

# UNESCO UNITWIN Network

**Innovative, Sustainable and Clean  
Energy Research and Education**

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United Nations  
Educational, Scientific and  
Cultural Organization



- UNESCO Chair on Innovative Sustainable Clean Energy Research and Education at the University of Genoa, Italy
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# Arizona State University

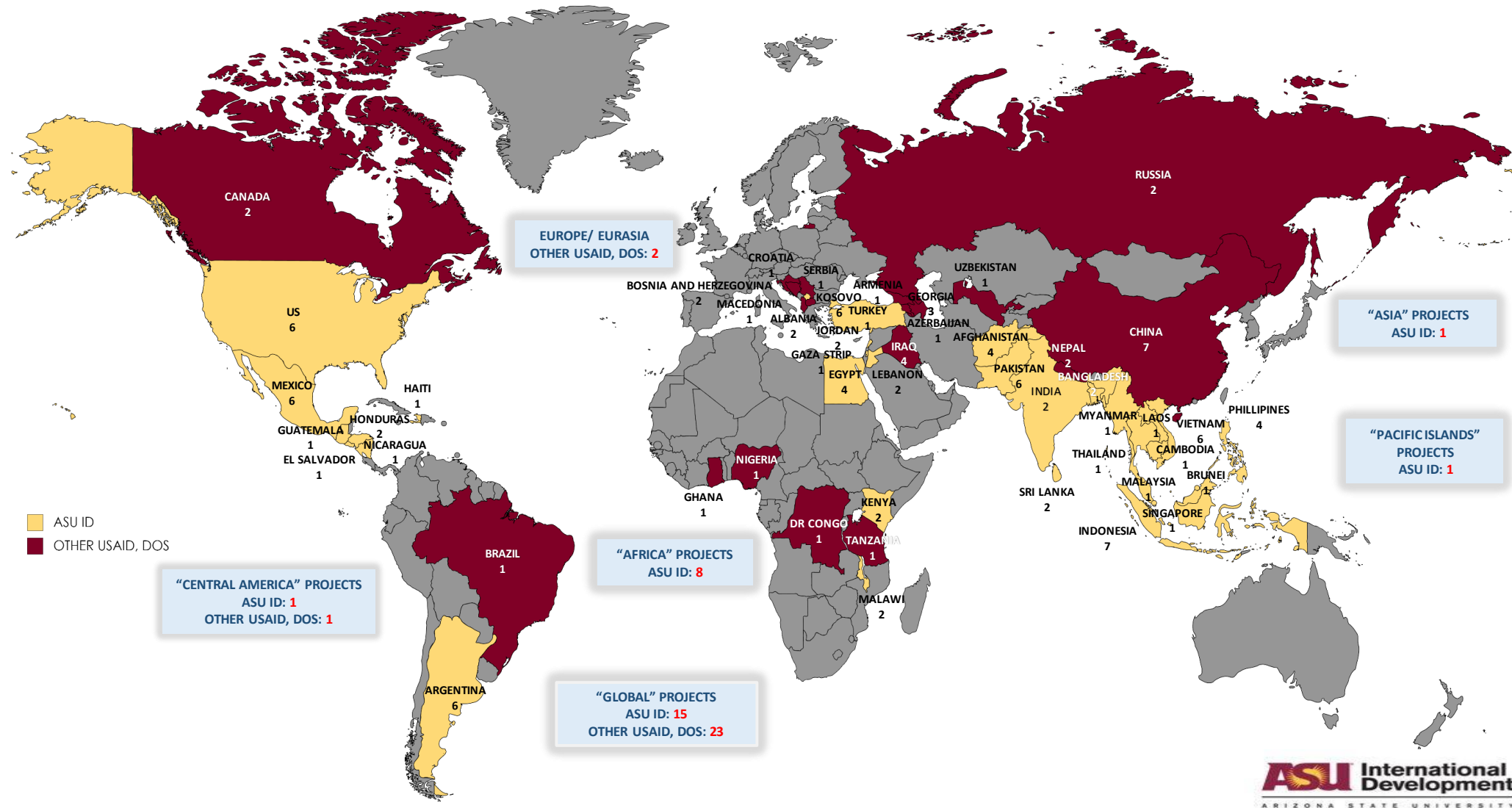


*ASU is a comprehensive public research university, measured not by whom it excludes, but by whom it includes and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves.*

- US-based public university with projects in 100+ countries
- Largest university in US: 130,000+ students with 4,000+ academic staff
- SDG ranking #9 in world, #1 for US institutions
- Rated #1 in Innovation by U.S. News and World Report
- Commitment to sustainability with world's 1<sup>st</sup> School of Sustainability
- Carbon neutrality in buildings by 2025 and transportation by 2035
- Emphasis on use-inspired research with direct impact to society



# Global projects with US federal support (circa 2017)



# Creating a process and culture of innovation



## Problem Curation

### Business

- User stories
- Business model canvas
- Mission model canvas
- SWOT analysis
- Pilot testing
- Commercial deployment



### Academic

- Literature review
- Scientific method
- Basic science
- Applied research
- Prototypes/Experiments
- Publication



### Innovation

- Product
- Process
- People

### Solution

- Technology
- Delivery
- Service
- Cost/Financing
- Warranty
- Training



# Resilience with an ROI

**Challenge:** Unlocking full potential of distributed energy resources with greater uncertainty in net loads, generation, and reliability of assets.

**Solution:** Integrate control of all technologies in intelligent energy management system (EMS) to enable market participation and resilient islanding operations.

- Resilience: provide 7-14 days of power to critical loads in the event of a grid outage
- Cost effectiveness: leverage public and private investment to reduce Capex and Opex, utilize variety of funding sources for incremental expansion
- Adaptability: adapt to changing missions or environmental conditions in real-time, or installation functions over the lifetime of an energy project
- Flexibility: facilitate resilience in master planning efforts by leveraging scalability and adaptability of the proposed approach

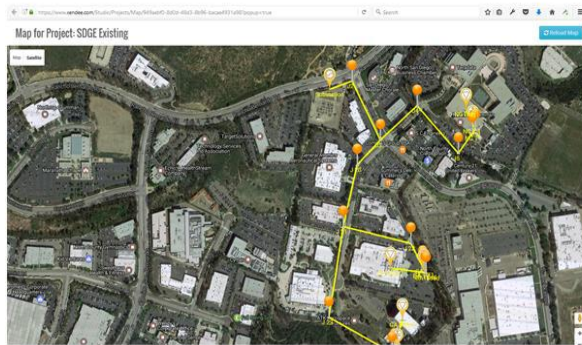


# Rapid Design and Evaluation of Microgrids to Reach Scale

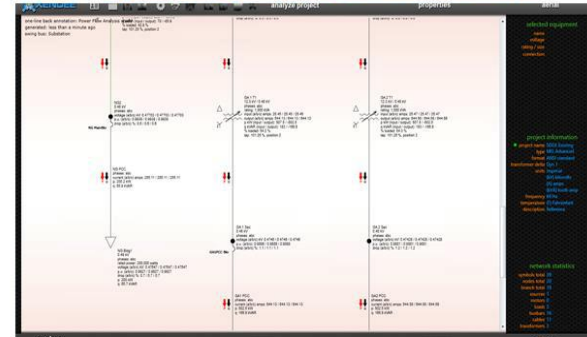
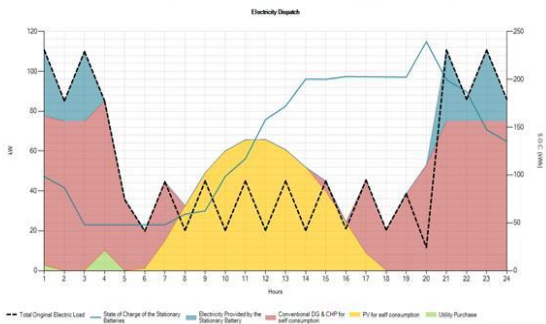
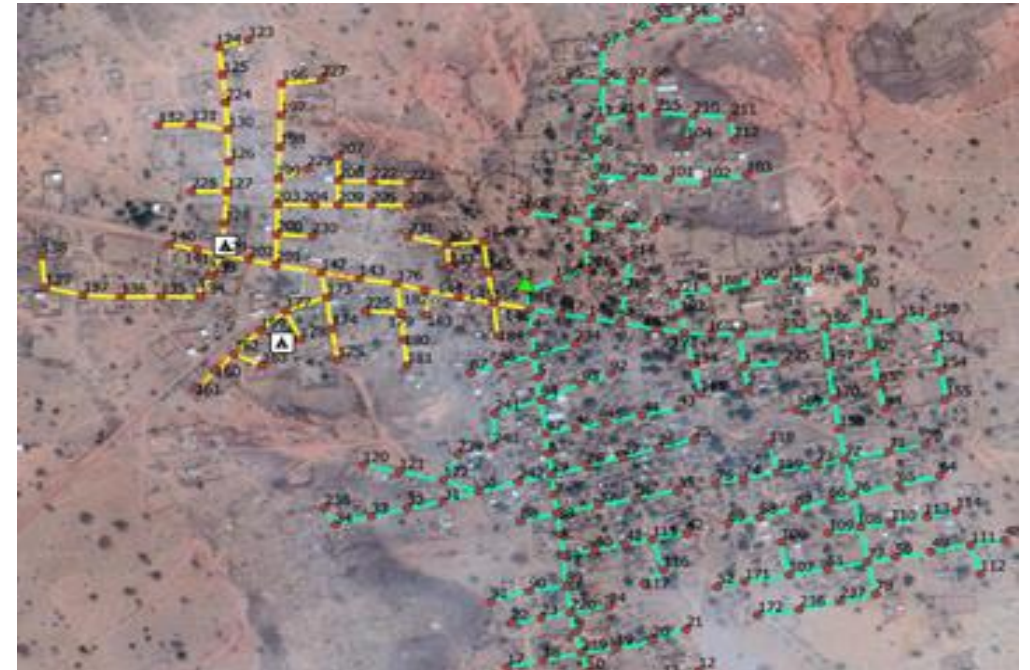
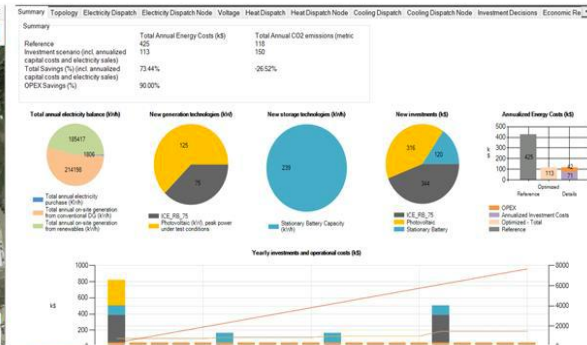
**Challenge:** Long time to design and quote. Each project is unique; start from scratch. How to prioritize.

**Solution:** Single tool combines analysis of generation, distribution, loads, economics. 80-95% time reduction.

## GIS layout



## Cash flow



## Time series

## Power flow



# Turnkey Infrastructure for Humanitarian Action

**Challenge:** Refugee populations need immediate assistance following natural disaster or conflict.

**Solution:** Turnkey power, water, and healthcare systems that can be redeployed to areas of need.

- Northern Uganda
- 18,000 people
- Limited healthcare
- Insufficient water
- No power



- Turnkey system
- 700 patients/week for outpatient care
- Power and water for staff housing

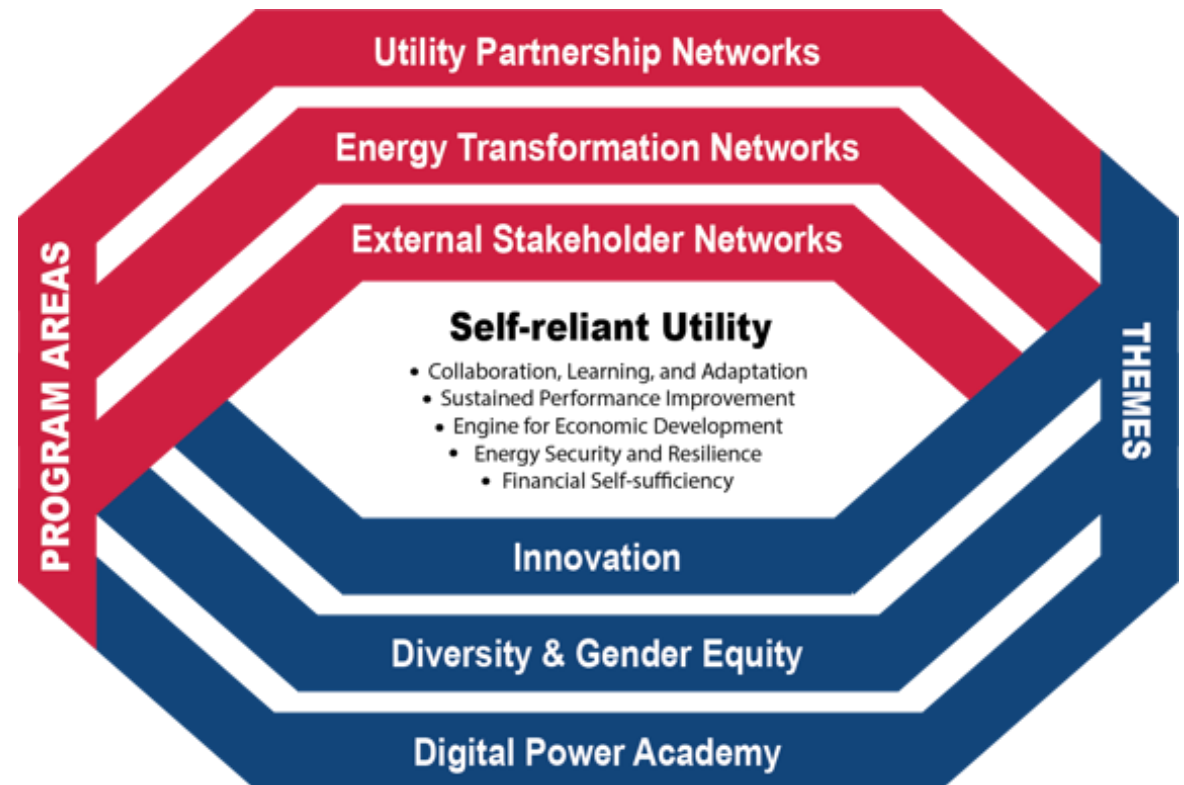


# Energy transitions in emerging markets

**Challenge:** Emerging markets using fossil fuels; high cost; poor power quality; limited electrification; utility debt; no financing; human resource capacity.

**Solution:** Global and local partnership networks enhance utility self-reliance by engaging the utility in a continuous process of innovation and adaptation to the rapidly changing energy industry.

This will be accomplished using a human-centric approach to change management that enables utilities to innovate while maintaining a reliable, resilient, and cost-efficient grid.

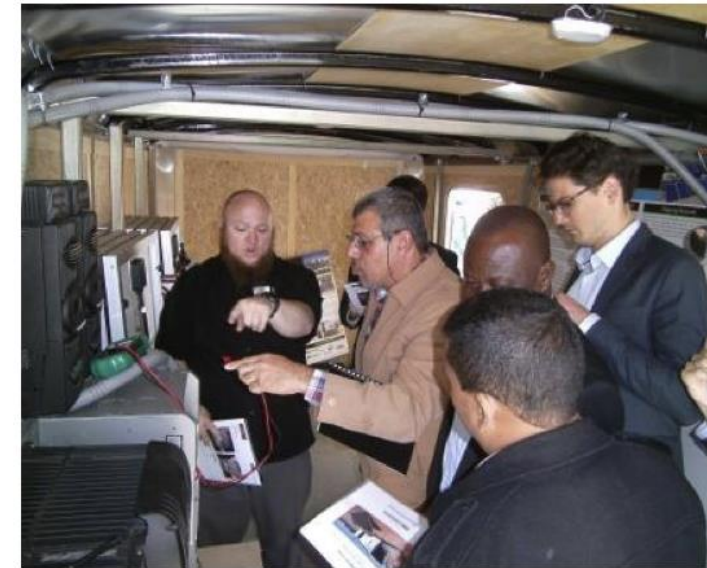




# Training for the future of energy security and resilience

**Challenge:** Increased demand for microgrids and grid modernization practices are requiring a new and/or updated workforce.

**Solution:** Develop and provide training for future and current managers, designers, operators, and technicians in grid modernization and microgrid technologies.



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