ELSEVIER

Energy Policy 32 (2004) 2067–2076

ENERGY POLICY

www.elsevier.com/locate/enpol

Electricity theft: a comparative analysis

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Abstract

Electricity theft can be in the form of fraud (meter tampering), stealing (illegal connections), billing irregularities, and unpaid bills. Estimates of the extent of electricity theft in a sample of 102 countries for 1980 and 2000 are undertaken. The evidence shows that theft is increasing in most regions of the world. The financial impacts of theft are reduced income from the sale of electricity and the necessity to charge more to consumers. Electricity theft is closely related to governance indicators, with higher levels of theft in countries without effective accountability, political instability, low government effectiveness and high levels of corruption. Electricity theft can be reduced by applying technical solutions such as tamper-proof meters, managerial methods such as inspection and monitoring, and in some cases restructuring power systems ownership and regulation.

Keywords: Electricity theft; Governance; Corruption

1. The Problem

An electric power system can never be 100% secure from theft. In many systems the amount of theft is small (1–2%) in terms of the electricity generated. But, the financial loss is high due to the large amount of electricity distributed. Nesbit (2000) noted that, "In the US, the consensus seems to be that theft costs between 0.5% and 3.5% of annual gross revenues in the US. That seems like a small amount—until you consider that US electricity revenues were in the $280 billion range in 1998. Therefore, between $1 and $10 billion worth of electricity was stolen."

Some power systems may forfeit more than 15% of power generated to various types of theft. A Transparency International (1999) report explains the situation in Bangladesh.

> In fiscal 1998–99 Bangladesh Power Development Board (BPDB) generated 14,150 MkWh of electricity, purchased another 450 MkWh from private sources, but billed for only 11,462 MkWh, giving a system loss of 22%. This was better than Dacca Electric Supply Authority (DESA) 40% but poorer than Rural Electrification Board (REB) 17%. The weighted average system loss in the power sector as a whole is estimated at 35%, which includes 21% technical loss. The balance 14% … was due to pilferage, theft and unauthorized use.

The financial losses are critical to many electric power organizations. Lost earnings can result in lack of profits, shortage of funds for investment in power system capacity and improvement, and a necessity to expand generating capacity to cope with the power losses. Some power systems in worst affected countries are near bankrupt. Corruption increases and becomes entrenched as favors can be "bought" from power sector employees in the form of inaccurate billing and allowing illegal connections. Political leaders intervene to ensure that cronies and supporters are not prosecuted. In 1998, the situation deteriorated in Pakistan to the extent that,

> The government took action and employed 35,000 army men to recover Water and Power Development Authority (WAPDA) dues and curb the theft. They have been conducting house-to-house raids with the staff of WAPDA, checking for any tampering of power meters. In the last year the army has found 100,993 instances of power theft, recovered Rs. 2.4 billion in fines and penalties and arrested 1188 people. Embarrassingly, many of the thefts were discovered in the houses, farms and mills of the ruling party legislators, 13 of whom were WAPDA officials.

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0301-4215/03/$ - see front matter
doi:10.1016/S0301-4215(03)00182-4

> Even the Minister for Population … resigned from her cabinet post on power theft charges (Rizvi, 2000).

Electricity theft is a complex phenomenon with many facets. In this article, electricity theft is defined and various types of theft are described. The international scope and trends of theft will be examined. How theft can become institutionalized as part of the political, economic and managerial culture of governance will be noted. Lastly, some methods of dealing with the problem of electricity theft are examined.

2. An increasing awareness

The emergence of power theft as a serious problem has evolved due to several recent trends. Most countries developed electric power systems that were highly centralized state owned monopolies, where efficiency and profits were not high priority. The privatization of the infrastructure and new modes of power policy requires the new business-like enterprises to operate efficiently and try to optimize profits in an environment of rapid change (Flavin and Lenssen, 1994; Patterson, 2001).

In many countries power theft is an issue of open discussion—even in the most efficient (such as in the USA) and moderately efficient (Malaysia) systems. In South Asian countries, electric power is rarely discussed without reference to power theft, since it is such a prevalent practice. However, in some countries (Thailand, China) the topic is rarely part the analysis of power systems.

The World Bank and Transparency International have been major forces in promoting efficient, non-corrupt governance of public and private sector organizations that provide essential services to the public. The development of a civil society in many countries has lead to a questioning of the effectiveness and efficiency of infrastructure and service delivery and promotes transparency in the operations of secretive bureaucratic organizations.

3. Inefficiency in electric power systems

In power systems, not all electricity generated reaches paying consumers because of inefficiencies and managerial practices.

3.1. System use

The electric power system will consume some of the electricity generated in order to produce and distribute the electricity. Lighting, maintenance, etc. have to be provided in power stations and facilities and this power is not subject to metering or "sold" in the commercial sense. System use can vary from 2% to 6% of generation.

3.2. Technical transmission and distribution (T&D) losses

Electric power is lost while being transmitted and distributed when it passes through transformers and is distributed in small capacity lines. Systems with long transmission lines risk a higher amount of T&D loss than shorter line systems. Also, the quality of the lines and transformers can affect efficiency of transmission and distribution. Power systems that invest significantly in maintenance and in the advanced technology of transmission and distribution can reduce technical T&D losses.

3.3. Gratis

A third type of loss is electricity allocated gratis. Some power systems provide free electricity without charge to certain people and organizations. The presidential or prime-minister's residence, members of parliament, or the royal palaces may not be charged for electricity or telephone. Free electricity may be provided to employees of the power system as in Thailand where the 32,000 employees of the Electricity Generating Authority of Thailand (EGAT) receive free electricity worth 1.5 billion baht.

4. Defining electricity theft

Four kinds of "theft" are prevalent in all power systems. The extent of the theft will depend upon a variety of factors—from cultural to how the power utility is managed.

4.1. Fraud

Fraud is when the consumer deliberately tries to deceive the utility. A common practice is to tamper with the meter so that a lower reading of power use is shown than is the case. This can be a risky procedure for an amateur, and many cases of electrocution have been reported. In Malaysia, "professionals" have approached residents and managers of businesses offering to "fix" the meter for a moderate fee (New Straits Times, 1999). During 2 months of raids in Malaysia on suspected areas 587 (86%) out of 684 inspected were confirmed to have tampered with their meters or stolen electricity (The Star, 1998). The losses can be substantial when fraud is by large organizations. In Aurangabad, India,

> The 22 proprietors of Jalna's seven mini-steel plants accused of massive power theft detected in Monday's raids by the Maharashtra State Electricity Board (MSEB) are absconding following the rejection of their plea for anticipatory bail by the Sessions Court … The MSEB has conclusive proof of the Rs 20-crore (Rs 200 million) power theft … (including) extremely sophisticated equipment the steel plants used to doctor their electricity meters…(Indian Express, 1998).

4.2. Stealing electricity

Electricity theft can be arranged by rigging a line from the power source to where it is needed bypassing a meter. In South Asian countries this practice is quite common in poor residential areas where those wanting electricity may not have lines allocated and may not be able to pay if they were connected. Called the *kunda* system in Pakistan, this practice is often accepted by power managers as a fact of life in poor communities. In Soweto, South Africa 6 tons of "spiderweb" cable used for such connections was recovered in 6 months by the electrical authority in raids (Campbell, 1999).

In Mexico,

> The millions of illegal customers, who steal electricity with wires known as *diablitos*, or 'little devils,' have pushed an overburdened electrical grid over the edge. …thousands of homes and businesses have been hit with power outages that electric company officials blame largely on pirates. Published reports say the thefts result in the loss of as much as $475 million revenues annually (Sullivan, 2002).

The illegal lines are easy to detect as they are often above ground and highly visible. However, one finds reports of staff being assaulted and needing police security to carry out the removal of the lines. Corrupt staff from the electricity organization may take bribes to allow the practice to continue. On a larger scale, businesses may bribe power organization staff to rig direct lines to their buildings or offices and the power does not go through a meter. The bribes can be much less than the cost of the power. Money also can be given to inspectors to keep them from finding and/or reporting the theft.

4.3. Billing irregularities

Billing irregularities can occur from several sources. Some power organizations may not be very effective in measuring the amount of electricity used and unintentionally can give a higher or lower figure than the accurate one. The unintentional irregularities may even out over time. However, it is also very easy in some systems to arrange for much lower bills to be given than for the power actually used. Employees may be bribed to record the meter at a lower number than is shown. The consumer pays the lower bill and the meter-reader earns unofficial salary. In another type of billing irregularity, office staff can move the decimal point to the left on the bill so that a person or company pays $47.48 instead of $474.80. Consumers may know that some power organization staff are "on-the-take" for providing these services. Employees may keep payments. A scheme in operation in Malaysia in the late 1990s diverted $1.59 million to private accounts before detection (BRDC, 2000). The staff can easily earn from this type of corruption, as it is not easy to detect. Corrupt practices may become institutionalized to the extent that employees regard the illicit payments as part of the job.

4.4. Unpaid bills

Some persons and organizations do not pay what they owe for electricity. Residential or business consumers may have left the city or an enterprise has gone bankrupt. In South Africa, a "culture of non-payment" is evident (Mkhwanazi, 1999). In Armenia, "Non-payment levels of 80–90% are typical in the residential sector. T&D losses are over 40%" (Tacis, 1998). The practice is widespread,

> Some systems have chronic non-payers—the very rich and politically powerful who know that their electricity will not be cut regardless of whether they pay or not. In India, farmers in some states regard electricity as a free service from government, and some political leaders and parties curry favor by promoting this practice and prevent the State Electricity Boards from collecting. Another chronic non-payment group can be government departments and agencies. The Pakistan Army discovered that some of the largest amounts owed to WAPDA were from government agencies—including the Army itself. The Karachi Electric Supply Corporation Director reported in 2000 that only 52 percent of the 1.67 million customers were paying their bills (News International, 2000).

In Indonesia in 2000, the military owed Rp. 23 billion (US$3.1 million) to Perusahaan Listrik Negara (PLN). This was a large part of the company's total unpaid claims of about Rp. 157 billion (Jakarta Post, 21 March 2000). Some analysts may not regard non-payment by as "theft." However, when it becomes institutionalized and people and organizations expect that they can get away with it, unpaid bills should fall into the "theft" category.

Non-payment is a problem not confined to poor countries. Lundin (2001) has explained the growing problem in the USA. In all countries, as electricity increases in price, some people have trouble paying their

bills regularly. This may encourage them to find ways of reducing their bills, such as tampering with the meter.

In a more conventional definition of electricity theft the category of Unpaid Bills may not appear. However, in some power systems the extent of the problem and its impact has serious consequences. Data on non-payment is not available easily that can be used for a comparative analysis for the purposes of this paper. The analysis in this paper deals primarily with theft in terms of billing irregularities, fraud and stolen electricity.

5. Measuring electricity theft

Electricity theft can be estimated, but not measured exactly. The most accurate estimate of theft is by conducting a thorough analysis of the power system. The revenue protection section of the Arizona Public Service Company (APS) carried out a recent study that is unique (Culwell, 2001). The APS provides electric power to the Phoenix metropolitan region and 11 of Arizona's counties—covering 40,000 miles^2 with 868,000 customers. The APS wanted a research project that would go beyond the usual studies that target meter tampering. They wanted to know the extent of meter tampering and the financial loss in such a way as to be able to extend the research to the whole of the APS system with a 95% confidence. The study involved selecting randomly 550 meters out of the 868,000, ensuring that they were spread among the urban and rural users (35% rural) and residential and industrial (12%) users. Each meter was thoroughly inspected–disconnected, opened, tested, and 52 items of information recorded about the meter. For determining theft the "beyond a reasonable doubt" criterion was used. Suspected theft required evidence that was "clear and convincing." The research study was implemented beginning on 3 April 2000 and was completed by 30 June the same year. The findings include:

- Definite meter tampering rate—0.72%.
- Probable meter tampering rate—1.00%.
- Actual loss in dollars—$330,148.

The data was extrapolated to the APS system to estimate that nearly 15,000 meters had been tampered with and show that the tampering losses per year were estimated to be $7,967,279 that was 0.518% of revenue loss for the APS. The APS study noted that the estimated loss ($5.1 million) was much higher among commercial accounts than the residential consumers.

The standard method of measuring power theft is by analysis of transmission and distribution losses (T&D losses). The method takes the difference between the amount of electricity generated (minus system use and gratis) in relationship to the amount metered and sold. If an accurate calculation is made of technical line losses, theft may compose a large part of the unaccounted amount—the non-technical line losses in the distribution network.

Very efficient power systems have less than 6% T&D losses—theft may be 1–2%. Less efficient systems may have 9–12% T&D loss and inefficient systems have line losses of over 15%. The Malaysian Tenaga system has T&D losses of 11% that includes theft losses estimated at 4%. Bangladesh estimates are T&D losses of 35% with 14% as theft. In Budapest, Elmu estimates that half of its 13% losses are due to theft (East European Energy Report, 1999). Indonesia's PLN estimated theft in power distribution in Jakarta at 7% in 1994 and 3.77% in 1996 (Priatna, 1999). Thus, a system operating with 22% T&D losses could lead analysts to estimate that around 10–15% are due technical T&D losses. The remaining 7–12% of the electricity disappeared, probably due to theft of various types. This is a blunt method for estimating theft and does not include non-payment.

6. Power theft: a comparative and historical perspective

Information is available on T&D losses for many countries from the World Bank. However, World Bank data on T&D losses for some countries is inaccurate and misleading as "0" T&D losses are recorded, or the figure given is less than 1%. This is impossible because some electricity always is lost during transmission and distribution.

It is neither realistic nor feasible to assess T&D losses in all countries given the limitations in the data. For this study, a sample of 102 countries was chosen. The basic data for the countries is from the World Bank's Development Indicators (2003). The main criteria for selection are:

- Available data on T&D losses for 1980 and 2000 to enable an historical perspective.
- Reasonable confidence in the accuracy of the data and that system use was not included.
- Countries selected have a good record in the collection of data in other social, economic and power sector variables.
- The confirmation of the country data by a second source such as the US EIA, reports on energy development, and statistics bureaus and electricity organizations in the selected countries.

Table 1 shows the distribution of T&D losses within ranges. If 16% or more T&D losses are viewed as systems with extensive theft, then over 40% of the sample countries have a serious problem.

Table 2 provides an overview of T&D losses by region for 1980 and 2000. The bottom row of the table shows that between 1980 and 2002 the losses increased from 11.69% to 16.23%. Comparing regional losses reveals

Table 1
T&D losses in 2000

T&D losses	Number of countries	Percent
4–10%	34	33.3
11–15%	25	24.5
16–20%	15	14.7
21–53%	28	27.5
Total	102	

Table 2
T&D Losses by region, 1980 and 2000

Region	Countries	1980 T&D loss percent	2000 T&D loss percent	Change percent
Western Europe	17	7.71	7.56	−0.15
Eastern Europe	24	9.68	18.18	+8.50
Middle-east, North Africa	11	11.18	19.63	+8.45
Africa	11	14.6	19.95	+5.35
North America	3	9.67	9.38	−0.29
South America	9	13.00	17.23	+4.23
Central America, Caribbean	9	15.50	21.68	+6.18
South Asia	5	25.20	27.55	+2.35
Southeast Asia	7	12.14	13.32	+1.18
East Asia, Australasia	6	8.67	7.65	−1.02
Total	102	11.69%	16.22%	+4.54%

that in only two regions did T&D losses decline in the 20-year period under review—Western Europe and North America. South Asia in 1980 had the highest T&D losses among the regions and further declined in the 20-year period. The highest increase appears in the Middle East/North Africa Region and in Eastern Europe.

The disturbing evidence is that losses (and theft) appear to be increasing in an era of readily available technological means (metering, for instance) to lower non-technical losses. Also, many of the power systems were privatized between 1980 and 2000, yet the data shows that overall, this has not impacted positively on power sector efficiency.

The lowest T&D losses (less than 6%) are in countries known for efficiency in management such as Finland, Germany, Japan, Republic of Korea, Netherlands, Singapore, Belgium, Austria, France and Switzerland. The power organizations are managed to ensure the deterrence, detection and prosecution of people and organizations engaged in electricity theft. While there is a low percentage of theft, the economic losses can be high due to the large amount of electricity generated.

High losses (over 30%) are in countries such as Albania, Haiti, Myanmar, Kyrgyz Republic, Nigeria, and Bangladesh. Common features are poverty and that each country has experienced political, economic and social turmoil. In tumultuous times government organizations cease to function efficiently, become prone to corrupt practices, investment is not made in system management, and the consumers take advantage of the system

Variations in T&D losses within each country may be large. In the Philippines the T&D losses were estimated to be 17% in 1997. However, assessment of regional variations shows that six of 15 regions had losses below 17%. One region has over 27% loss and five were between 20% and 27%. The Meralco region (Manila) reported losses of 12.4%, well below the rural areas (National Economic Development Authority, 1998, Table 5.4).

India has overall T&D losses of over 26%, but the losses vary in the 22 states. Losses of nearly 50% are experienced in Delhi, Jammu and Kashmir, and Orissa. Even Maharashtra, with the best record, has nearly 15% losses.

7. Governance and electricity theft

Understanding governance has emerged as an important element in explaining patterns of social, economic and political development Kaufmann et al., 1999). Electricity theft is related to a broader culture of governance or mal-governance. The World Bank Institute's Governance, Regulation and Finance Unit have compiled useful data. Attempting to measure governance, Kaufmann and associates developed six measures to assess the various dimensions of governance. Multiple indicators were used to measure each dimension for 175 countries. The dimensions are:

Voice and accountability: Aspects of the political process, civil liberties and political rights.

Political instability and violence: The likelihood that the government may be overthrown by violent means.

Government effectiveness: The quality of public service provision and the bureaucracy, competence of civil servants and the independence of the civil service from political pressure.

Regulatory burden: Incidence of market un-friendly policies such as price controls, and perceptions of burdens imposed by excessive regulation.

Rule of law: Abiding by the rules of society, effectiveness of the judiciary, and enforceability of contacts.

Graft and corruption: The exercise of public power for personal gain, bribery, impact of corruption on business.

Table 3 provides the correlation analysis of T&D losses (2000) for the 102 countries of the sample of this paper with the data from the Governance project created by Kaufmann et al. (2003). A negative correlation indicates that as the country scores on the

Table 3
Governance indicators and T&D losses

Governance dimension[a]	Correlation T&D losses	Level of significance
Voice and accountability	−0.496	>0.000
Political instability and violence	−0.555	>0.000
Government effectiveness	−0.682	>0.000
Regulatory burden	−0.503	>0.000
Rule of law	−0.644	>0.000
Graft/corruption	−0.636	>0.000

$N=102$. Pearson's r correlation coefficient.
[a] Data from Kaufmann et al. (2003).

Table 4
Total governance scores and T&D Losses

Total governance quartiles	Mean T&D loss percentage	Number of countries
Highest governance quartile	7.57	24
Second highest governance quartile	13.33	26
Second lowest governance quartile	22.00	26
Lowest governance quartile	22.51	26
Total	16.22	102

governance indicator go lower—indicating poor governance, one will find higher T&D losses (and theft).

The T&D losses are highly correlated with each of the governance dimension and all correlation coefficients were significant at less then the 0.001 level. Countries with higher T&D losses lack of civil rights, democratic institutions and accountability and endure political instability and possible violence. Government effectiveness is weak and there is a high regulatory burden. Rule of law is weak. The relationship of T&D losses with graft and corruption indicates that the two are closely intertwined. Power theft thrives (and is a part of) systems of mal-governance. The reverse can be said also to be true, that in well-governed systems, one finds much less power theft. The relationship of power theft to graft and corruption is not unexpected as examples of high power theft systems show evidence of corrupt practices within power sector organizations.

In order to illustrate the relationship between governance and T&D losses, the six governance indicators were combined into a total governance score for each country. The countries were then divided into quartiles on the basis of the total governance score. Table 4 provides the mean T&D losses for the countries in each of the quartiles. As is clear, the countries with lower governance have much higher T&D losses.

Electricity theft and corruption appear to be closely linked. It takes the connivance of power sector employees and even some politicians to perpetuate a system whereby high T&D losses and theft continue to occur. In the Indian, Pakistan and Bangladesh cases, the overwhelming evidence is that corrupt practices are widespread in the electricity sector. The Lucknow Electrical Services Authority General Manager conceded that, "Out of 110 millions unit of electricity supplied to the residents of Lucknow, at least 33% are pilfered and resulting in losses worth Rs 100 crores (Rs 1 billion) every year. He also admitted that most of the pilferage took place in connivance with power employees" (Tripathi, 2000).

8. The consequences of electricity theft

From a business perspective, electricity theft results in economic losses to the utility. Some may argue that large utilities providing essential services give poor service, over-charge, make too much money anyway, and, therefore, some theft will not break the company or drastically affect its operations and profitability. Others looking at the same situation would argue that theft is a crime and should not be allowed. An International Utilities Revenue Protection Association has been established to promote the detection and prevention of power theft–mainly for the financial security of power utility companies.

The consequences of theft in the worst case systems are important to the viability of the services provided. The combined losses (including non-payment of bills) in some systems have severe impacts resulting in utilities operating at a loss and must continually increase electricity charges. Locked into a culture of inefficiency and corruption, the electricity utilities have difficulty delivering reliable service. Even in reasonably efficient power systems, such as Malaysia's Tenaga, power theft accounts for losses of RM$500 million ($132 million) annually (Malay Mail, 1999). For large systems a 1% theft loss can be substantial. With sales of over $13 billion, 1% of theft for the Korea Electric Power Corporation is over $130 million. Lovei and McKechnie (2000) make a case that power theft impacts upon the poor by perpetuating a system that benefits the wealthy and powerful. Power systems may also promote "Grand Theft" by awarding lucrative contracts and monopolies that lead the enrichment of favored individuals.

India's power system is an illustration of a worst-case situation. In constant turmoil, State Electricity Boards (SEBs) have a high theft level and consumers do not pay their bills. The SEBs seldom have profits and are heavily subsidized for their losses (Smith, 1993). Only three SEBs made a profit in 1996/97 and the combined commercial losses were over 71 billion Rupees (about $1.6 billion). The SEBs cannot pay their bills for power purchased from the central government or IPPs nor for plant equipment and the railways for coal delivery. The whole system has been on the verge of financial collapse

for a decade. IPPs, especially foreign owned ones, are reluctant to enter the power field for fear that SEBs will not be able to pay them for power supplied.

9. What can be done?

Electricity theft can never totally be eradicated in any power system. In the very efficient systems of Japan, Western Europe and North America effort has been devoted to the technological and managerial methods necessary to reduce theft to levels tolerable. Many of these systems operate in a governance culture that promotes organizational efficiency and theft law enforcement. This does not mean that electricity consumers necessarily love their power company, but few will try to steal electricity.

Power system strategies for dealing with theft vary. Some organizations pay little attention to theft problems, perhaps hoping theft will disappear and not become a public issue. Other power systems treat electricity theft as highest priority.

The first-step in electricity theft reduction is to become knowledgeable about the theft problem. Few detailed studies of power theft exist and the work of the Prayas Energy Group (2002) in India provides many insights.

Unless the nature and extent of power theft is known in great detail, any attempts to deal effectively with the problem are prone to fragmented and limited action that have little over-all success. Therefore, power systems, whether national or regional, should be encouraged to initiate a detailed power theft analysis. The analysis must go beyond conventional engineering and managerial frameworks and understand and explain why theft occurs and what factors perpetuate theft. The information derived is essential to design an appropriate strategy for dealing with theft.

10. Reducing power theft

Three methods for reducing power theft are identified in this paper: technical/engineering, managerial, and system change.

10.1. Technicallengineering methods

Electric power is not a new technology and innovations taking place enable very efficient systems to be installed and maintained. Many power systems devote inadequate resources and effort to transmission and distribution systems and do not use the latest technologies. The investment necessary to reduce losses includes upgrading power lines, transformers, information technology monitoring systems, and installing and maintenance of modern metering systems that are at the interface of the organization and the consumers of the electricity.

Significant technological advancement in metering has occurred. Since much theft is from meter tampering, it is important to replace old, easy to tamper-with meters. New high-tech sealed meters that cannot be altered in any way and can be read automatically are costly, but can reduce theft when required of moderate to heavy power users (see Arruda, 2000; Iyer, 2000; Rajan, 1998). Szilvagyi (1999) makes a strong case that the investment in high technology metering requires a sound and complex infrastructure in place to make the system work effectively.

10.2. Managerial methods

Electric power organizations are very large entities that operate as bureaucracies even though many are private sector organizations. Combining strong technical improvements with an intelligent and active anti-theft program may result significant improvements (see Ahmedabad Electricity Co. Ltd., 2000).

Inspection and monitoring power users at regular intervals is essential to reducing theft (Gower, 2000). In Brazil, CEMIG had losses of $12 million. By spending $2.1 million on tests and inspection, $6.2 million was recovered (Arruda, 2000). The focus should be on areas or facilities that have the greatest potential amount of electricity theft in terms of electricity use. Studies have shown that the wealthy steal power for residential use, factories, and businesses (BRDC, 2000). More people may be stealing power in urban slum areas, but the amount of power is small by comparison. Yet inspection often targets the poor of the community.

Singapore's former Prime Minister Lee Kuan Yew commented that corruption was a "fact of life" and in Singapore it should not become a "way of life." The same comment could apply to electricity theft. Theft may be prevalent in all power systems to varying degrees as a "fact of life". Clearly, some power systems appear to be operating where electricity theft has become a "way of life".

Corruption is one of the most difficult problem areas for electricity organizations because power theft occurs with the connivance of employees of the power organization. Increased investigation and surveillance may provide opportunity for more corruption (Anuradha, 2000). Employees may even extort money from electricity consumers not to disclose theft. It is important to detect and prosecute corrupt power sector employees—this includes, if necessary, the ones at the very top of the organization. Employees should be paid adequately so that they will not have to resort to bribes in order to support a family.

The organizational factor in the power industry is important. Power utilities are very large, complex organizations. By the number of employees it can be a country's largest organization. EGAT and the two distribution agencies in Thailand have over 60,000 employees, Indonesia's PLN has over 50,000. Tenaga in Malaysia has 23,000 and WAPDA in Pakistan has over 100,000. Nearly one million work in India's state electricity boards. Most of the tasks are routine and in many organizations a bureaucratic culture is promoted whether private or public enterprise.

Electricity utility employees must interface extensively with the consumers of electricity—in residences, factories and offices. This allows "street level" decision making to take place (Lipsky, 1980; Hudson, 1993). Employees can exercise discretion by not reporting infringements or may alter bills. Since the typical power sector organization must operate at the consumer level, employees are scattered throughout the far corners of the country, making control and coordination from the central office difficult. When the product delivered is a scarce and essential commodity, as is electric power in South Asian countries, employees can exercise considerable discretion. Routine allocation found in some power systems becomes discretionary in others. For example, who will get connected to power? When will the connection be made? Where and when will power blackouts take place? How much should the user pay for power? These discretionary decisions can be "for sale" by the employees. The organization's management and employees thrive on power scarcity and there is little incentive to increase supply or to operate a more efficient or effective service.

The legal aspects of power theft have received attention in some countries. Outdated laws treat theft as a common crime. Several countries recently have adopted laws governing power theft and treat it as a special crime. The Andhra Pradesh amendments to the Indian Electricity Act (1910) contains punishments from 6 months to 5 years imprisonment, fines of between 5000 to 50,000 Rupees, and depriving the thief of electric power for up to 6 years. In Malaysia half-page ads newspapers warn consumers of the illegality of power theft with fines of up to RM 100,000 and imprisonment of up to 5 years. The new laws make the punishment for theft much easier to implement and the fines and penalties imposed a deterrent to future theft.

The problem of arrears or non-payment is a difficult one. Electricity is an essential commodity and a "no pay, no electricity" policy may not be politically acceptable in some countries. Disconnection also can be dangerous as a World Bank (1999) study noted, "In Albania, consumers with guns … threatened to shoot the utility officials who attempted to disconnect defaulting customers." The scope of this problem can be so serious that the financial viability of the organization is jeopardized. Contracting the bill collection to a private agency may promote some effectiveness in revenue collection. Providing alternative methods and places for bill payment may also help. Some power systems have promoted prepaid cards as a method to ensure payment. However, changing a culture of non-payment has no easy solutions (Barnes, 2000; Lundin, 2001). In some cases those owing the most money are government agencies, and collecting can confront legal and political hurdles.

10.3. System change

In the systems where power theft is the highest, electricity sector organizations are state owned and managed enterprises. Some power sector state enterprises have operated with substantial efficiency (in Singapore, for instance), so one cannot argue a case that the public sector is incapable of running services effectively and efficiently.

However, a case can be made that state owned and operated enterprises are not managed as true businesses and therefore do not try to optimize profits. The organizations may be intertwined into the political and bureaucratic structures and processes and there are few incentives to reduce theft. In the Indian case, theft did not slowly emerge, it has been around for many decades—it is just that nothing was ever done about it. Political leaders, power consumers and SEB managers and employees have benefited from the system.

A world trend has been deregulation and the transformation of public sector enterprises into the private sector. In the past decade many power systems were privatized and now operate as businesses with shares traded on the stock exchanges (Bacon, 1999). The total power sector is difficult to privatize into effective private sector enterprises because transmission and distribution are natural monopolies, and competition is essential to spur businesses to be more efficient.

National and state level power systems have been transformed in the past decade and the creation of an independent regulatory commission for electricity has been a common reform. The problem of how to deal with technical and non-technical losses is a complex one for the new commissions. The issues to grapple with include setting levels of "acceptable loss," whether utilities should be allowed to pass on theft and other inefficiency costs to customers, and whether utilities should be penalized if they do not achieve reductions in T&D and theft.

The transformation of electric power systems into more business-like enterprises means for many countries the elimination of subsidies provided by the state that kept electricity prices low for consumers. As prices in poor countries rise to international levels, many consumers are trapped. Their own income is by local standards—perhaps $2 to $5 per day, but their electricity

charges are the same as for a customer in Los Angeles who earns $80 per day. Under these conditions, consumers may feel that there is no alternative but to engage in electricity theft or not pay their bills.

Logic and theory suggests that private owned power organizations will be more concerned with theft than public sector organizations. Contrasting Malaysia's privatized system with Thailand's public enterprise system regarding electricity theft is interesting (Smith, 2003). Both systems have similar T&D losses of around 11%. In 1994 Malaysia divested Tenaga, the power generation, transmission and distribution enterprise for peninsular Malaysia. Government maintains majority ownership, but its shares are traded on the Kuala Lumpur stock exchange. Independent power producers (IPPs) were permitted from the mid-1990s to produce power and sell it to Tenaga for distribution. In the Thai case, the EGAT is a public enterprise that generates and transmits power to two large distribution public enterprises, the Provincial Electricity Authority (PEA) and the Metropolitan Electricity Authority (MEA). Attempts to privatize Thai electricity have been discussed for nearly 20 years, but the 32,000 member EGAT employees' union has vigorously opposed the change.

Electricity theft is not a big issue in Thailand because EGAT, PEA and MEA appear to have no concerted effort to deal with it. The enterprises make sufficient profits to keep the government happy and to provide the employees with free electricity as well as a substantial end of year bonus in EGAT equal to about US$1000 per employee. By contrast, in Malaysia, Tenaga has had to display its operations and profits to the public and shareholders. The recent economic crisis severely dented Tenaga's profitability. Low profits affect the stock market price of shares. Forced to run efficiently, Tenaga management turned, in a very serious way, to the reduction of power theft that causes losses of M$500 million a year.

Caution needs to be exercised about promoting privatization as a panacea for the ills of inefficiency. The Orissa (India) electricity sector was privatized in 1996 with the corporatization of the Orissa State Electricity Board, the establishment of the Grid Corporation of Orissa to manage T&D of electricity and the Orissa Electricity Regulatory Commission to regulate the system. The record shows uneven improvement (see Dixit et al., 1998). Power tariffs went up by 76%, T&D losses soared to 45%, and revenue collection was only at 54% of those billed (Dhume, 1999).

11. Conclusions

The evidence points to the increasing levels of power theft in many countries and the financial losses for some systems are so immense that the utility is in financial turmoil. Investment in improving the system and adding additional capacity cannot be undertaken, loans and payments cannot be met, and the consumer faces increased electricity charges. Even in efficient systems, theft losses can account for millions of dollars each year in lost revenue.

Electricity theft in its various forms can be reduced and kept in check only by the strong and assertive action of power sector organizations. The strategy and the action should be based upon a thorough understanding of the specific nature of the theft problem. A strong case can be made that each power system (including consumer's attitudes and behavior) has its own unique qualities and only by knowing the system and the problem can effective solutions be designed and implemented. Since a high level of power theft is linked with corruption, the analysis cannot be confined to technical and managerial perspectives and needs to be multi-disciplinary in approach.

Theft as an activity in some systems is closely intertwined with governance and with the social, economic and political environment. Corruption and electricity theft thrives off each other. In an overall culture of corruption as a way of life, electricity theft can be reduced to moderate levels by technical/engineering methods. But it is an uphill battle to reduce the electricity theft rate drastically as long as extensive corruption continues.

Reduction in power theft and keeping it within reasonable bounds is more likely to be successful in systems with a good governance culture. This is because the theft reduction mechanisms find a friendly environment for initiation and implementation. As part of generating and sustaining good governance in communities, electric power systems have the opportunity to take the lead in promoting sound corporate governance. The technological innovations make this task easier should the managerial skills and desire exist. Electric power systems can be restructured to make power sector organizations operate in competitive environments where efficiency and effectiveness in service delivery are both virtues and necessities.

Acknowledgements

The author thank Dr. Ron Watts for assistance and comments on this paper. This paper is an abridged and revised version of a report, Electricity Theft: Understanding a Growing Problem prepared for InovaTech Australasia, Ptv. Ltd.

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