Economic Commission for Africa

ACPC African Climate Policy Centre

Energy transformation in lower income developing economies

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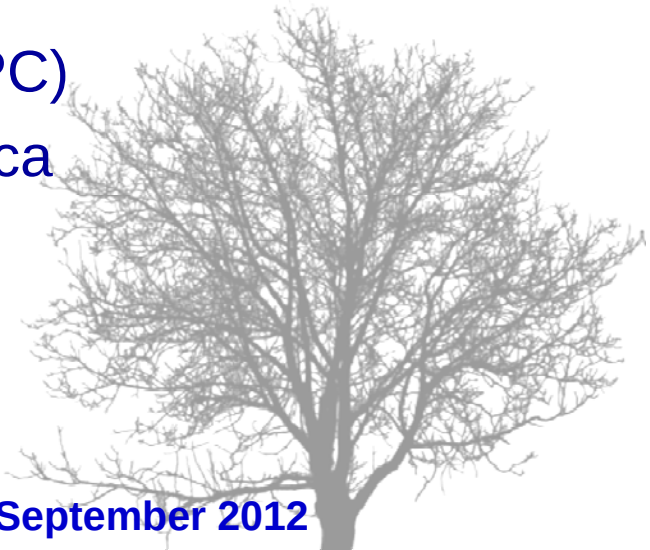
African Climate Policy Centre (ACPC)

UN Economic Commission for Africa

Climate Change Meets Policy



Low Carbon Society Research Network 4th Meeting, 17-18 September 2012

Outline

- Characteristics of energy sector in low income Economies
- Why does the energy access and energy security problem continue to persist?
- What opportunities exist?
- Climate change: obstacles and opportunities?
- Suggestions for energy transformation?

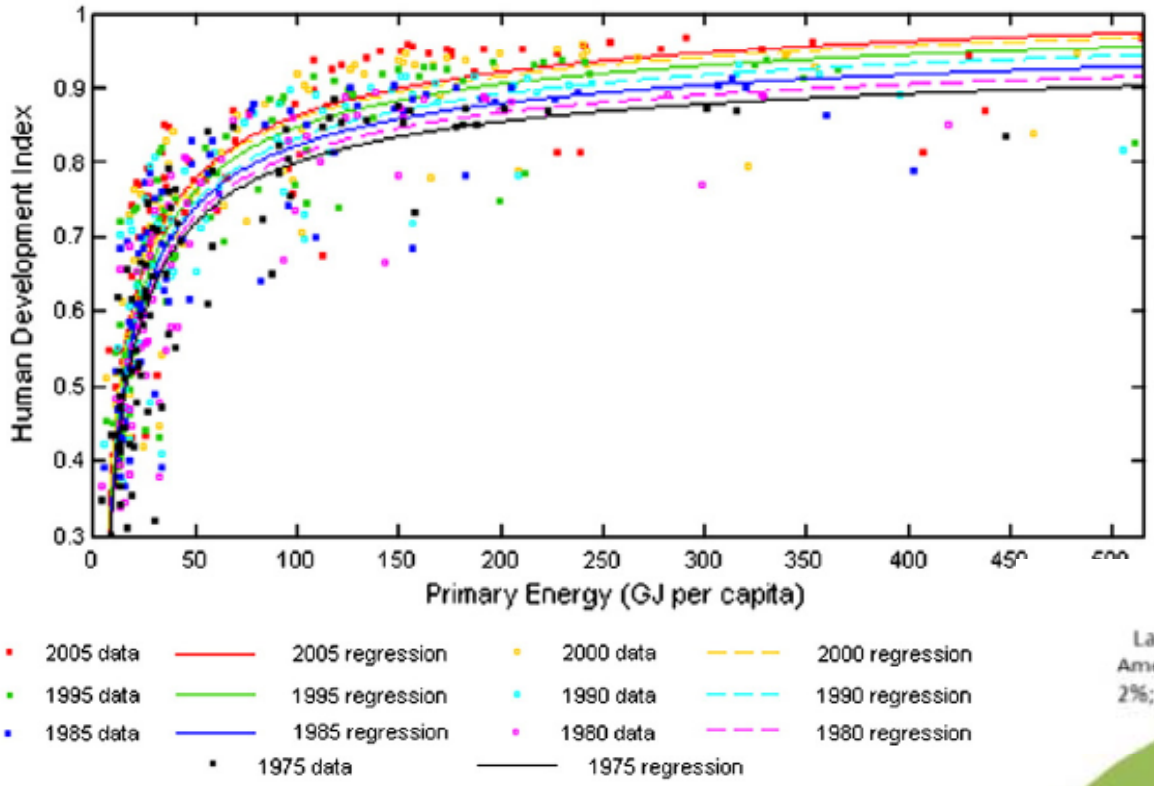
Some observations

- Low HDI, low GDP, Mixed GDP growth
- Some of the fastest growing economies in recent years
- Relatively high levels of inequality
- Fast growing population (high young population)
- High population dispersion
- Dominance of rural (agrarian) economy
- New oil and gas discoveries in new places

Key energy issues for low income countries

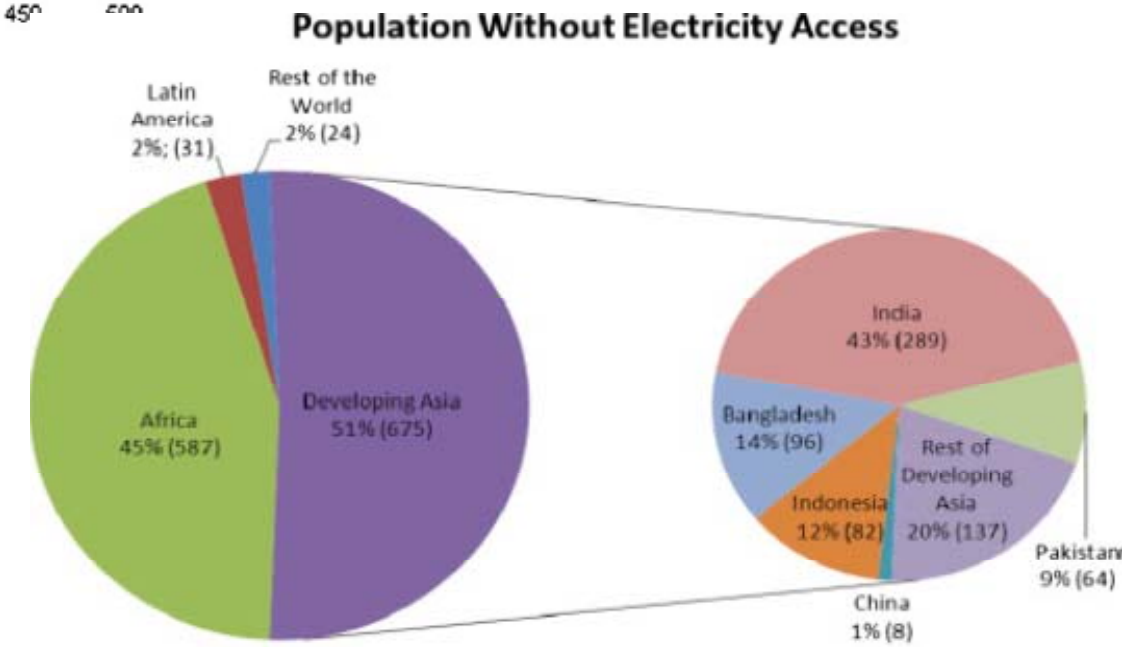
- Development - critical for livelihoods enhancement; Development needs energy
- Most low income countries are net energy importers (39 countries in Africa)
- Also there are a number of challenges, especially that of modern energy access across:
  - national
  - settlement (rural/urban)
  - social groups (gender and poor communities)

Level of energy access correlates with HDI



Steinberger and Roberts, 2011

Average energy access in sub-Saharan Africa = 31%; in rural Africa = 14%

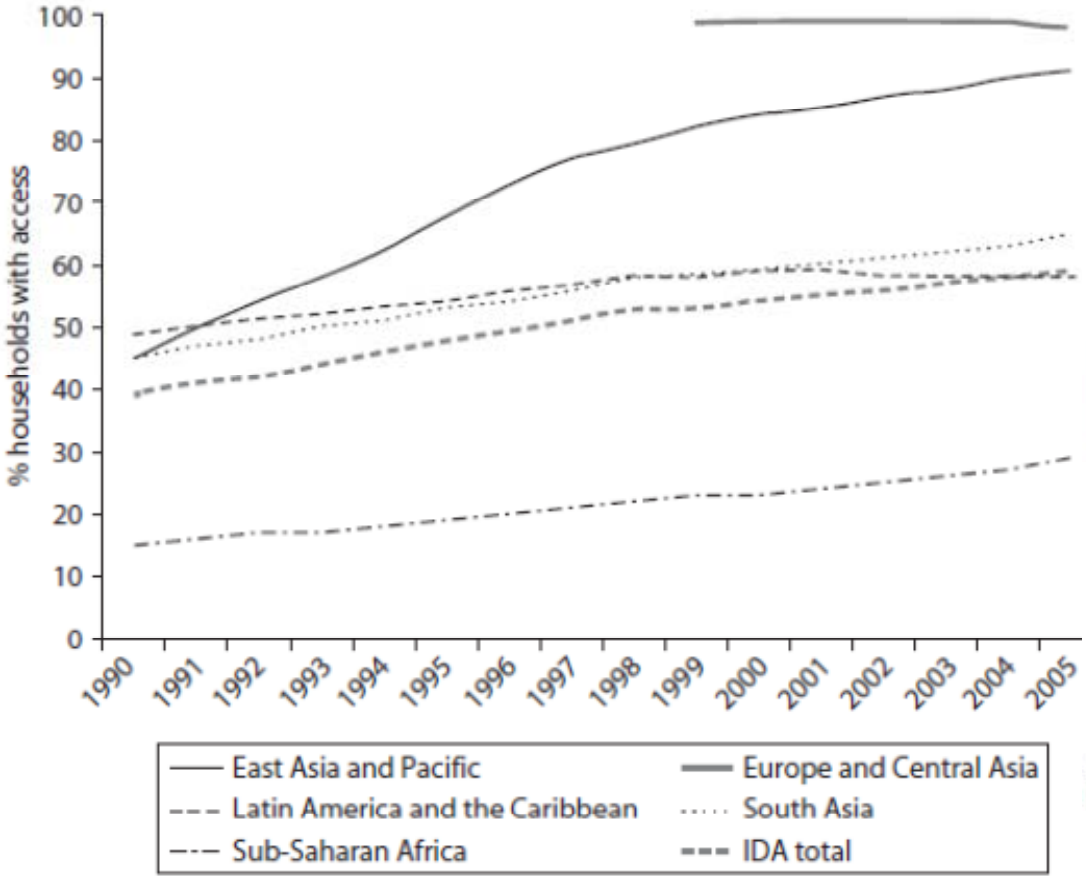


Global Distribution of population Deprived of Access to Electricity (population in millions)

Distribution of Population Deprived of Access to Electricity in "Big 5" Countries (population in millions)

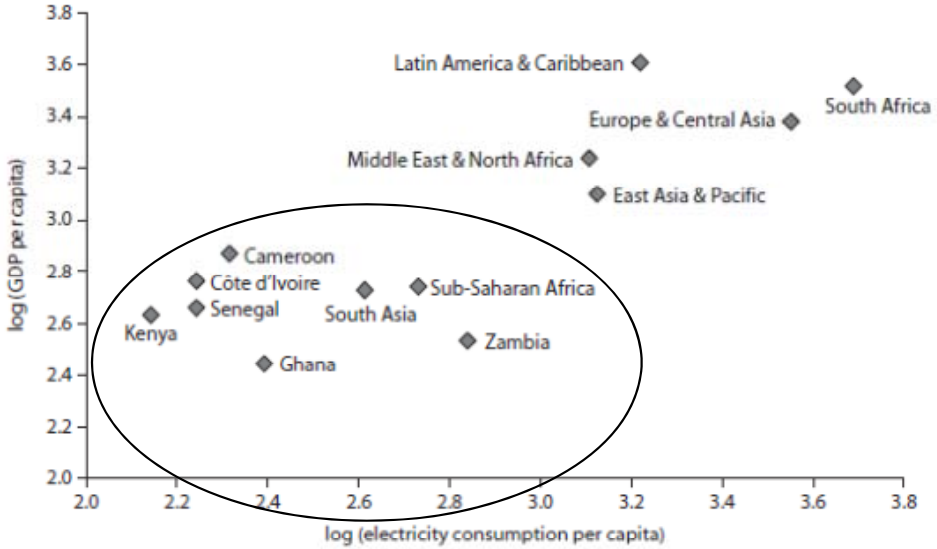
EIA, 2011

Household Electrification Rate in World Regions, 1990–2005



Source: Eberhard and others 2008.
Note: IDA = International Development Association.

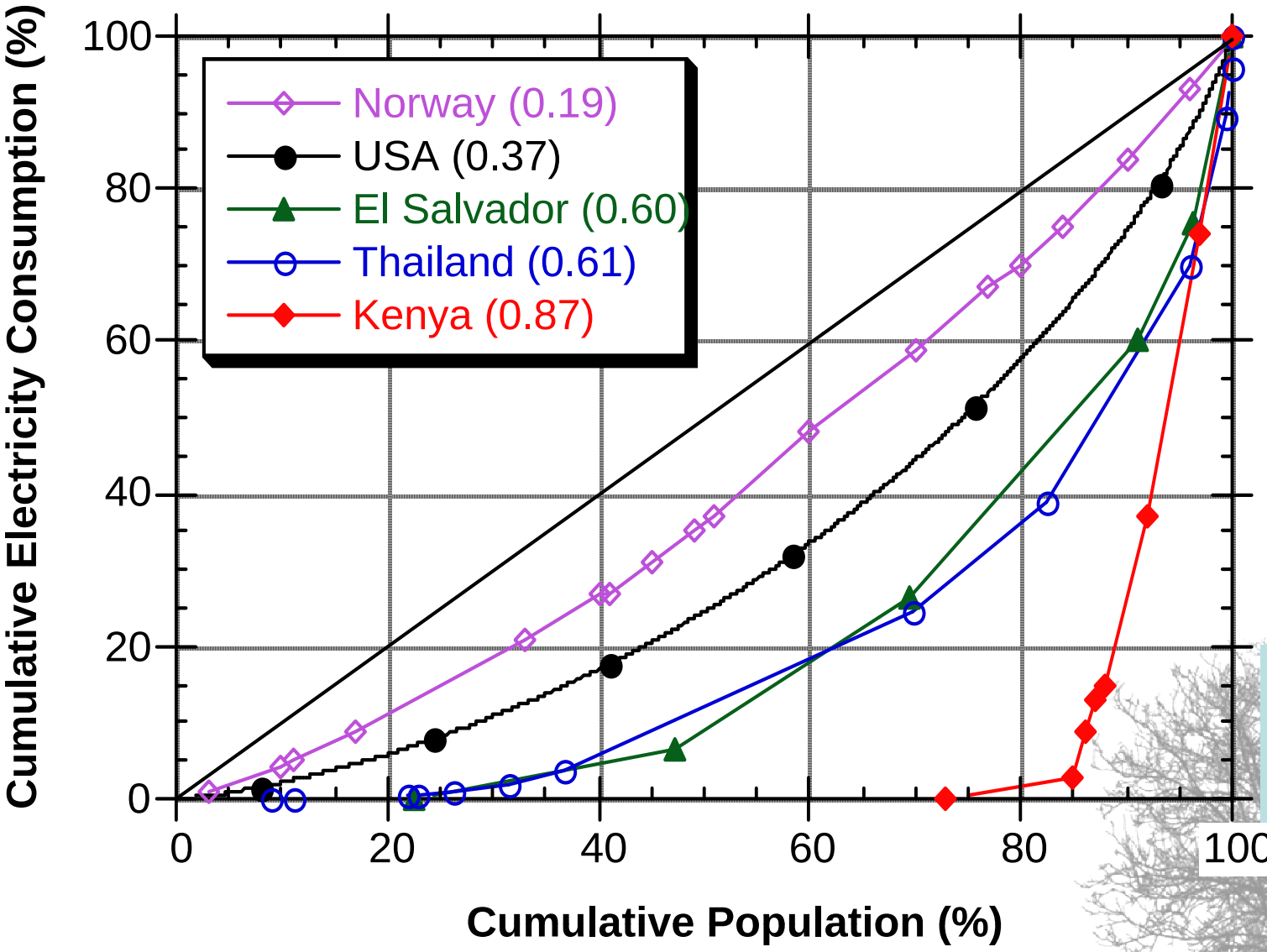
Per Capita Electricity Consumption and GDP



Source: Eberhard and others 2008.
Note: GDP = gross domestic product.

AICD, 2008

The Energy Gini

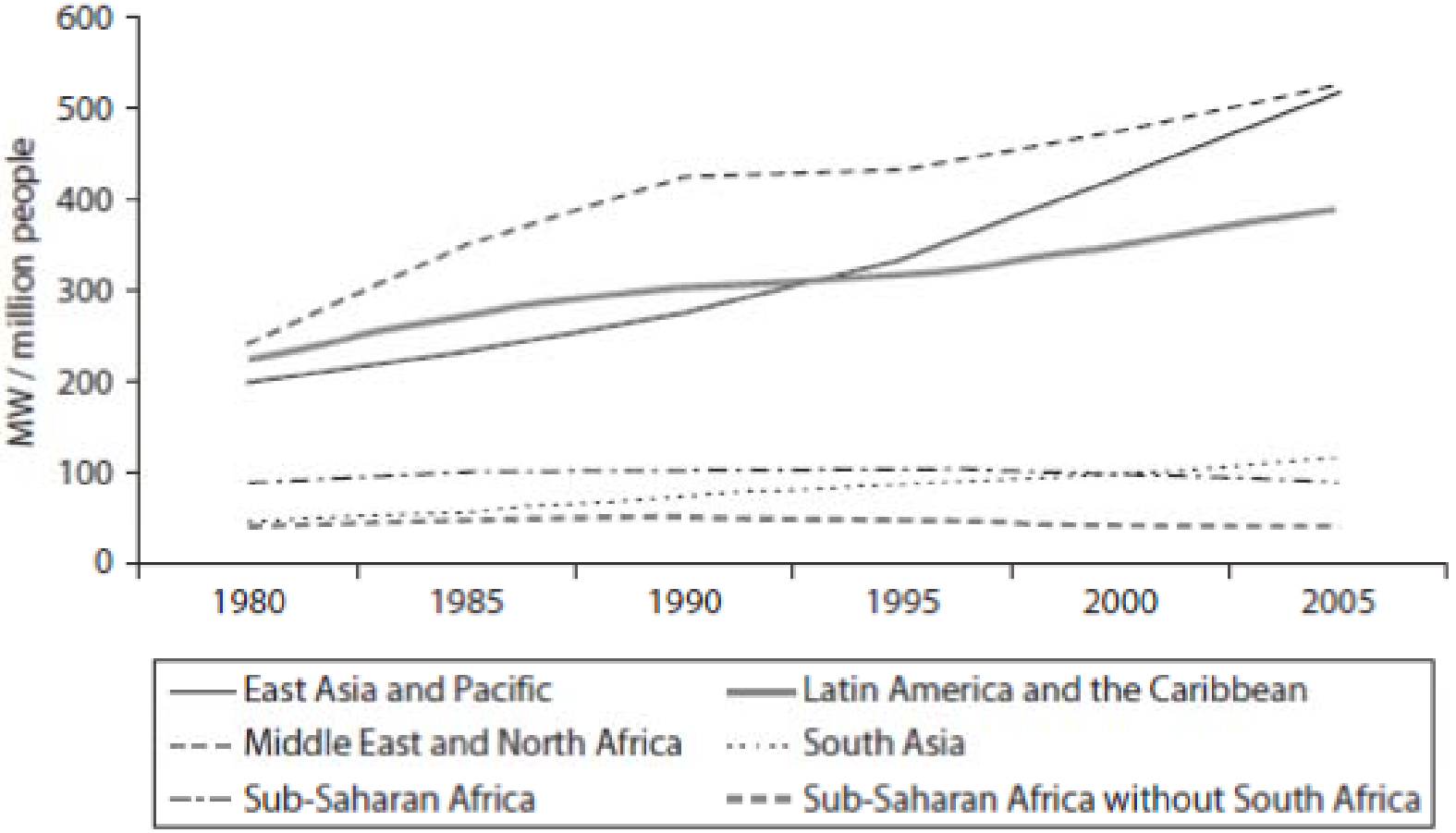


Over 90% elect
Consumed by
15% pop'n

Jacobson & Kammen, 2005

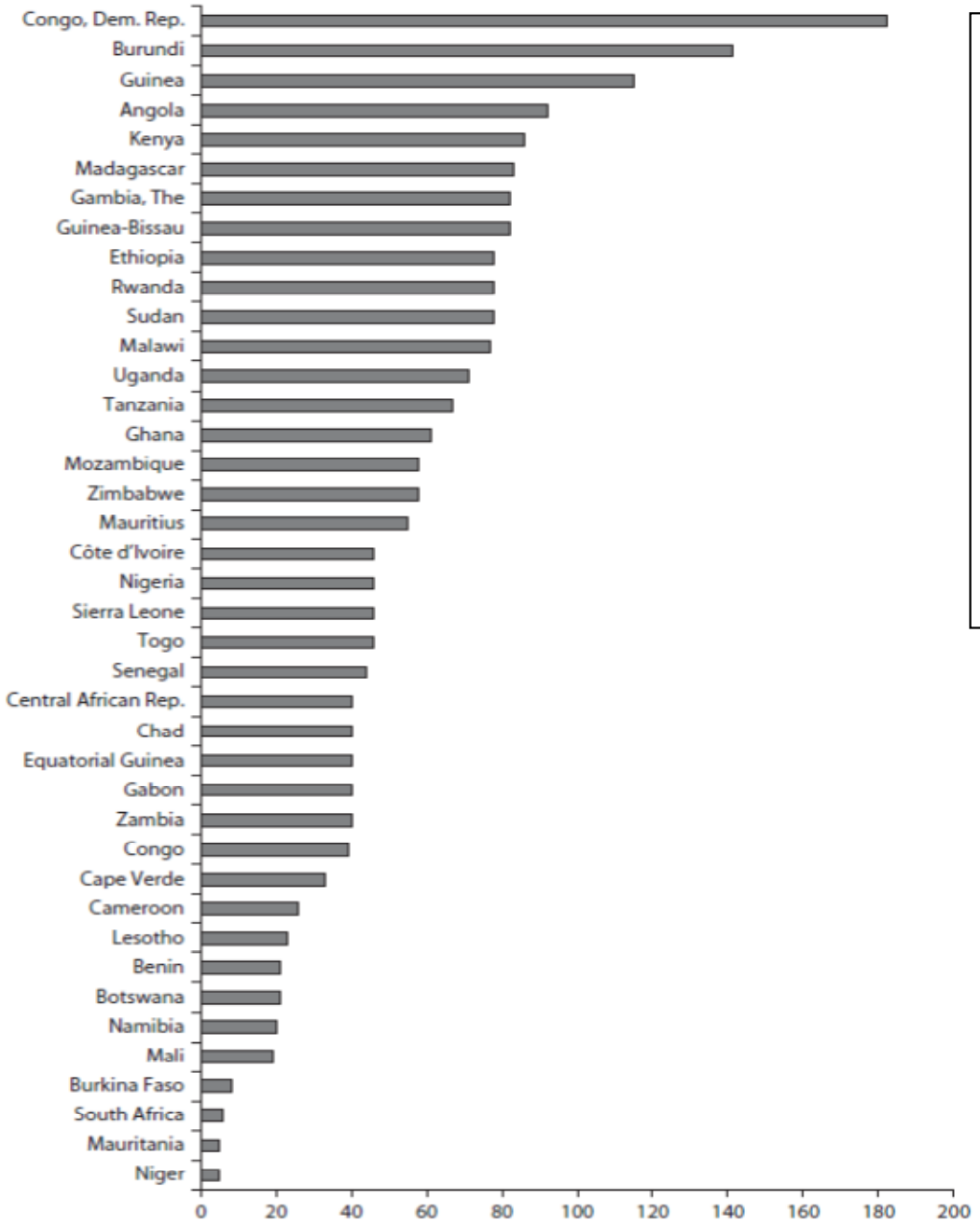
Power generation

- Combined power generation of SSA – 80GW (147GW)
- Capacity growth has been largely stagnant



Source: Derived by authors from AICD 2008 and EIA 2007.

Note: MW = megawatt



Source: Enterprise Survey database; World Bank 2008.

Power Outages, Days per Year, 2007–08

Cost more than 5% of GDP in Malawi, Uganda and South Africa, and 1-5% In Senegal, Kenya and Tanzania (Foster and Briceno-Garmendia, 2010).

Transmission & Distribution Losses

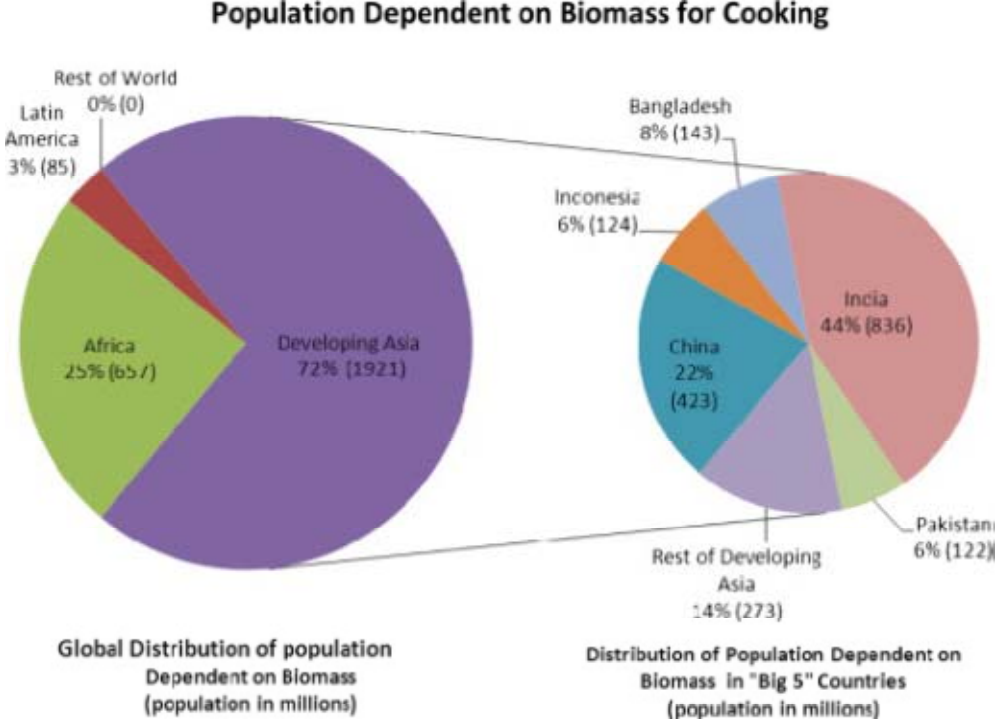
-Over 20% Senegal, IC, Ghana
- Over 30% Moz, Nig
- Over 45% Botswana

AICD, 2008

Key energy issues for low income countries

- Biomass use is significant – deforestation
  - Haiti (biomass) and Dominican Republic (LNG/Ker)
  - 2% and 37% tree cover
- Energy use in the productive sector is low, especially in agriculture

Biomass use - significant



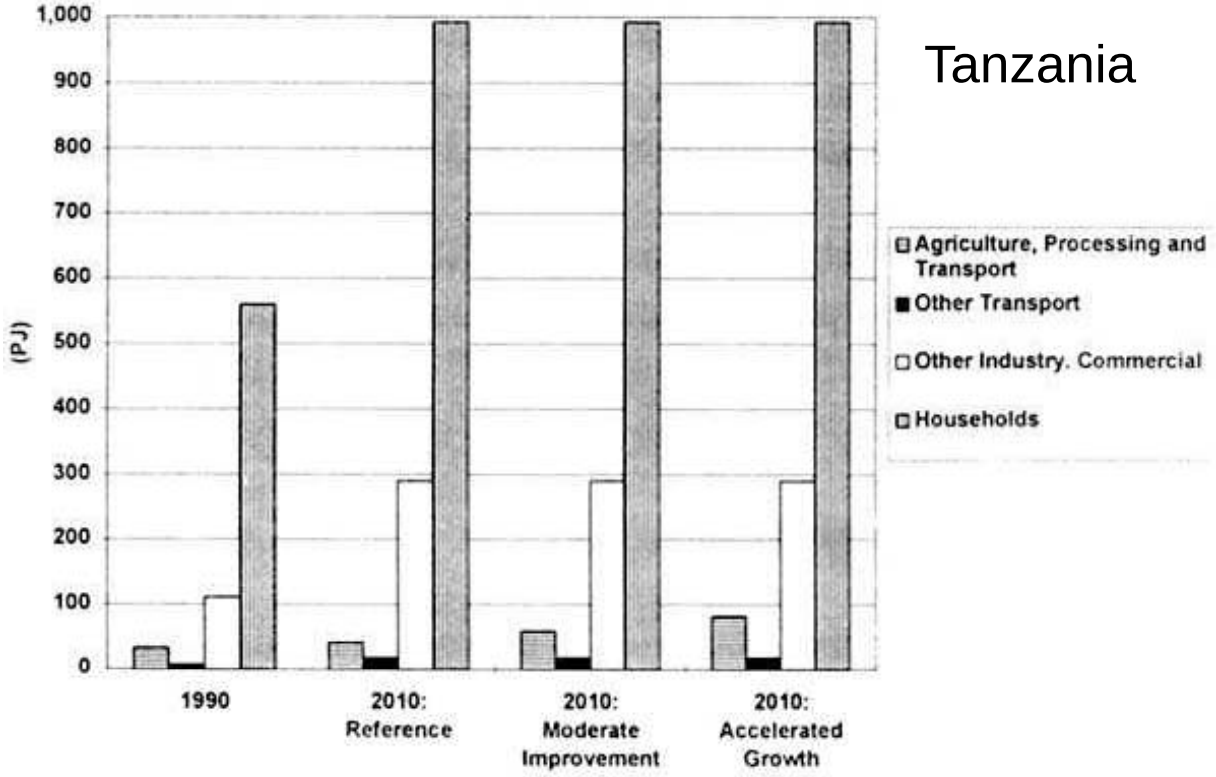
EIA, 2011

Share of agriculture to Economy

Share of employment – 60 to 80%
Share of GDP – over 25%

Share of modern energy use

Household – over 60%
Industry – 18%
Transport – 15%
Agriculture – 2%



Tanzania

Key energy issues for low income countries

- Energy is a major preoccupation for households
- Women – at the heart of the energy challenge


UGA41

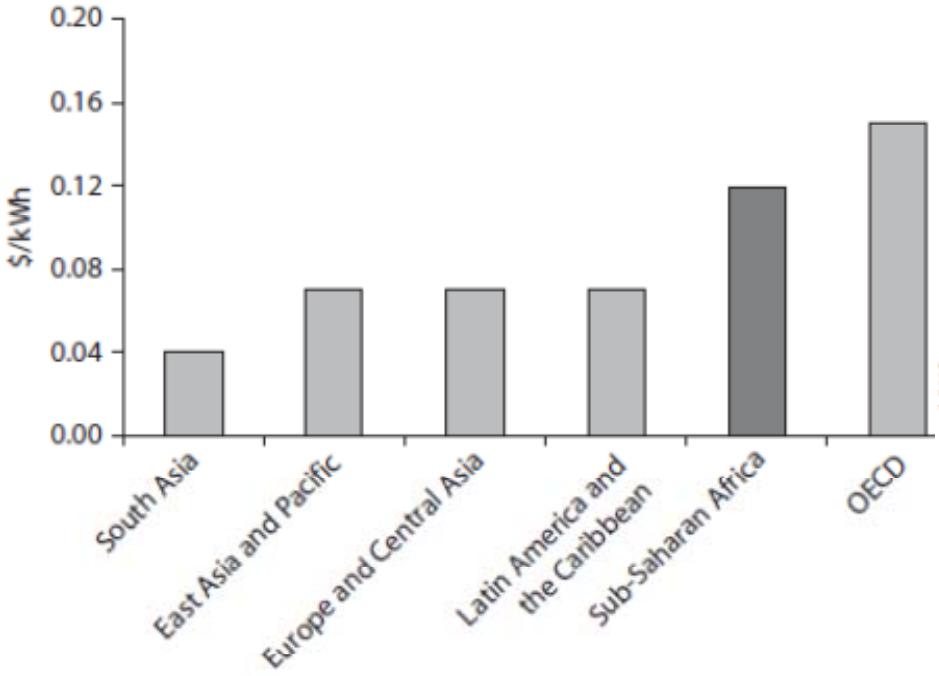
On the persistence of the energy access and energy security challenge

- Energy cannot be separated from development – underdevelopment is a driver of low consumption
- The price of modern energy (esp. electricity) is high, although there are exceptions

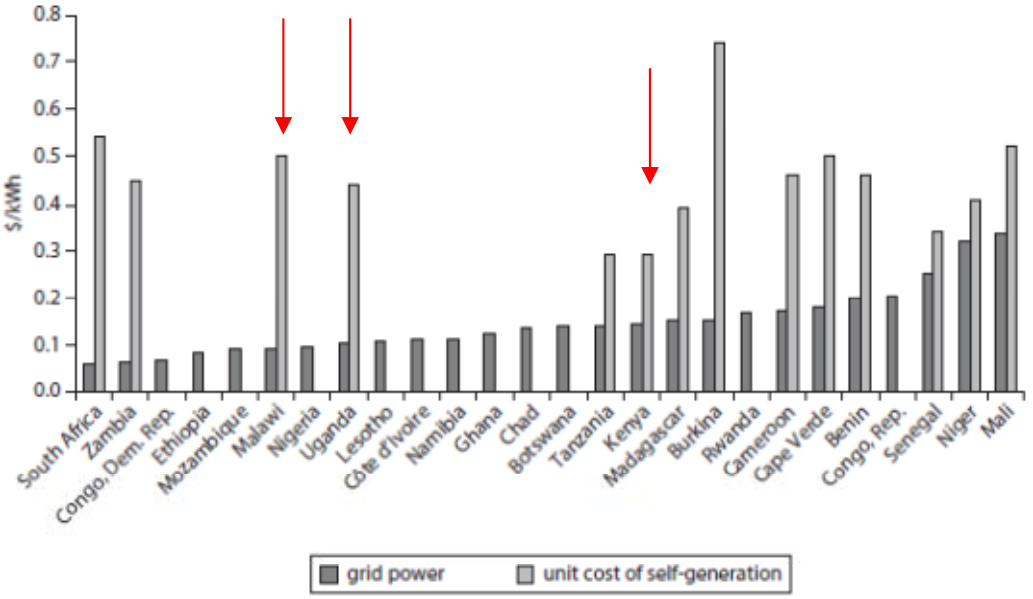
Africa's power is expensive

- Up to $0.30/kWh in Mali, Niger, Senegal
- $25/kWh in Burkina, R. Congo, Benin
- Even higher for self-generation

- Under $0.05/kWh in Ethiopia, DRC, Malawi, Zambia



Source: Briceño-Garmendia and Shkaratan 2010.
Note: OECD = Organisation for Economic Co-operation and Development.

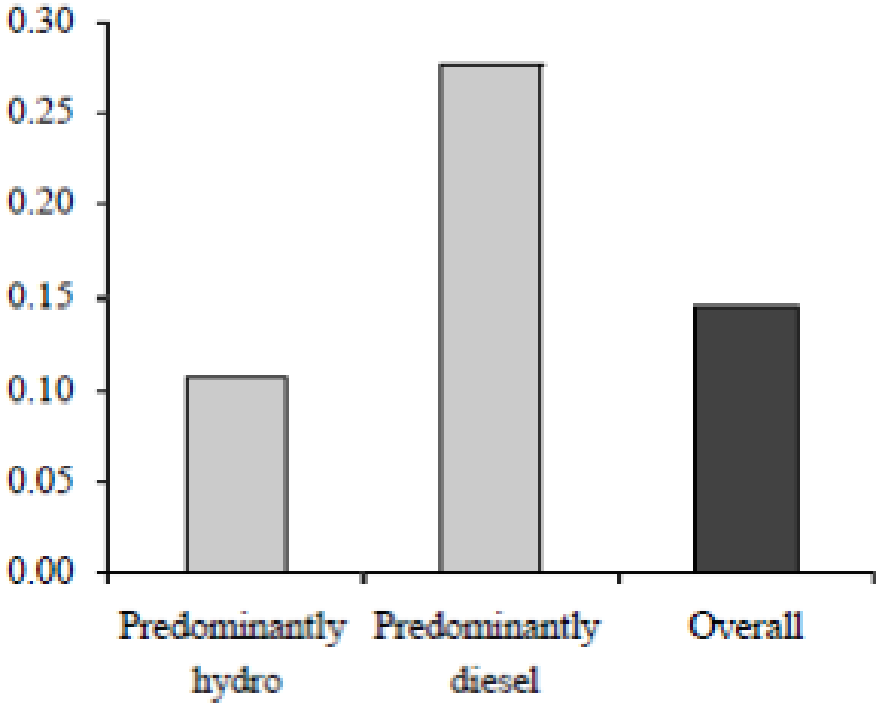


Source: Briceño-Garmendia 2008 and authors' calculations of own-generation costs based on Foster and Steinbuks 2008.

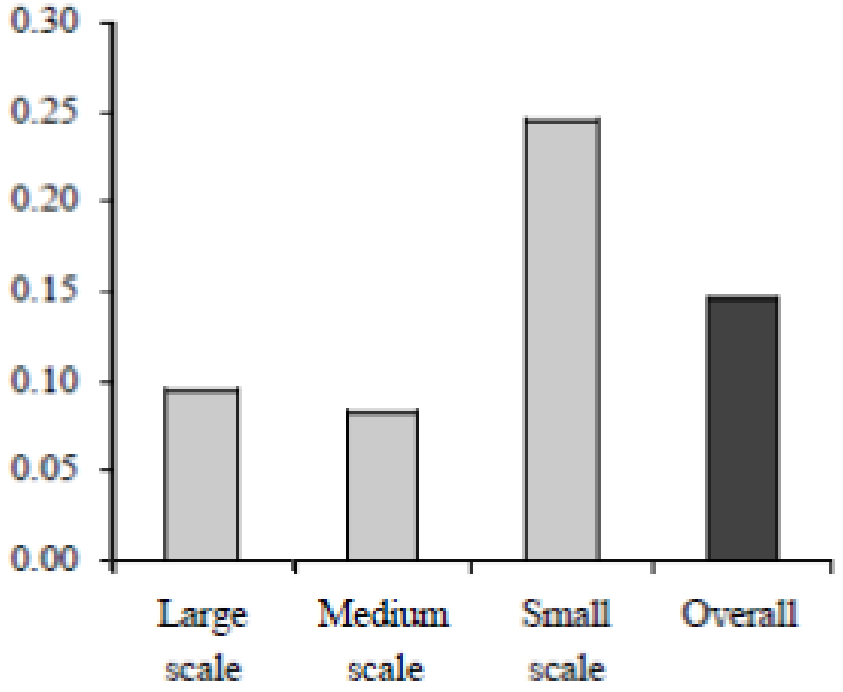
AICD, 2008

Disaggregated operating costs for power systems in SSA, 2005

(a) By technology ($/kWh)



(b) By scale of power system ($/KWh)



AICD, 2008

On the persistence of the energy access and energy security challenge

- Deficit of capital and skills
- Dispersed nature of settlement is problematic
- Sparse settlements also problematic for distribution at cost, in addition to income poverty

...Africa the least urbanized continent..

560 million sub-Saharan Africans lack access to electricity;

almost a perfect fit with rural settlement

What opportunities exist?

- Economic growth in recent years, economic diversification underway
- Productive sector critical for energy access
- New thinking and models in regulations and practices

Policy Experiments in Africa – RE Policies

Country	REGULATOR POLICIES			FISCAL INCENTIVES				PUBLIC FINANCING	
	Feed-in tariff	Biofuels obligation, mandate	Heat obligation, mandate	Tradable renewable energy credits	Capital subsidy, grant or rebate	Investment, production tax credits	Reductions in sales, energy, VAT or other taxes	Public investment, loans or financing	Public competitive bidding
Algeria	X								
Botswana							X		
Egypt					X		X	X	X
Ethiopia		X					X	X	
Gambia							X		
Ghana				X			X		
Kenya	X						X		
Mali							X		
Mozambique		X						X	
Morocco								X	
Rwanda							X	X	
South Africa	X			X	X				X
Tanzania	X				X		X		
Tunisia					X		X	X	
Uganda	X				X		X		
Zambia							X		

What opportunities exist?

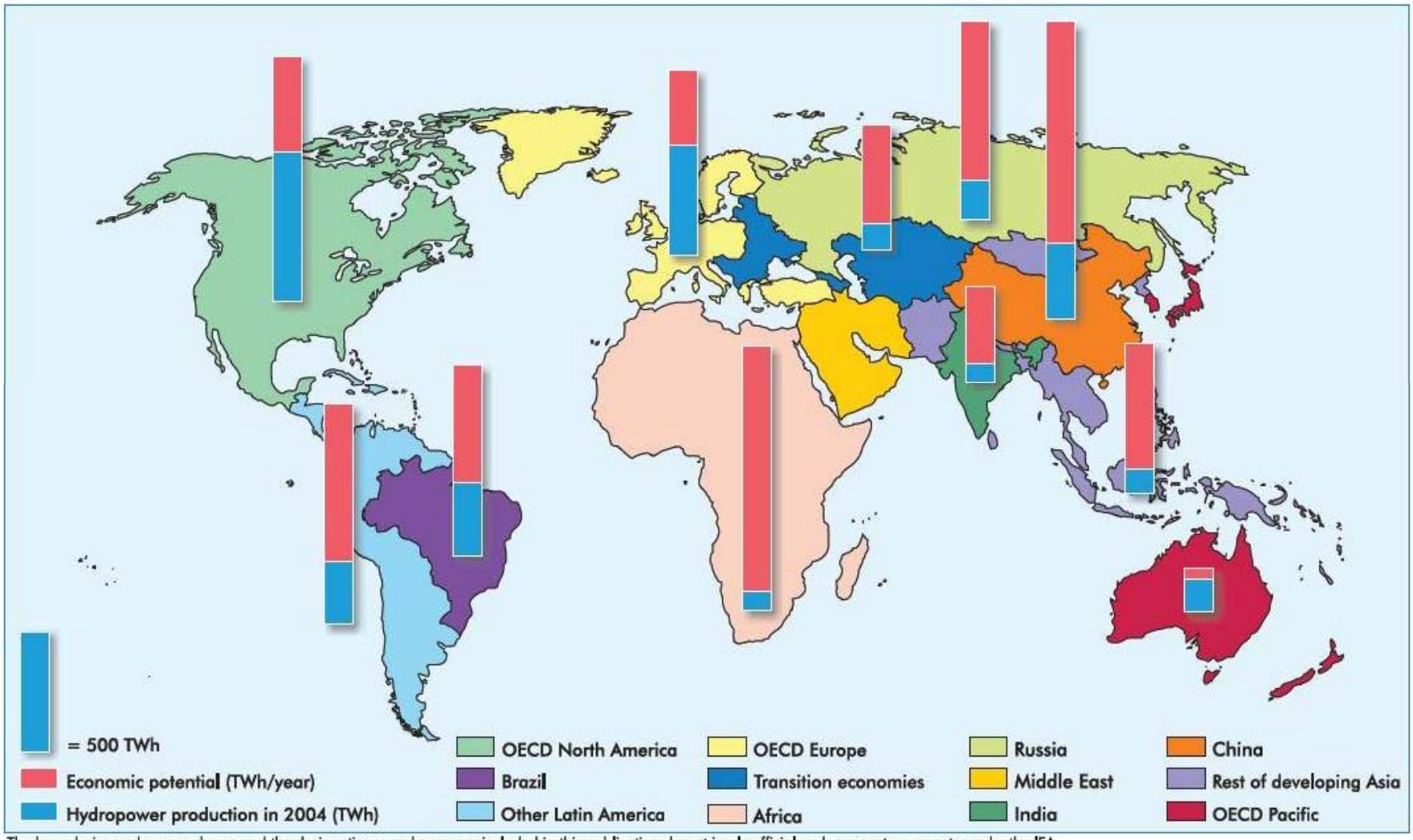
- Considerable natural resource-base
- Regional power pools as new openings

Energy Resource Potential of Africa

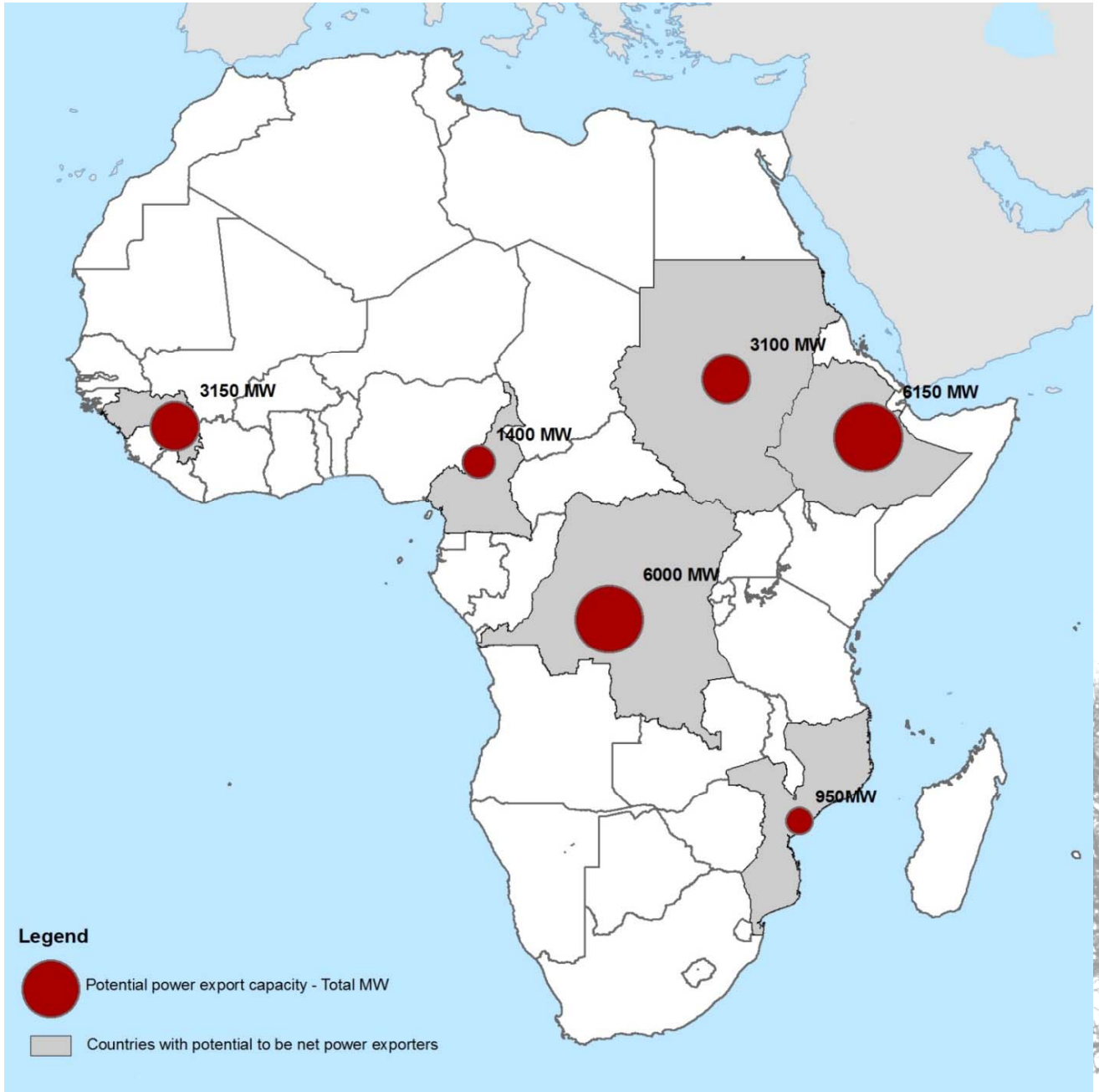
Energy Type	Reserves	Regional Distribution
Hydro	1,834 TWh/yr	Central Africa: 57% Eastern Africa: 32% Other Africa:11%
Biomass	Woody biomass: 70 billion tonnes	All regions
Solar	Solar insolation: 1800 – 2850 kWh/m^2.a	Most of Africa
Wind	Wind speeds: Southern Africa (6 – m/s) Northern Africa (5 – 8.5 m/s)	Most attractive sites in the Northern and Southern coasts.
Geothermal	9,000 MW	Eastern Africa

- Africa also accounts for:
  - 9.5% of proven crude oil reserves in the world (132.1 billion barrels)
  - 8% of proven natural gas reserves in the world (14.7 trillion M3)
  - 4% of proven coal reserves in the world (31,696 billion tonnes)

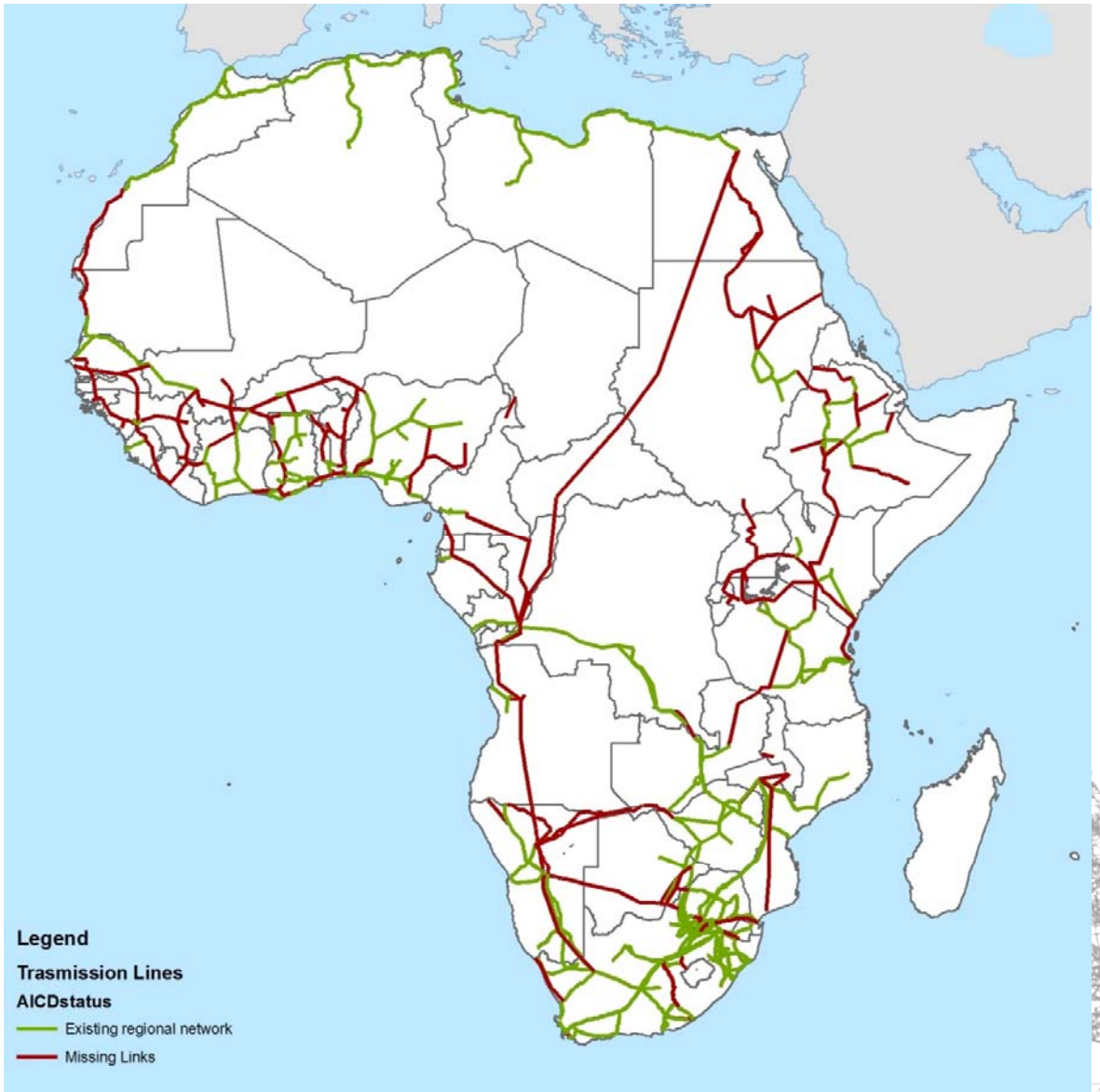
Africa is has a huge hydro-power potential..



Power Export Potential

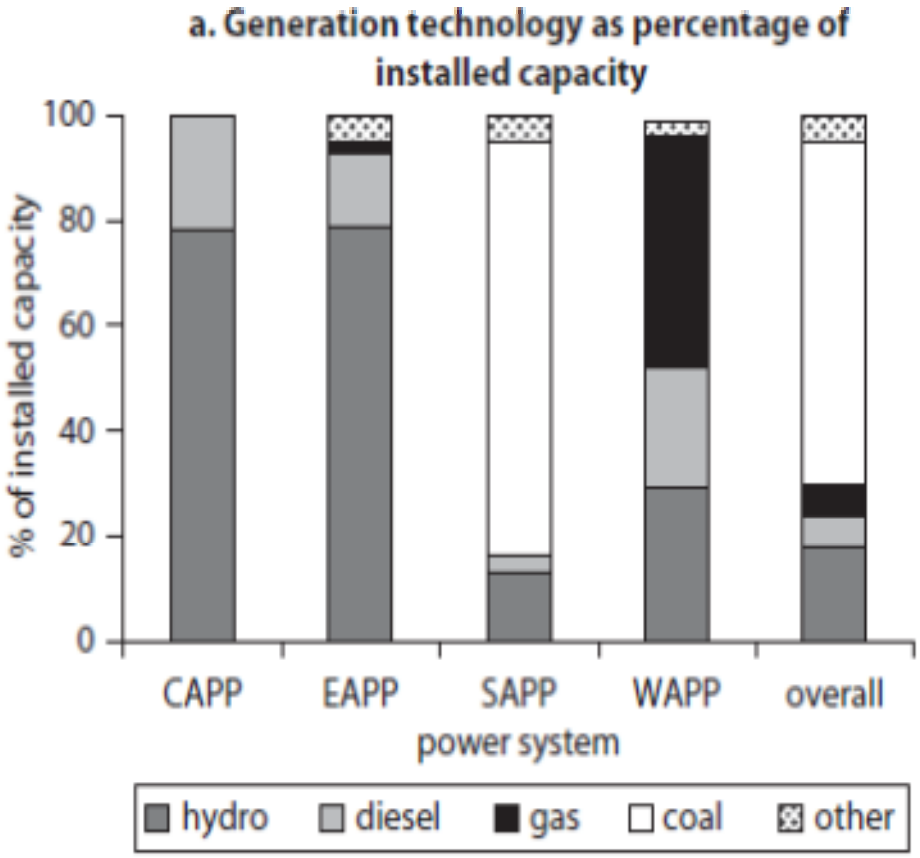


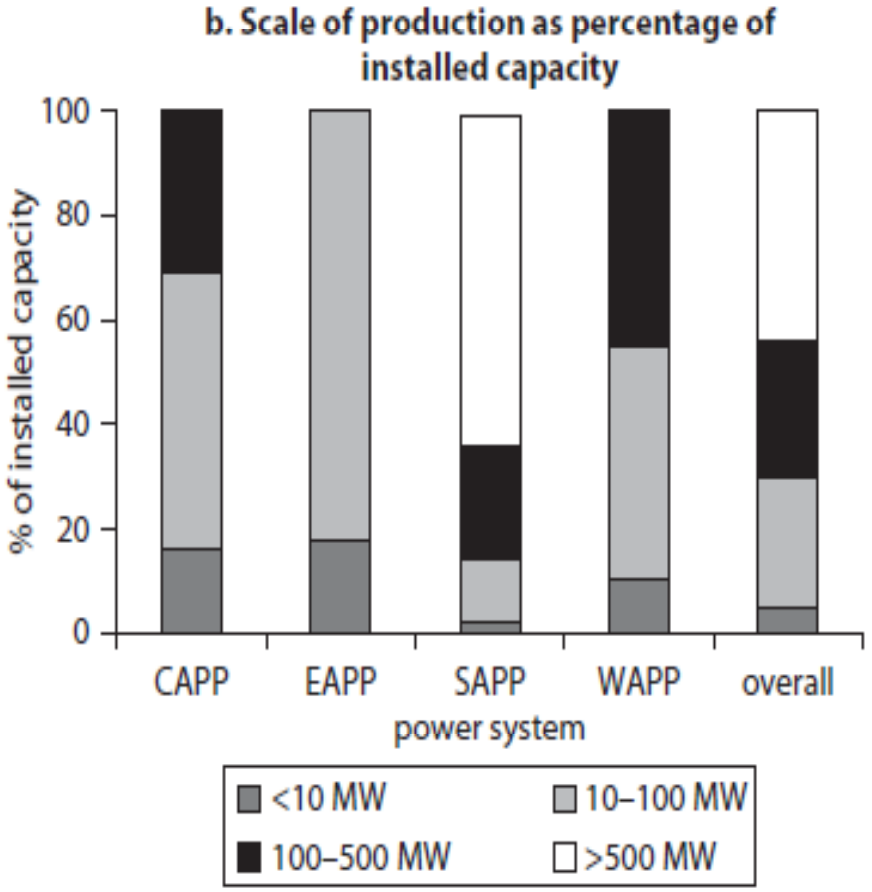
existing regional network



Missing links

Regional power pools





Africa Infrastructure Country Diagnostic, 2010

Climate change obstacles and opportunities?

- Low income countries lowest emitters; and yet are most vulnerable to a changing climate
  - Geographical location characterized by vulnerable areas (drought, flooding, sea level rise)
  - Excessive economic dependence on climate-sensitive sectors
  - Low adaptive capacity to respond effectively to impacts due to climate variability and change
- Energy-development dilemma

Abundance of	Scarcity of
•Renewable energy resources •Increasing hydro-carbons	•Skills •Capital •Governance capacity

- Latecomer advantage but delay (until new technologies, know-how and/or finance is available) is expensive, i.e high social discount
- Countries can capitalize on comparative advantage – Rail in Ethiopia
- Global partnership critical

Some suggestions for energy transformation?

- A number of actions need to come together
- Recognize that the energy problem is an outcome of failure of governance and try to correct it, taking into account country specific conditions – VISION SETTING/ownership (Rwanda)
- Fit for purpose policies – look beyond statements and include realistic and achievable targets with mid-term reviews (Ethiopia)
  - how policies are formulated is critical and the involvement of various actors is central (policy dialogue and build policy coalitions);
  - Address fragmentation;
  - Space for both centralized and decentralized options;
  - Well-targeted subsidies;
  - Policy coherence between access, security and sustainability
- Build robust (but flexible) institutional landscape at different levels to implement policies – the energy problem in LDCs is not only at national level but goes down to community level

Some suggestions for energy transformation?

- Strengthen knowledge institutions to provide input into national energy actions (with appropriate incentives) - Brazil
- Deal with full energy chain, but understand entry point(s) (Senegal)
- Sectoral energy strategies – nexus
- Finance is critical – what works is what matters and not what is ideologically convenient.
  - How to unlock domestic finance through innovative regulatory systems?
  - How to work with international partners?
- 'Think bold and act fast' – losses due to inaction are significant both in economic and wellbeing terms
  - Short-term imperatives & longer-term perspectives

Africa and other low income countries could try to do better in the pursuit of their development goals

Low carbon options could deliver good outcomes with global and local benefits

Gao Xiqing of the China Investment Forum at World Economic Forum 2012, speaking to African leaders “Do not necessarily do what we did. Policies of “sheer economic growth” should be avoided. We now suffer pollution and an unequal distribution of wealth and opportunities… You have a clean sheet of paper here. Try to write something beautiful.”

United Nations
Economic Commission for Africa

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Climate Change Meets Policy