GEN IV International Forum℠
Expertise | Collaboration | Excellence

# Global Potential for Small and Micro Reactor Systems to Provide Electricity Access

## Summary / Objectives:

Small and micro-scale modular reactors have received considerable attention for their potential to reduce costs, load follow and meet electricity needs in places where the size of conventional reactor technologies is unwarranted. This small scale is particularly relevant in the developing world where large centralized grids are uncommon and the need for electricity is considerable. More than 1 billion people globally are currently estimated to live without access to any electricity. The Agenda for Sustainable Development calls for reliable, affordable and clean energy for all people by 2030, creating an additional imperative for rapid low carbon technological deployment. This talk will present a novel market analysis of near-term energy demand. We use state-of-the-art **satellite imagery to identify regions with no night-time light as a proxy for electricity poverty, and ambient population to determine the number of persons in these regions**. GIS is used to create corresponding **maps showing the capacity needed to provide this degree of electricity as a function of location if only micro and mini-grids are available**. Additional considerations including resilience to natural hazards, siting considerations and competitive technologies are discussed.

## Meet the Presenter:

**Dr. Amy Schweikert** is a Research Assistant Professor in **Mechanical Engineering at the Colorado School of Mines**. She is a **Fellow in the Payne Institute for Public Policy and co-appointed in the Nuclear Science Program**. Her work focuses broadly in the areas of **infrastructure resilience and development**. This includes a focus on quantitative risk modeling for infrastructure related to climate change and hazard events. Additionally, her work looks at **socio-technical options for energy expansion** for underserved areas of the globe, including the role of nuclear energy as a component of the low-carbon energy technology portfolio.

2/3 of human beings are no electricity access
→ How much and where is electricity needed ?

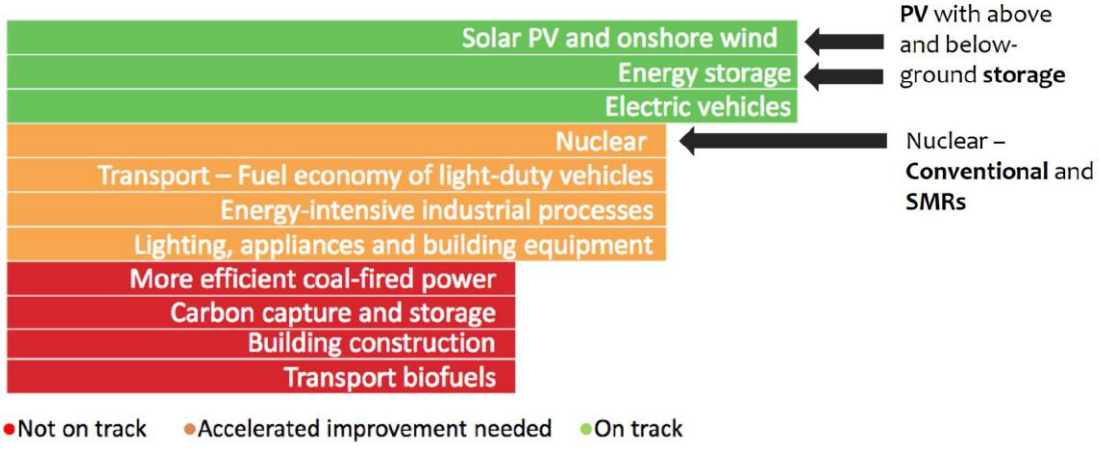
## Where Things Stand


11 million → 270 mil

**20 High Impact Countries**

- 2/3 of all persons with no access globally

## Clean Technology Options



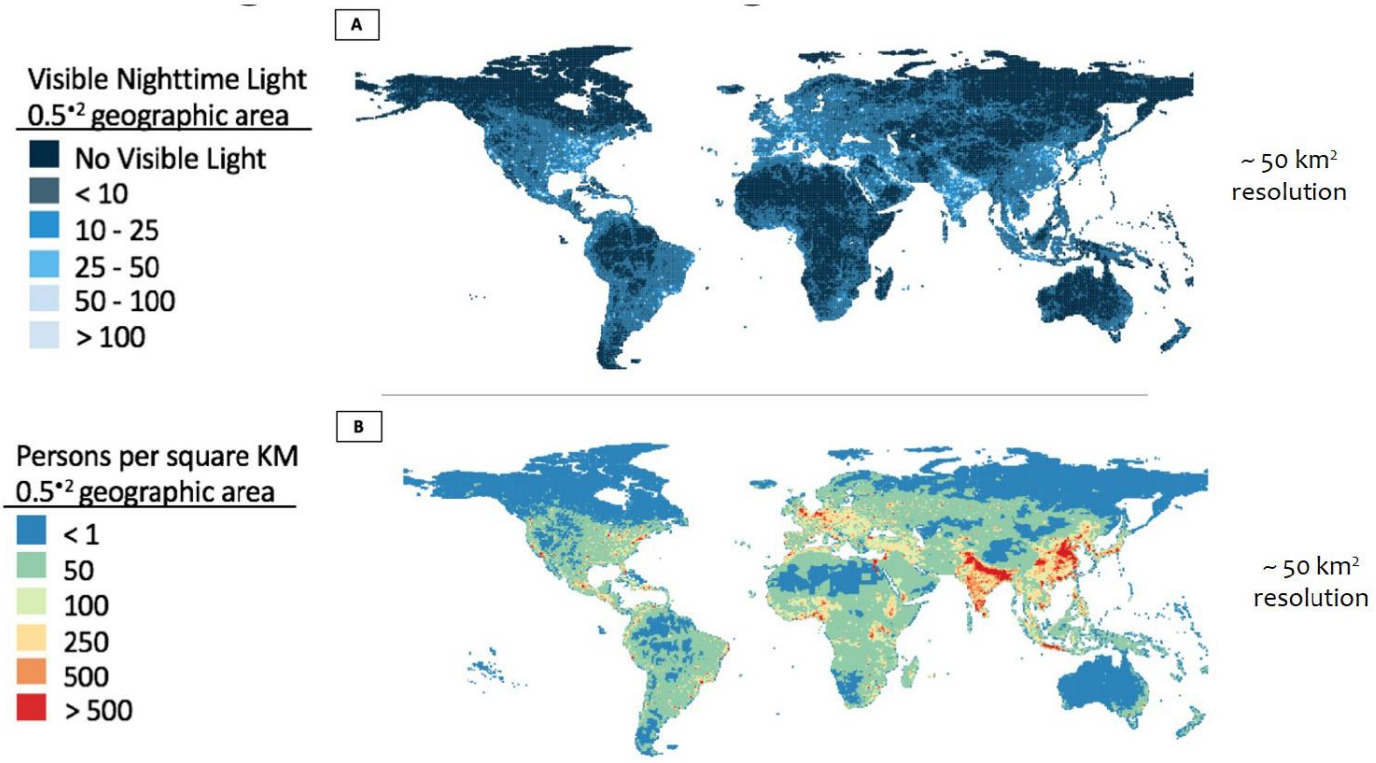

**PV** with above and below-ground **storage**

Nuclear – **Conventional** and **SMRs**

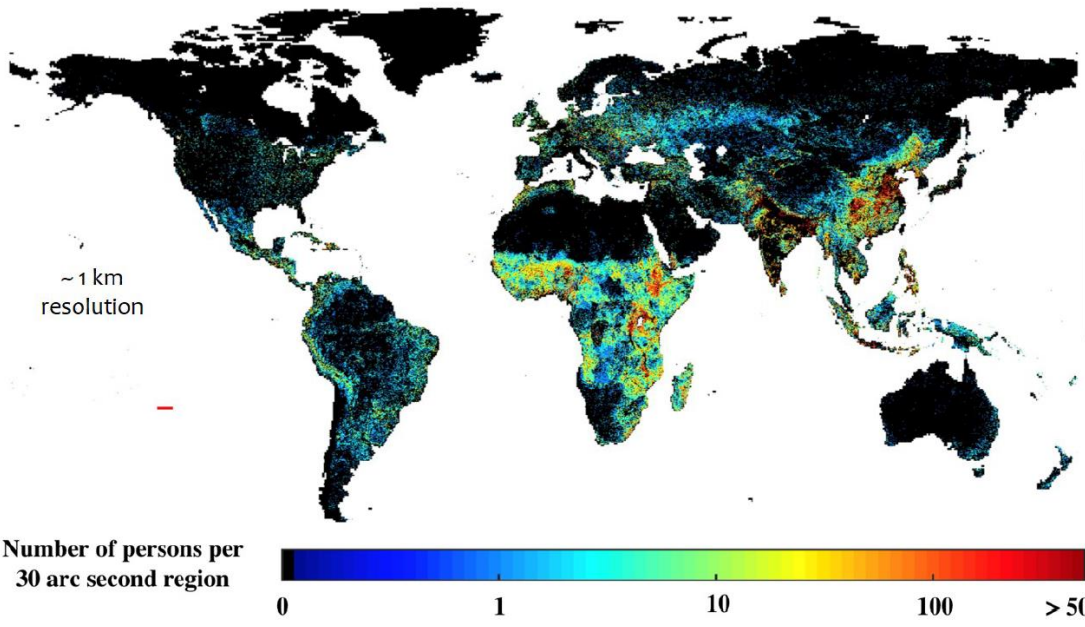
## The World at Night

Persons (electricity demands) with no visible light (electricity) cab be estimated.

# Visible Light and Population



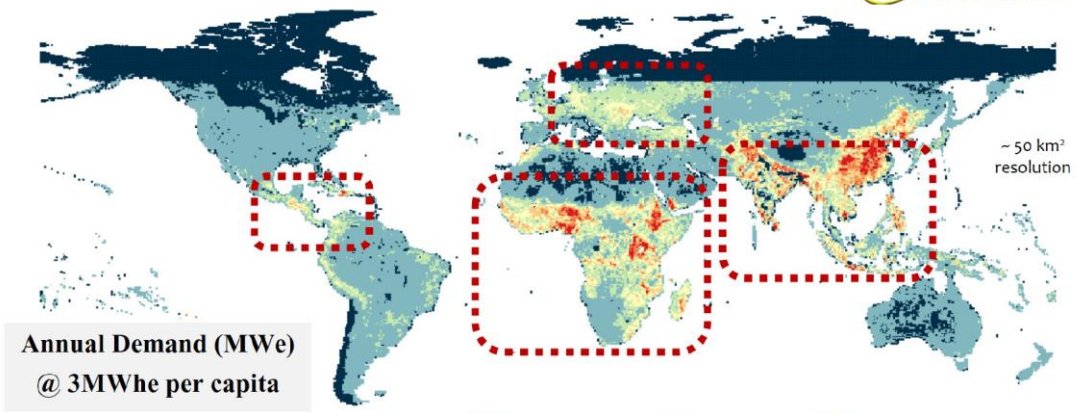

# Persons with no visible nighttime light




***Est. Electricity Poverty:***
**1.75 billion people**

Schweikert, A., Osborne, A. Stoll, B., Duncan, I., Deinert, M. "A Global Assessment of Resources Available to Address Electricity Poverty using Photovoltaics and Energy Storage" 2018. *In Review*

# Meeting Electricity Demand

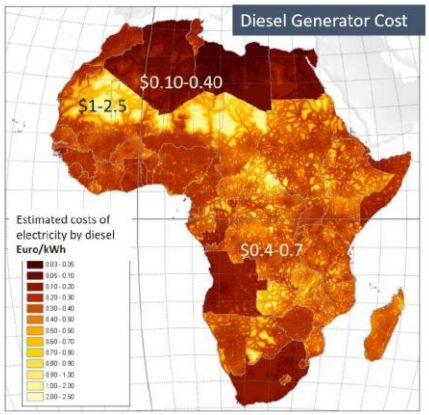



System size required to meet population electricity needs (MWe, Peak Watts, 0.85 capacity factor) Per 0.5°² geographic area

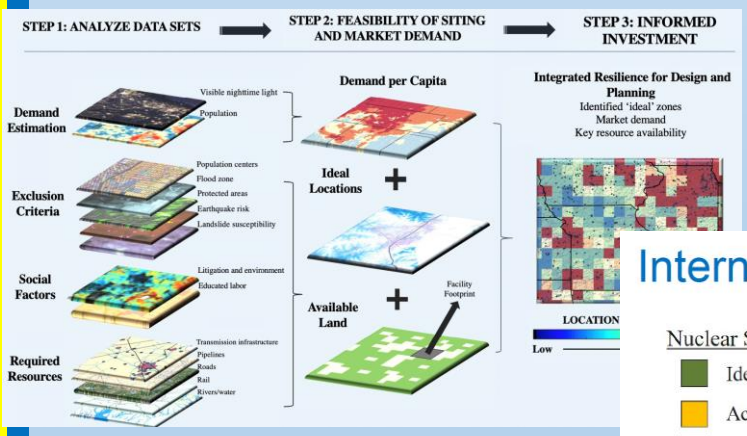
N/A | < 20 | < 100 | > 200 | < 5 | < 50 | < 200

Schweikert, A., Osborne, A. Stoll, B., Duncan, I., Deinert, M. "A Global Assessment of Resources Available to Address Electricity Poverty using Photovoltaics and Energy Storage" 2018. *In Review*

Demand mapping and Cost mapping.




| Technology | LCOE, Current [$/kWhe] | Direct $CO_2$ Cost [$/kWhe] | LCOE, $CO_2$ Tax [$/kWhe] |
|---|---|---|---|
| Natural Gas | $0.0453 | $0.0096 | $0.0549 |
| Nuclear PWR | $0.0547 | $0.00 | $0.0547 |
| Coal | $0.0658 | $0.0226 | $0.0884 |
| Solar | $0.1071 | $0.00 | $0.1071 |
| Nuclear SMR [NuScale] | $0.0421 | $0.00 | $0.0421 |

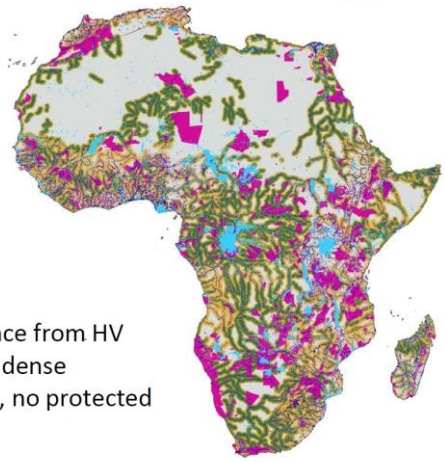




Site screening and market estimation can be performed by these technologies.

## International Site Screening

Nuclear Siting

- Ideal for siting
- Acceptable for siting
- Population centers
- Active fault zone
- Water
- Not suitable land



*"Ideal" and "Acceptable" Criteria*: Distance from HV Transmission and water source, outside dense population centers, no seismic fault line, no protected environmental regions