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# India SMART UTILITY Week 2024



U.S. INDIA COLLABORATIVE FOR SMART  
DISTRIBUTION SYSTEM WITH STORAGE



## UI-ASSIST Project\*: Brief Overview

*Presented By*

Ankush Sharma, **Suresh Chandra Srivastava**, Shiv Kumar Singh  
Indian Institute of Technology Kanpur, India

Emails: [ansharma@iitk.ac.in](mailto:ansharma@iitk.ac.in), [scs@iitk.ac.in](mailto:scs@iitk.ac.in), [shivks@iitk.ac.in](mailto:shivks@iitk.ac.in)

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## Supporting Ministries



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समन्वय जयते  
MINISTRY OF NEW AND  
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# UI-ASSIST Project under JCERDC (29 Sept 2017- 28 March 2024)



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सत्यमेव जयते

Department of  
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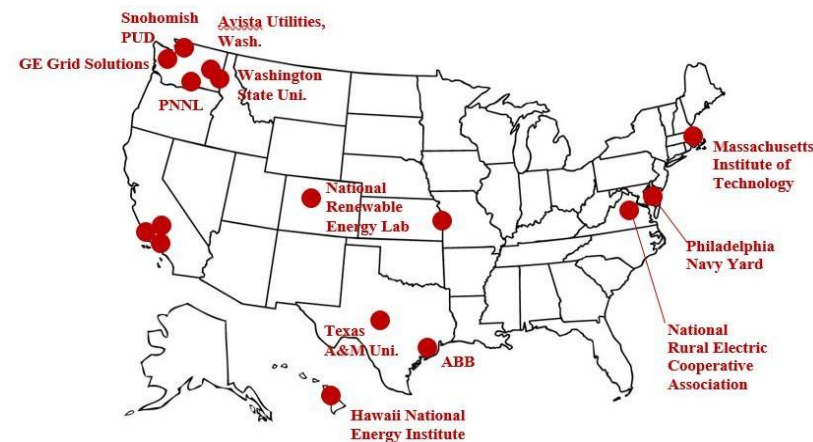
U.S. DEPARTMENT OF  
**ENERGY**



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**Objectives:** To develop  
future smart and  
resilient distribution  
systems facilitating

- Optimal utilization and management of DERs.
- Interfacing DER and microgrid controls with energy storage.
- Developing and demonstrating the ADMS/DSO functions.



Massachusetts  
Institute of  
Technology



**Lead Institutes**

Indian Institute Of Technology Kanpur  
Washington State University, Pullman, WA



# UI-ASSIST Project: Major Deliverables



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## R&D Outcomes

- Storage sizing, siting and control
- Charge-discharge algorithms
- Optimal scheduling
- Converter design
- Primary/Secondary Control
- Microgrid Protection,  $\mu$ EMS
- Forecasting
  - Solar, Load, & Wind as an extra
- ADMS platform
  - Load flow, Volt-Var, State estimation etc
- Local Electricity Market
- DSO framework
- TSO-DSO interaction
- Cyber Infra and Cyber Security

## Lab Testbeds- India

1. IIT Kanpur Testbed
2. IIT Roorkee Testbed
3. IIT Delhi Testbed
4. IIT Madras Testbed
5. IIT Bhubaneswar Testbed
6. TERI Smart Controller  
(Six lab test beds in US)

## Field Pilot Implementation- India

1. Rural field pilot by IIT Kanpur/DVVNL/SBF
2. Semi-urban field pilot by IIT Kanpur
3. Urban field pilot by IIT Kanpur
4. NETRA Semi-urban field pilot
5. Urban field pilot by TERI/BRPL  
(Five field pilots in US)

## Social Impact and Regulatory Aspects

## Workforce Development

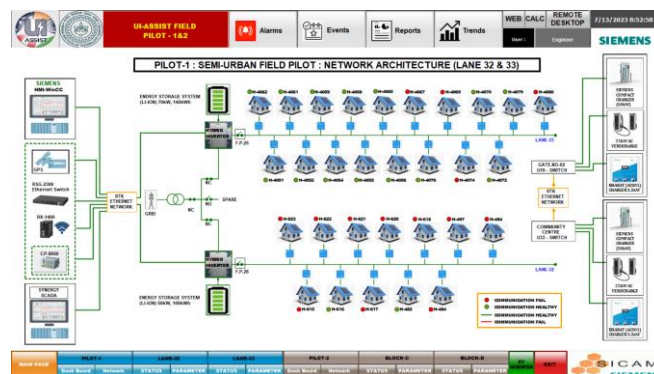


# Field Pilots Coordinated by IIT Kanpur



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## Rural Pilot (IITK, DVNNL/UPPCL, SBF)

- Two hamlets in Harnoo village, Kanpur, one having 30 kWp solar PV, 30 kW Biomass, other having 70 kW solar PV
- Both have 100kWh Li-ion BESS and are interconnected through AC-DC-AC converter
- Site data being received at MGC
- Remoted communication to control centre at IIT Kanpur.
- \*Cyber security audit carried out by a third party, E-Gyanam, and the suggestions/modifications are already incorporated.
- \*Safety clearance approval from Directorate of Safety Uttar Pradesh has been obtained.

\*all the field pilots

## Semi-urban Pilot (IITK)

- 5kWp Solar PV in 30 single storey houses in two lanes of IIT Kanpur.
- Centralized storage at two places (140 kWh and 100 kWh Li-ion BESS) in the substation,
- Two EV charging stations each having 50kW DC, 22kW AC, 7.6kW V2H & 3x3.3kW Bharat Chargers integrated with 25kW Solar PV.
- Self-sustained microgrid with Smart Metering & MEMS.

## Urban Pilots (IITK)

- Covers two Multistorey faculty housing towers, each having:
  - Solar PV - 25kW
  - BESS - 50kWh with Hybrid Inverter
- Integrated with Smart Metering &  $\mu$ EMS
- In case of power failure and unavailability of Solar PV output, BESS feeds common area lighting and lift loads.
- Thermal Energy Storage System (Capacity: 775 TRHR) at CESE building to relieve daytime AC peak load using phase change material (made functional in Nov 2020).
- Designed TES running hours during peak AC load of 150TR: 5 hrs.

# Field Pilots Coordinated by TERI and NETRA



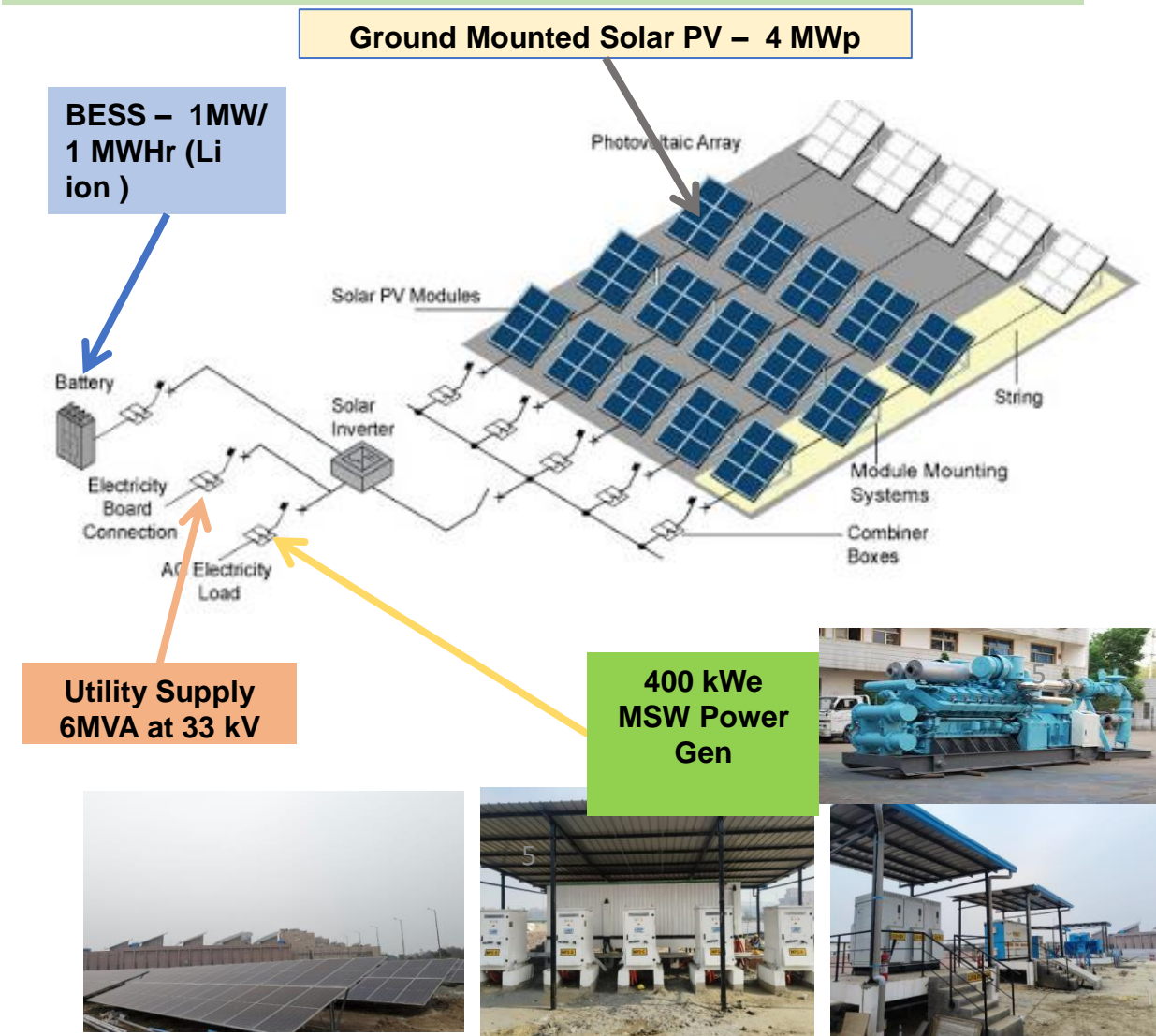
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## Urban Pilots by TERI and BRPL New Delhi

Pilot Locations	Installed BESS (LFP) Capacity	Application	Inter-connection Point with BRPL
<b>Category A</b> (New Friends Colony, Taimur Nagar)	288 kWh (4*72kWh stack)	<b>Primary:</b> overload management of DTR <b>Secondary:</b> energy arbitrage	At Low Tension terminal of 990 kVA DT
<b>Category B</b> (Ispatika Society, Dwarka, Sector-4)	216 kWh (3*72 kWh stack)	<b>Primary:</b> back-up power <b>Secondary:</b> energy arbitrage	At DG Output terminal connected to Grid
<b>Category C</b> (TERI School of Advanced Studies, Vasant Kunj)	72 kWh (1 stack of 72 kWh)	<b>Primary:</b> energy time shift <b>Secondary:</b> dispatchable solar PV generation	At Low tension terminal of 1600 kVA DT

## Semi-Urban Pilot by NETRA Greater NOIDA





# Early Meetings for Setting Up the Rural Pilot



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**Chabba Niwada Initial Meeting in late 2018**



**Bargadia Purwa- having lot of cattles**



**Small solar installations found**



**Ground Breaking Ceremony Nov 2019**



**Transformers and Wires by Local Utility**



**Meeting to finalize Society Byelaws for local management**

# Rural Field Pilot in Harnoo Village Kanpur



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## Chhaba Niwada AC microgrid

- 70kW Solar PV,
- 100kWh BESS with Hybrid Inverter
- 25kW AC-DC-AC converter for power sharing between both

## Bargadiya Purwa AC microgrid

- 30kW Solar PV,
- 100kWh BESS with Hybrid Inverter
- 30kW Biomass System utilizing cattle and farm waste

## Other Unique Features

- Six solar irrigation pumps enhancing agriculture produce, street lighting.
- Agriculture based cottage industries for providing the local employment.
- Unique model for managing and operating the rural microgrid

## Status Before Development

- Both village hamlets were unelectrified.
- Transformers and wires to houses provided by utility partner DVVNL with Grid supply being unreliable

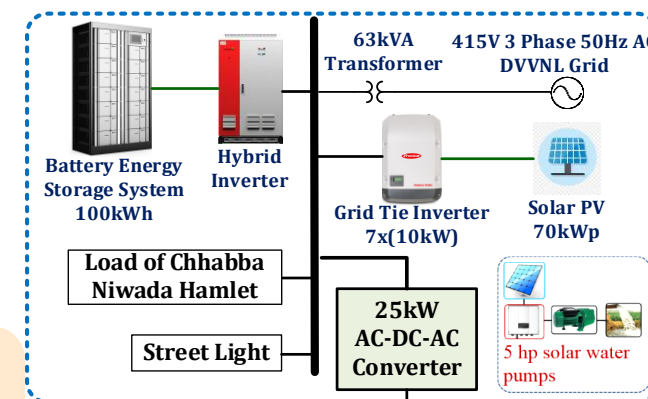
## Beneficiaries

- Approx. 700 people of Harnoo village are getting benefited
- Getting administrative approvals for the pilot land

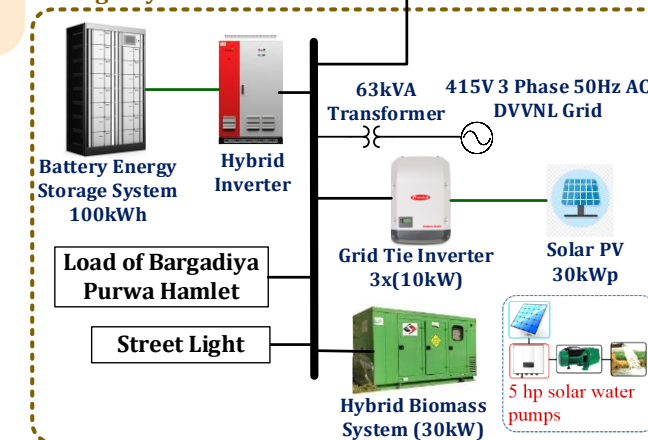
## Challenges

- Sensitizing & involving local community.
- Getting administrative approvals for the pilot land.

### Chhabba Niwada Hamlet



### Bargadiya Purwa Hamlet



**Remote connectivity to Smart Grid Control Centre (SGCC) is done for monitoring and tertiary control from ADMS developed.**



# Recent Activities in the Rural Field Pilot



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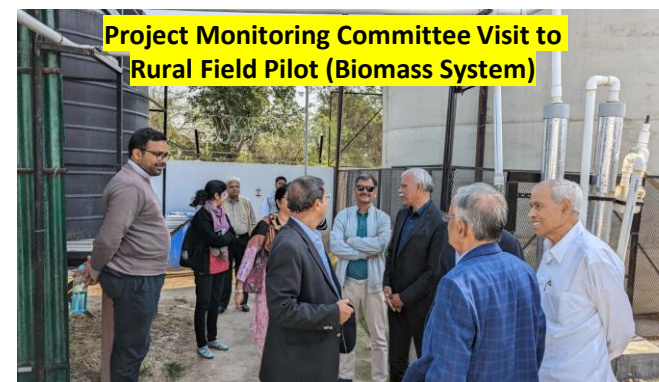
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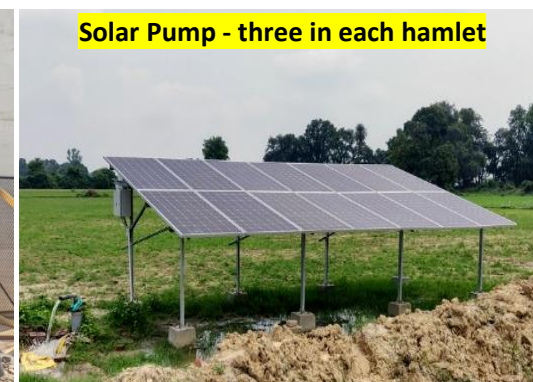
Biomass and ground mounted SPV



Training of Biomass System to Village People



Project Monitoring Committee Visit to Rural Field Pilot (Biomass System)



Solar Pump - three in each hamlet

## Bargadiya Purwa Hamlet - Rural Pilot



Ground mounted SPV



Control room and DVVNL transformer



Project Monitoring Committee Visit to Rural Field Pilot (Control Room)



Training Participants visit to Rural Field Pilot

## Chhabba Niwada Hamlet - Rural Pilot

### Post Installation survey key findings:

- Rural Hamlets getting 24x7 reliable power supply helping in children education, increased revenue generation. Increasing use of modern electrical appliances observed.
- Enhanced agriculture yield due to standalone solar irrigation pumps in the village.



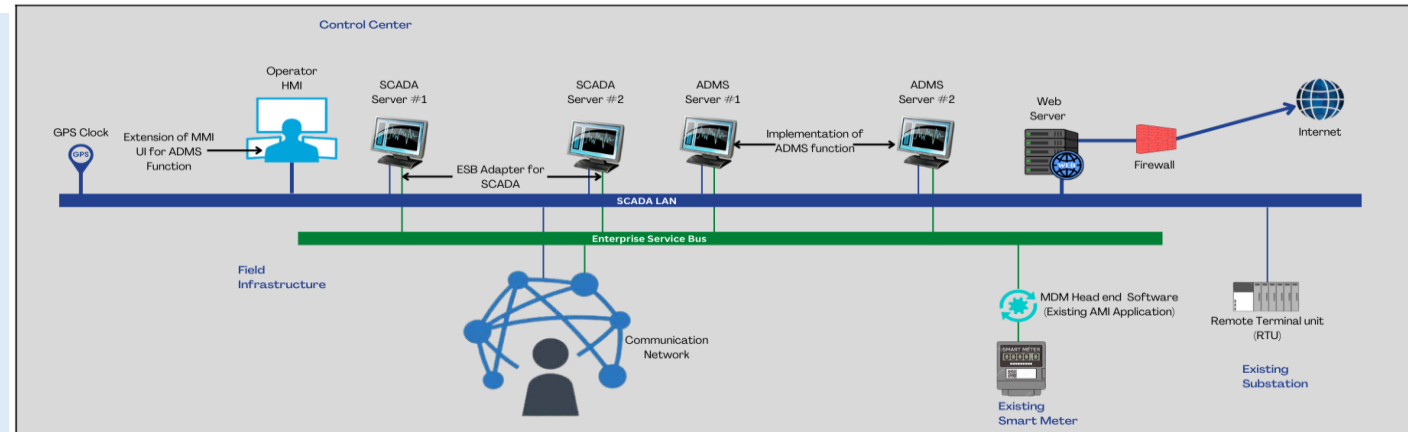
# ADMS Platform at IITK Smart Grid Control Centre



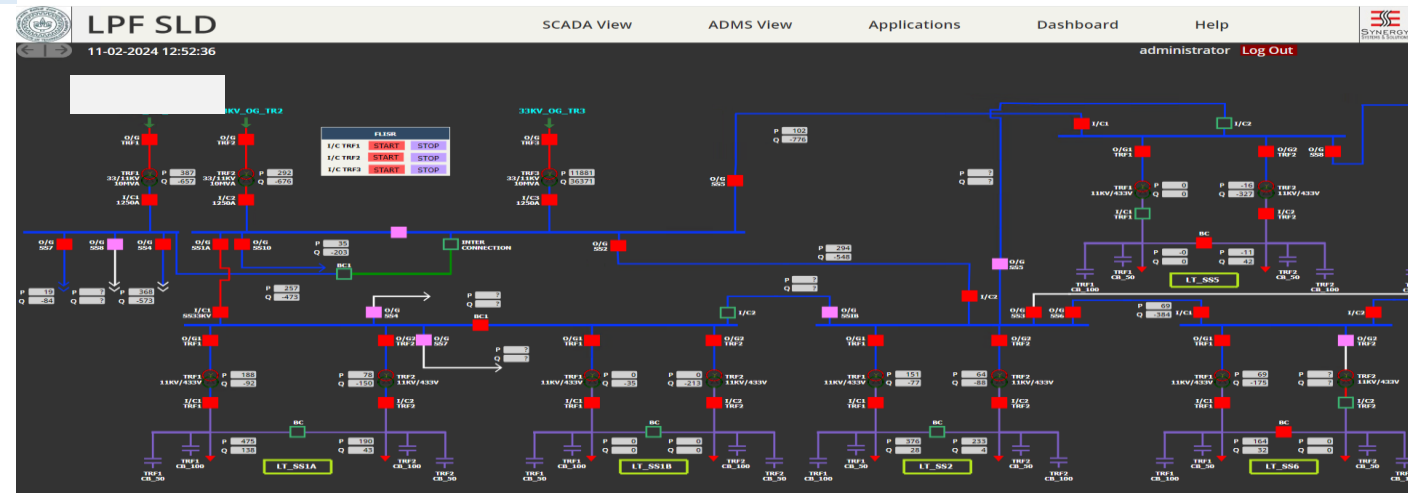
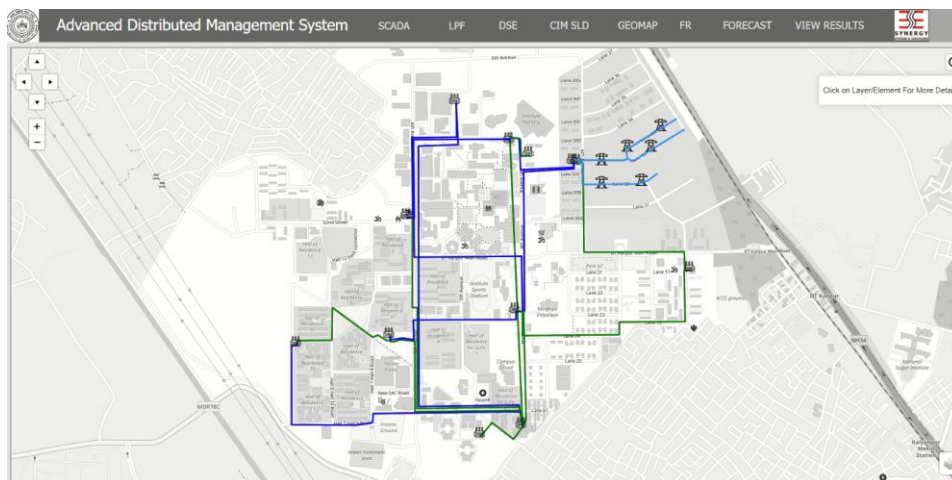
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- Indigenous setup at IITK with Synergy Systems & Solutions (Industry Partner)
- Integration with existing SCADA and MDM a on ESB
- Different ADMS Algorithms/DSO functions tested on the platform in plug and play mode
- Integration of microgrid controllers with existing SCADA
- Industry standard interfaces like –
  - CIM for modeling, ESB, IEC/OPC-UA protocols for data exchange
- GIS integration using OpenStreetMaps
- Serves as future testing of Smart Distribution concepts and training platform



- ❖ ADMS applications on top of SCADA – real-time communications interface
- ❖ ADMS module as a plug and play – distributed architecture
- ❖ Separate ADMS database around CIM



## Key Highlights: Value Addition to National Development



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1. Evolved future smart distribution systems integrating RES (Solar PV & Biomass), Energy Storage, cyber infrastructure, smart metering, MEMS, ADMS and EV charging infrastructure.
2. Social upliftment specifically through rural pilot providing 24x7 electricity access, meeting irrigation needs, enhancing local employment and education opportunities.
3. Reduced Carbon footprint using green energy sources (IITK pilots alone will reduce approx. 400 Tons of carbon emission per year, NETRA pilot alone will provide approx. 10-fold benefit)
4. Evolution of distribution system operator (DSO) model in Indian context.
5. Indigenous development of ADMS platform demonstrated at IITK (MAKE IN INDIA goal)
6. New networked microgrid model in rural area for reliable power sharing between villages.
7. Capacity building and skill development to utilities, industries, researchers and technicians.
8. Policy and regulatory recommendations for wider adoption of Smart Distribution Systems.
9. Micro-PMU developed using Indian NAVIC signal, its commercialisation through Startup.



# THANK YOU

*For discussions/suggestions/queries email: **isuw@isuw.in**  
visit: [www.isuw.in](http://www.isuw.in)*

## Links/References

<https://uiassist.org/>  
[https://uiassist.org/media/reports/UI-ASSIST\\_Compendium.pdf](https://uiassist.org/media/reports/UI-ASSIST_Compendium.pdf)  
<https://uiassist.org/media/reports/DSO-White-Paper.pdf>  
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