Key Drivers and Economic Impact of Non-Technical Losses in Distribution Power Systems: Experiences in Latin America

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November 4th, 2012
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The opinions expressed in this publication are those of the author and do not necessarily reflect the views of the Inter-American Development Bank, its Board of Directors, or the Technical Advisors.
1. Introduction

- An important measure of the performance of a transmission and distribution system is losses that are measured as the difference between energy generated and energy delivered to consumers.

Losses in Transmission and Distribution Power Systems

- Technical
  - Variable: They are caused by the current flowing through the lines, cables and transformers of the network.
  - Fixed: Most of these losses are caused by hysteresis and eddy current losses in the iron core of the transformers. The rest is due to the corona effect in transmission lines.

- Non-technical
  - They cover energy that is stolen from the power system.

- The objective of the paper is to examine key drivers and economic impact of losses in transmission and distribution power systems in the Latin American region.
2. Losses in Transmission and Distribution Power Systems in the World

Transmission and Distribution Losses in Developed Countries, 1971-2009

2. Losses in Transmission and Distribution Power Systems in the World

Transmission and Distribution Losses in Latin America, 1971-2009

3. Some Key Drivers of Losses in LAC

3.1 Population Density

![Graph showing transmission and distribution losses in Latin America, 2009, related to population density.](image)

3. Some Key Drivers of Losses in LAC

3.2 Economic Development

Transmission and Distribution Losses in Latin America, 2009

GNI per capita, PPP (current international $)

Transmission and Distribution Losses (% of Total Generation)

Argentina | Brazil | Colombia | Costa Rica | Panama | Venezuela

3. Some Key Drivers of Losses in LAC

3.3 Public/Private Sector Participation

Transmission and Distribution Losses (%) in Latin America, 2009

Private sector participation in Distribution

- Nicaragua: 24%
- Panama: 13%
- Brazil: 17%
- Colombia: 16%
- Venezuela: 27%
- Costa Rica: 11%
- Mexico: 16%
- Panama: 13%
- Brazil: 17%
- Colombia: 16%
- Chile: 11%
- Argentina: 15%

Private sector participation in Transmission

## 4. Economic Impact of Losses in LAC

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<tr>
<th>Issue</th>
<th>Description</th>
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<td>1. Utilities’ financial sustainability</td>
<td>Energy losses represent losses in revenues for utilities. To recover costs involved in the supply of electricity and to fill the utility viability gap, costs of losses should be covered by paying users or by Governments via targeted output-based subsidies.</td>
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<td>2. Allocation of electricity loss costs</td>
<td>Since one or more generators must produce this lost energy and since these generators expect to be paid for all the energy they produce, a mechanism must be devised to take losses and their cost into account in electricity markets. A fair mechanism is one in which participants that contribute more to losses (e.g. remote generators and consumers) pay a larger share that the others.</td>
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<td>3. Impact on electricity demand and economic grid expansion</td>
<td>On the demand side, losses reduction and improvement on energy efficiency would partially cover the expected demand rise without the necessity to increase the installed capacity. On the supply side, the impact on the utility to finance new generation capacity is particularly pronounced in countries like some LAC with a vertically integrated monopoly, where a (mostly) state-owned company is responsible for generation, transmission, and distribution, with limited transparency into the overall system.</td>
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### 4. Economic Impact of Losses in LAC

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<td>4. Losses and access to energy</td>
<td>Even when access to the grid is available, customers in many developing countries like LAC are plagued by unreliable power. Where system inefficiencies and theft create significant losses, utilities are unable to cover their costs. The result is that companies struggle with solvency and are unable to provide high-quality service to existing customers, let alone deliver new connections.</td>
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| 5. Measures to reduce losses and improve revenues for utilities | Social  
- Preventions of theft.  
- Social contracts with communities to encourage legal connections, etc.  

Economic  
- Management of payment risk.  
- Special tariff regimes (based on time of use, pre-paid formulas, etc.).  
- Flexible payment options, etc.  

Technical  
- Improvement in commercial processes.  
- Advanced metering systems as installation of electronic meters, prepaid meters, anti-damping connections and collective electronic meters, etc. |
5. Conclusions

• Electricity losses are more significant in developing than developed countries. Differences can vary from 5 to 30%. From LAC that have been studied, Chile and Costa Rica show the lowest loss levels (about 10%), meanwhile losses in Nicaragua and Venezuela reach 25-30%.

• Regarding key drivers analysis, population density affects losses in different ways LAC. Economic development positively impacts losses in LAC. The involvement of the private sector in generation, transmission and distribution has improved the situation somewhat, but there are still differences between the examined countries.
5. Conclusions

• Economic impact of losses on electric companies’ financial sustainability, particularly public state-owned, should be covered by paying users or by Governments via subsidies.

• Many best practices in public state-owned and private companies to diminish non-technical losses are found in different LAC than can be used as references by other countries in the region. Smart grid appears to be in the near future one of the most innovative and effective practices that can be implemented in the region to reduce non-technical losses.
Thank you very much for your attention!