“Power Sector Reform in Developing Countries”

Lessons from a Comparative Study of
Brazil, China, India, Mexico and South Africa

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What Have We Learned?
Overview of my Comments

1. Causes of Reform
   - ➢ From **state-centered** to **market-oriented** power systems
2. Pace and Character of Reform
   - ➢ Reform is **slow**
3. Outcomes
   - ➢ Most reforms get **stuck** part-way
   - ➢ Regulators are **critical** but rarely empowered
   - ➢ Low-income users are generally **not harmed** by reform

Standard Textbook Model for Reform: four “easy” steps

1. Unbundle	Separate generating, transmitting, distributing and marketing electricity.
2. Privatize	Sell those parts of the system amenable to competition.
3. Create Markets	Open power generation and marketing to competitive firms.
4. Create Regulatory Institutions	Set-up independent regulators to oversee conduct in the industry and regulate the monopoly-prone parts of the business .

1. Causes of Reform

- In the advanced industrialized nations
  - Origins: new ideas about economic organization
  - Goal: economic efficiency
  - Expected outcome: tariff *reductions*
  - Politics: relatively easy to build support
- In these five developing countries
  - Origins: economic and power crisis
  - Goal: financial solvency and investment
  - Realistic outcome: tariff *increases*
  - Politics: very difficult

Reform Strategies: No Textbook Model

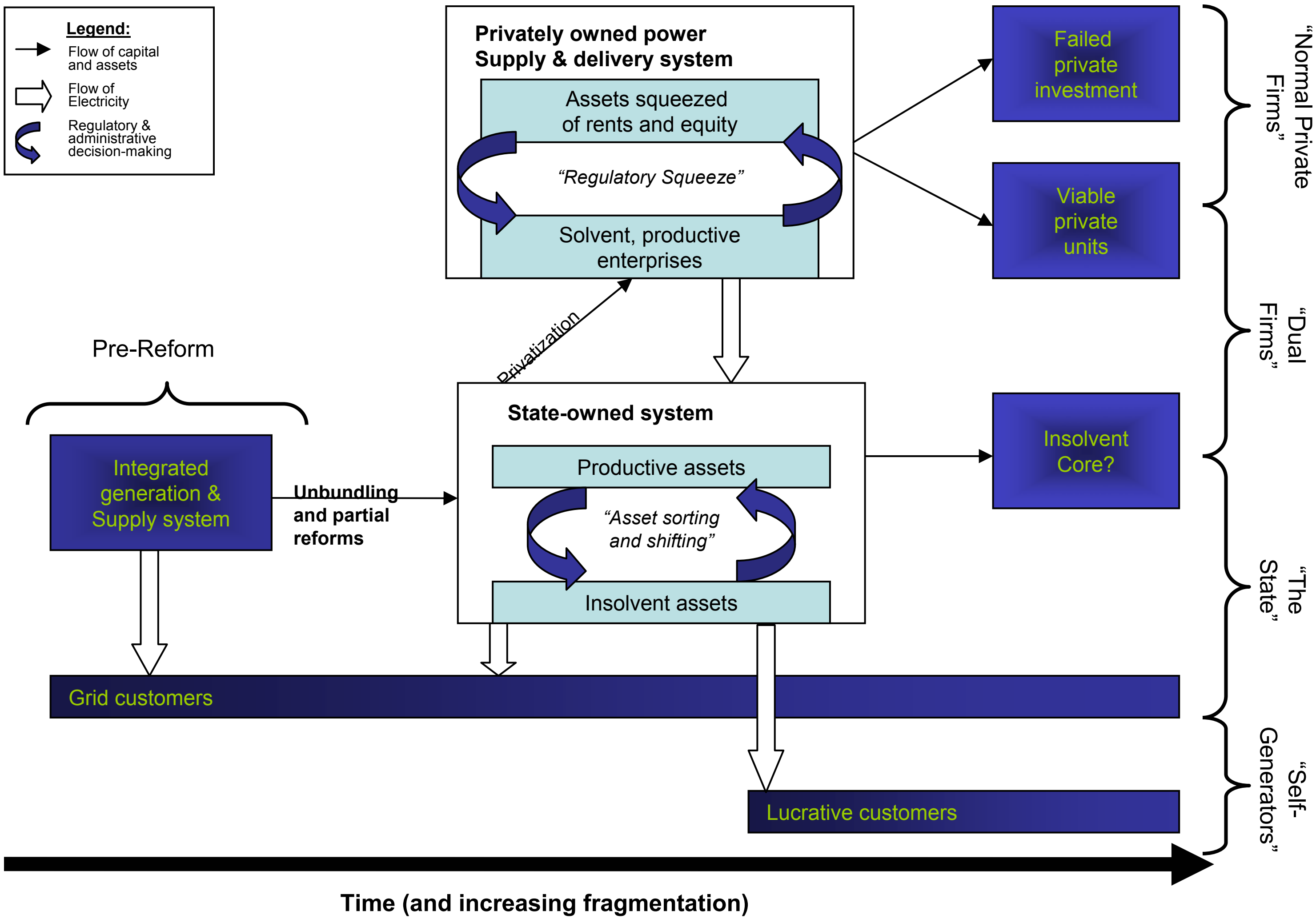
Country	Strategy
Brazil	Privatization of distribution and generation companies to raise money; allowance for IPPs; creation of hydro system operator; independent regulator
China	Reform at the margins (IPPs) and corporatization of state enterprises to raise money; nascent independent regulator
India	Reform at margins (IPPs and guaranteed returns for national power corporation) then seek private management of distribution; independent regulator.
Mexico	Reform at the margins (IPPs); reforms stalled due to political and constitutional barriers; independent regulator
South Africa	Aggressive electrification; redrawing of boundaries for distributors; corporatization of utility; independent regulator; IPPs expected

2. Pace and Character of Reforms

- Reform is slow, because…
- Electricity Reforms depend on other reforms
  - Finance
    - Soft budgets of state companies kill competition
  - Judicial delegation
    - Independent regulators
  - Factor Markets
    - Labor; fuels
  - Corporate Governance and accounting
    - Essential for regulatory oversight and private investment
  - Competition Policy
    - No evidence yet—no markets
  - Contrast w/ OECD
    - reform with “rule of law,” market institutions, and independent financial sectors <u>already in place</u>

3. Outcomes: Market Structure

- Emergence of “dual markets”
  - Partially state-controlled
    - Soft budgets; tariffs
    - Highly political allocation of rents
  - Partially market
    - Project and concession bidding
    - Market experiments
      - E.g., Six provinces in China (1999-2001)
  - <u>Not</u> a transient outcome, but stable equilibrium


Legend:
Flow of capital and assets
Flow of Electricity
Regulatory & administrative decision-making
Privately owned power Supply & delivery system
Assets squeezed of rents and equity
"Regulatory Squeeze"
Solvent, productive enterprises
Failed private investment
Viable private units
Privatization
Pre-Reform
Integrated generation & Supply system
Unbundling and partial reforms
State-owned system
Productive assets
"Asset sorting and shifting"
Insolvent assets
Insolvent Core?
Grid customers
Lucrative customers
"Normal Private Firms"
"Dual Firms"
"The State"
"Self-Generators"
Time (and increasing fragmentation)

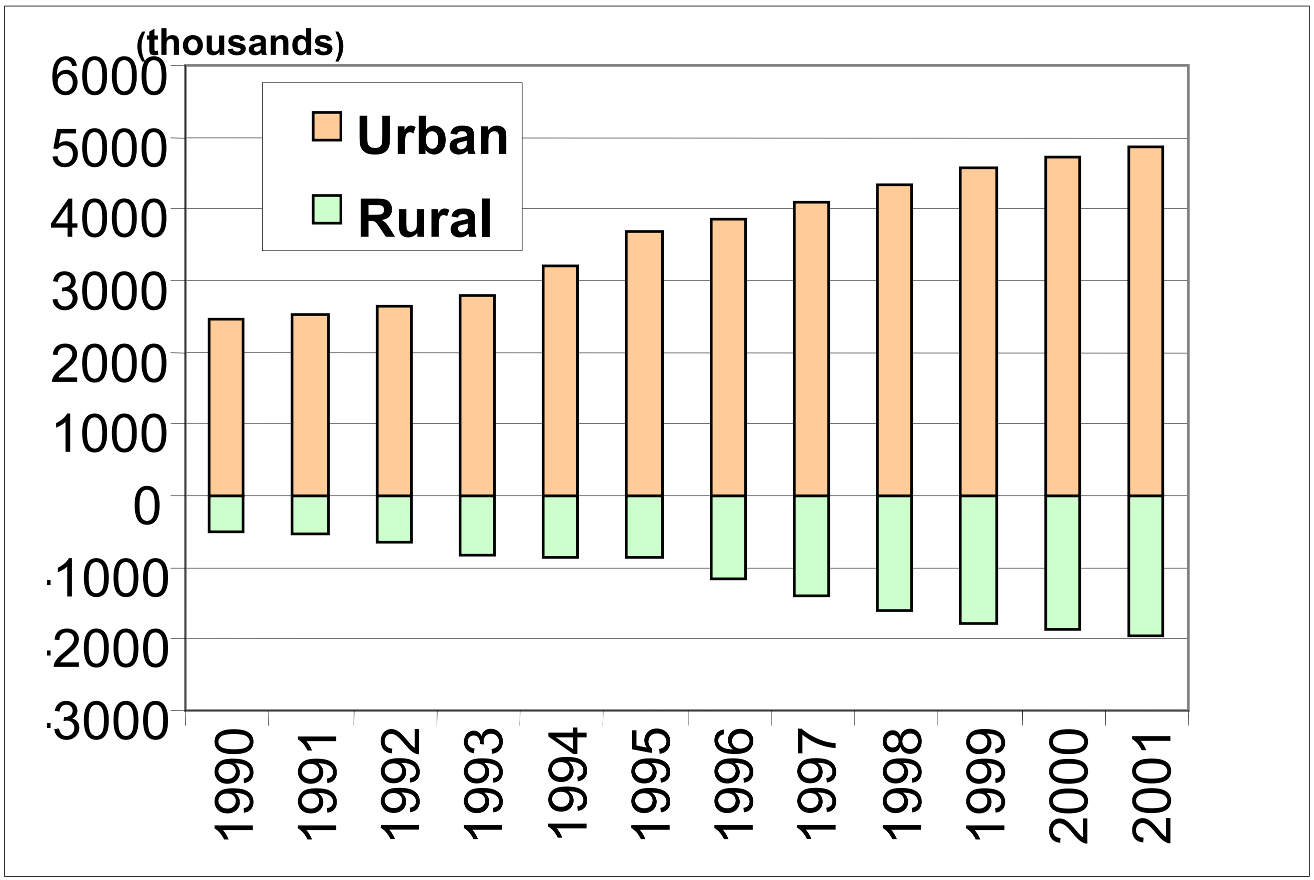
3. Outcomes: Regulation

- The Need for Regulatory Credibility
  - Even the best cases yield weak & uneven regulators
    - India (compare across states)
    - Brazil (ANEEL's inconvenient rulings)
  - Developing country regulators learn more from each other than from OECD "capacity building"

3. Outcomes: Energy Services for the Poor

- Fear that reform would undermine the social contract
  - Energy services for the poor
  - Environmental protection
  - Investment in R&D
- Outcomes mixed
  - Special programs to advance energy services for the poor
  - Environmental rules strengthened (and gas helps)
  - R&D mixed story (contrast U.S. with developing countries)

Cause: Policy
South Africa's National Electrification Achievement



Source: Gaunt, Load Research Programme, Energy Research Centre - Cape Town South Africa

Conclusions

- Most Market Reforms have not yet been "successful"
  - Reform is slow
  - Outcomes allow "dual firms" to dominate
  - Real markets are rare

- Market reforms tend to create weak links
  - Insolvent state companies; usually distributors

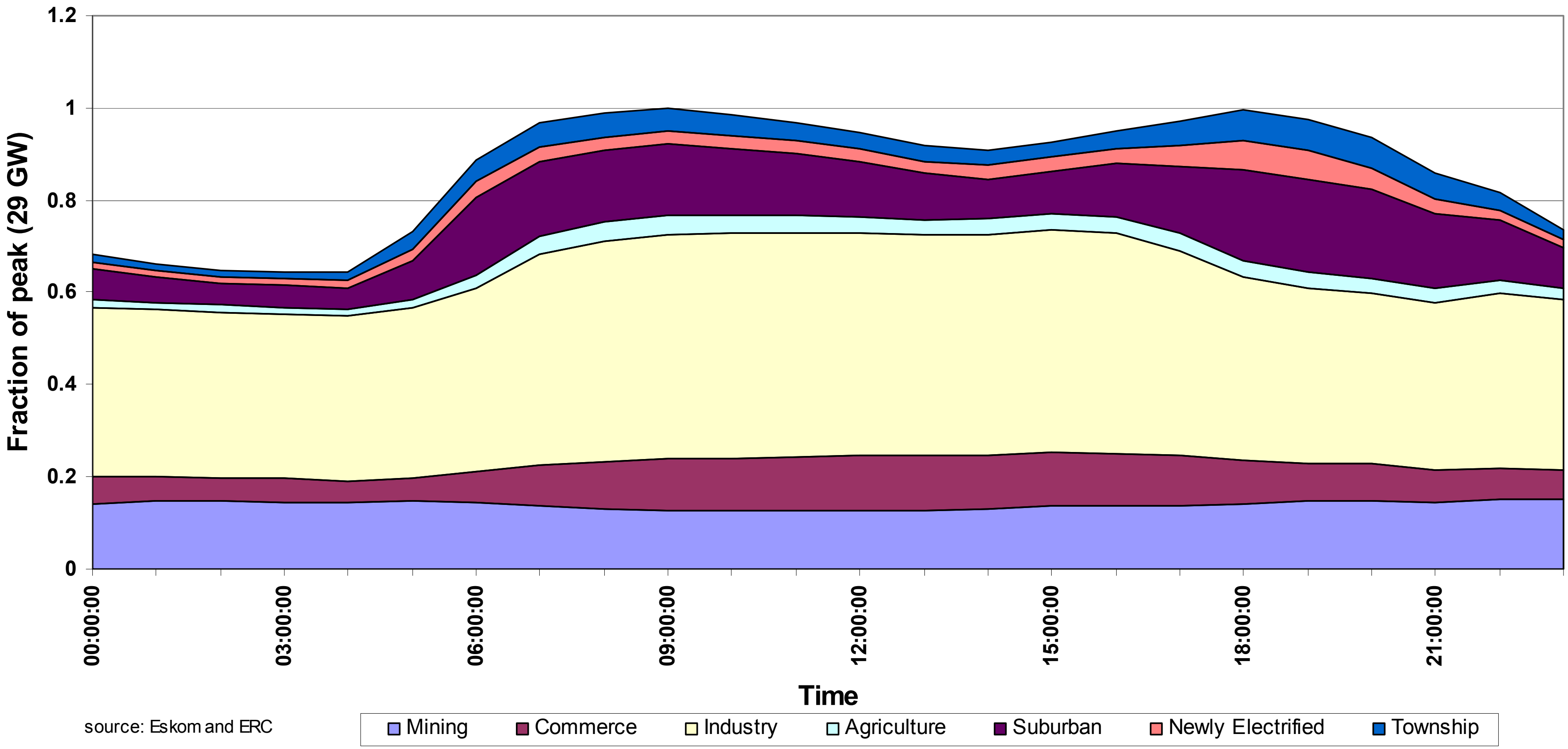
- Independent regulators are essential
  - Yet true empowerment is difficult

Supplemental slides

PESD Research Platforms

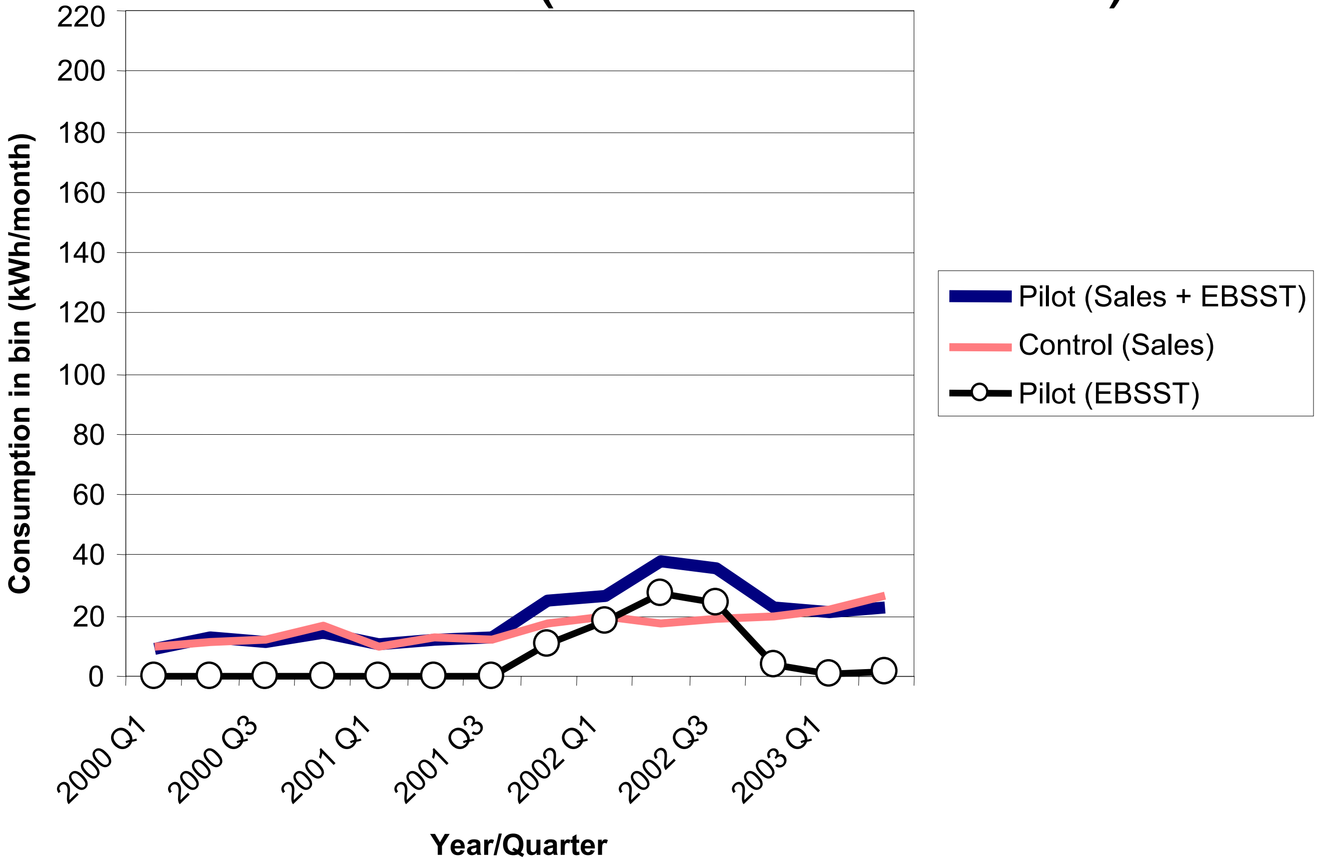
1. **Electricity Market Reforms**
   – Five-country comparison (Brazil, China, India, Mexico, South Africa)
   – Independent Power Producers (IPPs) in 12 countries
2. **Energy Services for the Very Poor**
   – Shift from traditional to modern fuels and technologies
3. **Geopolitics of Natural Gas**
   – Past and future of large pipelines and LNG
   – Gas demand in China and India
4. **Climate Change Policy**
   – Beyond Kyoto
   – Engaging developing countries
5. **National Oil Companies**
   – Causal relationship between strategies, political influence and performance
   – Studies underway on 14 countries

Peak winter load in South Africa (2002)



source: Eskom and ERC

South Africa’s Free Electricity Experiment: Measured Effects (7-15 kWh/month)

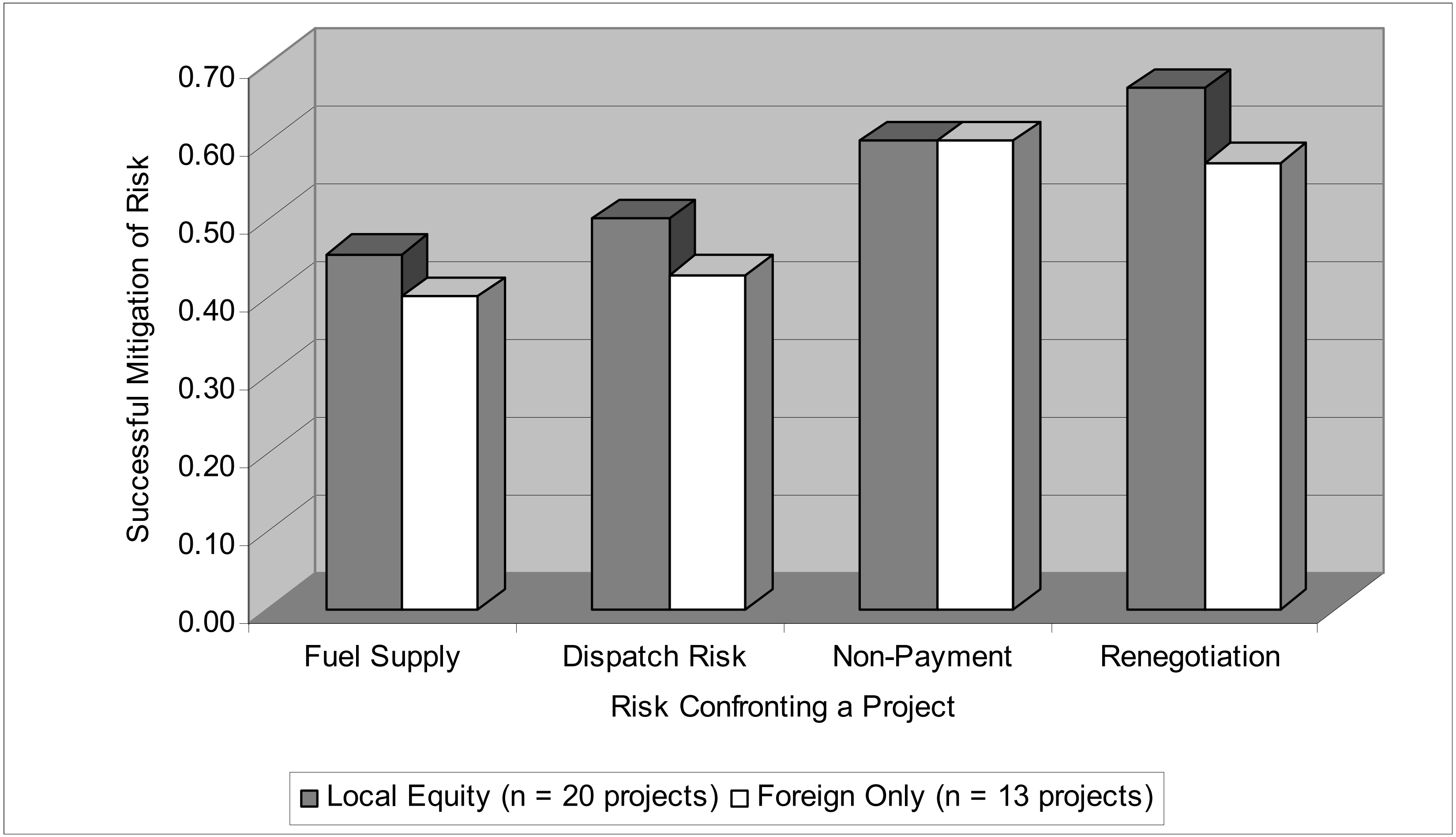


Source: Gaunt. Load Research Programme, Energy Research Centre - Cape Town South Africa.

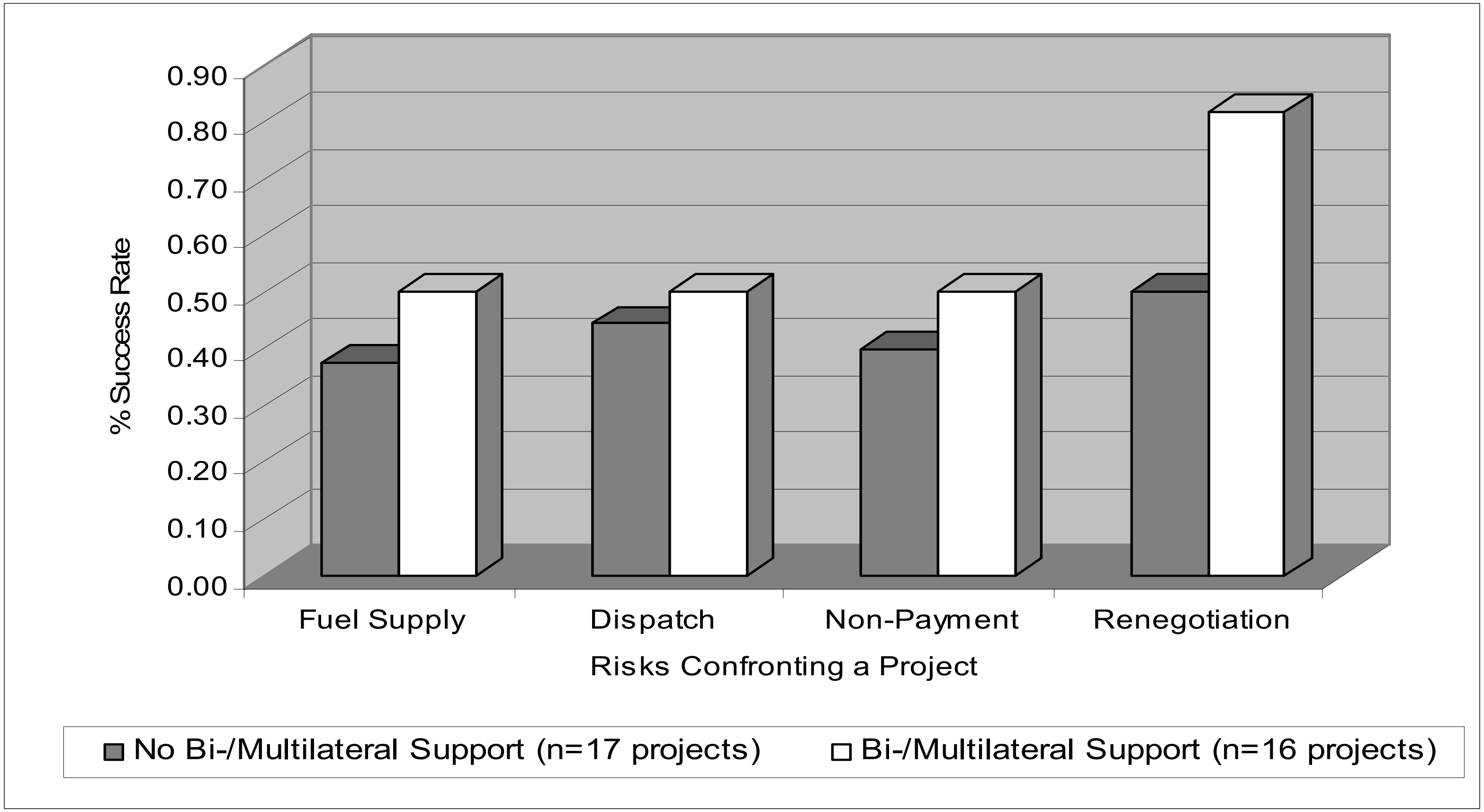
The Two Dimensions of IPP Outcomes

	Country Outcome POSITIVE	Country Outcome NEGATIVE
Investor Outcome POSITIVE	Country attracts competitive and sustainable investment. Projects are paid and enforced as originally agreed.	Country IPP obligations excessive, unnecessary or expensive. Projects are paid and enforced as originally agreed.
Investor Outcome NEGATIVE	Country attracts investment that produces electricity. Private investors are squeezed out in favor of other actors.	Country IPP obligations excessive, unnecessary; or mismanagement deters future investment. Private investors are squeezed out in favor of other actors.

Risk Mitigation Effects of Local Partners



Risk Mitigation Effects of International Lenders



Electricity Market Context for IPPs

Argentina (16+) **1992**	**1992**	**IPPs developed in privatized electricity market, selling in highly competitive contract and spot markets.**
Brazil	**1995**	**IPPs developed in partially private electricity market, selling to distribution companies and large users.**
China (32) **1985**	**1985**	**IPPs developed in reforming electricity market, selling to provincial power authorities.**
Egypt (3) **1998**	**1996**	**IPPs developed in unreformed electricity market, selling to vertically integrated national utility holding company.**
India (16) **1991**	**1991**	**IPPs developed in reforming electricity market, selling to state electricity boards.**
Kenya (4) **1996**	**1996**	**IPPs developed largely unreformed electricity market, selling to state transmission and generation monopoly.**
Malaysia (13) **1993**	**1993**	**IPPs developed in unreformed electricity market, selling to vertically integrated national utility.**
Mexico (16) **1995**	**1992**	**IPPs developed in unreformed electricity market, selling to vertically integrated national utility.**
Philippines (45) **1988**	**1988**	**IPPs developed in unreformed electricity market, selling to national generation and transmission utility.**
Poland (3) **1997**	**1997**	**IPPs developed in reforming electricity market, selling to a national grid operator; ongoing reform has led to stranded cost problems.**
Thailand (7) **1997**	**1994**	**IPPs developed in unreformed electricity market, selling to national generation and transmission utility.**
Turkey (9) **1994**	**1984**	**IPPs developed in unreformed electricity market, selling to national utility.**

Project Name	Country	Fuel	MW	Cost US$	$/MW	COD	Foreign Sponsor	Local Sponsors
Termoceará	Brazil	Nat'l Gas	290MW	$100	$345	2001	MDU Resources	EBX Capital
Macaé	Brazil	Nat'l Gas	928MW	$730	$787	2001	El Paso Energy	--
Norte Fluminense	Brazil	Nat'l Gas	780MW	$887	$1137	2004	Electricite de France	--
Uruguaiana	Brazil	Nat'l Gas	600MW	$350	$583	2000	AES Corp.	--
Caña Brava	Brazil	Hydro	450MW	$426	$947	2002	Tractebel Energia	--
Shajiao C	China	Coal	1980MW	$1,870	$944	1996	CEPA → Mirant	Guangdong gov't
Meizhouwan	China	Coal	724MW	$755	$1043	2001	Intergen, El Paso, Lippo	--
Shandong Zhonghua	China	Coal	3000MW	$2,200	$733	2003	CLP, EDF	Shandong gov't
Sidi Krir	Egypt	Nat'l Gas	685MW	$418	$610	2002	Intergen	--
Suez	Egypt	Nat'l Gas	683MW	$340	$498	2003	EDF	--
Port Said	Egypt	Nat'l Gas	683MW	$338	$495	2002	EDF	--
GVK Jegurupadu	India	Nat'l Gas	216MW	$261	$1208	1996	CMS	GVK
Lanco Kondapalli	India	Nat'l Gas	250MW	$285	$1140	2000	CDC Globeleq	Lanco
Essar Power	India	Naphtha/Gas	515MW	$514	$998	1995	--	Essar Steel
CLP Paguthan	India	Naphtha/Gas	655MW	$734	$1121	1998	Powergen → CLP	--
PPN	India	Naphtha/Gas	330MW	$252	$764	2001	El Paso, PSEG, Marubeni	Reddy Group
ST-CMS	India	Coal	250MW	$320	$1280	2002	CMS	ST Power
IberAfrica	Kenya	Diesel	44MW	$65	$1477	1997	Union Fenosa	KPLC Pension
Tsavo	Kenya	Diesel	75MW	$85	$1133	2001	Cinergy, CDC, Wartsila, IFC	IPS (Agha Khan)
Monterrey III	Mexico	Nat'l Gas	1190MW	$610	$513	2001	Iberdrola	--
Rio Bravo II	Mexico	Nat'l Gas	568MW	$234	$412	2002	EDF	--
Merida III	Mexico	Nat'l Gas	530MW	$260	$491	2000	AES, Nichimen	Grupo Hermes
Navotas I	Phil.	Diesel	210MW	$40	$190	1991	CEPA → Mirant	--
Pagbilao	Phil.	Coal	700MW	$888	$1269	1996	CEPA → Mirant	--
Quezon	Phil.	Coal	460MW	$895	$1946	2000	Intergen, Ogden	PMR Resources
Casecnan	Phil.	Hydro	140MW	$495	$3536	2001	CalEnergy, Peter Kiewit	LA Prairie, San Lorenzo
Cavite	Phil.	Diesel	63MW	$22	$349	1995	CMS → Covanta	--
ENS	Poland	Nat'l Gas	116MW	$132	$1138	2000	Enron (Prisma)	JAC International
Elcho	Poland	Coal	220MW	$324	$1473	2003	PSEG	EC Chorzow
Eastern Power	Thailand	Nat'l Gas	350MW	$250	$714	2003	Marubeni	GMS
Independent Power	Thailand	Nat'l Gas	700MW	$369	$527	2000	Unocal, Westinghouse	Thai Oil
Gebze, Adapazari, Izmir	Turkey	Nat'l Gas	3860MW	$2000	$518	2002	Intergen	Enka
Trakya Elektrik	Turkey	Nat'l Gas	478MW	$600	$1255	1999	Enron (Prisma)	Gama

World Forum on Energy Regulation III

Project Name	Country	Fuel	MW	Cost US$	$/MW
Termoceará	Brazil	Nat'l Gas	290MW	$100	$345
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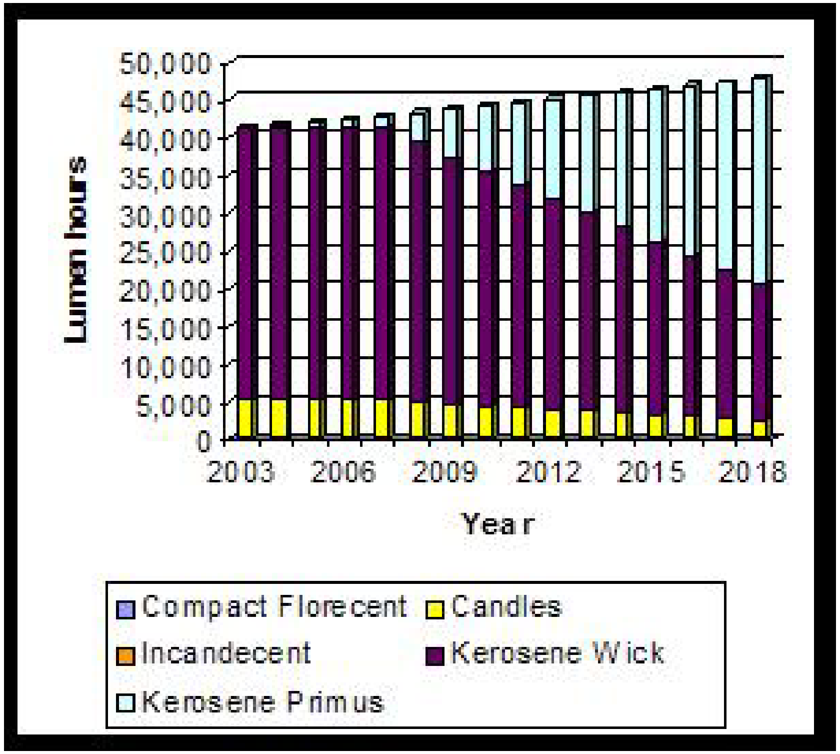
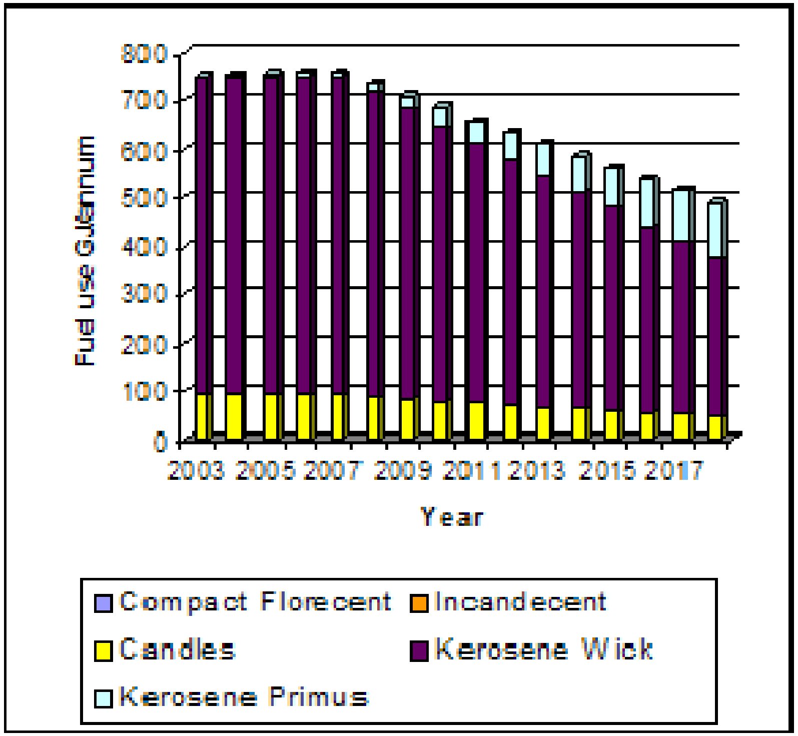
Cost-saving Alternatives to Free Electricity: LPG

Peak Co-incidence Factor	Annualized Savings (Rand)
100%	401
90%	353
80%	305
70%	258
60%	210
50%	162

Source: Howells et al., 2005. Draft

Lighting Efficiency for a Rural Village in South Africa: Base Case lighting services and fuel use



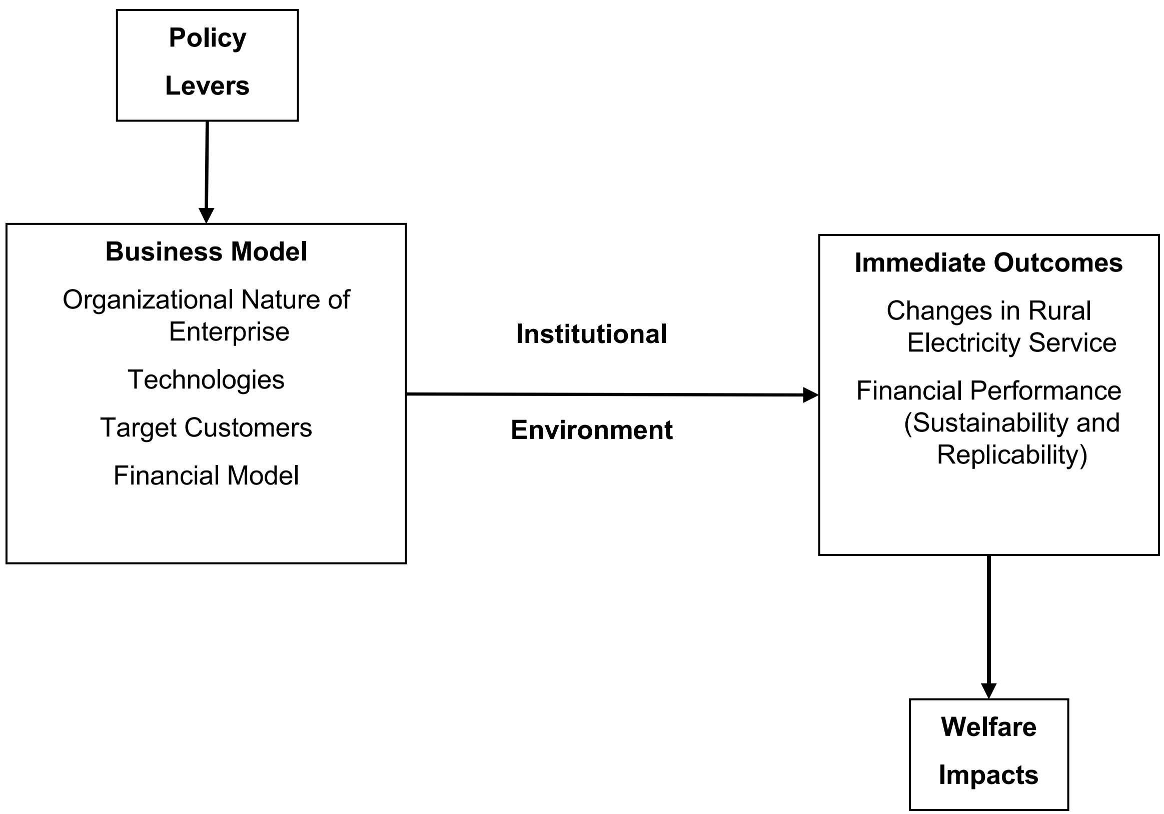


Source: Howells et al., WP18, PESD (http://pesd.stanford.edu)

The Role of Distributed Power Generation

- Institutional, financial and technical impediments to rural electrification
- Rural populations are dispersed, small consumers and low-income
  - poor customers for grid based systems
- Distributed Power Generation:
  - Variety of technology options (renewable and non-renewable, isolated and mini-grid)
  - Variety of business model options (centralized vs. decentralized, governmental vs. non-governmental)
  - Can aid end-use customers in improving access and quality

Research Outline: Linking Distributed Rural Electrification Policies to Welfare Impacts



360 kW Small Hydro Unit in Zhejiang Province, China (Total Plant Capacity 1.18 MW)

One of 40,000 plants providing 28 GW of power in rural China