Electricity Access and Demand Growth

Johannes Urpelainen

Prince Sultan bin Abdulaziz Professor of
Energy, Resources and Environment

Founding Director, Initiative for
Sustainable Energy Policy (ISEP)

Johns Hopkins School of
Advanced International Studies

ISEP

Today's Talk

- Electrification: India in the world
- Relationship between electrification and demand growth
- Policy implications

ISEP

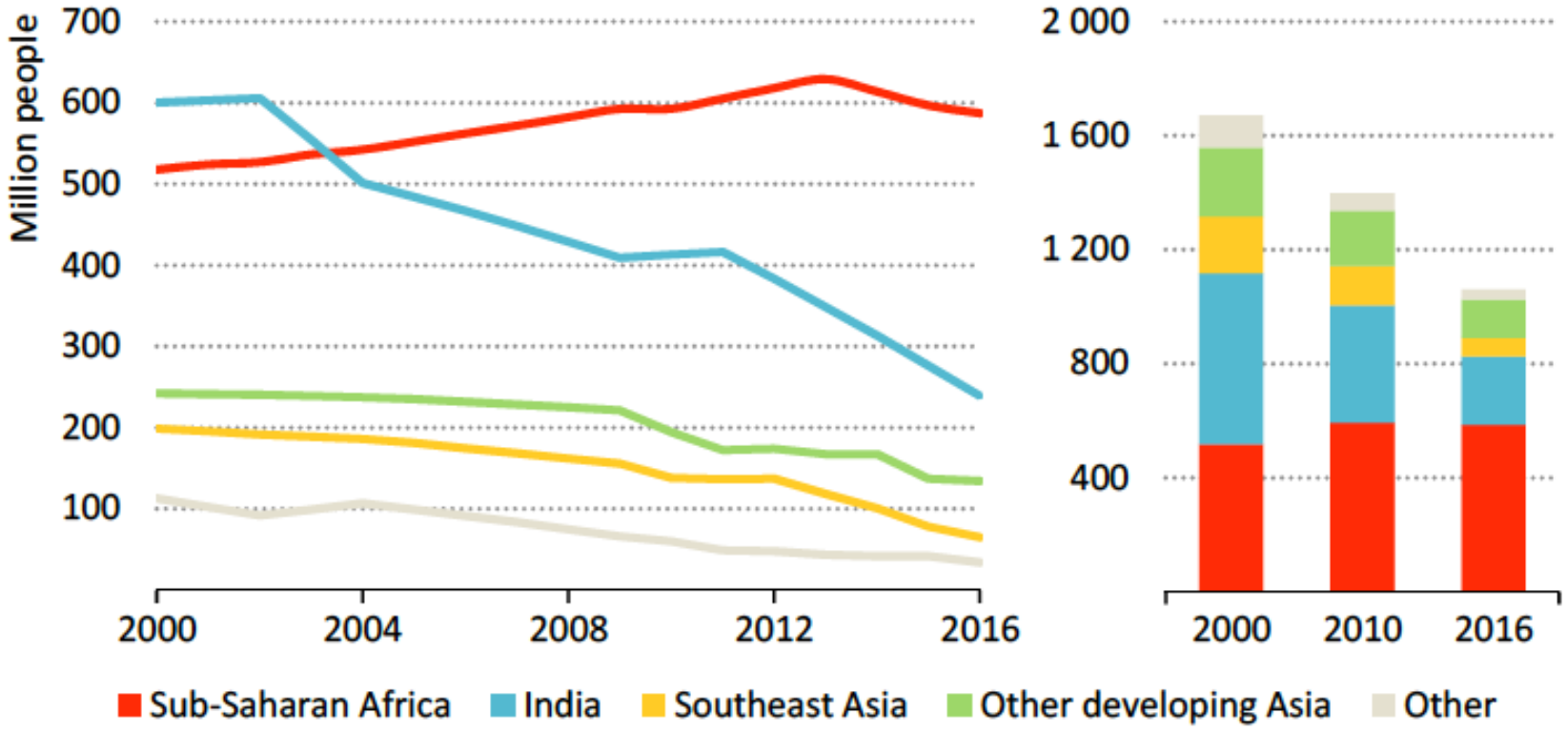
Electricity Access in India

- 2001-2016: 55% to 80%
- Epicenter: Uttar Pradesh and Bihar
- *Saubhagya* scheme

ISEP

Electricity Access Globally

Figure 2.1 ▷ Population without access to electricity by region



ISEP

Modes of Electricity Access

- Grid extension: the historical normal
- Distributed generation: an emerging alternative
- Comparing costs of electricity access: geography, income
- India: overwhelmingly grid – different story in Sub-Saharan Africa

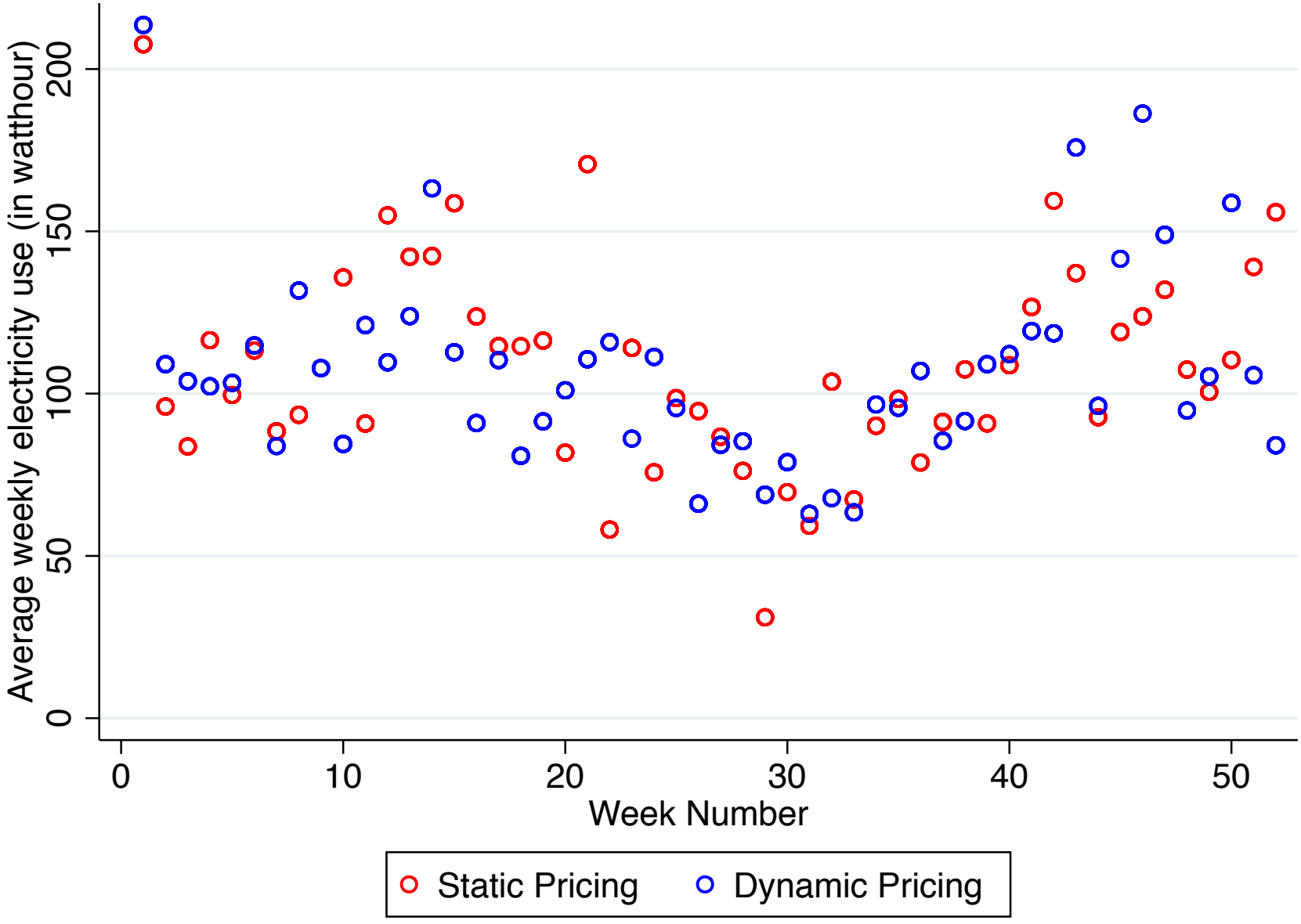
ISEP

Electricity Access and Power Demand

- Do standard energy-economy models underestimate demand growth?
- Mexico: tipping points in power demand
- Evidence from India, Haiti, Kenya, Uganda: minimal power demand among the poor – especially in off-grid setting
- Highly relevant to India: remaining non-electrified households are very poor, given grid is now accessible everywhere and connection costs low
- Comparing costs of electricity access: geography, income
- India: overwhelmingly grid – different story in Sub-Saharan Africa

ISEP

Energy Demand in an Unnao Micro-Grid



ISEP

China's Story

- 1949: no rural electrification
- 1978: 68% rural electrification - before economic reforms
- 1997: 97% rural electrification
- From distributed small hydro to a national grid

ISEP

Rural Electricity Demand in China

- Per capita demand, rural areas, 1993-2002: from 168 kWh to 404 kWh
- Washing machines among rural population, 1990-2004: 9.1% to 37.3%
- Higher wealth levels and reliable service encourage appliance ownership, leading to growing consumption

ISEP

Vietnam's Story

- 1975: no rural electrification, major infrastructure destruction from war
- 1996: 50% national electrification rate
- 2009: 96% national electrification rate

ISEP

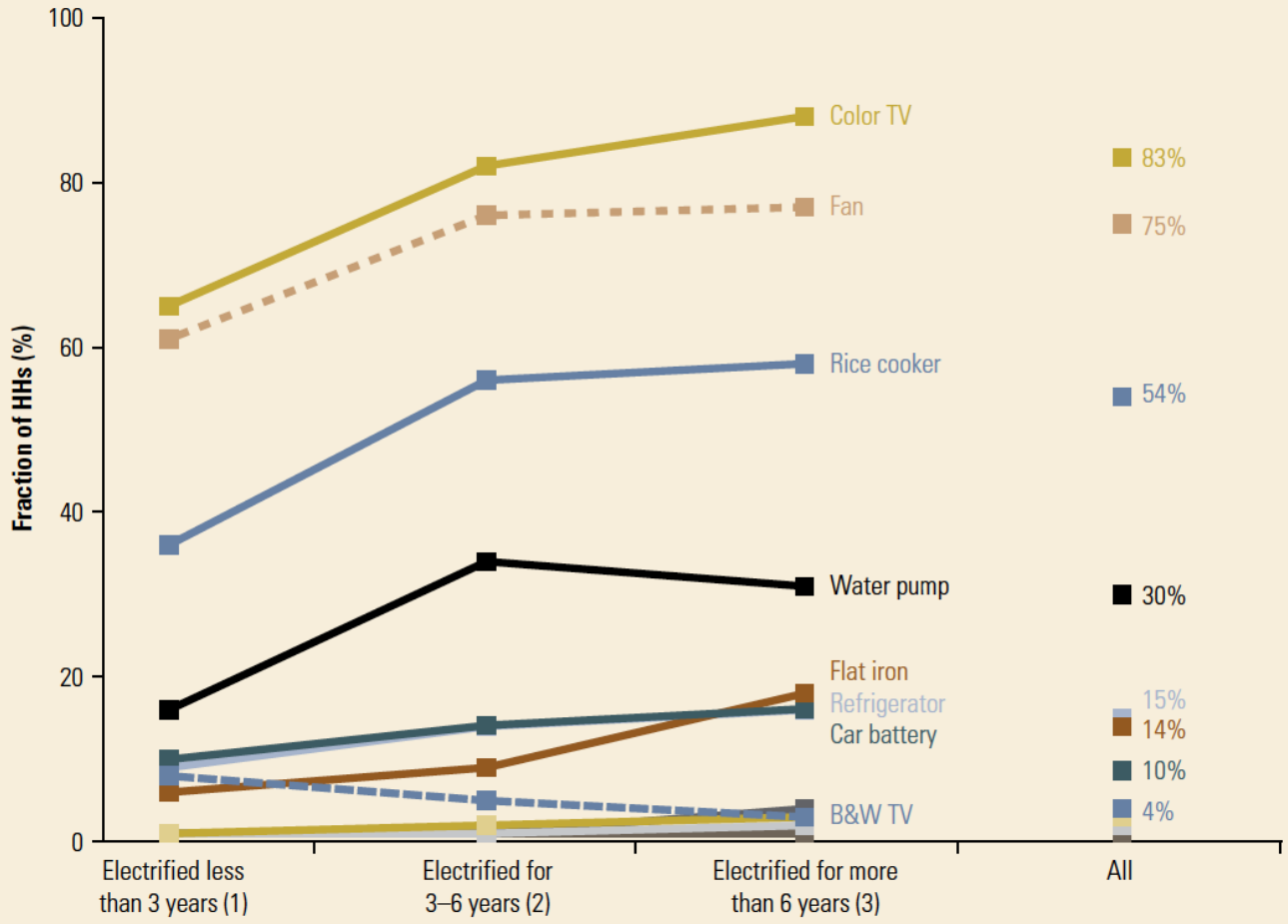
Rural Electricity Demand in Vietnam

- Per capita demand, 1975-2009: from nothing to $\sim$ 300 kWh
- Appliance ownership in 2008, rural areas: 83% color television, 75% fan, 55% rice cookers
- Higher wealth levels and reliable service encourage appliance ownership, leading to growing consumption
- Important role of affordable appliances

ISEP

Appliance Ownership Over Time, Vietnam

FIGURE 10 APPLIANCE OWNERSHIP, BY YEARS OF ELECTRIFICATION



ISEP

Conclusion: Implications for India

- Key to rural demand growth: income growth, quality of service, affordable appliances – in that order
- India: negligible power demand among rural poor – could this change?
- Rural electricity demand to depend on success in poverty alleviation
- Without income growth, quality of service and less expensive appliances play a secondary role

ISEP