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# Review of International experience with incentive regulation – for application in Mongolia’s electricity transmission and distribution sectors

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## **ABBREVIATION AND ACRONYMS**

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CAIDI	Consumer Average Interruption Duration Index
CPI	Customer price unit
ERA	Energy Regulatory Authority
EPRC	Economic Policy Reform and Competitiveness Project
EUCI	Electricity utility Consultation Lnc.
GAF	Growth adjustment factor
MAIFI	Momentary Average Interruption Frequency Index
NDC	National Dispatcher Center
O&M	Operation and Maintenance
OHSC	Ontario Hydro Service Company (owner of Ontario Transmission)
PBR	Performance based regulation
PES	Public Electricity Supplier
ROE	Return on equity
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SC	Social Cost
UBEDN	Ulaanbaatar Electricity Distribution Network
USAID	United States Agency for International Development



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## **BACKGROUND AND PURPOSE OF REPORT**

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### **1. Background**

Mongolia's Energy Regulatory Authority (ERA) is considering implementation of an incentive regulatory mechanism for the transmission and distribution companies. In this regard, the ERA has requested the EPRC Project Team to draft a report on international experience with incentive, or performance-based,<sup>1</sup> regulatory mechanisms.

It is understood that this incentive regulatory mechanism is being considered for implementation as early as 2007, although a specific implementation date has not yet been specified. It could therefore apply under the single buyer market currently in place in Mongolia, and during the bilateral contracts market scheduled for implementation during the latter part of 2008. As a result, the design of the incentive regulatory mechanism is reviewed within the context of the current market structure, in effect, a vertically-integrated market with separate business units. However, the concepts discussed in this paper are consistent with the bilateral contracts market design envisioned in the March 31, 2006 Draft *Rules for the Wholesale Power Market of Mongolia National Power System*. The goal is to promote improved performance of the transmission and distribution licensees consistent with the ultimate move to greater competition. If implemented in 2007 in advance of the bilateral contracts market, transmission and distribution licensees will be in a better position to "perform" once the new market is introduced.

### **2. Purpose of Report**

This report documents international experience with incentive regulatory mechanisms. In addition, a discussion and example of how such a mechanism might be designed for Mongolia's transmission and distribution companies is provided. The goal is to reduce the regulatory burden while providing incentives to utilities to improve performance to the benefit of consumers.

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<sup>1</sup> Incentive regulation goes under a number of different names. While typically referred to as incentive regulation in Europe, it is often referred to as performance based regulation (PBR) in North America. It also goes under the names: price cap regulation, revenue cap regulation, yardstick regulation, etc.



## SECTION I: WHAT IS INCENTIVE REGULATION?

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Mongolia currently practices cost-of-service regulation. Under traditional cost of service regulation, utilities are allowed to recover prudently-incurred costs plus a return on investment. This form of regulation requires frequent regulatory reviews, a daunting task for the ERA as there are currently 57 energy licensees in Mongolia. In addition, cost of service regulation provides little incentive to utilities to increase service offerings to customers or to cut costs – regardless of performance, the utility recovers its costs plus a profit.

The primary objective of incentive regulation is to inject competitive market incentives into monopoly markets and weaken the link between costs and tariffs. Under incentive regulation, price or revenue is capped, providing utilities with the incentive to improve efficiency and reduce costs to increase profit margins. Incentive regulation is a more light-handed form of regulation, resulting in:

- Less frequent regulatory reviews, and as a result, reduced costs of regulation;
- Reduced cost of power owing to sharing of utility cost reductions between utilities and consumers; and
- Improved risk allocation between utilities and consumers.

When designed properly, incentive regulation has produced significant value to both utilities and consumers. For example, under incentive regulation during the ten year period from 1992 through 2002, the National Grid Company in England and Wales reduced its unit cost of transmission by 37%, while increasing transmission system availability by a full percentage point to over 99% and increasing the capacity of the transmission system in excess of 20%<sup>2</sup>.

Most incentive regulation schemes institute a revenue, or price, cap that is adjusted annually to account for input price increases offset by productivity improvements to ensure that customers share in any benefits derived by the utility. Often, a “Z-factor” is included in the revenue/price cap formula to allow direct pass-through to consumers of costs over which the utility has no control; i.e., equipment repair costs following a severe weather event, changes in the tax system, etc. A typical incentive regulation formula is shown below.

$$\text{Price}^t = \text{Price}^{t-1}(1 + \text{In} - X) \pm Z$$

Where:

- t = current period
- t-1 = last period
- In = inflation index
- X = productivity factor
- Z = pass-through costs beyond utility’s control

The incentive regulation plan is reviewed at regular intervals, for example, every three to five years when revenues/prices are reset. The length of the review period is selected to ensure that consumers share in the utility’s efficiency gains while providing the utility with enough time to gain a return on its investment.

The incentive to cut costs under incentive regulation leads to reliability and service quality concerns on the part of consumers. In this regard, incentive regulatory schemes generally include performance benchmarks related to reliability, market efficiency, customer service, and perhaps, employee and public safety. Performance benchmarks are normally based on

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<sup>2</sup> Jon Carlton, Vice President and Director of Regulatory Research, National Grid, at EUCI Performance-Based Ratemaking Conference, Denver, CO, November 9-10, 2000.

historical and/or peer group performance, and may include financial bonuses or penalties when the utility exceeds or falls short of the benchmark.

For transmission and distribution “wires” businesses, incentive regulation means:

- Revenues will be tied to performance, so there is:
  - Greater opportunity to increase profits and shareholder value; and
  - Increased business risk as revenues are tied to performance with no guarantee of full recovery.
- Performance will be transparent:
  - Compared directly with other “wires” businesses; and
  - Subject to peer pressure.

## SECTION II: KEY DESIGN ISSUES

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There is a number of key design issues associated with an incentive regulatory mechanism, as follows:

- What form of cap?
  - Price Cap – permitted changes in prices driven by changes in price indices. The cap is normally applied to the utility’s average price.
  - Revenue Cap – permitted changes in revenue driven by changes in price indices. Can include an absolute cap on revenues, in which case a growth factor is often included, or a cap on revenues/customer (so the growth factor is built in). At the end of the year, actual revenues are compared to allowed revenues, with the difference added as a refund or surcharge to rates in the following year.
- What is the appropriate basis for initial tariffs; i.e., current tariffs, recent cost of service, etc.
- Correctly specifying the adjustment formula, in particular, the input price index and offsetting productivity index. The design should reflect current industry factors, including the cyclic nature of the power industry and the effects of competition within and external to the industry.
- Benchmarks to ensure against performance deterioration. Benchmarks might include customer service (as measured through customer surveys), reliability, employee and public safety, etc.
- Incentives might be included linked to performance related to customer service or reliability. A discussion of such performance indicators and incentives is provided in the EPRC report entitled Proposal for Expanding the ERA’s Financial Benchmarking System and Implementing Performance Agreements, dated August 2006.
- Term of performance agreement; i.e., three to five years.
- “Z” factor - must be carefully evaluated to include only costs that are truly beyond utility’s control.

There may also be an earnings sharing mechanism when profits exceed or fall below certain thresholds.

Most incentive regulatory mechanisms include conditions under which the mechanism can be re-opened, and in extreme cases, terminated. Such provisions normally apply when something goes drastically wrong, such as a utility’s rate of return falling below a pre-determined level.

The incentive formula and mechanism must be consistent with:

- The market structure;
- The role of the regulated entity; and
- The overall goals and objectives of the consumers.



### **SECTION III: INTERNATIONAL LESSONS LEARNED**

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A collection of notes relating to international incentive regulatory mechanisms is included in Annex A. This annex is included for reference only. It is based on information that is somewhat dated (about five years old), but identifies problems encountered with earlier incentive regulatory designs, and provides a number of lessons for Mongolia, as outlined in this section of the report.

A case study of lessons learned in other jurisdictions undertaken by the Canadian province of Ontario is summarized below:

- Incentive regulation can result in price declines to consumers while providing higher returns to utilities;
- Even with price declines, customers will perceive superior utility returns as inequitable;
- If customers perceive one aspect of restructuring as inequitable, they will view entire restructuring process with suspicion. A closed regulatory process can add to perception that utilities are being treated too leniently;
- Distortions caused by superior returns suggest that regulators must carefully consider the linkage between prices and returns; and
- Cost cutting under PBR is aggressive, leading to mergers, particularly amongst distribution companies

The Ontario study identified the following principles of an incentive regulatory mechanism:

- Address all requirements of legislation and regulations
- Protect consumers and result in prices that are just and reasonable
- Discourage cross-subsidization between regulated and competitive services
- Encourage greater economic efficiency and incentives to maintain quality of service
- Permit utility the opportunity to earn a reasonable return on capital and maintain financial viability. Be transparent and as simple as possible. PBR administration costs should not exceed benefits
- Allocate benefits fairly between the utility/shareholder and customers
- Be flexible and able to handle changing and varied circumstances
- Facilitate the use of efficient processes

Based on an analysis of incentive regulation in international jurisdictions, the following general statements can be made with regard to design parameters:

- Revenue Cap is the dominant form of incentive regulation for wires businesses
- The consumer price index (CPI), or the retail price index, is most commonly used for allowable price increases
- The productivity, or X-factor, is set on the basis of many inputs, and may ultimately reflect a negotiated position
- In-period reviews have posed a major challenge in many jurisdictions. Earnings-sharing mechanisms, such as those used in California, make annual reviews a requirement in order to determine the customer's share of excess revenue earnings. In-period reviews increase regulatory risk, reduce price stability, and increase the level and cost of regulation. In some cases, constant in-period reviews have effectively reduced incentive regulation to cost-of-service regulation. Greater discipline is necessary, staying with the formula through up and down years. Some jurisdictions have implemented, or are considering implementation of yardstick regulation whereby revenues are based on industry averages

- With regard to the selection of performance indicators:
  - There are limited industry benchmarks available. Those that do exist tend to be wide ranging owing to inconsistent reporting requirements
  - It is common for Distcos to be benchmarked against other Distcos in the jurisdiction; Transcos tend to be benchmarked against international Transcos, or against their own historical performance
  - Indicators tend to be too many and too specific. There is a need to be more broad-based, and better reflect what customers value. At the retail level, customers care about level of service, reflected by quality of supply, and utility response to queries and requests, such as billing questions and new service connection requests. A large number of indicators can produce perverse incentives to utilities, and impede a utility's ability to direct capital and operations and maintenance funds to those areas that return the greatest customer satisfaction.
  - Penalties and peer pressure, rather than rewards, are more commonly used to give effect to performance benchmarks.
  - There is a general trend toward more market-based rewards and penalties in competitive electricity markets; i.e., performance related to transmission line outages tied to market impacts. Performance indicators that are not tied to market impacts are not providing the proper incentives to utilities to direct capital and O&M expenditures to the components of the network that have the greatest financial impact on consumers.

## SECTION IV: RECOMMENDATION FOR MONGOLIA

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The approach followed in this analysis takes into account the current state of the electricity industry in Mongolia. For example, there remains a number of “issues” with tariffs, in particular, the current understanding that tariffs are not high enough to enable power companies to attain financial self-sufficiency. On the other hand, it is very difficult to raise tariffs in the current political climate. Our assumption is that tariffs should be based on costs. In this regard, the incentive mechanism is designed on the basis that it will provide power companies with a reasonable opportunity to recover their costs and make a profit. In reality, the mechanism may reflect only shadow prices<sup>3</sup>, and actual power company revenues will be adjusted to reflect political social considerations.

In addition, when making recommendations relating to specific design aspects of the incentive regulatory mechanism, we have compared the expected outcome of the design decision to the expected outcome under the regulatory mechanism in place today. In effect, we have not allowed ourselves to become bogged down in details in an effort to reach perfection. Instead, we have looked to develop a design that enables Mongolia to initiate incentive regulation in an effort to provide incentives to power companies to improve performance and customer service relative to what is likely to transpire under the current mechanism. This has enabled us to avoid some of the pitfalls that have confounded other jurisdictions embarking on incentive regulation, particularly those that arise when data are simply not available.

As noted, this design enables Mongolia to implement an incentive regulatory mechanism at this time in spite of current data deficiencies. However, we cannot over-emphasize the importance of true and accurate data and information to the regulatory process. Mongolia is currently in the process of acquiring better data, and as this data and information become available, it should be incorporated in the incentive regulatory mechanism to enhance and improve effectiveness in meeting its design objectives.

### 5.1. Price or Revenue Cap?

As noted, under price cap regulation prices represented by the average tariff are capped independent of costs. Price cap regulation has two principal disadvantages:

- Encourages increased sales contrary to energy efficiency goals, although this might be addressed through the “Z” factor, or through rewards in performance standards; and
- Less suitable for firms with high fixed costs (i.e., wires companies) – declines in energy transfers can reduce revenues without corresponding cost decreases

Under revenue cap regulation, the utility’s overall revenues are capped independent of costs. Revenue caps are much the same as price caps, but revenue is adjusted for changes in input prices net of productivity improvements. Adjustments might allow for changes in growth; i.e., changes in the number of customers. Revenue caps reduce incentives and risks associated with sales. Revenue is constrained so there is an incentive to reduce unit costs and number of units sold in order to maximize total profits. Variations in sales are not as likely to cause financial distress.

The disadvantages of revenue caps are:

- Encourages utility to raise prices to reduce sales and maximize profits
- Pricing tends to be more volatile

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<sup>3</sup> Shadow prices mean prices that are tracked and recorded, but not necessarily applied.

It is possible to combine the features of both models in order to offset the disadvantages. Most international jurisdictions use revenue caps for their wires companies. It is recommended that Mongolia likewise use a revenue cap for its transmission and distribution companies.

## **5.2. Basis for Initial Revenues**

Initial revenues may be set on a number of bases, as follows:

- Current revenues
- Updated cost of service studies and revenue requirement
- Benchmarking; i.e., against other like-utilities
- Negotiations

Internationally, it is common to use current revenues, or an updated cost of service study as the basis for the revenue requirement. In Mongolia, the ERA conducts audits of power company costs when the companies submit a request for tariff increase. Therefore, it is recommended that initial revenues for the incentive regulatory mechanism be based on the following:

- Use the latest ERA audited prices and revenue requirement when available; Use current revenues when ERA audited prices and revenue requirement are not available.

## **5.3. Adjustment Formula**

The adjustment formula includes the indices under which revenues are allowed to increase. The formula includes an escalation factor such as CPI that is offset by a productivity factor. Revenue cap formulas may also include a growth factor.

Many jurisdictions have attempted to develop price escalators reflecting the mix of utility price inputs. It is understood that the ERA is currently going through such an exercise. While the concept makes sense, it is often difficult to gain agreement on the correct “basket” of input prices as proportions often vary from one utility to the next. It can also be difficult to find a published index, or indices, that are free of interpretation.

The inflation factor should relate to, but not directly reflect, the costs that Mongolia’s transmission business and distribution businesses face. For example, if an industry had only labor costs, the inflation factor should be based on a country-wide labor index rather than an industry-specific labor index. If based on the industry’s actual labor costs, there would be no incentive to aggressively reduce labor costs.

For these reasons, most jurisdictions use an exogenous index such as CPI (or a variation such as retail price index). CPI is often published by independent Government institutions at regular intervals. It is recommended that Mongolia likewise use a broad-based published Government index that is free of interpretation such as CPI. Use of an independently-derived and broad based index such as the CPI will eliminate any claims relating to price manipulation as the power companies have little influence or control over the index.

The determination of an appropriate productivity factor can be challenging. Productivity indices are normally based on one of the following:

- A review of the utility’s recent historical productivity improvement (the physical relationship between outputs and inputs). It can be based on the annual change in revenue requirement excluding variations due to inflation and growth;
- Published productivity indices for a similar industry group, or the jurisdiction’s industry as a whole; or
- Negotiation

It would be difficult to base a productivity factor in Mongolia on historical performance. Revenues are currently below the levels necessary for financial self-sufficiency, and power companies generally feel they have not had enough revenue to meet current customer needs let alone invest in technologies that would improve performance.

The Government does not publish a specific index relating to productivity, but does publish an index on value-added per employee<sup>4</sup>. This is a measure of productivity, and a specific index for “electricity, thermal energy and steam” is published. Over the past five years, overall value-added per employee in Mongolian industry has improved by an average of almost 9% per year. For the “electricity, thermal energy and steam” sector, the figure is 2.5% annually. This compares to CPI over the same period averaging almost 5% per year.

Because retail tariffs currently generate less revenue than needed, consideration should be given to setting the productivity factor at a negative figure; i.e., let revenues rise at a level above inflation. However, retail tariff would also have to be raised in real terms, and there appears to be little appetite in Mongolia to increase tariffs at levels above inflation. Therefore, it may be appropriate to set the productivity factor at zero (i.e., allow revenues to increase at the inflation rate) at least until the ERA has conducted a full audit of costs and the resulting revenue requirement to enable comparison to the revenues needed to operate in a financially self-sustaining manner.

Because a revenue cap mechanism is being recommended, a growth adjustment factor should be incorporated in the formula. Growth is viewed as the primary driver of transmission and distribution system expansion. The growth factor should be based on the most recent load forecast, and should be specific to each “wires” company. The growth factor should relate to demand rather than energy because the peak demand is what typically drives transmission and distribution investment decisions.

Therefore, the formula would be defined as follows:

$$R_{2007} = R_{2006} (1 + \text{CPI} - X + \text{GAF}) \pm Z$$

Where: R = revenue (excludes one-time Z factors)  
 CPI = inflation factor for 2006  
 X = productivity factor  
 GAF = growth adjustment factor - forecast growth in peak demand  
 Z = Z factor for one-time costs incurred in 2006

#### 5.4. Performance Benchmarks

In order to guard against cost cutting to levels where performance starts to deteriorate, benchmarks are employed. If performance is not up to the benchmarks, the utility is called in by the ERA to explain the performance deterioration. If the explanation does not satisfy the ERA, penalties may be imposed. In the U.S. state of Maine for example, if the utility fails to meet any of eight performance indicators, penalties of up to US\$3.64 million can be assessed.

International experience has shown that benchmarks should be broad-based rather than targeted, and should be limited to those that are of value to consumers. They should also be well-recognized in the industry with standard reporting mechanisms. In this regard, the following benchmarks are recommended for Mongolia:

- Distribution Companies
  - SAIDI

<sup>4</sup> See Mongolian Statistical Yearbook – 2005.

- SAIFI
- Customer service measured through customer surveys
- Employee and public safety
- Transmission Company
  - Frequency of delivery point interruptions; total number of delivery point interruptions divided by total number of transmission delivery points. Includes forced, planned and momentary interruptions, but not force majeure events
  - System minutes of unsupplied energy; energy not delivered to customers due to sustained delivery point interruptions divided by annual system peak. Includes all outages but those resulting from force majeure events
  - Customer service measured through survey of distribution companies and generation companies
  - Employee and public safety

Note that these benchmarks are proposed based on international experience. Mongolia will first need to review the statistics it compiles for its transmission and distribution sectors, and then choose its benchmarks accordingly.

Some jurisdictions include productivity incentives linked to performance in customer service or reliability. For example, San Diego Gas & Electric had productivity incentives as follows:

- Reliability
  - SAIFI benchmark: 0.9 outages/customer/year +/- 0.15
    - Maximum incentive: +/- US\$3.75 million
  - SAIDI benchmark: 52 minutes/customer/year +/- 15
    - Maximum incentive: +/- US\$3.75 million
  - MAIFI<sup>5</sup> benchmark: 1.28 outages/customer/year +/- 0.3
    - Maximum incentive: +/- US\$1.0 million
- Customer Satisfaction
  - Based on customer service monitoring system, call center responsiveness
  - Service guarantee: \$50 credit to customer if more than 4 hours late for service appointment
- Worker Safety

Performance incentives such as these are normally offered only when there is a particular aspect of service that customers want to see improved. In light of the current tariff situation in Mongolia, and the fact that there does not appear to be significant customer discontent relating to reliability or customer service issues, performance incentive bonuses are not recommended at this time.

Note that loss reduction is often raised as an area requiring improvement in Mongolia. However, the formula itself provides a significant incentive for loss improvement. The author is unaware of any other specific concerns related to performance of the wires companies, so makes no recommendations in this regard. However, discussion should take place among the stakeholders to determine if losses, or other areas of performance, are worthy of additional incentive beyond that provided by the formula.

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<sup>5</sup> MAIFI is the momentary average interruption frequency index in outages/customer/year

### **5.5. Term of Performance Agreement**

As discussed, the length of the performance agreement is a key design component. If too short, the payback period will not be long enough for a utility to recover its investment plus a profit, so there will be little incentive to invest. If too long, the customers receive reduced benefits.

As incentive regulation is new in Mongolia, and because the country will be going through a transition period with regard to tariff and market reform, it is recommended that the performance agreement be set at three years initially, with annual reviews to ensure it is working as anticipated. Consideration should be given to extending the performance period to five years in subsequent performance agreements.

### **5.6. Z-Factor**

The intent of the Z-factor is to allow recovery of costs over which the power company has little control. The Z-factor must be carefully evaluated to ensure it includes only those costs that are truly beyond the company's control. If too much cost is included in the "Z" factor, little room is left for cost improvement.

Following discussion with ERA and NDC staff, it appears that there have been no extraordinary expenses incurred by the power companies in 2006, so the Z-factor should be set to zero subject to a power company making a specific case for rate relief owing to an extraordinary event before the ERA.

### **5.7. Earnings-Sharing Mechanism**

In some international jurisdictions, earnings sharing mechanisms are incorporated in the incentive regulatory mechanism when profits exceed or fall below certain thresholds. Such mechanisms increase confidence that power companies will not earn excessive profits, or suffer excessive losses.

The disadvantages of earnings sharing mechanisms are that they reduce the incentive for power companies to reduce costs, and increase the costs of regulation. Generally when earnings sharing mechanisms are included, they apply only if earnings fall outside a band; i.e., sharing only when earnings are more, or less, than 300 basis points of the target earnings. There is no sharing if earnings fall within the band.

As the performance period will be short (i.e., three years) with annual reviews of performance, and because tariffs are likely to remain below costs for a period of time, no earnings sharing mechanism is proposed for Mongolia. Earnings sharing mechanisms might be considered in subsequent performance periods.



## **SECTION V: POWER COMPANY INCENTIVES**

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There has been significant discussion about the effectiveness of an incentive regulatory mechanism when the power companies are owned by Government. There is less motivation through profits, and profits may be difficult to achieve during the early years when retail tariffs under-collect that necessary for the power companies to operate in a financially self-sustaining manner.

We believe that incentive regulation remains a valuable exercise at this time in Mongolia because it will instill a commercial attitude amongst power company staff, making them better prepared for future market reform and privatization. The effectiveness of incentive regulation would be enhanced by offering rewards to management and regular staff when performance targets are achieved. As noted in the EPRC report entitled *Proposal for Expanding the ERA's Financial Benchmarking System and Implementing Performance Agreements*, dated August 2006, the "Social Cost" component of energy rates might be used as a vehicle for providing such employee incentives:

*In Mongolia, energy rates include a "Social Cost" (SC) component in the licensee's tariffs. SC includes employee allowances for items such as food, transportation, training, supplemental heating allowance, bonuses and travel. The SC is around 2.5% of the total revenue requirement. For example, for Power Plant #3 the SC component of the tariff is 1.15 tg/kWhr out of a total tariff of 45.15 tg/kWhr.*

*The EPRC team and ERA should consider use of the Social Cost component as a means for financial consequences in a performance agreement.*

*The arguments in favor of using SC include the following:*

- *Using SC is part of the rate tariff and thus clearly under ERA's authority, and*
- *SC is a financial issue in which all employees have a stake.*

When the target performance benchmarks are achieved, the ERA would direct a portion of the company revenues to the SC. If the ERA chooses to use SC in a performance agreement, performance benchmarks would be used that are consistent with those included in the incentive regulatory mechanism; i.e., SAIDI, SAIFI, customer satisfaction, employee and public safety, etc. An example of how such a mechanism might be employed in Mongolia is provided on pages 11 through 13 of the previously mentioned EPRC report on benchmarking. Examples of performance agreements are also provided in the report (see annexes).

Another avenue for rewarding performance is through Resolution No. 59, Appendix No. 1 of the Resolution issued by the State Property Committee on February 5, 2004 entitled *Methodology to Determine Monthly Salaries for Positions of Directors of State-Owned Self-Financing Enterprises and Executive Directors of State-Owned or Predominantly State-Owned Enterprises*. Under this regulation contracts are developed with target performance levels relating to economic and financial operations and results to provide incentives to directors of state-owned enterprises. Directors receive bonuses if they fulfill the obligations of the contracts as determined by the State Property Committee. Contracts could be drafted for the directors of the power companies with bonuses tied to the performance indicators in the incentive regulatory mechanism.

Generally, the former approach is preferred where all employees would be rewarded if their power company meets performance levels outlined in the incentive regulatory mechanism.

However, combining both approaches may be the most effective way of encouraging all employees of the power companies toward achievement of the goals specified in the performance measures of the incentive regulatory mechanism.

## SECTION VI: SAMPLE CALCULATION OF INCENTIVE REGULATORY MECHANISM FOR MONGOLIA

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A revenue cap formula with adjustments for inflation, expected productivity improvements and system growth is recommended. An example of the formula used to determine revenues using Ulaanbaatar Electricity Distribution Company as an example, follows.

$$R_{2007} = R_{2006} (1 + \text{CPI} - X + \text{GAF}) \pm Z$$

Where:  $R_{2007}$  is allowed revenue for the year 2007

$R_{2006}$  is actual 2006 revenues - 9211.5 million togrogs relating to the distribution business only (excludes one-time Z factors). This figure provided by ERA.

CPI is inflation factor – assumed to be 7%, but should be based on latest forecast of Mongolia’s CPI for 2007 as reported in Mongolian Statistical Yearbook

X is productivity factor - assumed to be 0 in this calculation, but in future, consideration should be given to using average of past five years productivity reflected by “value added per employee” reported in latest Mongolian Statistical Yearbook for “Electricity, Thermal Energy, Steam”

GAF is growth adjustment factor – assumed to be 4%, but should be based on official forecast growth in peak demand for UBEDN

Z is Z factor, or one-time costs incurred in 2006 – assumed to be zero, but should include extraordinary one-time costs that were beyond UBEDN control.

On this basis, UBEDN revenues for 2007 would be:

$$\begin{aligned} R_{2007} &= 9,211.5 \text{ million togrogs } (1 + .07 - 0.0 + .04) + 0 \\ &= 10,224.8 \text{ million togrogs} \end{aligned}$$

UBEDN’s target revenues for 2007 would be 10,224.8 million togrogs, and rates for 2007 would be established to recover this amount. At the end of 2007, if UBEDN’s revenues exceed this amount, the overage would be subtracted from the revenues calculated for 2008. If below this level, the deficiency would be added to the revenues calculated for 2008.

For example, if UBEDN’s actual revenues for 2007 turn out to be 10,000 million togrogs, actual inflation is 8%, and actual growth in demand is 5%, and there are no extraordinary events leading to “Z” charges, the true-up for 2008 would be determined as follows:

Calculation of allowed revenues for 2007 based on actual inflation, demand growth and Z-factor:

$$\begin{aligned} &9,211.5 (1 + .08 - 0.0 + .05) + 0 \\ &= 10,409.0 \text{ million togrogs} \end{aligned}$$

As actual revenues were 10,000 million togrogs, UBEDN over-collected by 409 million togrogs, so the 2008 allowed revenues would be decreased by the overage amount of 409 million togrogs.



**ANNEX A: COLLECTION OF NOTES RELATING TO INTERNATIONAL  
INCENTIVE REGULATORY MECHANISMS**

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## **ANNEX A: COLLECTION OF NOTES RELATING TO INTERNATIONAL INCENTIVE REGULATORY MECHANISMS**

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### ***Draft Statement of Principles for Regulation of Transmission Revenues in Australia***

- Consistent regulation of transmission networks to occur January 1, 2003
- Propose continued use of revenue cap based on CPI-X with service standards
- $P_0$  and glide path adjustment
  - $P_0$  is allowed revenue at start of regulation period
  - Glide path applies to regulatory period beyond initial period. Allows for gradual sharing of efficiency gains between users and Transco. Extends regulatory period, so encourages greater investment by Transco
  - In year 6, Transco keeps 80% of efficiency gains, in year 7, keeps 60%, etc until year 10 when all gains revert to customers
  - Recommend use of glide path for O&M expenditures, but not rate of return and capital expenditures
- Service standards
  - Transcos propose service standards and benchmarks as part of regulatory application
  - Commission publishes annual statistics comparing performance of each Transco - peer pressure. Includes: system minutes, availability, voltage quality. Many other possibilities proposed.
  - Penalties for non-performance to be developed - perhaps bonuses and penalties applied to allowable revenue
  - To consider market-based measures in future
- Five year regulatory period, with possibility of extending it in future
- Opposed to within-period reviews as increases regulatory risk
- Use Australian CPI as widely accepted compromise
- For X, use combination of performance indicators based on history, international benchmarks and forward looking assessments of cost drivers

### ***Distribution Price Caps in Britain***

- 1990-1995: allowed level of average regulated revenue to increase by more than rate of inflation, by up to 2.5% annually in real terms
  - to allow for investment to improve reliability
  - company-specific X factors for each Public Electricity Supplier (PES), with weighting formula which allowed average regulated revenue to change in response to changes in customer mix

### ***Supply Price Caps in Britain***

- 1990-1994: RPI-X for controllable costs, profit
  - cost pass-through of costs beyond PES' control
    - average electricity purchase costs
    - average cost of fossil fuel levy
    - allowed transmission cost per unit
    - allowed distribution cost per unit
    - average cost of Pool settlement
  - adjustment for under- or over- recovery of allowed revenues in previous year

### ***Distribution Price Caps in Britain***

- 1995-2000
  - significant cuts in allowed revenues
  - additional annual reductions in allowed revenues (RPI-X)
  - annual reconciliation of revenue with actual allowable collections, with excess collection refunded to consumers

### ***Performance Standards in Britain***

Guaranteed (must be met in each individual case)

- response to fuse failure
- restoration after outage
- providing supply and meter
- notice of interruption
- investigation of voltage complaints
- response to inquiries re: charges, payments
- scheduling and keeping appointments

Overall (not guaranteed on individual basis)

- % of supplies reconnected within 3 hours of outage
- % of supplies reconnected within 24 hours of outages
- all voltage deficiencies corrected within 6 months
- connecting new customers
- reconnection of disconnected customers by end of working day on which payment made

### ***Ofgem's Year 2000 Review for Distribution***

- Information and Incentives Project “aims to strengthen the financial incentives on companies to maintain or improve the quality of supply”

- September 2000 issued final proposals for output measures and monitoring delivery between reviews

Prompted by citation of:

“weaknesses in the way RPI-X has been applied... the need to reduce the emphasis on periodic negotiation with the regulator, to increase the emphasis on outperforming peers, to understand better the cost drivers of the business... to address a potential imbalance between incentives to efficiency in respect of operating and capital costs, to give clearer incentives in respect of quality of supply”

- $\leq 2$  percent of regulated revenue exposed to incentives
- Minimize number of output measures subject to direct financial incentive, for simplicity’s sake
- Incentivise outputs important to both domestic and business customers
- Study further what customers value
- No intention to set disaggregated targets for output measures at this time

#### **Ofgem’s Year 2000 Review: Proposed Output Measures**

- Number of interruptions to supply
- Duration of interruptions to supply
- Customer satisfaction
- Measure of customers’ satisfaction with response they receive when they contact the distribution businesses
  - to be measured via surveys conducted within 5-10 days of customer contact
  - PESs to assist in design of survey
- Interruptions to supply (number, duration)
  - consultants found up to 15% inaccuracy in reporting to Ofgem, owing to varying interpretations and definitions
  - short interruptions: definition extended from 1-3 minutes, to strengthen incentives to install auto-switching devices that operate in 1-3 minutes
  - but still required to report interruptions  $<3$  minutes

#### **Ofgem Yr 2000 Review: Monitoring Medium Term Performance**

- Ofgem concerned that distribution businesses may improve output measures, at the expense of medium-term performance
- Want to provide comfort to consumers that distribution plans consistent with overall, long-term integrity of distribution network
- Therefore intend to monitor:
  - analysis of network reliability using fault rates and fault causes on certain asset types over time (info already collected)
  - narrative from distribution businesses explaining changes in trends, evaluation of future failure rates, report on actions taken to remedy trends
  - provision of activity based information such as number of different asset types repaired, refurbished, maintained

***Distribution PBR in Norway***

- Revenue cap PBR
- Begun in 1/97
- Financial data for 1994 and 1995 used as basis
- Allowed revenue based on probable costs for 1997, with 2% reduction for general productivity improvement
- Return on capital 7% above/below base rate
- Undue/windfall profit rebated in year 2 after relevant year
- Individual productivity requirements set in 1998, with permitted income allowed to increase as % of increased energy delivered
- Lacks benchmarking, key incentives and penalties

**PBR in the Netherlands**

- Electricity Act of 1998 sets 2000 prices at 1996 levels
- PBR and benchmarking applied for tariffs 2001-2003
- RPI-X type PBR
- X factors recently set by regulator
- Average X factor per year 5.9%, highest over 9%
- National transmission company is benchmarked against international transmission companies
- Regional network companies (about 20) against each other
- Supply companies
  - Licensed supply companies are benchmarked against each other
  - Yardstick competition: allowed revenue is based on average level of own purchase costs and of the whole sector
  - Capped margin per customer based on 2000 levels

**Argentina Experience: Edesur**

- 1992-2002: initial tariff period
  - fixed price, calculated in \$US, adjusted for US inflation, with energy costs a direct pass-through to consumers
  - fixed distribution margin allows reasonable rate of return
  - to improve its profitability, Edesur must reduce operating costs and energy losses to a greater degree than is built into distribution margin
- Pre-specified service standards (e.g. voltage, outage duration and frequency, customer satisfaction)
- Failure to meet standards can result in penalties or loss of concession license
- Distribution margin set w/reference to certain operating efficiency standards, but does not incorporate explicit return on investments
- 2002: distribution margin to be reset until 2007, and reset every 5 years thereafter; methodology not yet determined

**San Diego Gas & Electric**

- PBR for distribution in effect 2000 to 2002
- RPI – X, with x-factors ranging from 1.32 to 1.62
- Earnings sharing when ROE exceeds target by more than 0.25%
  - Customers receive 75% when earnings are at .25% above target ROE, decreasing to 0% at 3% above ROE

**Performance indicators**

- Reliability
  - SAIFI benchmark: 0.9 outages /customer/year +/- 0.15. Maximum incentive: +/- \$3.75 million
  - SAIDI benchmark: 52 minutes/customer/year +/- 15. Maximum incentive: +/- \$3.75 million
  - MAIFI benchmark: 1.28 outages per customer per year +/-0.3. Maximum incentive: +/- \$1 million
- Customer Satisfaction based on customer service monitoring system, call center responsiveness. Service guarantee: \$50 credit if 4 hours late for service appointment
- Worker safety

**Maine Alternative Rate Plan 2000**

- RPI-X for 2001 to 2007 time frame
- X-factor ranges from 2.0 to 2.9%
- If ROE less than 5.2%, price index adjusted by 50% of revenue deficiency. No earnings sharing above that level
- Penalties if fail to meet any of 8 performance indicators. Maximum penalty is \$3.64 million in any year
- Reliability
  - SAIFI benchmark – 1.8 outages /customer/year
  - CAIDI benchmark – 2.58 hours per customer per year
- Customer Satisfaction: complaint ratio, % of business calls answered, % of outage calls answered, new service installation, call center service quality, market responsiveness

**Ontario Distribution PBR**

- Price cap based on RPI-X for period 2001 – 2003
- Initial rates based on 1999 revenue requirement
- Inflation index based on Ontario discos' historical cost input increases
- Base X-factor on Total Factor Productivity of 1.5% based on ratio of total output quantity index to total input quantity index
- First generation plan requires monitoring and reporting of service quality indicators
- Reliability
  - SAIDI, SAIFI and CAIDI – as minimum, remain within range of historic performance
- Customer Service: new service connection, meeting appointments, telephone access, emergency response, written response to inquiries, underground cable locates
  - Minimum standards based on survey of utilities

### ***Ontario Transmission PBR Proposal***

- Revenue cap with adjustments for inflation, expected productivity improvements and system growth, as follows:

$$R_{2000} = R_{1999} (1 + I - X + GAF) +/- Z$$

Where: R = revenue – R1999 = \$1255M (Can)  
(excludes one-time Z factors)  
I = inflation factor - Ontario CPI for 2000 as forecast in summer 1999  
X = productivity factor – 2.4% proposed by OHSC  
GAF = growth adjustment factor – 0.1% forecast growth in peak demand  
Z = Z factor - \$46M for one-time costs incurred in 2000

### ***Quality of Service Safeguards***

- Goal is to maintain performance at historical levels. Basis is that past performance has been adequate, and customers have expressed no desire to pay for improved performance
- Selection criteria:
  - Measurable
  - Comparable
  - Balanced and complementary

### ***Frequency of delivery point interruption***

- Total number of interruptions at all delivery points divided by total number of transmission delivery points
- Includes forced and planned outages, but not force majeure events
- Includes momentary interruptions
- Historical performance - 1.55 to 2.31
- Proposed threshold target of 1.93 delivery point interruptions/year

### ***System minutes of unsupplied energy***

- Energy not delivered to customers due to sustained delivery point interruptions divided by annual system peak
- Includes all outages but those resulting from force majeure events
- Historical performance - 11.1 to 33.7 system minutes
- Proposed threshold target of 22.6 minutes of unsupplied energy

### ***One-hour restoration commitment***

- Driver to expedite the restoration of sustained interruptions
- Percentage of sustained delivery point interruptions restored within one hour
- Historical performance - 75.3% to 84.8% (excludes force majeure, but does not materially impact data)
- Proposed target of restoring 78% of all sustained interruptions within one hour

### ***Twenty-four hour restoration commitment***

- Measure of company's response to customer's emergency needs
- Percentage of sustained delivery point interruptions restored within 24 hours

- Historical performance - 99.66% to 100% (force majeure not included but has no material effect)
- Proposed annual target of 99.9% of all interruptions restored within 24 hours

**Market efficiency performance measure**

- Transmission system unavailability impacts efficient operation of the electricity market
- When circuits out of service, market participants are unable to fully use transmission system
- Total annual circuit hours not available due to outages on all transmission circuits divided by total possible circuit hours available
- Historical performance - 1.89% to 3.23%
- Proposed annual target of 3.0% transmission system unavailability
- Ultimately, incentives would be based on expected costs the company would incur in meeting the targets. Would be included in revenue requirement. Company would pay out amounts to market participants based on actual performance with respect to the targets during the year.

Performance Measure/Utility	Standard
<b>SAIDI<sup>a</sup></b>	
	<b>Minutes</b>
Boston Edison	108.8
Commonwealth Electric	115.0
Energy Gulf States	158.0
Pacific Gas & Electric	145.0
Public Service Company of Colorado	79.0
San Diego Gas & Electric	52.0
South ern California Edison	55.0
<b>SAIFI<sup>b</sup></b>	
	<b>Number of Interruptions</b>
Boston Edison	1.040
Central Maine Power	2.000
Commonwealth Electric	1.484
Energy Gulf States	2.600
Maine Public Service Company	3.100
Pacific Gas & Electric	1.480
San Diego Gas & Electric	0.900
<b>Call center response times</b>	
	<b>Percentage of calls answered</b>
Bay State Gas Company	95% within 30 seconds emergency/
	80% within 30 seconds billing <sup>c</sup>
Boston Edison	70% within 30 seconds
Boston Gas Company	95% within 30 seconds emergency/ 80% within 30
	seconds billing
Commonwealth Electric	67% within 30 seconds
Commonwealth Gas	35% within 30 seconds <sup>d</sup>
Public Service Company of Colorado	70% within 45 seconds
San Diego Gas & Electric	80% within 60 seconds
Scottish Power/PacificCorp	80% within 20 seconds
South ern California Edison	75% within 50 seconds <sup>e</sup>

Notes: a: System Average Interruption Duration Index

b: System Average Interruption Frequency Index

c: Bay State is seeking to reduce the standard to 75 percent within 40 seconds for billing calls

d: Subject to revision upon further data tracking

e: For 90 percent of all weeks

Source: This Table was is based on Table 3 in Acting on Performance-Based Regulation, By Ron Davis, Electricity Journal, May, 2000

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