9-17-2012

SLIDES: Impacts of Energy Deficits in Cooking, Illumination, Water, Sanitation, and Motive Power

Paul S. Chinowsky

Follow this and additional works at: http://scholar.law.colorado.edu/energy-justice-conference-and-technology-exposition

Part of the Business Law, Public Responsibility, and Ethics Commons, Energy Law Commons, Energy Policy Commons, Entrepreneurial and Small Business Operations Commons, Environmental Engineering Commons, Environmental Health and Protection Commons, Environmental Law Commons, Environmental Policy Commons, Environmental Public Health Commons, International Business Commons, International Law Commons, International Public Health Commons, Power and Energy Commons, Science and Technology Commons, Sustainability Commons, Transportation Commons, Water Law Commons, and the Women's Health Commons

Citation Information
http://scholar.law.colorado.edu/energy-justice-conference-and-technology-exposition/13

Reproduced with permission of the Getches-Wilkinson Center for Natural Resources, Energy, and the Environment (formerly the Natural Resources Law Center) at the University of Colorado Law School.
Impacts of Energy Deficits in Cooking, Illumination, Water, Sanitation, and Motive Power

Paul S. Chinowsky
Mortenson Center for Engineering in Developing Communities
Institute for Climate and Civil Systems (iClics)
University of Colorado
The Impact of Energy Deficits

• Individual Perspective
• Community Perspective
• National Perspective
• International Perspective
Individual Perspective

• Energy Affects Everything
  – No Refrigeration - Vaccines
  – No Illumination – Productivity and Education
  – Lack of Telecommunications
  – Lack of Pumping Infrastructure
  – Need for Natural Resources for EVERYTHING
Individual Impact

• Children exposed to open-fire cooking in developing countries experience difficulty with memory, problem-solving and social skills.

• 75 percent of Sub-Saharan Africans, or 550 million people, do not have access to electricity. In South Asia, some 50 percent, or 700 million people, lack access.

• Energy investment is also falling in industrialized countries
The Development Dilemma

- Who are we trying to help?
- What are we trying to achieve?
- What are we trying to influence?
- What is the broader legacy?
The Vertical Placement

- World Bank
- United Nations

[Diagram showing vertical placement with categories: National, Regional, Community, Individual, Dams, Power Networks, Highway Corridors, and a note on Funding]
Infrastructure Planning

Planning requires long-term Outlooks

- Roads – 20-30 years
- Buildings – 30 – 50 years
- Dams – 100 years
Community Focus

- Shelter
- Governance
- Natural Resources
- Infrastructure
- Health
- Economy
- Education
- Food Security

Focus on Community
Education
Food Security
Governance
Natural Resources
Infrastructure
Shelter
Health
Community Focus
Economy
Education
Community Focus
Shelter
Food Security
Governance
Natural Resources
Infrastructure
Health
Community Focus
Economy
The Development Dilemma

• Who are we trying to help?
• What are we trying to achieve?
• What are we trying to influence?
• What is the broader legacy?
A Lack of Infrastructure Resources

WHAT HAPPENS WHEN WE FORGET
## Background: Africa

<table>
<thead>
<tr>
<th>Normalized units</th>
<th>African low-income countries</th>
<th>Other low-income countries</th>
<th>African middle-income countries</th>
<th>Other middle-income countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paved-road density</td>
<td>34</td>
<td>134</td>
<td>284</td>
<td>461</td>
</tr>
<tr>
<td>Total road density</td>
<td>150</td>
<td>29</td>
<td>381</td>
<td>106</td>
</tr>
<tr>
<td>Main-line density</td>
<td>9</td>
<td>38</td>
<td>142</td>
<td>252</td>
</tr>
<tr>
<td>Mobile density</td>
<td>48</td>
<td>55</td>
<td>277</td>
<td>557</td>
</tr>
<tr>
<td>Internet density</td>
<td>2</td>
<td>29</td>
<td>8.2</td>
<td>235</td>
</tr>
<tr>
<td>Generation capacity</td>
<td>39</td>
<td>326</td>
<td>293</td>
<td>648</td>
</tr>
<tr>
<td>Electricity coverage</td>
<td>14</td>
<td>41</td>
<td>37</td>
<td>88</td>
</tr>
<tr>
<td>Improved water</td>
<td>61</td>
<td>72</td>
<td>82</td>
<td>91</td>
</tr>
<tr>
<td>Improved sanitation</td>
<td>34</td>
<td>53</td>
<td>53</td>
<td>82</td>
</tr>
</tbody>
</table>

Source: Yepes, Pierce, and Foster 2008.
Note: Road density is measured in kilometers per 100 square kilometers of arable land; telephone density in lines per thousand population; generation capacity in megawatts per million population; electricity, water, and sanitation coverage in percentage of population.
Some Statistics on Current Infrastructure

- **Electricity**
  - All of Africa (800 million ppl) has similar power generation to Spain (45 million ppl)
    - Equal to 3 hours of 1 100-watt lightbulb per person per day

- **Phones**
  - 1999-2006: 100 million new subscribers to mobile phones
  - In many countries: more access to phones than piped water!

- **Roads**
  - 1/3 of rural Africans don’t have 2 km access to all-season roads (MDG goal)
  - Asset value of many road networks exceed 30% of country’s GDPs
    - Presents a HUGE maintenance issue

- **Farmland**
  - Less than 5% of farmland is irrigated (accounts for >20% of farm revenue)
Access to Basic Services

- If current trends continue, it will take 50 years for universal access to services in Africa
  - Due to population growth, urban coverage has decreased in recent years

Figure 1: Access to household services

(a) Rural-urban divide
(b) Stagnant trends

Source: Banerjee and others, 2008.
Figure 2  Africa’s *regional* infrastructure challenge

(a) ICT: closing the circle

(b) River basins: managing commons
Roads & Power: Existing and Needed

(c) Roads: connecting the dots
(d) Power: toward regional pools

Estimated Needs

- Estimated $75 million USD/annum to bridge the gap in Africa’s infrastructure needs
- Equal amounts needed for New Expenditure and O&M
- 50% needed for Power infrastructure investments
- This adds up to 12% GDP per country average
  - Over 40% GDP for fragile states

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Infrastructure spending needs for Sub-Saharan Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>US$ billion per year</td>
</tr>
<tr>
<td></td>
<td>Capital expenditure</td>
</tr>
<tr>
<td>ICT</td>
<td>0.8</td>
</tr>
<tr>
<td>Irrigation</td>
<td>0.7</td>
</tr>
<tr>
<td>Power</td>
<td>23.2</td>
</tr>
<tr>
<td>Transport</td>
<td>10.7</td>
</tr>
<tr>
<td>WSS</td>
<td>2.7</td>
</tr>
<tr>
<td>Total</td>
<td>38.1</td>
</tr>
</tbody>
</table>

Source: Briceno-Garmendia and others, 2008.
Note: Figures refer to investment (except public sector) and include recurrent spending. Public sector covers general government and nonfinancial enterprises.
Regionalism

The Current Gap

• Infrastructure is highly fragmented (legacy of colonialism)
  – Extremely low levels of inter-regional: power, transport, and fiber optic systems
  – 2008: only 16% of power generated is traded (all to/from South Africa)

• BUT: inter-regional development is key: most economies are too small to develop and support major systems
  – 60% of hydro-electric power potential in SSA is in Ethiopia and the Democratic Republic of Congo

To Close the Gap

– USD$500 million/annum invested in 28 GW of interconnectors to make Africa regional power pools connect and reduce cost from $0.30 kw/h to $0.10 kw/h

– Est. return of up to 160%
Impact

• Lack of infrastructure is a major constraint to doing business
  – Reduces firm productivity by 40%
  – Equal to: Corruption, Crime, Red Tape and limited Finance Markets
  – “Power” is the #1 most limiting factor
    • Electricity, internet, etc.
How to Address Necessary Changes?

- More Funding?
- Better Governance?
- Private or Public?
Current Spending

- Current expenditure on infrastructure could increase by 50% with *no added funding increase*

  By:
  - Addressing institutional bottlenecks;
  - Better planning;
  - Earlier completion of feasibility studies,
  - Efficient procurement processes;
  - Move to multi-year (medium term) budgeting

![Diagram showing infrastructure spending by type of country](image)
There is No Single Solution to Ending Poverty
The Development Dilemma

• Who are we trying to help?
• What are we trying to achieve?
• What are we trying to influence?
• What is the broader legacy?
Paul S. Chinowsky
paul.chinowsky@colorado.edu

Mortenson Center for Engineering in Developing Communities
Institute for Climate and Civil Systems (iClics)
University of Colorado