

RE-EMPOWERED

Renewable Energy EMPOWERing European and Indian communities

“Renewable Energy EMPOWERing European and Indian communities”

*Integrated local energy systems (Energy islands):
International cooperation with India
LC-SC3-ES-13-2020*

Prof. Nikos Hatziargyriou

National Technical
University of Athens
ICCS, NTUA, Greece

Prof. Chandan Chakraborty

Indian Institute of
Technology Kharagpur,
IITKGP, India



European
Commission

Horizon 2020
European Union funding
for Research & Innovation



Consortium

RE-EMPOWERED
Renewable Energy EMPOWERING
European and InDian communities

Partners

European			Indian	
1	ICCS-NTUA (Coordinator)	Greece	8	Indian Institute of Technology Kharagpur (Indian Coordinator)
2	Imperial College London	United Kingdom	9	Indian Institute of Technology Bhubaneswar
3	Danmarks Tekniske Universitet	Denmark	10	CSIR-Central Mechanical Engineering Research Institute
4	Bornholms Varme As	Denmark	11	Lab Concern Ltd. (India)
5	Protasis Sa	Greece	12	Visvesvaraya National Institute of Technology
6	Deloitte Advisory, S.L.	Spain	13	Indian Institute of Science
7	DAFNI	Greece		



Purpose

The main goal of RE-EMPOWERED is to develop and demonstrate solutions for energy transition of local energy systems based on multi-energy Microgrids, interconnecting multiple energy vectors. The multi-energy structure will be used to optimize their joint operation. The benefits will be demonstrated in 4 pilot sites leading to an increased share of renewable generation and higher energy efficiency of the wider local energy system.

RE-EMPOWERED will develop a **complete set of solutions for local energy systems** that will be demonstrated in four pilot sites, two European and two Indian, complementary in size and organisational and technical maturity.

The solutions will range from **planning tools** for designing or upgrading energy systems, to **control and optimization tools** for the management of microgrids, **interoperable platforms** for the integration of the available energy carriers, the digitization of the system and **advanced hardware infrastructure** for upgrading the local systems.

- 1. ecoEMS:** will be the energy management system responsible for optimizing the performance of large isolated (e.g., non-interconnected islands) or weakly connected systems.
- 2. ecoMicrogrid:** will be responsible for the management and optimization of microgrids.
- 3. ecoPlanning:** will support the planning of rural isolated or weakly interconnected systems, to optimize the installation of a mix of energy technologies aiming to increase renewable generation.
- 4. ecoDR:** will support demand side management via load scheduling and incentive-based demand response with a dynamic pricing scheme.
- 5. ecoPlatform:** will be an interoperable platform for the integration of all developed solutions and will facilitate digitization and interoperability of the local energy systems.
- 6. ecoMonitor:** will include smart sensors that will monitor air and water quality to provide insights regarding possible corrective actions and impact of the RES integration.

- 7. ecoCommunity:** will be the platform dedicated to the energy communities' members and stakeholders aiming to facilitate their active involvement in the energy system.
- 8. ecoResilience:** will develop resilient PV and Wind Turbine assets able to withstand extreme weather conditions, such as cyclones and floods.
- 9. ecoConverter:** will be economically viable modular “plug and play” converter for dc/ac microgrids.
- 10. ecoVehicle:** will be used to electrify and upgrade small vehicles for transport, namely four-wheelers and small boats.

ecoTools – Maturity scale (TRL)

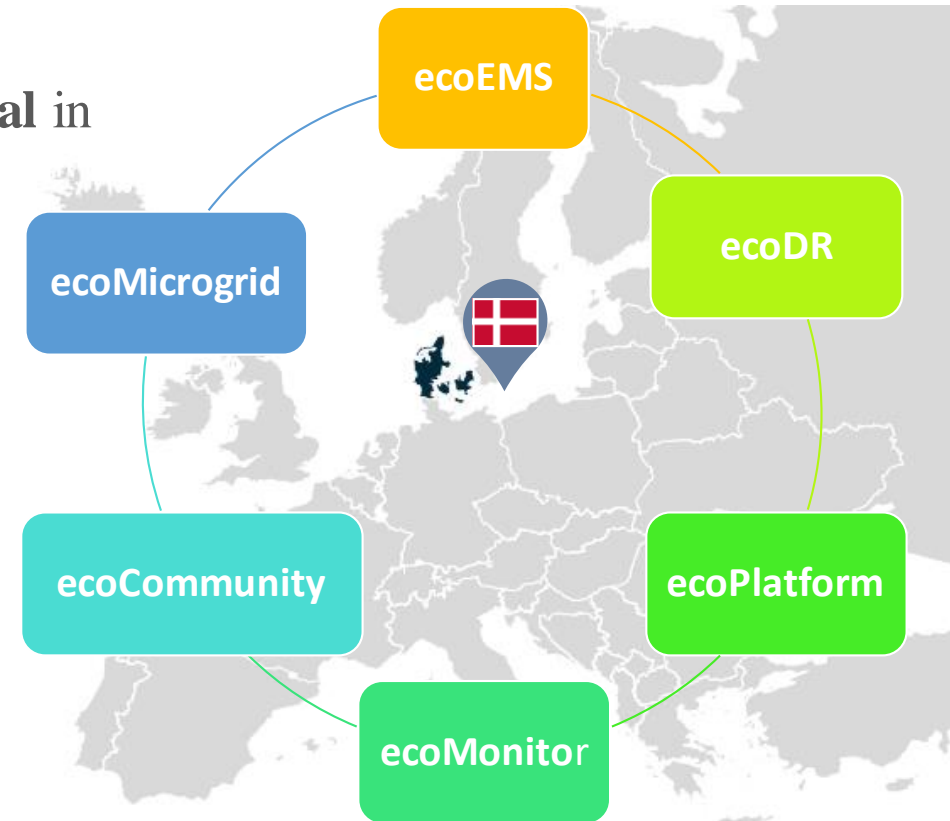
RE-EMPOWERED
 Renewable Energy EMPOWERing
 European and InDIan communities

Solutions	Development stage (TRL)								
	1	2	3	4	5	6	7	8	9
ecoEMS						→			
ecoMicrogrid					→				
ecoPlanning									
ecoDR						→			
ecoPlatform					→				
ecoConverter					→				
ecoMonitor				→					
ecoCommunity			→						
ecoVehicle					→				
ecoResilience			→						

Demo Site: Bornholm Island, Denmark

RE-EMPOWERED
Renewable Energy EMPOWERing
European and InDIan communities

- Embracing green agenda for 30 years aims to become **CO2 neutral** in 2025, and a **zero-emissions** and **climate-friendly community** by 2035
- In 2019 received the RESponsible Island Prize for:
 - ✓ Share of RES produced by innovative energy technologies,
 - ✓ Environmental and socioeconomic sustainability and impact
 - ✓ Citizen and community involvement
 - ✓ Replicability of the solution
- An island experienced on synergies of electricity with other energy carriers, through **RE-EMPOWERED** aims to increase:



Energy efficiency

RES
penetration

Integration of
energy vectors

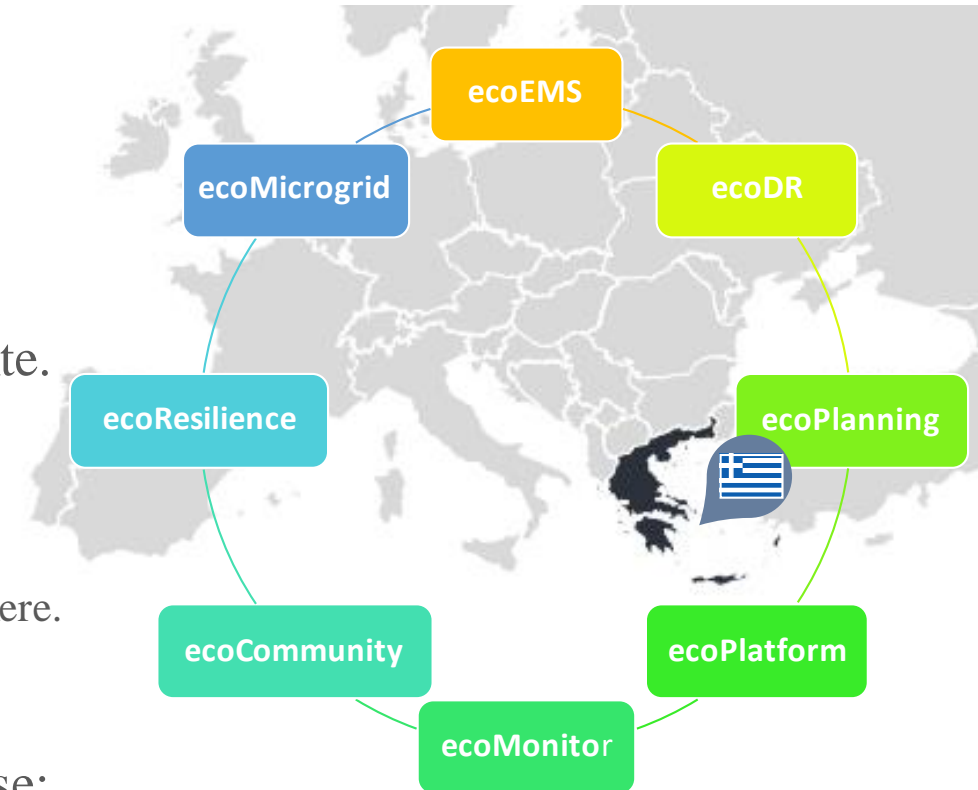
Population
awareness

Customer
engagement

Demo Site: Kythnos Island, Greece

RE-EMPOWERED
Renewable Energy EMPOWERING
European and InDIan communities

- Kythnos has a long history in sustainable energy installations.
 - ✓ First wind farm in Europe (1982)
 - ✓ First microgrid in Europe, in Gaidouromadra (2001)
 - ✓ Advanced decentralized DSM techniques demonstrated for first time
 - ✓ Live testbed for smart grid technologies within several European projects
- Based on the past experience it provides an ideal demonstration site.
- **RE-EMPOWERED** will:
 - Accelerate digitization and energy transition of Kythnos
 - Build an economically sustainable and attractive multi-layer architecture
 - Be the prototype, replicable for non-interconnected islands in Greece and elsewhere.
- The above-mentioned will facilitate the main goals, thus to increase:



Energy efficiency

RES penetration

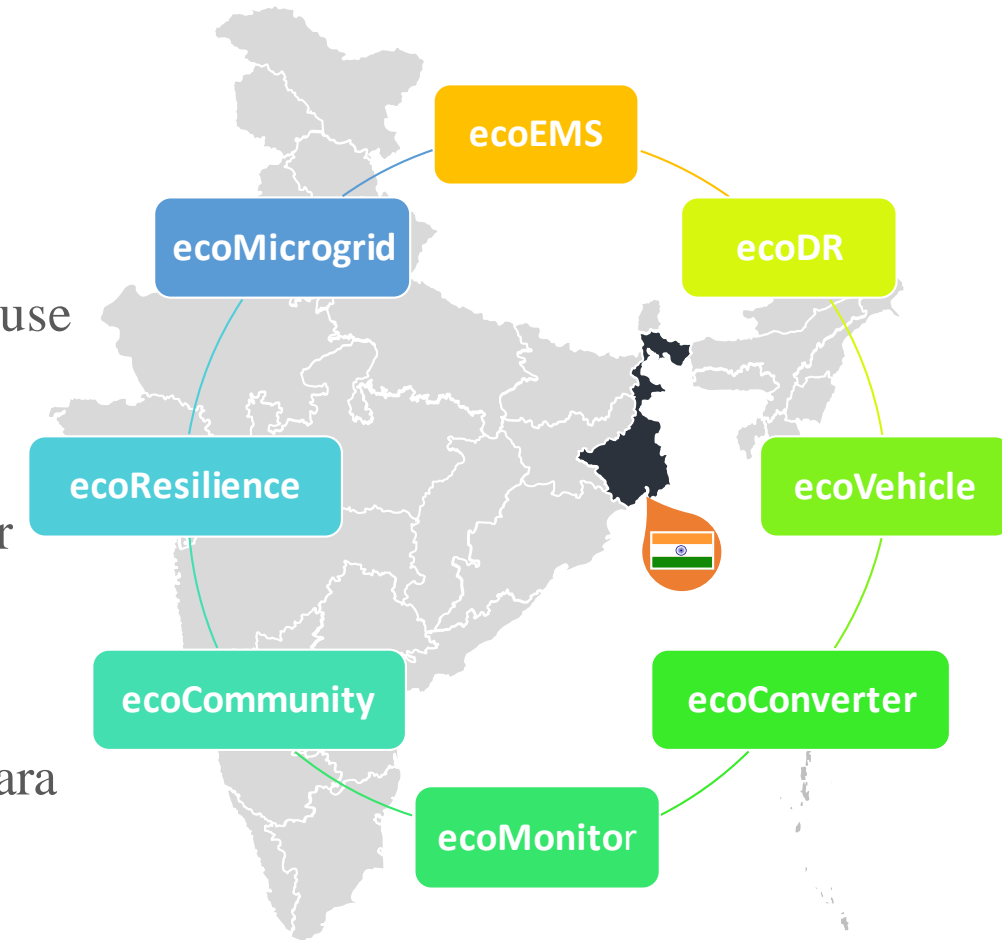
Population awareness

Customer engagement

Demo Site: Ghoramara Island, India

RE-EMPOWERED
Renewable Energy EMPOWERING
European and InDIan communities

- Ghoramara is located 92 km south of Kolkata:
 - Residents live in very poor conditions
 - Affected by severe cyclonic storms
- The area is isolated from the utility grid and the residents mostly use Kerosene-lamps, while some houses roof-top PV panel-based electricity
- Additionally, the area is lacking the supply of pure drinking water
- For transportation purposes, people use paddle-boats
- **RE-EMPOWERED** will:
 - Develop a local microgrid system to cater electricity in Ghoramara
 - Create a sustainable energy community for the island
 - Improve quality-of-life for the people



RES penetration

Quality-of-life

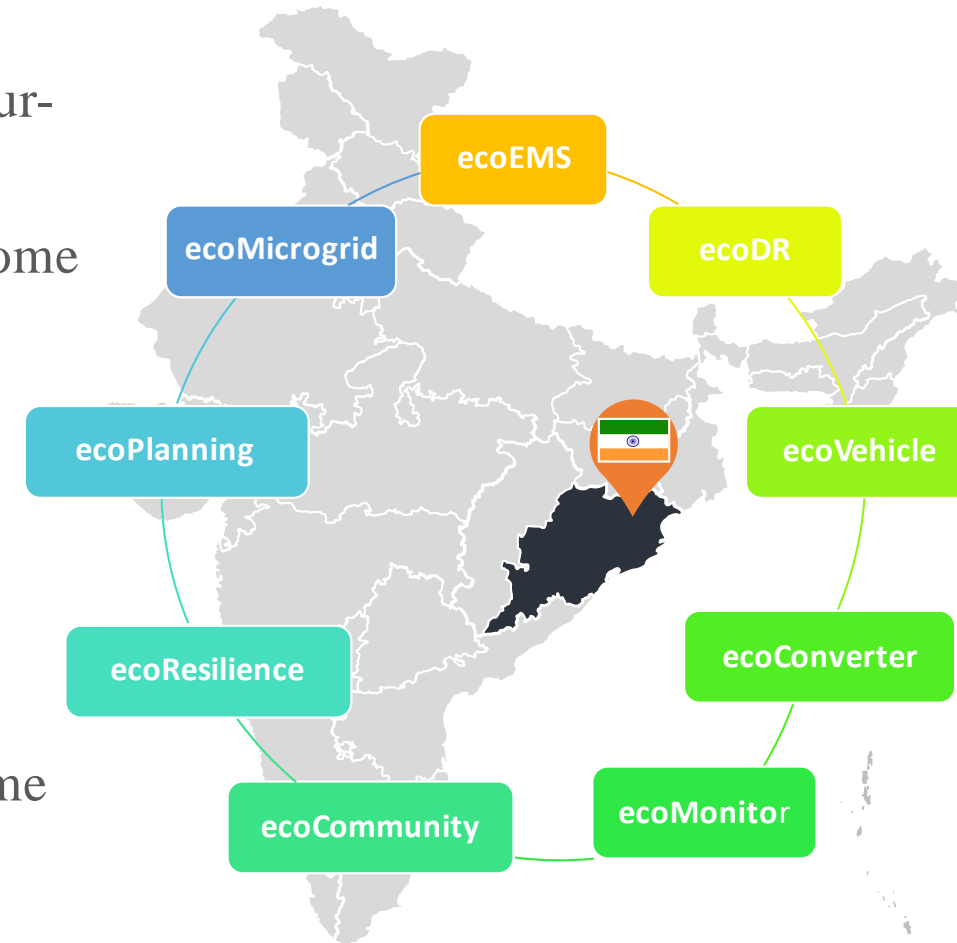
Energy Community

Resilience

Demo Site: Keonjhar, Odisha, India

RE-EMPOWERED
Renewable Energy EMPOWERING
European and InDIan communities

- Kanheigola, Nola and Ranipada are small villages in Harichadanpur-Tehsil reserve forest in Keonjhar District of Odisha State
- The villages are not interconnected to main utility grid, but have some basic renewable energy facilities (solar PV and battery backup)
- These will be upgraded and coupled with various available energy vectors
- Moreover, the villages are lacking facilities for water purification
- **RE-EMPOWERED** aims to:
 - Develop, demonstrate the integration of various energy vectors
 - Promote off-grid systems for energy uses that will generate income in agriculture and small businesses
 - Optimize the operation of the off-grid systems



RES penetration

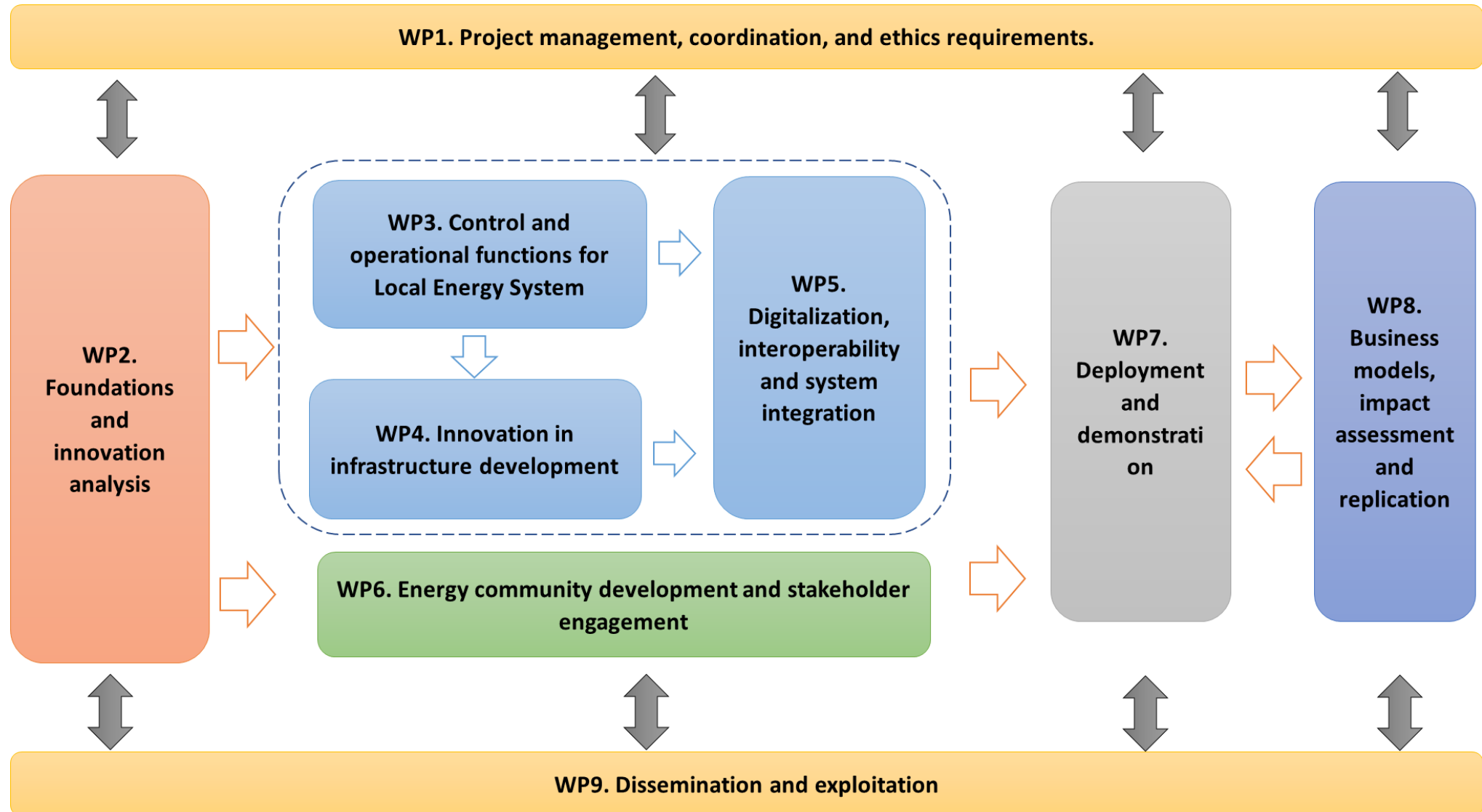
Energy Efficiency

Population awareness

Customer engagement

Work Plan

RE-EMPOWERED
Renewable Energy EMPOWERing
European and InDIan communities



Thank you for your attention!

RE-EMPOWERED
Renewable Energy **EMPOWERING**
European and InDian communities



**SMART
RUE**

smartgrids Research Unit ECE NTUA



National
Technical
University of
Athens

Nikos Hatziargyriou
nh@power.ece.ntua.gr

www.smartrue.gr