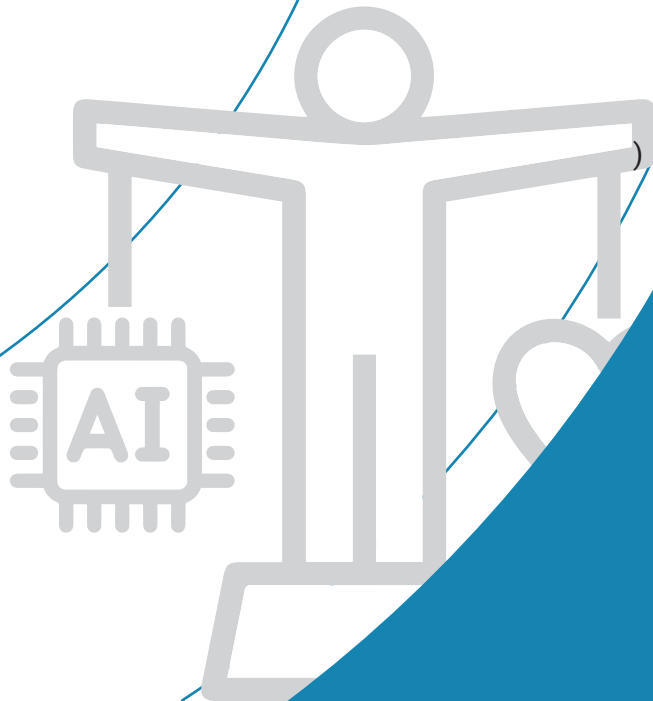
We developed a prototype application for demand forecasting of slow-moving and non-moving inventory items that are common in the defence services. After experimenting with different statistical and machine learning models, the team was able to demonstrate a 10% to 20% improvement in the accuracy of forecasts for the given sample data



## AI & Digital Transformation



CSTEP along with the Indian Institute of Science (IISc) and the National Institute of Advanced Studies (NIAS) organised a virtual workshop on 'Smart Cities in Karnataka – Experiences and the Road Ahead'











Released the E-Depot tool (E-Bus Depot Electrification Planning and Operational Tool) to help the transport department and electricity distribution companies to make sound decisions regarding the deployment of electric buses

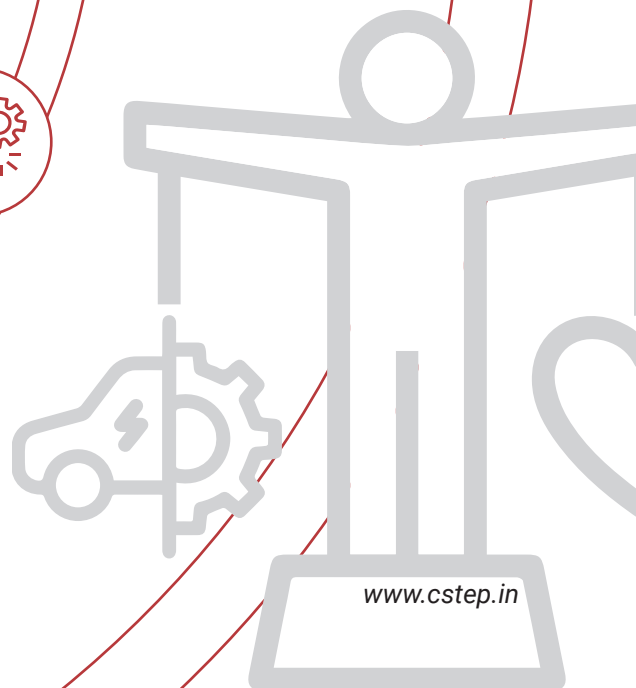


Published a study on solar energy-based EV charging

## Strategic Studies



Developed a technology assessment framework (TAF) to assess the applications and sustainability of various technologies





## Stories of Impact



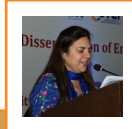
*"CSTEP's reports will be used as a base for studying and making clean air action plans for non-attainment cities (in Karnataka) through a Plan-Do-Check-Act approach."*

Dr Shanth A Thimmaiah, Chairman,  
Karnataka State Pollution Control Board (KSPCB)



*"The scientific evidence highlighted in CSTEP's study of air pollution in Bengaluru can inform both line departments and KSPCB in preparing city micro action plans."*

Ms Puja Tewary, India Coordinator,  
Climate and Environment Programs,  
Bloomberg Philanthropies



# Winds of Change

With Bengaluru being identified as a non-attainment city, CSTEP, an Institute of Repute under the National Clean Air Programme, is working with the Karnataka State Pollution Control Board (KSPCB) and the Bruhat Bengaluru Mahanagara Palike (BBMP) to better the air quality in the city. The source apportionment and emission inventory studies that the Centre for Air Pollution Studies (CAPS) conducted for Bengaluru identified the sources of pollution and their contribution to the deteriorating air quality of the city. Implementing the recommendations suggested in these studies, which were released by the state chief minister S R Bommai at an event organised by KSPCB, can reduce the city's air pollution levels by 20 to 30% by 2024. CSTEP is also training Karnataka state officials to conduct these studies for other cities, such as Davangare and Hubballi. Such assessments ensure that policy measures are not ad-hoc, but informed through scientific studies.



# Whither the Weather?

CSTEP studied changing climate patterns – from warmer summer maximum and winter minimum temperatures to heavier and more frequent rainfalls – at a district level in states across India. It projected the likely changes expected over the next three decades, while comparing it to the historical 30 years (1991-2019). The analysis looked at two representative scenarios: medium emissions and high emissions.

The study got widespread policy engagement with various state governments incorporating the analysis into their State Action Plans on Climate Change. The report findings also got extensive media coverage with national and regional media running exclusive features on the implications of climate change in various states of India, while referring to CSTEP's analysis.



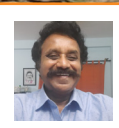
*"The revision of the State Action Plan on Climate Change (SAPCC) involved analysing the Climate Change policies and actions of Kerala State and preparing a roadmap to achieve green growth with low carbon intensity and high climate resilience in tune with the NDCs. The team of experts from CSTEP, with their vast technical experience and knowledge in this field, did this exercise comprehensively in a short time."*

Suneel Pamidi, IFS,  
Director, DoECC



*"The workshop on Climate Modelling, Vulnerability Analysis and Risk Assessment conducted by CSTEP helped the scientists and researchers of Odisha Climate Change Cell gain a better understanding of vulnerability mapping at the state and district levels, in conjunction with climate change projections."*

Dr. Krishna Chandra Pal  
Senior Scientist (Ecology & Environment)  
Forest, Environment & Climate Change Department  
Govt. of Odisha



*"As a part of EMPRI's outreach, I have associated with CSTEP several times over the last decade. CSTEP's solutions to the problems faced by society are rooted in quality research with a scientific approach, robust methodology, and thorough analysis."*

Dr. KH Vinaya Kumar, IFS (Rtd),  
EMPRI FELLOW ENVIRONMENT & Director (Research) EMPRI

Stories of Impact





## Stories of Impact



*"EcoSoch Solar is one of the premium installers of solar rooftop systems in Bangalore. It's very important that we access a site for accurate shadow-free panel layout to provide correct quotes to our customers. The CREST Tool developed by CSTEP is a game-changer technology that allows us to predict the maximum solar capacity possible on customer roofs without ever requiring us to step out of our offices, giving us the ability to reach out to more customers efficiently and economically. We look forward to other cities adopting CREST for making India's transition to renewables faster."*

Harsha Kuntur  
MD, Ecosoch

# A Green Revolution

While the role of renewable energy to help decarbonise India has long been recognised, we are still developing technologies that can help scale up these solutions for real impact. CSTEP, which had earlier undertaken the solar mapping of Bengaluru through aerial imagery, is currently undertaking similar exercises in cities in Madhya Pradesh such as Sanchi, Gwalior, Indore, Jabalpur, and Bhopal through aerial imagery. Drones are deployed to accurately map the solar potential of every building in the city. High-resolution aerial imageries captured through this exercise are used to reconstruct a 3D model of the city for assessing the potential of rooftops to generate solar energy. CSTEP's Rooftop Evaluation for Solar Tool (CREST) helps electricity distribution companies and house owners pick up feasible spots for the installation of solar panels, helping cities go green, thereby helping India meet its ambitious RE targets.



# Action on Malnutrition

Over the last few years, CSTEP has partnered with the Department of Health and Family Welfare (DHFV) and the Department of Women and Child Development (DWCD) of the Government of Karnataka in their digitisation efforts. With SNEHA, we built a digital platform for tracking the health and nutrition of women and children in Anganwadis and Nutritional Rehabilitation Centres (NRCs). SNEHA NRC app is being used in all 32 district Nutritional Rehabilitation Centres (NRCs) in the state now for managing the rehabilitation of children suffering from acute malnutrition.

We also developed a digital survey platform called Sameekshe, being used by the Government of Karnataka to conduct integrated health and family surveys. Sameekshe has enabled the recording of data of over 1 crore individuals in Karnataka last year, while eliminating errors, inconsistencies, and duplication by linking to ration card id or family id.



Demography And Evaluation Cell,  
Directorate of Health and Family Welfare Services,  
Arogya Soudha, Magadi Road, Bengaluru – 560 023

Date : 07-05-2022



CERTIFICATE OF APPRECIATION

Sir / Madam,

**Sub:** Appreciation for CSTEP's remarkable contribution to Demography wing in development of app and training of eSameekshe survey.

*"With CSTEP as our partner, we have been successful in initiating the digitalisation of care process in Nutritional Rehabilitation Centers. SNEHA NRC application has simplified data collection, automated the process, and ensured timely reporting. We are happy with its usage across all 32 district NRCs and see more potential to enable data-driven decisions in the future."*

Dr Sridhar, Deputy Director, Nutrition, GoK

*The Demography and Evaluation Cell, Directorate of Health and Family Welfare Services, Government of Karnataka issued a Certificate of Appreciation for CSTEP's remarkable contribution in digitising the Integrated Family Health Survey with Sameekshe application. CSTEP's contribution throughout the lifecycle, from planning, design and development to support during implementation and training was acknowledged by the Demography and Evaluation Cell.*

*"SNEHA NRC application developed by CSTEP in collaboration with IITB has made it easy for NRC staff to record data and generate monthly performance reports. The reports have automated the calculation of sphere indicators, freeing up NRC staff time to focus on caring for children."*

Mr Vishwanath, Nutrition Consultant, UNICEF

Stories of Impact



# Public Engagement and Outreach



Launched 'Science Says', a video series to discuss scientific concepts in an engaging manner and connect with society at large



In the run-up to COP26, we released a video titled 'Climate Conundrum', which discusses the historical responsibility of developed nations to curb emissions



Prepared a video as part of the Global Goals Week, showcasing how CSTEP is working towards a sustainable, secure, and inclusive society



Launched Instagram Reels and YouTube Shorts to engage with a younger demographic



Organised 'Turning the Tide', a talk by Prof Martin Siegert from the Imperial College London on sea-level changes and what they mean for us



Launched 'Voices from the Ground', a new series of articles to capture the ground reality of the issues we are working on. In the first series, we talked about air pollution in Punjab





# FOOTPRINT

**66**  
Opinion  
Pieces

**11**  
Journal  
Articles

**130**  
CSTEP  
Mentions

**1**  
Working  
Paper

**36**  
Blogs

**10**  
Policy  
Briefs

**14**  
Research  
Reports

**2**  
Conference  
Papers

**12**  
Project  
Videos

**19**  
Events  
(Hosted/ Co-  
organised)

**12**  
Newsletters

**9**  
Podcasts

**3**  
Interviews

**3**  
MoUs



**PERSPECTIVE Exchange**  
Business as a Force for Climate Good




**Mr Pramod Bhasin**  
Chairman of the Board of Governors, Indian Council for Research on International Economic Relations (ICRIER)


**Quotes & Notes**  
Riding Green with E-DEPOT




**PERSPECTIVE Exchange**  
Smart Grid Technologies & Clean Energy Transition in India



**Mr Reji Kumar Pillai**  
President, India Smart Grid Forum (ISGF), Chairman, Global Smart Energy Federation



**Dr Jai Asundi**  
Executive Director, CSTEP



**Mr Abhishek Nath**  
Head-Energy and Power Sector, CSTEP

**podcasts**

09



**PERSPECTIVE Exchange**  
Clean Energy Transition & India's Power Sector



**Mr Vipul Tuli**  
CEO, South Asia, Sembcorp Industries, and Chair, Power Committee, FICCI




**Dr Jai Asundi**  
Executive Director, CSTEP



**Mr Abhishek Nath**  
Head-Energy and Power Sector, CSTEP

**Electric Mobility**




**PERSPECTIVE Exchange**  
Strengthening the Innovation Ecosystem in India



**Dr. Jai Asundi**  
Executive Director, CSTEP; Member, CSIR Council

**science Says**

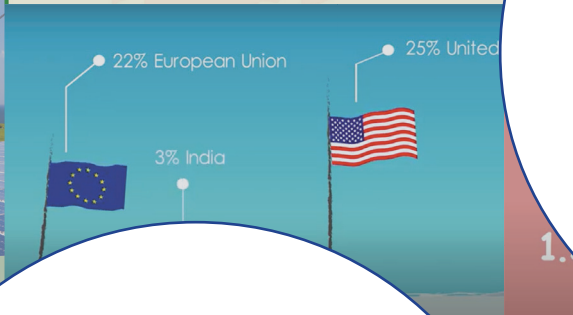
03



**PERSPECTIVE Exchange**  
Renewable Energy & Citizen Impact



**Ms Deepali Khanna**  
Managing Director - Asia Regional Office, The Rockefeller Foundation



**PERSPECTIVE Exchange**  
Ecosystem Restoration & Role of Business



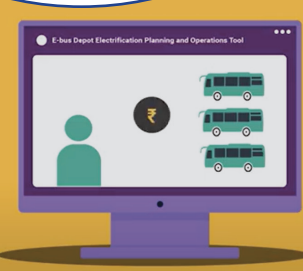
**Dr Mukund Rajan**  
Chairman - Ecube Investment Advisors, & Chair - Environment Committee, FICCI

**Insta Reels/YouTube Shorts**

03



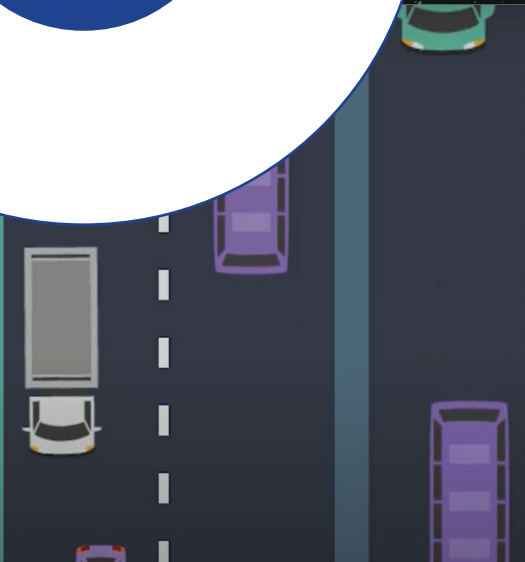
**E-bus Depot Electrification Planning and Operations Tool**




**E-DEPOT**

**Paving the Way for E-Mobility**

CSTEP



**The electric vehicle revolution is here.**





We seek to inform long-term policy decisions using in-depth analysis of multiple pathways, technologies, and climate risks to facilitate formulation of pragmatic solutions that address India's developmental needs while also promoting climate action that is low carbon-intensive and climate resilient.



Dr Indu K Murthy  
Sector Head – Climate,  
Environment and Sustainability

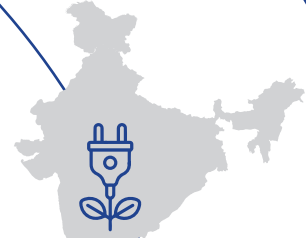
## Looking Ahead



We are focussed on enabling green energy transition in the country with specific emphasis on the 2030 timelines.



Abhishek Nath  
Sector Head – Energy and Power



We are enabling the development of innovative solutions to tackle problems in Energy & Power and Climate, Environment and Sustainability sectors by harnessing the power of data, AI/ML, and digital technologies.



Mr Rajesh Shenoy  
Sector Head – AI and  
Digital Platforms



We aim to incubate and foster new avenues to enable clean energy transition with a focus on green hydrogen, circular economy, and green mobility.



Thirumalai NC  
Sector Head – Strategic Studies



Our communication strategy is geared towards influencing public policy for creating a sustainable, secure, and inclusive society.



Ms Sreerekha Pillai  
Head – Communication and Policy  
Engagement







Engaged with the communication team and researchers to host video conference calls, webinars, and live events



A secure VPN tunnel implementation helped the team to collaborate with third-party vendors to allow access to web servers hosted in-house



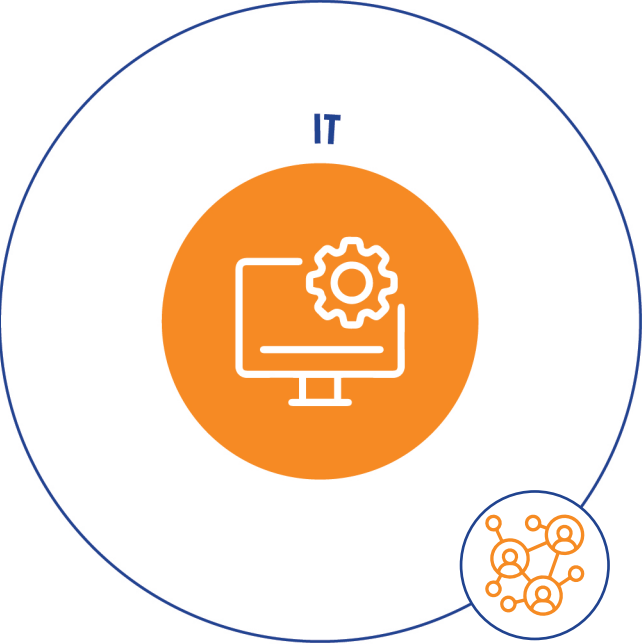
End-users were migrated to MS Office 365 cloud platforms for email exchanges, Team calls, and sharing of files

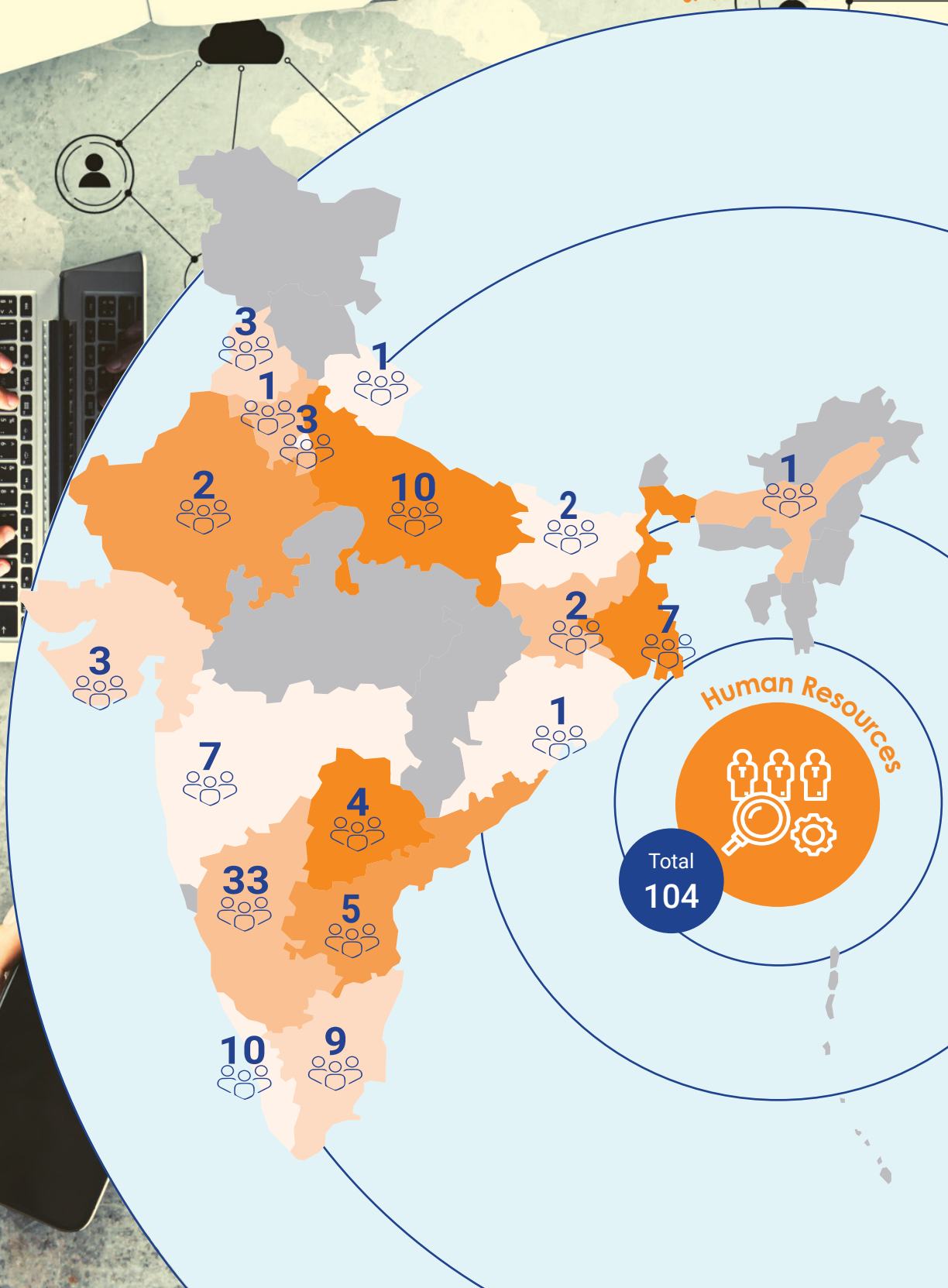
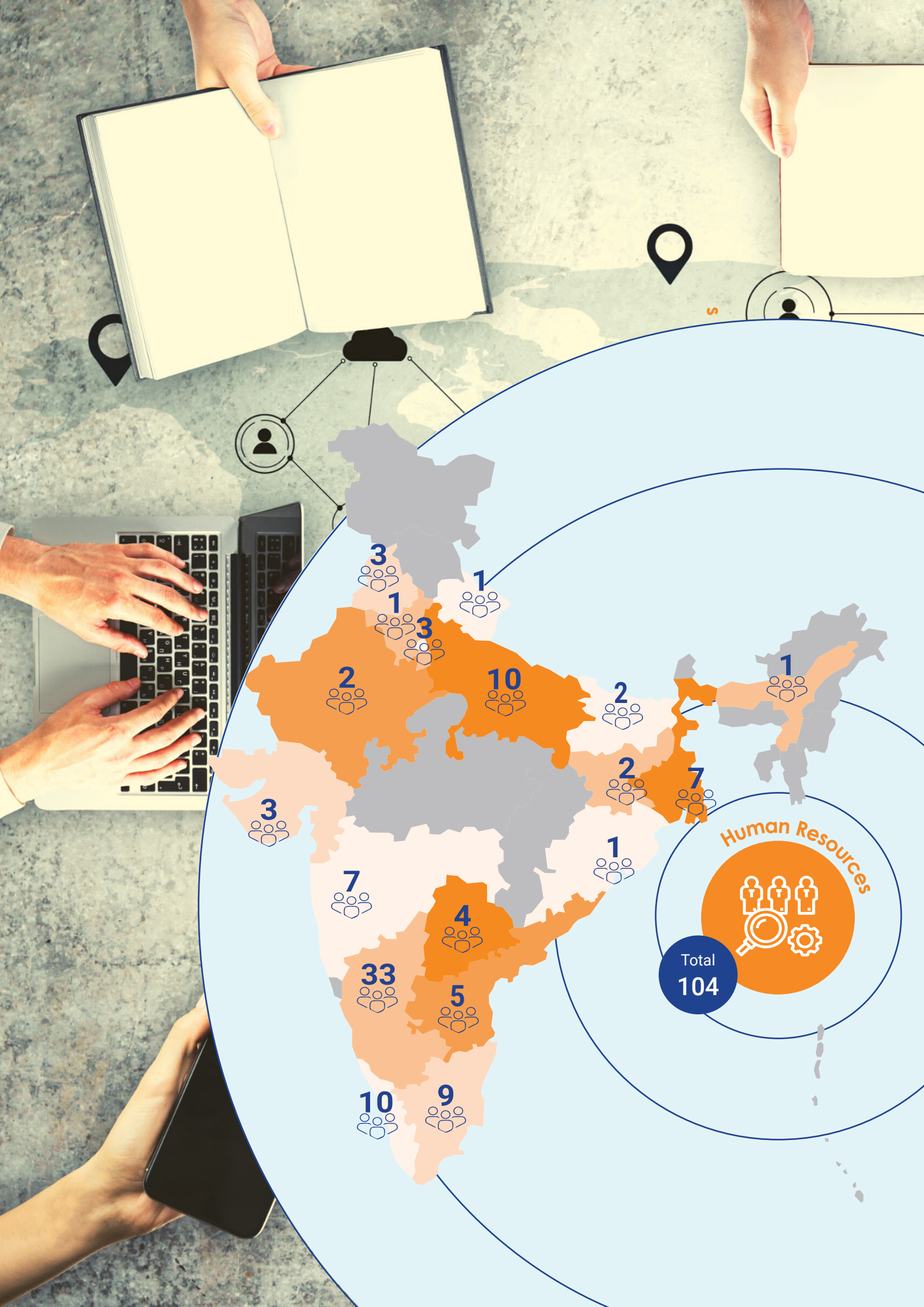


IT technical support team continued to work on remote management tools such as Team Viewer, MS Teams, and Any Desk to troubleshoot technical problems

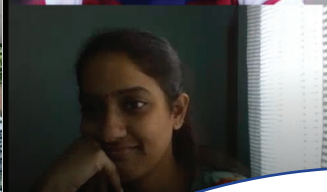


Introduced high-performance clusters for research teams to run simulations, generate research reports, and explore new dimensions









Staying connect







Picture in picture

# ed during COVID

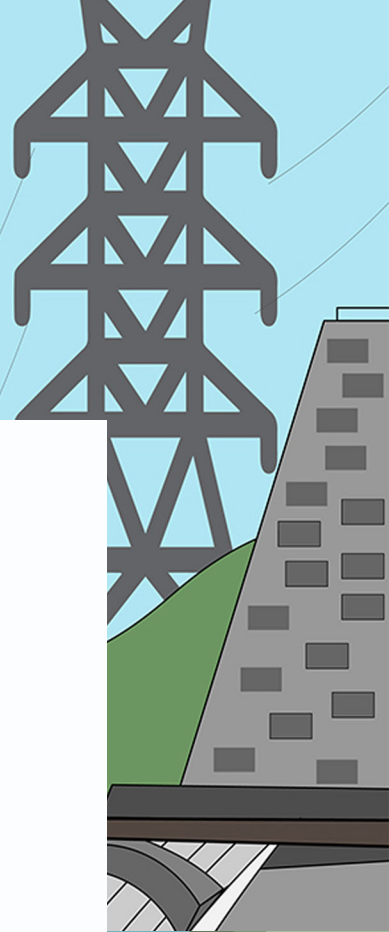
al Hour







I have read so much about Pumped-hydro. It's definitely worth the view!



**CENTER FOR STUDY OF SCIENCE, TECHNOLOGY & POLICY**

**Bengaluru**

# 18 & 19, 10th Cross, Mayura Street,  
Papanna Layout, Nagashettyhalli (RMV II Stage),  
Bengaluru - 560094, Karnataka, INDIA

**Noida**

1st Floor, Tower-A, Smartworks Corporate Park, Sector-125,  
Noida-201303, Uttar Pradesh, India



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[@cstep\\_India](https://twitter.com/cstep_India)



**Air Pollution: The Invisible Killer**

