The role of government has been a central theme in this class. ECOF is an embodiment of much of our collective thinking in this regard. The nature, stability and capacity inherent in government at all levels plays a profound role in its ability to pursue electrification programs of this and other kinds. Indeed, the ability of individual governments to effect an ECOF-like partial privatization strategy in particular depends strongly on many aspects of its institutions and capacities, including legal, banking, and administrative.

Broad theme of this lecture - the rural electrification strategy pursued by the three countries (China, India, South Africa) we will discuss, and by all countries, proceeds over a timeframe of many decades, and reflects history, contemporary economic realities, and the priorities and ambitions of the regime in power at all stages along the way.

China

Theme - electrification strategy was a series of thrusts reflecting the political order of the day, and the identification of rural electrification as necessary for economic growth outside the cities, and of preserving social order by limiting urban migration.

First Stage 1949-1977 Isolation. Establishing a top down planning and funding regime largely ignoring rural electrification.

Formation of a vertical rural system with central experimentation but little investment, and local administration starting with <4MW of small hydro capacity in rural areas, and less than 1% of electricity consumption.

Separate rural and urban systems with a focus on urban and peri-urban areas.

“Self-construction, self-management, self-consumption” national policy with largely central planning downward through local governments and mostly local funding.
Not much happened - roughly half of the counties developed small hydro mainly driven by agricultural applications - the affordable equivalent of PV of the 1970’s – and beginning in 1973 the opportunity for investor ownership of hydro assets.

**First wave: central subsidy 13.8% with balance from county.** A county is the 3rd level of administrative division - Province, Prefecture, County, Township, Village - with roughly 1M people.

(6.3GW over 90,000 (70kW ave) hydro) covering 70% of the population.

_Cultural Revolution 1966-1976_  
_Great Leap Forward 1958-1962_  
_Opening Up 1978 onward Deng Xiaoping_

**Second Stage 1978-1997** The Opening-Up leads to Market Reform as Central Government Transfers Management to Local Government and focus shifts to industrialized commercial production and investment.

Re-integrated planning under central government pressure and control with local management followed steady growth in rural grids driven by small enterprise with central government playing minor financing role, but setting cost recoverable tariffs for new generators.

This made investment in diesel and coal plants attractive investments for local administrations.

This accelerated with expanded local control over taxation and reinvestment in electrification – positive feedback.

Policy reform came from national electrification agency which subsidized and undertook planned county scale expansion beginning 1983.

By 2000 650 counties were electrified after first qualifying with mainly hydro generation of increasing scale. This was the rapid phase.

The Township and Village Enterprises (TVE) focus (beyond agriculture) helped catalyze the economic growth linkage with 62% used in productive applications by the end of the period.
The central government role was critical in financing through grants and loans, ensuring inter-county coordination, and encouraging local resource usage – NDRC and predecessors.

Third wave central subsidy split with provinces, and balance from country and debt (49%) held by coop.

85% reliability  
90% of households  
200kWh per capital consumption


Poor rural reliability and high losses due to sloppy operations and aging soviet era equipment (30%).

Divergence in effective urban and rural tariffs due to surcharging by counties to cover higher costs and support unrelated programs were limiting economic expansion and impact.

Pilot counties showed that losses could be dramatically reduced with upgraded regional grids.

Desire to sell urban supply excess in undersupplied rural market. Unified commercial structure under SOE’s and subsumed entire commercial and operating structure separated from local administration.

Massive capital injection by the national government completed UA.

Township Electrification Program and successor Village Electrification Program aim at improving service using off-grid technologies in more remote areas where millions still have little service.

These were serious efforts aimed at efficient model development for residential plus industrial service with full government funding and competitive bidding among service integrators and service operators.
Success Factors in Chinese Electrification

Local initiative and control with central planning

Phasing to meet present demand with upgrading.

Explicit linkage between economic (agricultural) output and electrification.

Allowing cost recovery to ensure investment.

Building locally, with central leadership and funding.

Role of central government in driving for standardization to reduce costs, improve performance and close capacity gaps.

India: centralized effort, grid-centric, linkage to local enterprise narrowly focused on agriculture, no local ownership, cost recoverable tariffs.
South Africa

- idiosyncratic and not an example “of” Africa, but a rapid electrification success with many lessons. A huge success? You judge.

- Program proceeded in waves similar to those in China case:
  1. Initial efforts and achieving consensus on approach
  2. Institutional reforms and launch with course corrections
  3. “BAU” or build out phase.

- Started with <30% electrified in 1993 both urban (a good thing) and rural. With democratic elections in 1994 Integrated National Electrification Program (INEP) commenced under NERSA.
- 55% reserve margin
- Lots of expertise
- Strong institutionalized integrated utility Escom, later Eskom.
- Lots of coal
- A social fiasco coming apart at the seams.
- Thought that the program would be self-funding by using up excess capacity and creating value - this turned out to be wrong.

- As of 2013 89% with 74% on prepaid meters, and essentially completed now. Eskom now has 55% of end users and distributes through municipal authorities in remainder, many of them technically unfit.
- Tariffs were among the lowest in the world - not so after World Bank mandates following Medupi funding agreement.

- Expansion model funding went from Eskom to national government in 2001 following Eskom’s corporatization (taxes and dividends to gov.)

- Declared electricity access “for cooking, heating, light, comms a human need” in 1998. This gives an important measure of the intent of the INEP – economic growth was downplayed as a justification.
• By 2009, the country achieved a 75% electrification rate with 88% urban and 55% rural population having access to electricity. In 2009, 3.4 million households still lacked access to electricity, of which almost 50% live in informal settlements.

• The present wave of projects will effectively achieve UA – limited by issues such as the number of people living in temporary structures due to a lack of housing.

• Method was centrally planned and executed by Eskom (2/3) and municipal authorities (1/3) in a coordinated manner, and almost entirely grid extension with central generation. Initially Eskom funded, but stopped after corporatization.

• Off-grid contribution was minimal. SHS used for whole filling on a competitive tender basis especially in rural schools and hospitals via concessions issued competitively to energy services providers who had to also provide cooking fuels in addition to SHS with maintenance obligations – only when electrification was not feasible within the foreseeable (>3yr beyond end of current phase) future. The model has not worked well, with many concessionaires failing. Solar and hydro micro-grids were tried and failed to gain traction.

• Free basic electricity introduced in 2001 50kW/month. Tends to cap utilization.

• Many business model innovations.

• Main distinction from Chinese experience has been the lack of strong direct economic growth resulting from the SA focus on residential and public service electrification, and not industrial uses. This is itself an aspect of the nature of the population to be served, but is significantly itinerant, very poorly educated, and sparse – as opposed to the equally poor but socially and economically better established rural Chinese villages and townships. The pace and success of the program otherwise cannot be disputed. Many impacts may be only seen in the long term.