How to Improve the Performance of Infrastructure Service Providers

Should Electricity Sectors in Developing Countries be Unbundled?

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Distinction between Integration and Unbundling is not Clear Cut in Practice

✓ Can have vertical unbundling without horizontal unbundling (but not the reverse)
✓ Can have partial vertical unbundling (G + T/D, G/T +D, etc)
✓ Can have full vertical and horizontal unbundling in G and integration of T&D, for example (also integrated G&T with vertical and horizontal unbundling of D)
✓ Can have vertical unbundling in lesser forms than ownership unbundling - accounting, management, legal (holding company) – an issue in the EU
✓ Can have unbundling of retail supply (S) from D, and then some re-integration of G with S for risk management, keeping T&D unbundled (both vertically and horizontally for D)
✓ Can have unbundling of G services in wholesale power markets (commodity energy, reserve capacity, ancillary services)
Correlation of Power Supply Structures with Power Market Structures

- Vertically integrated monopoly as a national utility or monopolies as regional utilities
- Wholesale power competition in a national power market of gencos, discos, and large users with an ISO and transco
- Purchasing agency as the national transco, with many gencos and regional discos
- Purchasing agency as the national genco, transco, disco, genco/transco, or transco/disco
- Vertically integrated monopoly as a national utility or monopolies as regional utilities
- Retail power competition with supply unbundled from distribution in addition to wholesale competition

Horizontal unbundling and competition
Traditional Economic Arguments against Unbundled Power Systems

✓ **Public good**: service reliability and uniform standards and procedure among interconnecting segments of the grid

✓ **Natural Monopoly**: against wasteful duplication of T&D facilities

✓ **Economies of scale**: Large size and capital requirement of efficient plants (hydro and coal base load plants). Weakened when smaller combined cycle units became cost effective

✓ **Economies of scope**: Tight coordination (centralized investment and operation), savings in metering, billing etc.

✓ **Economies of transaction costs**: Reduce costs due to asset specificity and incompleteness of contracts

✓ **Better management of financial risks**
But These Arguments Might Not Hold for All Power Systems

They are based on specific underlying assumptions:

✓ Lower cost of capital for a utility
✓ Utility as sole buyer of generation
✓ No third party access
✓ Savings coming from incentives (to reduce costs) minor when compared to economies of scale and scope

They ignore changes post-restructuring:

✓ Introduction of new regulatory policies and market structures that can solve the “problem” of unbundling (but whose overall impact might go either way)
✓ Special case of regional power pools with integrated utilities operating under independent system operators (found among U.S states, but more difficult among a group of countries) – services are unbundled in the wholesale markets
Claimed Advantages of Unbundled Power Systems

✓ Increase transparency in costs, transfer prices and corporate structures helps protect public interest
✓ Better control of the different elements of the value chain via regulatory benchmarking
✓ Relieves need to establish an overriding business model for the four fundamentally different businesses of production-transport-trading-sales in an integrated company
✓ Easier to introduce competitive pressures in the supply chain
✓ More agile exploitation of market opportunities by suppliers – both incumbents and new entrants
✓ Easier for non-traditional service providers to enter the market
Another View Asserts an Optimal Degree of Integration Exists Below Full Unbundling

A view based on financial risk management, rather than economic concepts, is that an optimal degree of integration can exist.

✓ Depends on the mutual interest of generators and retail services providers in mitigating financial risk.

✓ Presence of “systemic” risks, which can only be partially mitigated by provision of (physical and financial) reserves and contracting under unbundling. Such risks were not sufficiently taken into account when unbundling began.

✓ Retail utilities continue to serve a large contingent of core customers – mostly residential and small consumers – who rely on inter-temporal smoothing of retail rates.

✓ This view is based on analysis of power systems in some OECD countries with well-developed financial markets (U.S.A., England & Wales, Australia, Canada, New Zealand, Scandinavia).

EU Experience with Unbundling Power Systems - 1

Unbundling is mainly conducted to improve transparency, efficiency and market orientation

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Increasing transparency</td>
<td>55%</td>
<td>(38%)</td>
</tr>
<tr>
<td>Improving Efficiency</td>
<td>42%</td>
<td>(52%)</td>
</tr>
<tr>
<td>Increasing market orientation</td>
<td>40%</td>
<td>(45%)</td>
</tr>
<tr>
<td>Regulatory requirements</td>
<td>37%</td>
<td>(26%)</td>
</tr>
<tr>
<td>Increasing controllability</td>
<td>35%</td>
<td>-</td>
</tr>
<tr>
<td>Improved cooperation opportunities with 3rd parties</td>
<td>34%</td>
<td>(13%)</td>
</tr>
<tr>
<td>Increasing shareholder value</td>
<td>10%</td>
<td>(13%)</td>
</tr>
<tr>
<td>Empowerment of the spin-offs</td>
<td>9%</td>
<td>(3%)</td>
</tr>
</tbody>
</table>

1) Multiple responses

Conclusion

- Spinning off individual divisions is mainly done due to the requirements of market liberalization
- The comparison with the survey conducted in December 2000 shows that efficiency improvement is no longer the most important reason, but rather increasing the transparency (legal requirement, value contribution of individual corporate divisions becomes clearer)
- Legal conditions are playing an increasingly important role for unbundling
- Some companies explicitly emphasize the improved cooperation opportunities with third parties on the individual levels of the value chain

Source: Booz, Allen, Hamilton (2003) survey of EU power utilities
EU Experience with Unbundling Power Systems - 2

Challenges of unbundling

- Expenditure for spin-off too high: 54%
- Interface problems: 51%
- Emergence of departmental egotism: 46%
- Increased management complexity: 42%
- Deterioration of internal communication: 39%
- Decision-making paths are longer: 29%
- Synergy losses: 15%
- Higher costs expected: 12%

Results

- Realizing the Unbundling requires an expenditure which many companies regard as (too) high
- Moreover, separate units cause an interface problem and departmental egotism emerges
- Partial optimum versus corporate optimum

Source: Booz, Allen, Hamilton (2003) survey of EU power utilities
A Linkage Between Integrated Power Systems and Country-Level Corruption in the EU?

- Countries with a higher CPI score (less corruption) have a more complete unbundling regime

\[ \text{CPI} = \text{Corruption Perception Index}; \quad \text{VIU} = \text{Vertically Integrated Unit} \]

Source: Van Koten & Ortmann. 2007. *The Unbundling Regime for Electricity Utilities in the EU: A Case of Legislative and Regulatory Capture?* CERGE-EI
Empirical Findings of Linkage Between Integrated Power Systems and Country-Level Corruption in the EU

EU-15 member states:
✓ more corrupt -> more likely to have chosen a weak unbundling regime

NMS-10 member states:
✓ more corrupt -> less likely to have chosen a weak unbundling regime
✓ reported early adoption of formal EU requirements as a cheap means to increase their chances to be judged eligible for accession into the EU.

Source: Van Koten & Ortmann. 2007. The Unbundling Regime for Electricity Utilities in the EU: A Case of Legislative and Regulatory Capture? CERGE-EI
Empirical Comparison of Vertically Integrated and Unbundled Systems in US Power Markets

✓ Study (Kwoka 2002) to measure economies of coordination between generation and distribution for about 150 US electric utilities with a wide range of size and degree of vertical integration that operate in regional power pools

✓ These utilities operated under US-style cost-plus regulation. Study focused on costs – not prices.

✓ Concluded that the least integrated distributors incur on average significantly higher total costs than the most integrated (6.27 cents/kWh versus 5.35 cents/kWh).

✓ But this difference increased markedly with utility size. The smallest utilities showed small diseconomies of coordination. The largest utilities showed very substantial economies of coordination (over 50%)

What is the Extent of Unbundling of Power Systems in Developing Countries?

Divide 150 Developing Countries between those that have:
✓ Vertically integrated power systems, and
✓ Fully or partially unbundled power systems, including:
  ✓ Systems that have always been partly or fully unbundled, with
  ✓ Systems that were recently unbundled

✓ Analyse this division by three variables:
  ✓ Geographical region
  ✓ Power system size group
  ✓ National per capita income group
V.I. is Still the Main Power Supply Structure by Number of Developing Countries (2005)

- Vertically integrated monopolist (53%)
- Vertically integrated monopolist + IPPs (24%)
- Regional discos, IPPs, genco/transco as single buyer (11%)
- Many discos, gencos, IPPs, transco as single buyer (4%)
- Power market, gencos, discos large users, transco-SO or ISO (9%)

V.I. monopolist – 77%; Partially unbundled – 11%; Fully unbundled – 13%
In 8 Latin American countries:*

- Divestiture and concessions through \textit{unbundling and regulation for market competition}
- Have progressed most among these countries under a clear reform vision
- Private participation was steered first to power distribution to reduce the huge system losses—technical and non-technical
- Initial reform priority was predictably regulated retail tariffs with pass-through of purchased power costs beyond the distributor’s control, freedom to disconnect non-payers, and regulated access to the transmission network.

*Argentina, Bolivia, Brazil, Chile, Colombia, El Salvador, Panama, Peru
Role of Unbundling in Two Regional Approaches to Power Reform - 2

In 7 Asian countries:*  

✓ Greenfield investment by IPPs through long-term contracts with state-owned suppliers – generally fully or partially integrated
✓ Have progressed much less than the 8 Latin American countries
✓ Private participation was steered first to investments in power generation to meet rapidly growing demand for electricity
✓ Initial reform priority was to remove serious distortions in wholesale power prices, create viable purchasers of the output, and help IPPs to manage uncertainty in their revenues.

* China, India-Orissa, Indonesia, Malaysia, Pakistan, Philippines, Thailand
## Distribution of Power Supply Structures in Developing Countries by Region (by number of countries)

<table>
<thead>
<tr>
<th>Region and total number of countries in region</th>
<th>Power supply structure group</th>
<th>Vertically integrated monopolist</th>
<th>Vertically integrated monopolist +IPPs</th>
<th>Regional discos, IPPs, genco/transco as single buyer</th>
<th>Many discos, gencos, IPPs, transco as single buyer</th>
<th>Power market gencos, discos, large users, transco-SO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>49</td>
<td>39</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>EAP</td>
<td>17</td>
<td>10</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ECA</td>
<td>28</td>
<td>7</td>
<td>2</td>
<td>10</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>LAC</td>
<td>32</td>
<td>14</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>MENA</td>
<td>13</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SAR</td>
<td>11</td>
<td>3</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>79</td>
<td>36</td>
<td>16</td>
<td>6</td>
<td>13</td>
</tr>
</tbody>
</table>

Source: Reforming Power Markets in Developing Countries: What have We Learned? E&M SB WP#19
## Distribution of Power Supply Structures in Developing Countries by Installed Supply Capacity (by number of countries)

<table>
<thead>
<tr>
<th>Installed power capacity group in 2002 (MW)</th>
<th>Power supply structure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vertically integrated monopolist</td>
</tr>
<tr>
<td>&lt;300</td>
<td>43</td>
</tr>
<tr>
<td>301–1,000</td>
<td>13</td>
</tr>
<tr>
<td>1,001–5,000</td>
<td>11</td>
</tr>
<tr>
<td>&gt;5,000</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>79</strong></td>
</tr>
</tbody>
</table>

Source: Reforming Power Markets in Developing Countries: What have We Learned? E&M SB WP#19
Distribution of Power Supply Structures in Developing Countries by National Income (by number of countries)

<table>
<thead>
<tr>
<th>Income group (per capita in 2003)</th>
<th>Power supply structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical monopolist</td>
<td>Vertically integrated monopolist + IPPs</td>
</tr>
<tr>
<td>Low</td>
<td>43</td>
</tr>
<tr>
<td>Lower middle</td>
<td>21</td>
</tr>
<tr>
<td>Upper middle</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
</tr>
</tbody>
</table>

Source: Reforming Power Markets in Developing Countries: What have We Learned? E&M SB WP#19
Power System Size and National Income for Unbundled Systems in Developing Countries

Source: Reforming Power Markets in Developing Countries: What have We Learned? E&M SB WP #09
A clear empirical threshold presently separates groups of developing countries by unbundling:

- System size of 1000MW
- Country annual per capita income of $900

Almost all the countries with unbundled power systems (A) lie above these thresholds.

But these threshold levels are only empirical; they can change - up or down - as more countries unbundle their power systems.

It can be surmised that:

- Country income level has a relatively stronger influence on the roles of the public and private sectors and market regulation.
- Power system size has a relatively stronger influence on market structure.
Big Differences Between Groups of Developing Countries

About 60 countries lie above both threshold levels of power system size and per capita income (A):

✓ Have low proportion of population without access to electricity supply (9% average)
✓ Are perceived to have a relatively medium level of corruption (TI Corruption Perceptions Index in 2004 average 2.5)

About 50 countries lie below both threshold levels of power system size and per capita income (B):

✓ Have high proportion of population without access to electricity supply (83% average)
✓ Are perceived to have a relatively high level of corruption (TI Corruption Perceptions Index in 2004 average 3.6)

(About 40 countries lie above one threshold level and below the other level – B&C )

This finding indicates that starting conditions matter for designing power sector reforms – see World Bank’s OGN
Illustration of OGN’s Guidance on Differences in Starting Conditions - 1

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market structure</td>
<td>Limited vertical unbundling. Single buyer with some simple bilateral trading for wholesale power</td>
</tr>
<tr>
<td>Regulation</td>
<td>Semi-autonomous regulatory agency mainly responsible for oversight of concessions.</td>
</tr>
<tr>
<td>Role of private sector</td>
<td>Mainly IPPs; concessions in distribution under public-private partnerships.</td>
</tr>
<tr>
<td>Role of public sector</td>
<td>Continued ownership of most power supply facilities. Main financier of sector development.</td>
</tr>
<tr>
<td>Role of competition</td>
<td>Limited to bidding for long term agreements by IPPs and distribution concessions by private operators.</td>
</tr>
</tbody>
</table>
### Illustration of OGN’s Guidance on Differences in Starting Conditions - 2

**Large middle-income countries**

<table>
<thead>
<tr>
<th>Market structure</th>
<th>Substantial vertical and horizontal unbundling. Bilateral trading or central exchange for wholesale power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation</td>
<td>Autonomous regulatory agency that issues licenses and approves retail tariffs and trading arrangements.</td>
</tr>
<tr>
<td>Role of private sector</td>
<td>Privatized generators and IPPs. Privately owned and financed distributors under long-term licenses.</td>
</tr>
<tr>
<td>Role of public sector</td>
<td>State ownership of hydro &amp; nuclear generation, transmission and weak distribution zones.</td>
</tr>
<tr>
<td>Role of competition</td>
<td>Competitive bidding for wholesale power contracts under bilateral trading or bidding into a power exchange.</td>
</tr>
</tbody>
</table>
Key Issue for Consideration

Should threshold levels for system size and per capita national income such as those determined empirically be adopted as a guide for whether to vertically unbundle small power systems in low-income countries?

- ✔ by ownership?
- ✔ if not ownership, by legal/corporate means in holding co.?
- ✔ if not legal/corporate, by internal management structure?
- ✔ if not by management structure, by accounts?
- ✔ or just leave the system fully vertically integrated and use PPPs such as management contracts, leases or concessions?
THANK YOU