Economic Policy Reform and Competitiveness Project

Proposed retail tariff reform plan for Mongolia's Central Electricity System

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ABBREVIATION AND ACRONYMS

CHP	Combined Heat and Power
ERA	Energy Regulatory Authority
EPRC	Economic Policy Reform and Competitiveness Project
NDC	National Dispatcher Center
O&M	Operation and Maintenance
USAID	United States Agency for International Development

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PREAMBLE

Over the past year, the Economic Policy Reform and Competitiveness Project (EPRC) under USAID Contract No. 438-C-00-03-00021-00 has been assisting the ERA with development of a tariff reform plan to rationalize the current retail tariff regime consistent with the ERA's responsibilities under the Energy Law and its commitment in the Memorandum of Understanding executed with the Ministry of Fuel and Energy.

A reliable and reasonably priced electricity supply is vital if Mongolia is to experience continued economic expansion in the future. As early as 2004 both EPRC and the World Bank were aware of a number of problems with Mongolia's retail tariff regime. Most importantly, large tariff increases were, and still are, necessary if the power sector is to meet current and future electricity demand with adequate levels of service reliability in a financially self-sustaining manner. In addition to the inadequacy of tariffs, there are a number of other problems with Mongolia's retail tariff regime. Specifically, there is significant cross-subsidization between customer classes, the number of customer classes is limited leading to cross-subsidization within customer classes and tariff designs do not effectively meet the tariff design objectives, which include efficiency, fairness and yielding the required revenues.

The importance of tariff reform is acknowledged in the Memorandum of Understanding (MOU) between the Ministry of Fuel and Energy (MoFE) and the Energy Regulatory Authority (ERA). The purpose of the MOU is to:

> *strengthen collaboration between the Parties on energy sector policy and strategy, regulation of the sector and certain regulatory reform issues and implementation, in particular, on matters including improvement of the financial situation of licensed companies, tariff reform, new bilateral contract power market structure; ERA annual budget preparation and approval; support of the Energy Working Group; certain heat sector issues; and sustained operation of the ERA in accordance with the provisions of the Law of Mongolia on Energy approved on February 1, 2001 (as it may be amended or restated in the future).*

A tariff review includes three components, as follows:

1. Determination of the revenue requirement necessary for power companies to operate in a financially self-sustaining manner;
2. A cost of service study that allocates the revenue requirement to the different customer classes on the basis of the cost to supply the class. The allocated cost is compared to current revenues derived from the customer class to determine the level of cross-subsidization between customer classes; and
3. Development of tariff designs to recover the allocated revenue from each customer class.

In order to ensure accuracy of data, gain timely feedback and provide training on the various concepts, EPRC with the ERA's assistance developed four reports over the past year, one on each of the three tariff review components identified above, and a fourth report that combines the three earlier reports and develops the recommendations into a comprehensive retail tariff reform plan that extends over the next several years. EPRC and the ERA conducted a series of workshops on the reports for regulators industry stakeholders. The workshops helped with the feedback process and enhanced the training effort on tariff design concepts. The workshops were conducted after each report was translated and delivered to the ERA.

The chronology of events over the past year culminating in this report entitled ***Proposed Retail Tariff Reform Plan for Mongolia's Central Electricity System*** is documented in the table below.

Event	Report/presentation	Date
1	Presentation to ERA on ***tariff design and marginal cost principles***	Mar 5, 2007
2	Report entitled ***energy sector financial and tariff issues***	May 25, 2007
3	Report entitled ***retail electricity tariffs for Mongolia's central electricity system – revenue allocation and cross-subsidy analysis***	Oct 3, 2007
4	Presentation to ERA on ***revenue allocation and cross-subsidy analysis***	Oct 10, 2007
5	Report entitled ***review of Mongolia's retail tariff designs for the central electricity system***	Jan 18, 2008
6	Presentation to ERA on ***tariff design review***	Feb 27, 2008
7	Draft report entitled ***proposed tariff reform plan for Mongolia's central electricity system***	Mar 10, 2008
8	Presentation to ERA and other stakeholders on ***retail tariff reform plan***	Apr 2, 2008
9	Final report entitled ***proposed retail tariff reform plan for Mongolia's central electricity system***	May 29, 2008

ERA staff has reviewed this retail tariff reform plan and have no comments or issues regarding it. The energy working group and key energy sector stakeholders now need to move to implementation of the Plan.

EXECUTIVE SUMMARY

A reliable and reasonably priced electricity supply is vital if Mongolia is to experience continued economic expansion in the future. The importance of tariff reform is acknowledged in the Memorandum of Understanding between the Ministry of Fuel and Energy and the Energy Regulatory Authority. The purpose of the Memorandum of Understanding is to:

> *strengthen collaboration between the Parties on energy sector policy and strategy, regulation of the sector and certain regulatory reform issues and implementation, in particular, on matters including improvement of the financial situation of licensed companies, tariff reform, new bilateral contract power market structure; ERA annual budget preparation and approval; support of the Energy Working Group; certain heat sector issues; and sustained operation of the ERA in accordance with the provisions of the Law of Mongolia on Energy approved on February 1, 2001 (as it may be amended or restated in the future).*

The Economic Policy Reform and Competitiveness Project (EPRC) under USAID Contract No. 438-C-00-03-00021-00 is assisting the ERA with development of a tariff reform plan to rationalize the current retail tariff regime consistent with the ERA's responsibilities under the Energy Law and its commitment in the Memorandum of Understanding. This report outlines the rationale for tariff reform and presents the methodology and schedule (i.e., the "tariff reform plan") for periodic adjustments to the retail tariff regime according to the issues and priorities of the ERA.

Summary of conclusions

A large increase in retail electricity tariffs is required as summarized below:

- Despite substantial improvement in the past three years resulting from implementation of international accounting standards, there remain a number of inappropriate accounting practices in the sector. The more material of these involve using tax accounting treatment for capitalized maintenance and the lack of properly valued property, plant and equipment. The financial effect of adjusting for these categories plus several lesser items would necessitate a 33 billion MNT revenue increase to bring the power sector to break-even. This is equivalent to 25% of the 2008 revenue forecast, and still would not be sufficient to bring the sector to financial self-sustainability. This figure is understated as there is no provision for either a return on capital or for a working capital allowance (i.e., the financing of daily cash flows). Further, it is recognized that much of the required ongoing maintenance has been deferred, so a higher expenditure is required to avoid the premature deterioration of sector assets.
- The electricity licensees indicate that owing to increasing input prices they need a tariff increase if they are to maintain current levels of service, let alone fund much needed improvements. These tariff increases would be in addition to those resulting from the adjustments to accounting practices identified above. The 4% tariff increase in October 2007 and the recently imposed increase in the time-of-use tariff for the entity class representing a 3% increase in revenues have not kept pace with Mongolia's 14% inflation rate in 2007.
- Increasing electricity demand and retirement of aged and inefficient generation equipment that has reached the end of its useful life require that Mongolia construct new generation, transmission and distribution facilities or risk stunting economic growth and face power/heat shortages.

- Government social initiatives such as connection of customers in the Soums to the main power grid and the Renewable Energy Law will put increasingly upward pressure on retail tariffs.
- Comparison with the international community confirms that Mongolia's retail tariffs are far below levels needed to maintain the financial integrity of the power sector. Mongolia's residential and industrial retail tariffs are only 26% and 46%, respectively, of the international average.

The World Bank reports that even a 60% tariff increase in real terms (i.e., over and above inflation) between 2008 and 2014 will not achieve financial self-sufficiency, although it will move Mongolia significantly in that direction. EPRC's estimate of the required tariff increase is comparable to that of the World Bank.

In addition to the need for a large tariff increase, there are a number of other problems with the retail tariff regime as follows:

- There is significant inter-class cross-subsidization in the tariff structure; i.e., household customers are receiving a substantial cross-subsidy from the entity customers.
- There is significant intra-class cross-subsidization in the tariff structure brought on by too few customer classes; i.e., Small Entity customers supplied at the low voltage level are receiving a substantial cross-subsidy from the Large and Medium Entity customers supplied at high and medium voltage levels.
- Tariff designs do not meet the primary design objectives including fairness, efficiency and generation of the required revenues:
    - Owing to the uniform national tariff there is cross-subsidization between customers of different distribution companies and less transparency, leading to reduced incentives for distribution companies to improve efficiency.
    - There is currently no load research data relating to demand contributions of the different customer classes making it impossible to accurately allocate demand costs to different customer classes.
    - Tariffs do not include fixed monthly customer charges so recovery of the basic costs of hooking a customer up to the system and the ongoing costs of metering, billing and the provision of other customer services such as energy efficiency and demand management programs is not ensured.
    - Although the current Time-of-Use (TOU) tariff for the entity customer class is providing reasonably efficient price signals, a design methodology should be adopted that sets the nighttime off-peak period price at a floor price recovering as a minimum the variable cost of power, the daytime shoulder period price at the average tariff for the class, and the evening peak period price at a level necessary to recover the remainder of the revenue requirement assigned to the class.
    - A number of improvements should be made to the TOU tariff designs for the households and Streetlight customer classes, including:
        - The time periods should be made consistent with those for the entity customer class.
        - Rates for each period should be derived using the same methodology described for the entity customer class, but based on the floor price and revenue requirement specific to the household and Streetlight customer classes.
        - The TOU prices should be increased for the household customer class over time to reduce the price differential between the TOU and non

time-varying tariffs in a manner that is consistent with efforts to reduce the cross-subsidy currently being paid by Entities on behalf of households and Streetlights.

- If the Government of Mongolia is interested in providing a subsidy to "vulnerable customers" through the electricity sector, it should develop a clear policy outlining the target subsidy group, the level of subsidy to be provided, who is to pay for the subsidy and how the subsidy is to be conveyed to the target group.

Issues and priorities

The Exhibit below summarizes the primary issues relating to Mongolia's retail tariff regime and shows the priority of each as agreed to with the ERA.

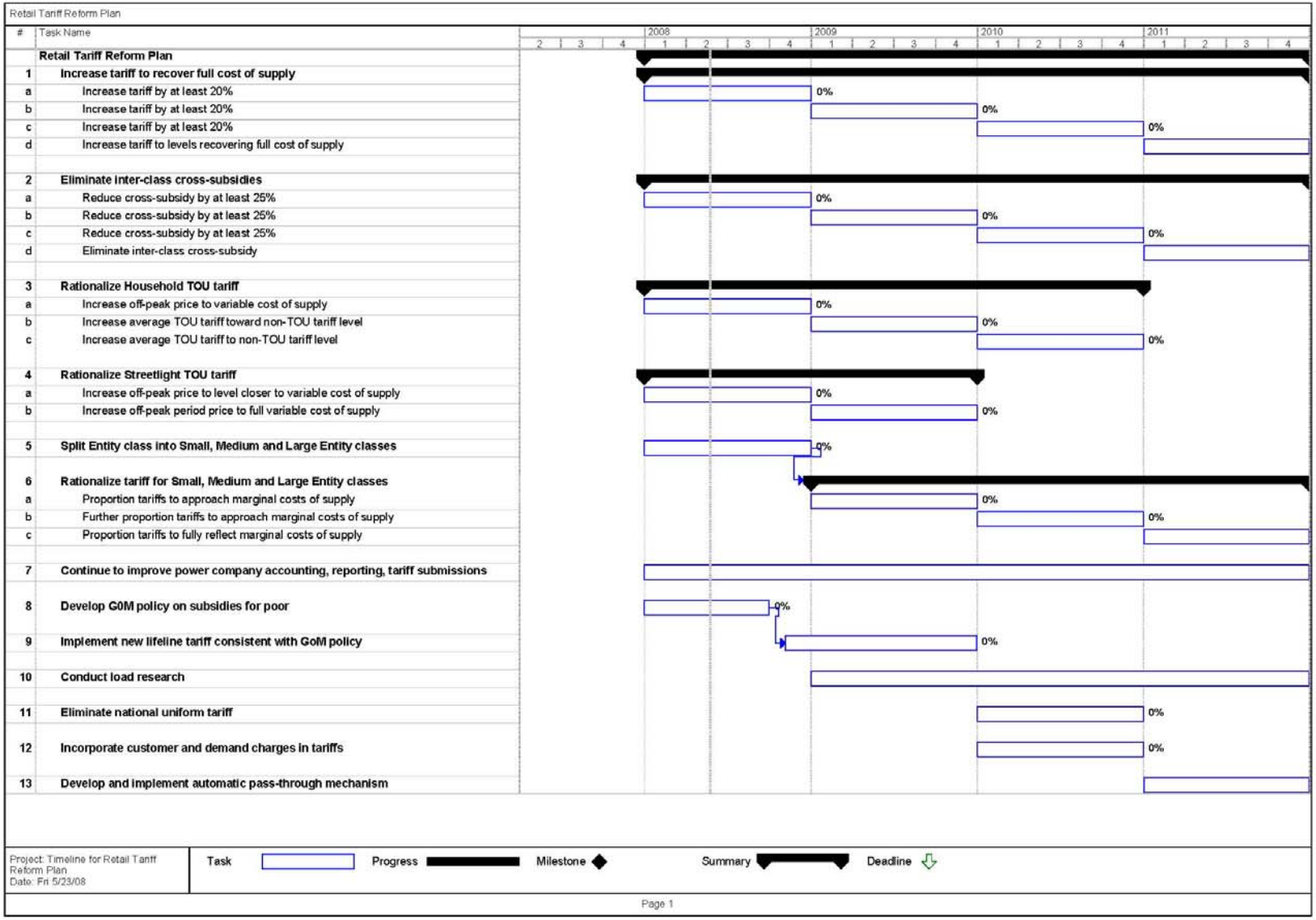
Issue	Priority
Increase average retail tariff to levels enabling financial self-sufficiency of power companies	High
Reduce and make transparent cross-subsidies between customer classes	High
Develop social policy relating to lifeline tariffs for the poor and implement lifeline tariff	High
Increase customer classes to reduce and make transparent cross-subsidies within entity customer class	High
Rationalize time-of-use tariffs including time periods and charges for each time period for each customer class	High
Continue to improve accounting standards, financial reporting and tariff submissions by power companies	Medium
Add customer charges to retail tariffs	Low
Add demand charges to retail tariffs, particularly those served from HV network	Low
Eliminate National Uniform Tariff	Low
Design and implement load research program	Low
Develop automatic pass-through mechanism (i.e., fuel adjustment clause)	Low

Proposed retail tariff reform plan

The proposed retail tariff reform plan is shown in the exhibit below. A detailed verbal description of the plan is provided in ***Section 6***. The plan is based on the issues and priorities developed with the ERA and is proposed for discussion with industry stakeholders including the GoM.

A key consideration in the development of the tariff reform plan is the time frame over which it will be implemented. The required tariff increase is very large, of the order of 50 to 60% in real terms and Mongolia's inflation rate is in the double digits (about 14% in 2007). If double digit inflation continues, tariffs will have to double (i.e. a 100% increase) over the next four years if the power companies are to become financially self-sufficient and the GoM is to receive a reasonable return as the principal shareholder. It is desirable to spread such large increases over a period of years in order to smooth the impact on consumers. Conversely, the time period should not be too long because it sends the wrong signal to potential investors (i.e., they will not take it seriously and will be less likely to invest), and because it is necessary to fund much needed capital expenditures in the near term, particularly if Power Plant #5 proceeds as planned. On this basis, four years has been selected as the period over which tariffs will be rationalized. This equates to tariff increases of the order of 20% in each of the four years of the plan.

Proposed retail tariff reform plan



SECTION I: BACKGROUND

A reliable and reasonably priced electricity supply is vital if Mongolia is to experience continued economic expansion in the future. Currently, there are a number of problems with Mongolia's retail tariff regime. Most importantly, large tariff increases are necessary if the power sector is to meet current and future electricity demand with adequate levels of service reliability in a financially self-sustaining manner. The World Bank reports that even a 60% tariff increase in real terms (i.e., over and above inflation) between 2008 and 2014 will not achieve financial self-sufficiency, although it will move Mongolia significantly in that direction.[1] In addition to the inadequacy of tariffs, there are a host of additional problems with Mongolia's retail tariff regime. Specifically, there is significant cross-subsidization between customer classes, the number of customer classes is limited leading to cross-subsidization within customer classes and tariff designs do not effectively meet the tariff design objectives including efficiency, fairness and yielding the required revenues.

Clause 9.1.5 of the Law of Mongolia on Energy (2007.01.11) relates to the ERA's powers which include:

- To establish a pricing and tariff system that enables supply of energy at the lowest possible cost and allows an adequate rate of return.

Further, Clause 26.2 of the Energy Law 2007 states that the following principles shall be observed in determining tariffs:

- tariffs should be based on real costs of operations;
- costs should be allocated to different consumer classes according to their requirements on electricity and heat supply;
- tariffs should enable regulation of energy consumption;
- tariffs should ensure price stability;
- tariffs should ensure that revenues of licensees are sufficient to support their financial viability;
- the tariff structure for electricity and heat should be clear and understandable for consumers;
- the least-cost principle should be followed while tariffs should be sufficient to enable compliance with the requirements of technical and technological safety in energy generation, transmission, distribution, supply and dispatching;
- the cost should be determined based on prior years' performance. However, depreciation of future investments or renewals should not be incorporated in the cost.

Currently, the tariff regime falls far short of meeting these principles. The need for tariff reform is acknowledged in the Memorandum of Understanding (MOU) between the Ministry of Fuel and Energy (MoFE) and the Energy Regulatory Authority (ERA). The purpose of the MOU is to:

> *strengthen collaboration between the Parties on energy sector policy and strategy, regulation of the sector and certain regulatory reform issues and implementation, in particular, on matters including improvement of the financial situation of licensed companies, tariff reform, new bilateral contract power market structure; ERA annual budget preparation and approval; support of the Energy Working Group; certain heat sector issues; and sustained operation of the ERA in accordance with the provisions of*

[1] See World Bank Draft Report by Economic Consulting Associates entitled *Mongolia: Strategic Development of Energy Sector*, page "x", September 2006.

the Law of Mongolia on Energy approved on February 1, 2001 (as it may be amended or restated in the future).

The MOU was signed by the parties on January 29, 2008. The points relating specifically to retail tariffs on the Central Electricity System (CES) follow:

The Parties shall:
3.1. Collaborate for developing and implementing the electricity and heat tariff elaboration program,
3.2. Upgrade time-of-use tariffs of industrial, entities and residential consumers,
3.3. Re-develop and implement lifeline tariffs for residential consumers,
3.4. Renew entity and residential consumers' classes,
3.5. Carry out surveys and estimates for adjusting electricity and heat retail tariffs,
3.8. Carry out revenue and cost audits of energy companies to ensure adherence to International Financial Reporting Standards (IFRS),

A critical barrier to implementing a tariff reform plan is the typical political and public sensitivity to tariff increases, so a key issue concerns structuring tariff adjustments to minimize social and economic turmoil. In this regard, the Economic Policy Reform and Competitiveness Project (EPRC) under USAID Contract No. 438-C-00-03-00021-00 is assisting the ERA with development of a tariff reform plan to rationalize the current retail tariff regime consistent with the ERA's responsibilities under the Energy Law and its commitments in the MOU. This report outlines the rationale for tariff reform and presents the methodology and schedule (i.e., the "tariff reform plan") for periodic adjustments to the retail tariff regime according to the issues and priorities of the ERA.

This report relates to Mongolia's retail electricity tariffs on the CES. It does not address tariffs in other areas of the country (i.e., the Western and Eastern Electricity Systems), and does not address the heat sector.[2] The report provides analyses relating to retail electricity tariffs for the CES, including: the overall revenue requirement for the power sector, cost allocation and cross-subsidies between customer classes and within customer classes and tariff designs and their adequacy in meeting tariff design objectives. On the basis of these analyses, issues are identified and prioritized and a tariff reform plan is developed including a time-bound plan for implementation. The tariff reform plan is intended to restore the financial health of the power sector and eliminate the financial burden on the Government of Mongolia (the "GoM"), reduce cross-subsidies and make transparent those cross-subsidies that remain, and improve tariff designs so they better meet design objectives. This document may be used as an input to the Public Information/Education campaign being developed by the ERA, MoFE, SPC and EPRC with the intent, among other things, to motivate Government to act on the tariff reform plan to reduce subsidies and move the sector toward financial self-sufficiency.

There have been two comprehensive studies of Mongolia's tariff regime conducted in recent years including: 1) the June 2003 report entitled *Tariff Methodology for the Energy Sector in Mongolia*, prepared by PA Government Services Inc for the USAID Mission to Mongolia, and 2) the December 21, 2004 report entitled *Design of Electricity Prices for Generation, Transmission and Distribution for Mongolia*, prepared by SYNEX Consulting Engineers for the World Bank. It is not the intent of this study to duplicate the work in these reports, but rather to draw on the analyses undertaken in these reports and present a tariff reform plan that accommodates current priorities, technical capabilities and political realities in Mongolia. In this sense, the objective is to move the process forward so Mongolia's power sector can

[2] Heat sector tariffs are being addressed by the World Bank.

achieve financial self-sufficiency over a reasonable period of time and mitigate social upheaval to the extent possible.

The report is organized as follows:

Section 2 – Revenue Requirement

Section 3 – Cost Allocation and Cross-subsidy Analysis

Section 4 – Tariff Design Review

Section 5 – Summary of Issues and Priorities

Section 6 – Proposed Retail Tariff Reform Plan

SECTION II: REVENUE REQUIREMENT

A. Financial health of the power sector

The 2006 financial statements submitted by the power companies show a small profit for the power sector as a whole.[3] However, the bonus system encourages management of state-owned enterprises to show a profit, and accounting practices used in the compilation of the financial statements are inconsistent with Mongolian Accounting Law which is based on international practice.

Only one company has been externally audited (by KPMG-Vietnam in 2004), and a number of data insufficiencies and inconsistencies were identified. A detailed external audit of all companies and a proper asset valuation would provide more precise presentation of the financial status of the sector, but would require a significant amount of time and money. As an alternative, EPRC has reviewed available data and has identified the major known accounting deficiencies. The 2006 financial results as reported by power companies and the profit/loss for the power sector adjusted for the accounting deficiencies are summarized in ***Exhibit 1***. A description of the accounting deficiencies follows.

- Much of the routine maintenance costs are currently capitalized rather than expensed, thus artificially reducing the revenue requirement. This accounting treatment appears to comply with the Mongolian Legal Entity Income Tax Law, but is inappropriate under Mongolian Accounting Law which is based on international accounting requirements. If financial statements were adjusted to show the proper accounting treatment of routine maintenance costs annual operating expense for the sector would increase by approximately 14 billion MNT.
- Asset valuations are currently incorrect. In an effort to determine the impact revaluation would have on tariffs, the MoFE has requested the power companies to conduct asset revaluations during 2008. PP4 has already completed its asset revaluation which will be used as the model for other power companies. The PP4 study resulted in an asset valuation figure that is three times higher than current values. Offsetting the higher asset values are longer asset lives, so the impact on depreciation and resulting tariffs is not as significant as it would be otherwise. The ERA estimates that based on PP 4 experience, asset revaluation for the entire power sector would result in a 14 billion MNT increase in revenue requirement (equivalent to 10.6% of the total revenue forecast for the power sector in 2008). This figure aligns closely with an asset revaluation study conducted previously by the ERA which estimated an annual increase in depreciation of approximately 13 billion MNT. In summary, it is evident that sector asset values and depreciation are under-stated.
- It is apparent that the sector is currently losing about 33 billion MNT annually. It is believed that this number is understated even after making the adjustments shown in ***Exhibit 1*** as there is no provision for either a return on capital or for a working capital allowance (i.e., the financing of daily cash flows).
- Additionally, the above fails to account for two substantial expense categories. The first is the need for additional investment and the replacement of expiring existing

[3] It is understood that all generating companies with the exception of Power Plant #2 lost money in 2007. According to financial statements, the distribution companies were profitable, but just barely, and there remains the issue of inconsistencies in the financial reporting of power companies so the profitability of the distribution companies is questionable.

assets. This is well established in a number of documents currently available through the World Bank and within the Ministry of Fuel and Energy. Second, it is recognized that much of the required ongoing maintenance has been deferred. A higher expenditure is required to avoid the premature deterioration of sector assets.

In addition to the accounting deficiencies, the power companies indicate that owing to increases in input prices (i.e., gasoline, diesel fuel, coal, railway transportation, imported spare parts and materials, fees on land and water resource use, tariffs for water and sewage utility services, etc.), a tariff increase is needed if they are to maintain current levels of service. Required tariff increases owing to these inflation pressures are over and above those necessary to compensate for the accounting deficiencies identified above.

An electricity tariff increase of 2.2 MNT/kWh, or about 4%, was implemented on October 1, 2007. A further increase in the time-of-use tariff for the entity customer class was introduced on March 1, 2008 and is expected to increase power sector revenues by about 4 billion MNT annually, representing about 3.0 % of the revenues forecast for 2008. These tariff increases fall far short of restoring the financial health of the power sector. In fact, the tariff increases do not keep pace with Mongolia's 14% rate of inflation in 2007 (driven largely by increases in fuel and food costs).[4]

[4] See *The World Factbook* produced by the Central Intelligence Agency at https://www.cia.gov/library/publications/the-world-factbook/geos/mg.html.

Exhibit 1. Power sector financials – as reported and adjusted for accounting deficiencies

As Reported (million MNT)					
	Licensees	2003	2004	2005	2006
1	CHP 2	32	(651)	(141)	(16)
2	CHP 3	458	(5,422)	4,597	1,676
3	CHP 4	1,057	(3,085)	175	256
4	Darhan CHP	467	573	199	6
5	Erdenet CHP	237	142	(142)	32
6	UBEDN	(344)	22	87	16
7	DSEDN	(763)	339	59	81
8	EBEDN	62	102	(302)	72
9	BNSEEDN	19	(145)	(121)	3
10	CETN	381	400	99	103
11	UB Heat Network	(791)	(2,516)	771	975
12	Darhan Heat Network	117	105	135	170
13	NDC	4	5	6	2
	CES Total	**936**	**(10,134)**	**5,423**	**3,376**
14	Dornod Energy System	(142)	(138)	(963)	(489)
15	Dalanzadgad CHP	-	(1,564)	(1,118)	(1,469)
16	Baganuur Heat Station	(284)	25	(209)	(459)
17	Nalaih Heat Station	(0)	-	0	(344)
18	Western Electricity Transmission Network	(172)	36	(20)	(11)
	Local Licensee Total	**(597)**	**(1,640)**	**(2,310)**	**(2,772)**
	Sector Total As Reported	**338**	**(11,775)**	**3,113**	**604**

Adjusted Sector Profit (Loss)				
Sector Total as Reported	338	(11,775)	3,113	604
Less Adjustments:				
Capitalized Maintenance		14,000	14,000	14,000
Additional Depreciation		13,000	13,000	13,000
Accrued interest expense		5,000	-	-
Bad debt expense		4,000	4,000	4,000
Other		2,000	2,000	2,000
Total estimated accounting adjustments		**38,000**	**33,000**	**33,000**
Adjusted Sector Profit (Loss)		**(49,775)**	**(29,887)**	**(32,396)**

B. Comparison with tariffs in other international jurisdictions

The inadequacy of Mongolia's retail tariffs is evidenced when comparing its retail tariffs to the average retail tariff of a sampling of international jurisdictions whose tariffs generally recover the full cost of providing electricity service. The International Energy Administration (IEA) provides such data in its annual publication of *Key World Energy Statistics*. Mongolia's tariffs are compared to the IEA country average in ***Exhibit 2***.

Exhibit 2. Retail electricity prices in select countries [5]

Country	Households ($/kWh)	Industry ($/kWh)
Australia	0.099	0.061
Austria	0.203	0.126
Canada	0.068	0.049
Chinese Taipei	0.079	0.057
Czech Republic	0.137	0.109
Denmark	0.324	0.076
Finland	0.140	0.080
France	0.152	0.053
Germany	0.212	0.084
Greece	0.114	0.069
Hungary	0.174	0.128
Ireland	0.226	0.150
Italy	0.253	0.236
Japan	0.189	0.121
Korea	0.103	0.068
Luxembourg	0.183	
Mexico	0.120	0.103
Netherlands	0.273	
New Zealand	0.147	0.066
Norway	0.121	0.057
Poland	0.134	0.079
Portugal	0.204	0.123
Slovak Republic	0.173	0.128
Spain	0.165	0.091
Switzerland	0.133	0.082
Turkey	0.113	0.101
United Kingdom	0.221	0.132
United States	0.100	0.061
Average	***0.163***	***0.096***
Mongolia	***0.042***	***0.044***
As a % of Average	***25.8***	***46.3***
Average of 5 Lowest Countries	***0.099***	***0.056***
Mongolia as a % of Average	***42.6***	***79.8***

[5] Prices are in US$ and relate to first quarter of 2007 (or latest available). Source: International Energy Agency – Key World Energy Statistics, 2007, page 43. Mongolia's prices converted at an exchange rate of 1165 MNT = 1 US$.

As can be seen, Mongolia's retail residential, or household, tariffs are only about 26% of the country average, while Mongolia's industrial tariffs are about 46% of the country average. The situation has actually deteriorated since 2006 when Mongolia's household and industrial tariffs were 30% and 52% of the IEA country average, respectively. Even when compared to the five lowest priced countries, Mongolia's retail household tariffs are only 43% of the five-country average.

C. Impact of future generating stations on retail tariffs

The generating stations in the CES are quite old and inefficient and a number of them are reaching the end of their economic lives. Plant retirements coupled with increasing electricity demand are driving the need for new construction. However, Mongolia does not currently have a formally approved, least-cost generation expansion program. Only the Newcom wind project has proceeded beyond the feasibility stage. The ERA has issued a license and approved the tariff for this project.

In addition to the Newcom project, there was a ground breaking ceremony for Egiin HPP in June 2006 and a brick-laying ceremony for a pumped storage project in Ulaanbaatar, but as of this date, there remains no committed financing for either project. Currently, there is considerable interest in development of a new thermal generating station, referred to as Power Plant #5 (PP 5). This plant would be a combined heat and power (CHP) plant fuelled with coal to capture the increased efficiency of such technology while recognizing the need to meet heating load requirements in Ulaanbaatar.

Tendering documents are currently being prepared for PP 5, and are expected to be ready to issue to international power plant development companies in May 2008. Proposals will be due 60 days after issuance of the tender. The tender will require the successful bidder to propose a turnkey combined heat and power project with a capacity of approximately 300 MW, either as a BOT, IPP or Public/Private Partnership. The bidders will be required to:

a) Perform a Feasibility Study;
b) Prepare a complete design and engineering package including plans and drawings;
c) Construct and commission the facility; and
d) Act as owner/operator of the facility for a specified period of time before transferring ownership to the GoM.

As PP 5 remains in the early stages of study, it is not possible to provide an accurate estimate of plant costs. The September 2006 World Bank report referenced earlier (see Footnote 1) shows levelized costs of CHP projects constructed in recent years based on information from International Energy Agency *Projected Costs of Generating Electricity: 2005 Update*. The table is repeated in ***Exhibit 3***. It shows that the levelized cost of a new CHP plant such as PP 5 is about US$ 30/MWh after allowing for heat credit (in 2005 US Dollars). A March 1, 2000 press release in *WWW-Business Opportunities in Eastern Europe & the CIS* indicates that a contract was awarded to U.S. based PSEG Global to build a combined heat and power plant in Poland for U.S. $320 million. The installed capacity of the plant is 220 MW electrical and 500 MW thermal. It is noted that costs for coal plant have increased in recent years, by more than 25% in the case of the United States and this does not incorporate costs associated with mitigation of plant emissions leading to global warming.

Exhibit 3. Levelized cost of electricity production from CHP

Source	Country	Net capacity		Life	Capital costs			Fuel costs		O&M		Total levelised cost (electricity)		
		Electric	Heat			@10%		Thermal efficiency		Fixed	Variable	Before Heat Credit	Heat Credit	After Heat Credit
		MW		years	$/kW	$/kW/year	type	Electricity	$/MWh	$/kW/year	$/MWh	$/MWh	$/MWh	$/MWh
2002 Master Plan	Mongolia	80	160	40	1,688	172.6	Lignite	38%	6.6	33.8	0.7	35.0	6.9	28.1
2005 IEA Gen Costs	Germany	500	600	35	1,320	136.9	Lignite	35%	7.2	64.9	0.0	34.2	4.1	30.1
2005 IEA Gen Costs	Germany	200	280	35	1,455	150.9	Lignite	36%	7.0	64.9	0.0	35.9	4.8	31.1
2005 IEA Gen Costs	Slovakia	20	98	40	1,538	157.3	Lignite	36%	7.0	72.3	0.0	37.8	17.3	20.5

The ERA provided the estimates shown in ***Exhibit 4*** of plant outputs and costs levelized over the life of the Egiin HPP and Newcom projects. The costs for PP 5 are from the World Bank report referenced earlier. The pumped storage project is not included in ***Exhibit 4*** because it would be a net consumer rather than producer of energy.

Exhibit 4. Potential generation expansion projects

Alternative	Technology	Output	Levelized cost
Newcom Wind Farm	Wind	50 MW Capacity 112.2 GWh Annual Energy	US$ 0.08/kWh, or MNT 93/kWh
Egiin River HPP (Stage I & II)	Hydro	220 MW Capacity 412 GWh Annual Energy	US$ 0.058/kWh, or MNT 67.6/kWh
Power Plant #5	CHP	300 MW Capacity 2100 GWh Annual Energy	US$ 0.03/kWh, or MNT 35.0/kWh

New generation additions will be more costly than Mongolia's current generation. ***Exhibit 5*** provides a breakdown of the current average retail tariff by power sector component. As can be seen, generation is currently 33.82 MNT/kWh, representing about 64% of the current average retail tariff (53.2 MNT/kWh).

Exhibit 5. Breakdown of current tariff by component

Component	Cost (MNT/kWh)	Percentage of total (%)
Generation	33.82	63.6
Transmission	1.89	3.6
Transmission Losses	1.34	2.5
Distribution	8.02	15.1
Distribution Losses	6.45	12.1
Supply	1.67	3.1
Total	***53.2***	***100.0***

The cost of production from the Newcom Wind project is close to triple the current average cost of generation in the CES, while the cost of production from the Egiin River project is double. Production from PP 5 is comparable to the current average cost of generation, but as noted, reliable cost estimates are not yet available for this project. Financing costs and the cost of delivered coal will be key drivers of development costs. In any regard, new generation projects are expected to have a significant impact on retail tariffs in Mongolia. According to the ERA, the Newcom and Egiin River projects would increase the average retail tariff by MNT 4.74/kWh, representing almost 9% of the current average retail tariff.

In addition to new generation projects, the transmission and distribution component of the power sector will likewise require additional capital for asset replacement and upgrades to meet growing demand. The Ulaanbaatar Distribution Company alone estimates new capital requirements of the order of 175 billion MNT in the coming years. Transmission and distribution capital requirements will likewise put upward pressure on retail tariffs.

D. Government social initiatives

Government social initiatives such as the renewable energy law and connection of electricity customers in the soums to the main grid will further contribute to retail tariff increases. The renewable energy law requires the transmission licensee to purchase all power from generators that qualify as "renewable" at tariffs falling within the range published in the law and approved by the ERA[6]. The tariff ranges are summarized in ***Exhibit 6***.

[6] The ERA has little choice but to approve a tariff that falls within the range since it is required by law.

Exhibit 6. Range of power purchase tariffs in renewable energy law

Renewable energy source	Tariff range (US$/kWh)
Wind	0.08 to 0.095
Hydro	0.045 to 0.06
Solar	0.15 to 0.18

In each case, the tariff is considerably higher than the current average cost of CES generation of US$ 0.029/kWh[7]. Therefore, new generation projects that are categorized as "renewable" under the Law will put increasingly upward pressure on retail tariffs.

The Government has an aggressive program to connect customers in the soums to the main power grid. As retail tariffs do not recover the full cost of supplying these customers, the ERA estimates that a subsidy of the order of 0.82 MNT/kWh, representing about 1.5% of the current average retail tariff will be necessary. This subsidy will come either from other electricity consumers through higher retail tariffs (or decreased service), or in the form of a direct Government payment to the electricity sector. In either case, retail customers ultimately pay for this Government program.

E. Summary

A large increase in retail electricity tariffs is required as summarized below:

- Despite substantial improvement in the past three years resulting from implementation of international accounting standards, there remain a number of inappropriate accounting practices in the sector. The more material of these involve using tax accounting treatment for capitalized maintenance and the lack of properly valued property, plant and equipment. The financial effect of adjusting for these categories plus several lesser items would necessitate a 33 billion MNT revenue increase to bring the power sector to break-even. This is equivalent to 25% of the 2008 revenue forecast and still would not be sufficient to bring the sector to financial self-sustainability. This figure is understated as there is no provision for either a return on capital or for a working capital allowance (i.e., the financing of daily cash flows). Further, it is recognized that much of the required ongoing maintenance has been deferred, so a higher expenditure is required to avoid the premature deterioration of sector assets.
- The electricity licensees indicate that owing to increasing input prices they need a tariff increase if they are to maintain current levels of service, let alone fund much needed improvements. These tariff increases would be in addition to those resulting from the adjustments to accounting practices identified above. The 4% tariff increase in October 2007 and the recently imposed increase in the time-of-use tariff for the entity class representing a 3% increase in revenues have not kept pace with Mongolia's 14% inflation rate in 2007.
- Increasing electricity demand and retirement of aged and inefficient generation equipment that has reached the end of its useful life require that Mongolia construct new generation facilities or risk stunting economic growth and face power/heat shortages. The Newcom Wind Project is the furthest advanced of the generation expansion options and has costs that are almost triple the average cost of generation in the CES today. At this early stage of development, a reliable estimate of the cost of Power Plant # 5 if it proceeds is not available.

[7] Prices are converted at an exchange rate of 1165 MNT = 1.0 US$.

- Government social initiatives such as connection of customers in the Soums to the main power grid and the Renewable Energy Law will put increasingly upward pressure on retail tariffs.
- Comparison with the international community and World Bank reports confirms that Mongolia's retail tariffs are far below levels needed to maintain the financial integrity of the power sector. Mongolia's residential and industrial retail tariffs are only 26% and 46%, respectively, of the international average.

In summary, large tariff increases must soon be implemented if the power sector is to meet current and future electricity demand with adequate levels of service reliability in a financially self-sustaining manner. The World Bank reports (see Footnote 1) that even a 60% tariff increase in real terms (i.e., over and above inflation) between 2008 and 2014 will not achieve financial self-sufficiency, although it will move Mongolia significantly in that direction. EPRC estimates show that a minimum tariff increase of 50% is needed, and plant replacement and additions to meet increasing demand will drive this figure higher to levels comparable to World Bank estimates.

SECTION III: REVENUE ALLOCATION AND CROSS-SUBSIDY ANALYSIS

A. Background

A critical component of any tariff rationalization plan is development of a cost of service study to determine the appropriate allocation of the revenue requirement to customer classes. The revenue allocation is compared to actual revenues collected from the various customer classes to determine the level of cross-subsidization in the tariff regime.

The cost of service allocates the overall revenue requirement to customer classes on the basis of the costs that each customer class imposes on the system. The cost of service study, therefore, is the basis for determining cross-subsidies among customer classes, and ultimately, the relative tariff increases among customer classes. For example, if household customers are being subsidized by entity customers, and an average tariff increase of 5% is justified, tariff increases of 3% to entity customers and 7% to household customers might be levied in an effort to reduce the cross-subsidy, and thus improve the fairness and efficiency of the tariff regime.

A cost of service study can be carried out on the basis of embedded (i.e., historical) costs or on the basis of marginal costs. In Mongolia's case, marginal costs have already been derived, while an embedded cost of service study has never been undertaken. The conduct of an embedded cost of service study would be a significant undertaking. Therefore, marginal costs are the preferred methodology for cost allocation in Mongolia at this time.

Rather than repeat work already undertaken by other consultants, marginal costs developed by Synex Consulting Engineers for the World Bank have been used. The marginal costs are documented in a December 21, 2004 report entitled *Design of electricity prices for generation, transmission and distribution for Mongolia*. As this study is concerned with retail pricing, and because Mongolia currently has uniform national tariffs, the results derived for retail customers of a combined distribution company including UBEDN, EBEDN and BSEREDN (referred to as BZUBEDN in Synex Report) are utilized. These companies represent the non-privatized distribution companies and are judged to provide a reasonable approximation of marginal costs at the retail level for Mongolia's CES system. The Synex report states that marginal costs of this combined distribution company are comparable to that in other international jurisdictions, in particular, Latin America.

B. Marginal costs and current average tariffs

The marginal costs for this combined distribution company (see table 7.9 of the Synex report) are shown in ***Exhibit 7***. Although the Synex report was completed in late 2004 no attempt has been made to update the figures to 2008 levels since they are being used only for cost allocation purposes (as opposed to tariff design). As current cross-subsidization is substantial, it will take a number of years to reduce cross-subsidization to generally acceptable levels. There will be plenty of time in the future to update the marginal cost study for application in the later years of the tariff reform plan.

Exhibit 7. Marginal costs in Mongolia

Level of supply	Capacity (US$/kW/year)	Energy (US$/MWh)	Combined cost (US$/MWh)	Combined cost (MNT/kWh)
Generation	5.3	24.9	35.6	41.5
Transmission (HV)	9.2	25.8	44.6	52.0
Distribution Primary (MV)	14.7	26.6	56.7	66.1
Distribution Secondary (LV)	24.7	30.4	80.8	94.1

Marginal costs both at the distribution primary level (Medium voltage, or MV, including 6 kV and 10 kV) and secondary level (low voltage, or LV, including 0.4 kV) are considerably higher than Mongolia's current average retail tariff of 53.2 MNT/kWh (about US$ 45.7/MWh).

Mongolia's current average retail tariffs for each customer class are shown in ***Exhibit 8***. This includes the recent increase in the time-of-use tariff for the entity customer class.

Exhibit 8. Mongolia's current average tariffs for the CES[8]

Customer class	Average tariff (MNT/kWh)	Average tariff (US$/MWh)
Entities	*53.6*	*46.0*
Household – Apartments	53.2	45.7
Household – Ger Districts	51.0	43.8
Household Time-of-Use	42.2	36.2
Household – Lifeline	40.5	34.7
Total household	**48.9**	**42.0**

C. Cross-subsidy analysis

The level of cross-subsidization in a tariff regime is determined by comparing revenues derived from actual tariffs to revenues generated from marginal cost-based tariffs. If the revenues currently collected from a class are greater than revenues that would be collected under marginal cost-based tariffs (proportioned to reflect the current revenue requirement), the customer class is paying a cross-subsidy. A cross-subsidy analysis of Mongolia's tariffs is provided in ***Exhibit 9***. Note that the entity class (Industrial/Commercial) is assumed to be supplied at the Medium Voltage (MV) level and the household class is assumed to be supplied at the Low Voltage (LV) level. Accordingly, marginal supply costs are assumed to be 56.7 US$/MWh and 80.8 US$/MWh for the entity and household classes, respectively.

[8] Sales and revenue forecast and tariffs relate to 2008 and were provided by the ERA in an Excel spreadsheet in January 2008. They have been adjusted to incorporate the increase to the TOU tariff for the Entity class imposed on March 1, 2008. Elasticity impacts and potential tariff migration impacts owing to the March 1, 2008 increase have not been incorporated.

Exhibit 9. Cross-subsidy analysis[9]

Customer class	Forecast sales (MWh)	Forecast revenues (Million MNT)	Marginal cost-based revenue allocation (Million MNT)	Cross-subsidy (Million MNT)	Revenue/ cost ratio (%)
Entity	2,045,289	109,711	99,997	9,713	1.10
Household	467,623	22,867	32,580	-9,713	0.70
Total	**2,512,912**	**132,577**	**132,577**	**0**	**N/A**

There are two principle comments to make concerning the cross-subsidy analysis, as follows:

- The entity class (Industrial/Commercial) is paying a substantial cross-subsidy of about 9.7 billion MNT to the household class. If this cross-subsidy were to be eliminated, the entity class would receive a tariff reduction of about 10%, while the household class would see a tariff increase of about 42%. The large increase in the household tariff relates to the small proportion of demand of this class relative to the entity class.
- The information derived from the cross-subsidy analysis is limited because there are only two customer classes. While the number of Household classes seems appropriate, the number of entity classes should be increased from one to three, including: Small Entity (i.e., shops) supplied from the low voltage network (0.4 kV), Medium Entity supplied from the medium voltage network (6 kV and 10 kV) and Large Entity (i.e., Erdenet Copper Mine) supplied from the high voltage (i.e., transmission) network (35 kV and 110 kV).

The ERA does not have readily available sales information categorized by voltage delivery level. In an effort to quantify the cross-subsidies among customer groups, sales information by voltage supply level has been approximated using data from the Synex report (Table 7.1). These data, although somewhat out of date were originally provided by the ERA and represent the best available data at this time. On the basis of these data, and the customer classes identified above, cross-subsidies would be as shown in ***Exhibit 10***.

[9] Ibid.

Exhibit 10. Cross-subsidy analysis with additional customer classes

Customer class	Forecast sales (MWh)	Forecast revenues (Million MNT)	Marginal cost-based revenue allocation (Million MNT)	Cross-subsidy (Million MNT)	Revenue/ cost ratio (%)
Large Entity	766,438	41,081	28,408	12,673	1.45
Medium Entity	658,383	35,289	31,023	4,266	1.14
Small Entity	620,468	33,257	41,663	-8,406	0.80
Household	467,623	22,867	31,400	-8,533	0.73
Total	2,512,912	132,494	132,494	0	N/A

As can be seen, Large Entity customers supplied at the HV level impose less cost on the power system, so would have less revenue allocated to them. The revenue/cost ratio for this new class would be 1.45, meaning they are paying 45% more than their fair share of the revenue requirement. The Medium Entity class would have a revenue/cost ratio of 1.14, meaning they are paying 14% more than their fair share of the revenue requirement. Small Entity customers supplied at the LV level impose similar costs on the power system as the household class, and would have more revenue allocated to them. The revenue/cost ratio for this new class would be 0.80, meaning they are paying 20% less than their fair share of the revenue requirement. Lastly, the household class would have a revenue/cost ratio of 0.73, meaning they are paying 27% less than their fair share of the revenue requirement. Breaking out sales among the additional customer classes in this manner provides a much truer picture of the cross-subsidization inherent in Mongolia's tariff regime. In particular, it clearly displays the cross-subsidization between customers within the entity class.

D. Summary

There is significant cross-subsidization in Mongolia's tariff regime both between and within customer classes; i.e., households are receiving a substantial cross-subsidy from the entity class and Small Entity customers supplied at the LV level are receiving a substantial cross-subsidy from the Large Entity and Medium Entity customers.

Large tariff increases are necessary if the electricity sector is to be financially self-sustaining and provide service at reasonable levels of supply quality and reliability in the future. The cross-subsidy analysis determines how much of the burden of these tariff increases should be placed on each customer class. In light of the significant tariff increases facing the electricity sector, it will be difficult to impose further tariff increases on the household class to address the cross-subsidization issue. However, this is not an issue that should be left unaddressed for long because it leads to inefficient and detrimental outcomes in the economy. For example, forcing industrial customers to pay more than their fair share of the cost of supply makes them less competitive in global markets, potentially leading to job loss and reduced economic growth in the economy as a whole. In addition, tariffs that are far below costs such as those for the household class promote greater consumption, resulting in an inefficient allocation of resources in the economy and further upward pressure on retail tariffs.

SECTION IV: TARIFF DESIGN REVIEW

A. Background

Once the overall revenue requirement for the CES has been determined and it has been allocated to customer classes according to the cost of service study, tariffs are designed to recover the share of revenues that has been allocated to each customer class. There are many potential tariff designs. The goal of the tariff specialist is to develop tariff designs that best meet the tariff design objectives.

In this section of the report, Mongolia's current retail tariff designs are analyzed and alternative designs are proposed that better meet the tariff design criteria.

B. Current retail tariffs

B.1. Uniform retail tariffs in the CES

Mongolia currently has uniform retail tariffs across the CES meaning that although the customer supply costs of each distribution company may vary (i.e., owing to differences in customer density, customer mix, etc.), the tariffs charged to the retail customer classes of each distribution company are the same; i.e., there is no geographic diversity of retail tariffs within the CES. This means that the customers of one distribution company are either paying or receiving a cross subsidy from the customers of another distribution company.

B.2. Customer classes and current tariffs

Mongolia's current retail tariffs for customers supplied from the CES are shown in ***Exhibit 11***. Besides the Streetlight class, there are only two customer classes – households (residential) and Entities (commercial and industrial).

All tariffs include only an energy charge – there are no demand or customer charges, and the energy charges include a single block. Each customer has a choice of two tariffs: 1) a single block, non time-differentiated energy charge, or 2) a single block, time-differentiated energy charge.[10]

There are two tariffs for the household class – one for Apartments and one for Ger Districts. The ERA indicates that Ger District customers receive a discount on their electricity tariff because they are paying a subsidy on the heat tariff to Apartment customers. The cost to supply Ger Districts is substantially higher than the cost to supply Apartments, but even when this is taken into consideration the ERA claims that a discount on the electricity tariff is due Ger Districts owing to the large size of the heat subsidy they are paying to Apartments.

Mongolia also has a lifeline tariff for the poor in the household class. The poor are determined through a means test; currently, fewer than 700 customers qualify for the lifeline tariff. The number of customers on the lifeline tariff has decreased from a high of about 1000 owing to a requirement that to qualify for the discount, customers must not be in debt to their supplying distribution company and must not have been caught stealing electricity.

Those customers who qualify for the tariff receive a discount on what is deemed to be the lifeline consumption level which varies by geographic location; i.e., a high of 75 kWh/month in Ulaanbaatar to a low of 40 kWh/month in outlying areas of the country. The lifeline tariff

[10] The ERA indicates there is an "unwritten rule" that Entity customers with average demand exceeding 200 kW must take power under the TOU tariff; i.e., they do not have the option of taking power under the non time-varying energy tariff.

was frozen at current levels on October 1, 2007 when all other tariffs were increased by 2.2 MNT/kWh. The current lifeline tariff is 41.0 MNT/kWh for Apartments and 39.0 MNT/kWh for Ger Districts. Consumption above the threshold level is billed at regular tariffs.

Exhibit 11. Retail tariffs in CES

Non time-differentiated

Households - Apartment	Households - Ger District	Entities
53.2 MNT/kWh	51.0 MNT/kWh	53.2 MNT/kWh

Time differentiated

Households	
Daytime (6:00 – 21:00)	53.2 MNT/kWh
Nighttime (21:00 – 6:00)	13.5 MNT/kWh
Entities	
Daytime (6:00 – 17:00)	53.2 MNT/kWh
Evening (17:00 – 22:00)	104.2 MNT/kWh
Nighttime (22:00 – 6:00)	31.8 MNT/kWh
Streetlights	
Daytime (6:00 – 19:00)	53.2 MNT/kWh
Nighttime (19:00 – 6:00)	8.57 MNT/kWh

B.3. Metering

Customers must pay for their meters and for the costs of meter calibration every two or three years. The cost of a regular meter measuring energy only ranges from 15,000 to 20,000 MNT. A time-of-use ("TOU") meter costs about 50,000 to 75,000 MNT. Costs for calibration are similar for both types of meters, about 4,000 to 5,000 MNT on each occasion. Although the cost difference between a standard energy-reading meter and a TOU meter is not huge (about 35,000 to 55,000 MNT), it can represent a barrier to participation in the time-differentiated tariff. However, owing to the success of various programs, penetration of the time-differentiated tariff has been quite high for household customers – about 50% of Apartments and by year-end 2008, it is expected that close to 100% of Ger Districts will have time-of-use meters installed. Although there is an unwritten regulation that all entity customers with average demand exceeding 200 kW must take power under the TOU tariff, participation in the time-differentiated tariff for this class is lower than for the household class.

Pre-paid meters are in common use in some areas of the CES, particularly Darkhan where the distribution company installed pre-paid meters at its own cost. The pre-paid meters are utilized with the TOU tariff. As is the case with other meters, customers are required to pay the costs of meter calibration every two or three years.

There are currently no meters at the consumer level in Mongolia that are capable of reading demand, and there are no plans on the horizon to install such meters.

C. Tariff design analysis

C.1. Tariff design objectives and ERA Priorities

Tariff designs are analyzed and evaluated on the basis of tariff design objectives. The ERA defines its primary design objectives consistent with the Energy Law and those in use in most every other jurisdiction in the world including:

- To generate the revenue allocated to each customer class;
- To be fair and non-discriminatory, charging similar prices to customers with similar consumption characteristics; and
- To promote efficient consumption decisions by customers.

In addition to these primary objectives, the ERA defines a number of secondary objectives, including:

- Simple and understandable
- Ease of administration; benefits of more complex tariff designs should exceed costs of administration
- Stable and predictable, both in terms of pricing and revenue
- Promote Government social initiatives

The ERA is currently evaluating a number of potential changes to its tariff designs, including:

- The addition of customer charges
- Re-consideration of the prices in the different time periods of the time-differentiated tariffs
- Expansion of the lifeline tariff to target more of the customers with incomes that fall below the poverty line

It is within the context of the ERA's tariff design objectives and priorities and the technical capabilities of the power companies to administer tariff designs that Mongolia's tariff regime in the CES is analyzed and evaluated.

C.2. Uniform tariffs across the CES

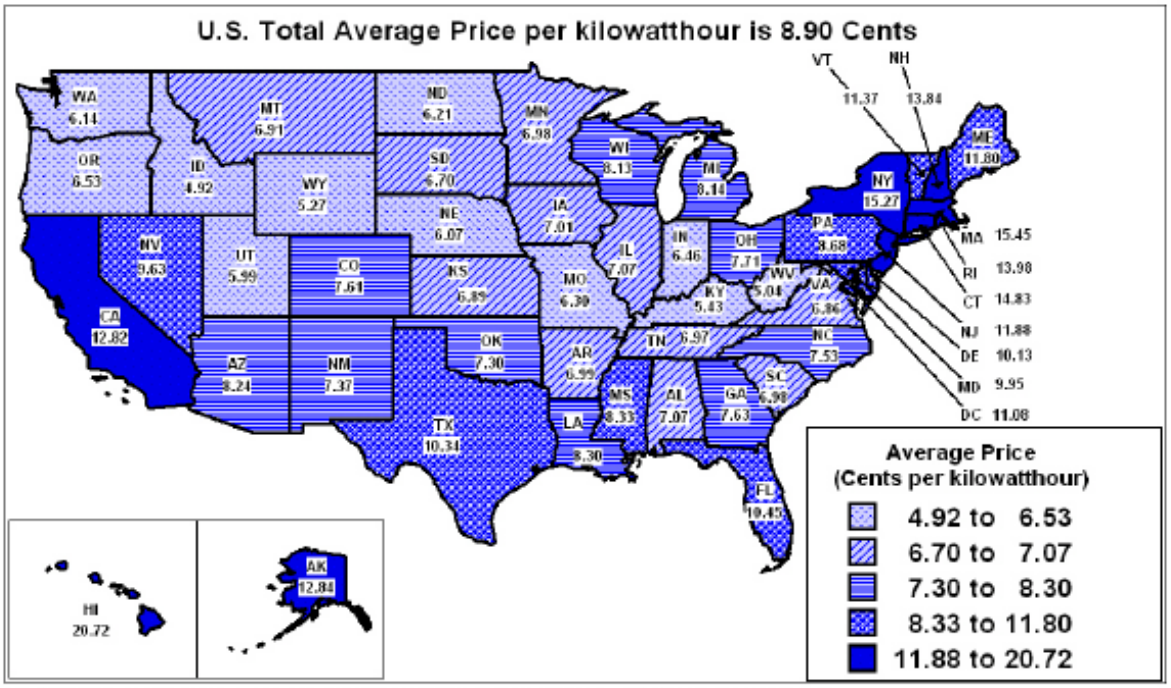
There are currently no plans in Mongolia to abandon the uniform retail tariff in the CES. It is understood that it would be politically difficult to make such a change at this time. However, a uniform tariff results in cross-subsidization of the customers of one distribution company by the customers of another distribution company. It can also reduce incentives for distribution companies to improve efficiency and performance because retail tariffs are the same for each company, meaning performance is not transparent to consumers.[11] In Mongolia, this disincentive is alleviated to some extent because the ERA establishes distribution company revenue requirements and tariffs on a company-specific basis. The ERA is also considering implementation of incentive regulation and performance agreements[12] at the distribution level on a company-specific basis. This would further mitigate the disincentive to improve efficiency provided appropriate performance targets are established.

Although it is politically difficult to eliminate the national uniform tariff at this time, consideration should be given to moving to a tariff regime in the future with separate retail tariffs for each individual distribution company. Every jurisdiction in the World that has wholesale competition has different retail tariffs for each distribution/supply company; i.e.,

[11] If consumers in one area of the country see that their tariffs are higher than those in another area of the country, they will exert peer pressure on their distribution company to improve efficiency and reduce costs.
[12] Baganuur and Southeast Region Electricity Distribution Company was on a performance contract in 2007.

United States, Western Europe, Eastern Australia, etc. ***Exhibit 12*** shows 2006 retail prices in each state in the U.S. Even jurisdictions that do not have wholesale competition may have different retail tariffs in different jurisdictions. For example, prior to the introduction of competition in the Province of Ontario in Canada there were 325 municipal utilities each with its own set of retail tariffs. Even countries with developing economies such as Pakistan have different retail tariffs in each Province. Mongolia will likewise have a non-uniform national tariff once it introduces its competitive bilateral contracts market. This will eliminate cross-subsidization between customers of different distribution companies and increase transparency of performance, pressuring distribution companies to reduce costs and improve efficiency.

Exhibit 12. Average retail price of electricity by state in 2006



Note: Data are displayed as 5 groups of 10 States and the District of Columbia.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Power Industry Report."

C.3. Customer classes

As noted, besides Streetlights there are only two customer classes, households and Entities. Entities pay the same tariff whether served at the HV, MV or LV level in spite of the higher costs for additional facilities and losses associated with supplying customers at lower voltage levels. The tariff is the same regardless of a customer's contribution to system peak demand, the primary driver of new capacity additions to the power system. This is contrary to fairness and efficiency objectives – customers are paying the same regardless of the costs they impose on the system so the tariffs are unfair, and because tariffs do not reflect costs, customers are receiving inefficient price signals. As there are clearly higher costs associated with supply at the lower voltage levels, larger customers supplied at higher voltage levels are paying a cross-subsidy to smaller customers supplied at lower voltage levels.

As discussed in the previous section, the entity class should be split into three classes in order to improve the fairness of the tariff regime, including Small Entity (i.e., shops) served at the LV level, Medium Entity served at the MV level and Large Entity (i.e., Erdenet copper mine) served at the HV level. These classes would be in addition to the household classes. As costs increase at lower voltage supply levels tariffs would likewise increase as they progress from supply at HV level to supply at the LV level.

As there is currently no load research data relating to demand contributions it is difficult to accurately allocate demand costs to different customer classes supplied at the same voltage level. It is recommended that Mongolia embark on a load research program to obtain such demand information. As noted in the Synex report, tariffs and customer classes could be separated by voltage supply level: transmission voltage (HV), distribution primary voltage (MV) and distribution secondary voltage (LV). Mongolia might consider splitting its customer classes by voltage supply as discussed, and simply charge the same price to Small Entity and household customers (i.e., all customers served from the low voltage system) as an interim measure until the ERA has developed demand-related load research data for customers

specific to Mongolia. Alternatively, Mongolia could use load research data from other jurisdictions and derive separate tariffs for the household and Small Entity classes on the basis of these data until the necessary load research data are accumulated.

With regard to the household class, there are currently two sub-classes including Apartments and Ger Districts. As explained earlier, the reason for two sub-classes is that although Ger Districts impose higher electricity supply costs on the system than Apartments, they are providing a cross-subsidy to Apartments in the heat tariff. Discussion with ERA staff indicates that they feel this discount on the electricity tariff is justified. This issue has received a great deal of political attention, and the ERA feels that the continued existence of the discount is consistent with Government social policy. For this reason, continuation of separate sub-classes for Apartments and Ger Districts is a high priority of the ERA with the discount maintained at the current level of 2.2 MNT/kWh.

C.4. Comparison of average tariffs

Sales, average revenue (i.e., average tariff) and total revenue forecast for 2008 for each customer class and each tariff are shown in ***Exhibit 13***.

Exhibit 13. Forecast 2008 sales and revenue data by customer class [13]

Tariff class	Projected sales (MWh)	Average tariff (MNT/kWh)	Total revenue (000 MNT)
Entities (Flat Tariff)	635,233.2	53.2	33,794,406
Entities (TOU Tariff)			
Day (6:00-17:00)	838,059.8	53.2	44,584,781
Evening (17:00-22:00)	181,517.3	104.2	18,914,103
Night (22:00-6:00)	390,478.5	31.8	12,417,216
Entities (TOU Total)	1,410,055.6	53.8	75,916,100
Entities Total	***2,045,288.8***	***53.6***	***109,710,507***
Households (Flat tariff)			
Apartments	155,654.4	53.2	8,280,814
Ger Areas	161,122.5	51.0	8,217,248
Households (TOU Tariff)			
Day (6:00-21:00)	108,602.7	53.2	5,777,664
Night (21:00-6:00)	41,467.9	13.5	559,817
Households (TOU Total)	150,070.6	42.2	6,337,480
Households (Lifeline)	775.4	40.5	31,403
Households Total	***467,622.9***	***48.9***	***22,866,945***
Streetlights (TOU Tariff)			
Day (6:00-19:00)	3,203.9	53.2	170,448
Night (19:00-6:00)	7,008.8	8.6	60,065
Streetlights TOU Total	10,212.7	22.6	230,513
Total System	***2,523,124.4***	***52.6***	***132,807,965***

[13] Sales and revenue forecast relate to 2008 and were provided by the ERA in an Excel spreadsheet on January 7, 2008. One-off customers such as the "Trolleybus Company", "Light for Condominium Owners Association" and "Railway" are excluded from the exhibit. The increase in the off-peak tariff for the Entity class implemented on March 1, 2008 is included.

When considering the average tariffs for the different customer classes, three points are noteworthy:

- Household customers pay substantially less than entity customers even though the costs of supply are higher. As was shown in ***Exhibit 7***, marginal supply costs at the MV level are US$ 56.7/MWh, while marginal supply costs at the LV level are US$ 80.8/MWh. While entity customers might be served at any of the HV, MV and LV levels, household customers are served at the LV level. This means there is significant cross-subsidization in the tariff regime as shown in the previous section of this report.
- In the case of the entity class, the time-differentiated tariff is now about 1% greater than the non time-differentiated tariff as a result of the tariff increase imposed on March 1, 2008. In the case of the household class, the time-differentiated tariff is about 21% less than the non time-differentiated tariff (compared to the tariff for Apartments). The time-differentiated tariff is expected to be lower as customers only opt for this tariff and the higher investment costs of the meter if they expect to reduce their electricity bills. In addition, by responding to the TOU tariff (i.e., transferring demand from the higher cost peak period to the lower cost off-peak period) customers are able to further reduce their average cost. However, the 21% reduction in the household TOU tariff is excessive, and is a major contributor to the large cross-subsidy the household class is receiving from the entity class. Further, now that the TOU tariff for the entity class is higher than the non-TOU tariff, entity customers are likely to migrate to the non TOU tariff unless the ERA puts the current "unwritten regulation" in writing so that customers with average demands exceeding 200 kW are required to take power on the TOU tariff.
- The Lifeline tariff implemented with the sole purpose of aiding the nation's poor is only 4% lower than the household TOU tariff.

C.5. Customer charges

It is widely recognized in the industry that retail tariffs should include a monthly customer charge that recovers costs specifically incurred by a distribution company to supply customers. A customer charge is most often levied as a fixed monthly charge per customer. A customer charge increases the fairness of the tariff regime by ensuring that costs to supply low consumption customers are fully recovered. For example, if there is no customer charge and a customer consumes no energy during a month, the utility will receive no revenue so will recover none of the costs to hook up the customer to the system, and none of the ongoing costs of billing, metering or the provision of other customer services offered by the utility; i.e., energy efficiency or demand management programs.

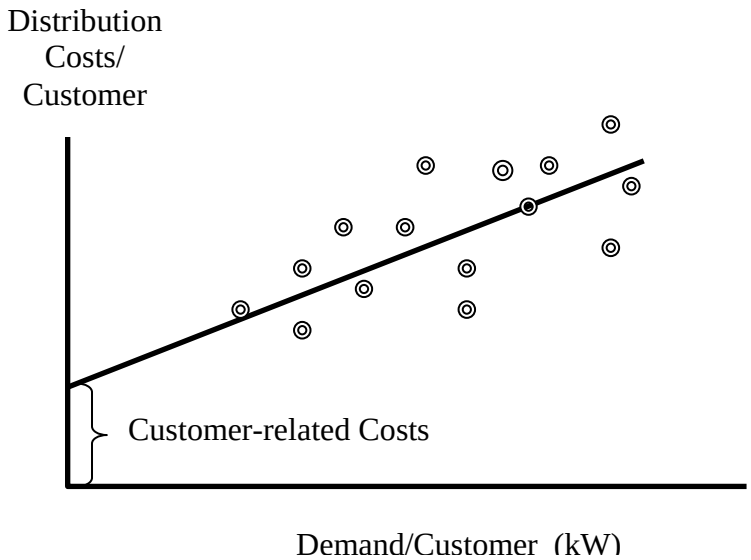
Generally, there is agreement that the direct costs of serving a customer including metering, billing, customer information and service connections should be classified as customer-related. However, a portion of the distribution system is built to connect customers to the system (the minimum system, or customer-related portion), and a portion is built to meet maximum customer demands placed on the system (the portion of the system beyond the minimum system, or demand-related portion). Calculating how much of the distribution cost that should be classified as customer or demand-related between the service connection and distribution substation tends to be controversial. Minimum system and/or zero intercept studies are often employed to identify the appropriate split for these facilities. In the United States, distribution

cost classifications range widely, with typical allocations to customer ranging between 30 and 70%.[14]

Using the zero-intercept method, the cost of serving no-load customers (the costs for facilities to connect customers at the minimum level of service) represents customer costs and is determined by plotting the cost of constructing a distribution system to meet various levels of customer demand. The y-axis of the plot represents distribution system costs per customer (in MNT per year) and the x-axis represents distribution system demand per customer (in kW). For example, to determine the demand- and customer-related components of the distribution system used to supply the residential class the cost/load points are plotted for distribution systems supplying a number of different residential sub-divisions. The estimate of total customer costs is where the plot crosses the zero-load axis. ***Exhibit 14*** provides an example of the zero-intercept method.

[14] A zero-intercept study completed in the Canadian Province of Newfoundland determined that about 30% of distribution costs should be classified as customer-related and about 70% should be classified as demand-related.

Exhibit 14. Zero-Intercept method of distribution cost classification



If the point at which the plot meets the y-axis is 12,000 MNT/kW/year, then the monthly customer charge would be a fixed 1,000 MNT/month for each customer in the household customer class. All distribution costs beyond this level would be classified to demand. Note that the zero-intercept method can be applied only when there is a large homogeneous group of customers served from a single point of supply. As such, it is generally relevant only for residential customers. Large commercial and industrial complexes normally are served from dedicated facilities at higher voltage levels so the customer charge includes the specific costs of the dedicated facilities.

In order to conduct a zero-intercept study, the ERA would need to request the Distribution Companies to provide distribution cost and demand per customer for a range of distribution systems that have been constructed in recent years. The data would need to include a diverse, but representative, sampling of distribution systems that have been installed to supply residential complexes in recent years.

The minimum system method of cost allocation includes an engineering analysis to determine the minimum distribution system necessary to connect customers to the system; i.e., the minimum distribution system includes only those facilities necessary to connect all customers but carry no load. This represents the portion of the distribution system that is judged to be customer-related. This methodology requires a fair amount of judgment, and for this reason is not recommended for Mongolia.

A simple means for developing a customer charge is to include only those costs incurred to specifically serve customers, such as metering, billing, customer information and service connections. This represents a minimum customer charge but may be acceptable at an introductory level. The ERA can further refine this figure in the future using the zero-intercept or minimum system methodologies. Alternatively, customer charges could be based on the figures provided in the Synex report which include US$ 0.67/customer/month for low voltage and US$ 0.93/customer/month for medium voltage. As the Synex report was completed in December 2004, these customer charges should be escalated for four years using an appropriate index; i.e., consumer price index.

C.6. Demand charges

A problem with tariff designs that include only a non time-differentiated energy charge is that they fail to signal customers to conserve both energy and capital expenditures on the power system. This is of particular importance in Mongolia given the significant load growth and capital outlays required for system expansion in the near future.

The absence of a demand charge can be alleviated by time-differentiating the energy charge. In effect, the demand charge is applied hourly as an adder to the energy charge during peak periods of demand that drive the need for system expansion. Since the peak period drives system expansion decisions, higher energy charges during the peak period signal customers to reduce demand at these times, which in turn reduces the need for capital outlays to meet system expansion needs. This not only reduces system expansion needs, but also leads to reduced demand during periods when energy costs are higher owing to the need to bring on less efficient generators to meet the increased demand. The energy benefits associated with time-varying energy charges are minimal at this time in Mongolia because economic dispatch is not being practiced.

The ERA is not considering the addition of demand charges to its tariff regime because they do not have demand-related load research and billing determinant data, and because they do not have meters that are capable of recording demand. Given the absence of demand meters and demand-related load research data, and given that time-differentiated tariffs are currently offered in Mongolia, the ERA will forego adding demand components to tariff designs at this time. However, if Mongolia decides to continue offering the non time-differentiated tariffs in the future, it is strongly recommended that a demand component be added to the tariffs in an effort to control growth in peak periods and reduce future capital outlays to meet system expansion needs. This is particularly relevant for large customers served at high voltage levels.[15] This would necessitate replacement of simple energy recording meters with demand recording meters for these customers.

D. Time-varying tariffs

D.1. Background

As demand charges currently do not exist in Mongolia's tariff regime and because there are no plans for implementing such charges, the focus of this report and the ERA's current efforts is on the energy component of tariffs. As already noted, there are no block charges – tariffs are limited to two types: 1) a single block energy charge, and 2) a single block time-varying energy charge. The non time-varying energy tariff collects all customer, demand and energy costs in a single charge. The time-varying energy tariff collects customer, demand and energy costs in an energy charge as well, but because the charge is time-varying, it is designed to collect demand costs in peak period hours, effectively representing an hourly demand charge. This encourages customers to constrain consumption during the peak periods which drive investment decisions, thus reducing the amount of investment needed in the future. Because of the substantial investment requirements facing Mongolia in the near future, the ERA has a great deal of interest in the design methodology for its time-varying tariffs.

The ERA provides a further breakdown from that shown in ***Exhibit 5*** of the average retail tariff on the CES of 53.2 MNT/kWh in ***Exhibit 15 below***.[16]

[15] This will not be an issue if the ERA imposes a regulation that the TOU tariff is required for all Entity customers with average demands exceeding 200 kW.

[16] Provided by the ERA in an email dated October 8, 2007, and updated during meeting on January 7, 2008.

Exhibit 15. Breakdown of CES average tariff

Tariff component	Average cost (MNT/kWh)	Percentage of average tariff (%)
Generation – capacity	13.18	24.8
Generation – energy	13.30	25.0
Generation – heat subsidy	7.34	13.8
Total Generation	***33.82***	***63.6***
Transmission capacity	1.89	3.6
Transmission losses	1.34	2.5
Distribution capacity	8.02	15.1
Distribution supply	1.67	3.1
Distribution losses	6.45	12.1
Total	***53.2***	***100.0***

There are no particular design considerations relating to the non time-differentiated tariffs that have not already been addressed with the exception that it includes only a single block. Blocks are often used to reflect differences in supply costs at different levels of supply, or to pass along a discount to lower consumption customers who might be representative of the poor; i.e., a lifeline tariff. Lifeline tariffs and block charges are discussed in greater detail in the next section of this report.

Current estimates of marginal supply costs are shown in ***Exhibit 7***.

D.2. Analysis of current TOU tariff designs

An important consideration in any time-varying tariff analysis is selection of the time periods. Time periods are defined in an effort to lump together hours when supply costs are similar, and once defined, tariffs are based on an average of the supply costs incurred during the time periods. For example, time periods may be defined for different periods of the day (i.e., daytime, nighttime and evening), and different seasons (i.e., winter, summer and spring/fall months). Mongolia's time periods and associated tariffs are shown in ***Exhibit 16***. As can be seen, the periods vary by customer class: the off-peak period for Entities is from 22:00 to 6:00, for households from 21:00 to 6:00 and for Streetlights from 19:00 to 6:00. While the variation is not large, it is not clear why there is any variation at all except that the shorter peak periods for households and Streetlights result in reduced exposure to the higher peak period tariffs. Selection of periods and costs should be driven by the costs on the power system as a whole. The fact that there are differences implies that a subsidy is being passed from the entity class to the household and Streetlight customer classes. The periods defined for Entities appear to be consistent with the system load shape which is often a good indicator of costs.[17] The daily load shape for typical winter and summer days is shown in ***Exhibit 17***.

[17] Load shapes are shown in the 2001 Master Plan. Discussion with the ERA indicates that the time periods have not been studied for many years, and in the absence of system simulation software and an economic dispatch regime, it will be difficult to define time periods any more accurately than those in use today. In any regard, the time periods should be consistent among customer classes.

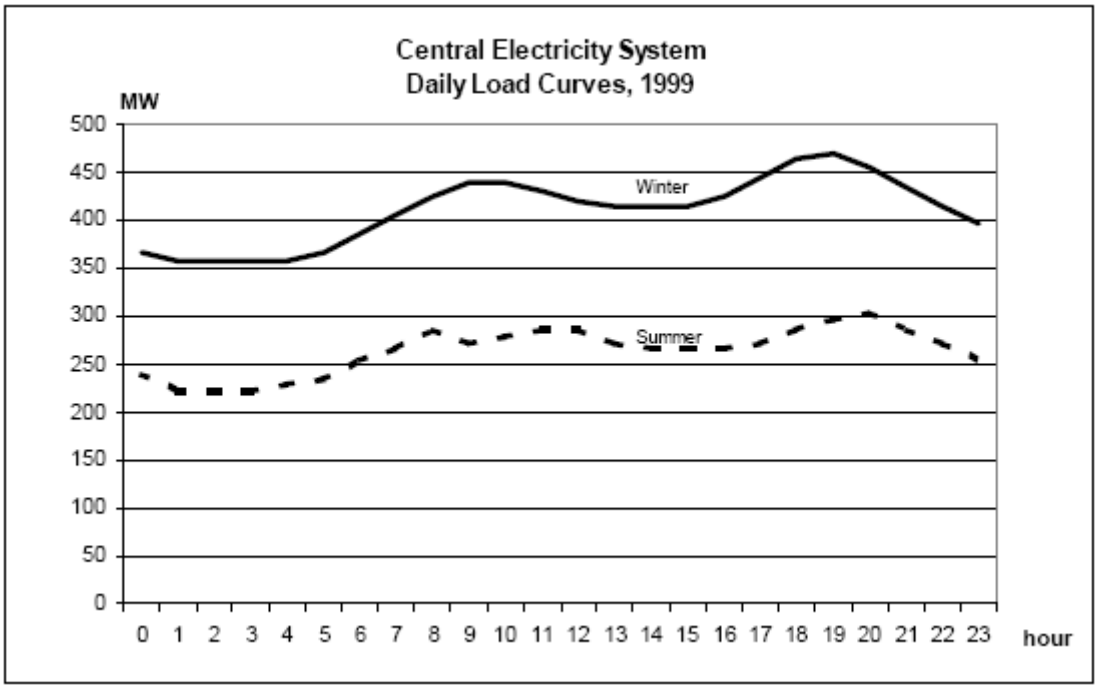
Exhibit 16. Time-of-use tariffs

Tariff class	Tariff (MNT/kWh)
Entities (Flat Tariff)	53.2
Entities (TOU Tariff)	
Day (6:00-17:00)	53.2
Evening (17:00-22:00)	104.2
Night (22:00-6:00)	31.8
Entities (TOU Total)	53.8
Entities Total	***53.6***
Households (Flat tariff)	
Apartments	53.2
Ger Areas	51.0
Households (TOU Tariff)	
Day (6:00-21:00)	53.2
Night (21:00-6:00)	13.5
Households (TOU Total)	42.2
Households (Lifeline)	40.5
Households Total	***48.9***
Streetlights (TOU Tariff)	
Day (6:00-19:00)	53.2
Night (19:00-6:00)	8.6
Streetlights TOU Total	22.6
Total System	***52.6***

Marginal costs are often used as a guide in establishing different prices for different time periods. However, in Mongolia's case fuel prices are subsidized, making it difficult to know what the true marginal cost of fuel is on the system. Complicating matters further is the fact that Mongolia does not practice economic dispatch. As a result, average fuel costs are a reasonable portrayal of energy supply costs on the system.

A practical approach to defining prices for the different time periods is to establish a floor price for off-peak period pricing, and adjusting prices in the other periods to send the desired price signal and recover the revenue allocation to the customer class. This methodology can be utilized to meet the three principle objectives of tariff design: generate required revenues, fairness through recovery of the revenues allocated to the class and efficiency by including a price signal that reflects the different costs of supply in different periods.

Exhibit 17. Daily load curves on the CES



Selecting an appropriate floor price is relatively straightforward. Sales in all periods should recover as a minimum the variable cost of supply – otherwise, the sector will lose money on each kWh of energy sold during the period. Average costs of each component of supply are shown in ***Exhibit 14***, and include:

Generation Energy	13.30 MNT/kWh
Transmission Losses	1.34 MNT/kWh
Distribution Losses	6.45 MNT/kWh
Floor Price (Total)	21.09 MNT/kWh

This represents a floor price for supply at the LV level, so is appropriate for households; however, many (but not all) of the entity customers are served at the HV and MV levels. Using the MV level as a proxy for the entity customer class requires that distribution losses be broken out by primary and secondary supply levels. This can be done by extrapolating from the marginal energy costs shown in ***Exhibit 7*** as follows:

[((26.6 – 25.8) / (30.4 – 25.8)) * 6.45] + 13.3 + 1.34 = 15.76

On this basis, the floor price for customers served at the MV level would be 15.76 MNT/kWh.

As can be seen in ***Exhibit 16***, the off-peak (nighttime) period prices for households and Streetlights are far below the floor price of 21.09 MNT/kWh. Following the tariff increase imposed on March 1, 2008, the off-peak period price for Entities is comfortably above the floor price when the LV level is used as the proxy, and considerably above the floor price when the MV level is used as the proxy (about double).

It might be argued that the generation heat subsidy should also be collected in the off-peak period. Being a subsidy, there is little reason to collect it only during peak periods unless it is judged to enhance the price signal. Including the generation heat subsidy would increase the floor price to 28.43 MNT/kWh for customers served at the LV level, and 23.10 MNT/kWh for customers served at the MV level. At these levels, the off-peak period price would remain

significantly below the marginal cost of energy shown in ***Exhibit 7*** (35.42 and 30.99 MNT/kWh, respectively).

The entity customer class TOU rate has three time periods. The shoulder, or daytime, period price is currently set at the average tariff price, or 53.2 MNT/kWh. This represents a reasonable approach, and is in fact recommended in the PA Government Services report referenced earlier. The peak period (evening) price should then be set at the level necessary to recover the remaining revenue requirement. For example, considering the 2008 forecast sales included in ***Exhibit 2*** and a floor price of 23.10 MNT/kWh, the peak (evening) period price would be determined as follows:

Revenue requirement from entity customers on TOU Tariff = 75,916.1 Million MNT

Off-peak (night) – Forecast Sales = 390,478.5 MWh, Tariff = 23.10 MNT/kWh

Shoulder (Day) – Forecast sales = 838,059.8 MWh, Tariff = 53.2 MNT/kWh

Peak (Evening) – Forecast Sales = 181,517.3

Peak Period Tariff = (75,916.1 – (390.4785*23.10) – (838.0598*53.2)) / 181.5173

= 122.92 MNT/kWh

This result is greater than the current peak period tariff of 104.2 MNT/kWh in the entity TOU tariff, sending a strong price signal for customers to reduce demand in the peak period as the ratio between peak and off-peak period prices would exceed 5 to 1. However, as noted earlier the ERA has recently imposed an increase in the off-peak period price to the entity class to 31.8 MNT/kWh. It is unlikely that this price will be reduced to the floor price described above. Based on 2008 forecast revenues, the current TOU tariff design with an off-peak period price of 31.8 MNT/kWh, a shoulder period price of 53.2 MNT/kWh and a peak period price of 104.2 MNT/kWh represents a reasonable tariff design as it recovers the cost of supply in all time periods and sends a strong price signal to consumers to conserve energy during the peak period with a peak to off-peak price differential of about 3.3:1.

Although the TOU tariff for the entity customer class appears reasonable, the TOU tariffs for the household and Streetlight customer classes clearly are ***not***. In both cases there are two time periods: peak and off-peak. The peak period rate is set at the class average tariff of 53.2 MNT/kWh, and the off-peak period rate is set at levels far below the floor price. It is a mystery why all household customers have not opted for the TOU rate. Even if a customer takes only a single kWh in the off-peak period, its electricity bill would be lower than it would be under the non time-varying tariff. The current TOU tariff designs for household and Streetlight customers fail to meet any of the three primary tariff design objectives; specifically, the tariffs do not generate the revenue requirement, they are inefficient because money is being lost on every kWh sold in the off-peak period, and the tariffs are unfair to both household customers on the non time-varying tariff and all customers in the entity class.

Complicating the design of the TOU tariff for households is the fact that the discount (or incentive) for the TOU tariff relative to the non time-varying tariff is substantial. For Entities, the difference is small with the average TOU tariff being 53.8 MNT/kWh relative to the non time-varying tariff of 53.2 MNT/kWh, representing a premium of about 1 %. For households, the difference is much greater, with the average TOU tariff being 42.2 MNT/kWh compared to the non time-varying tariff of 53.2 MNT/kWh, representing a discount of about 21 %. The TOU tariff should be less on average than the non time-varying tariff because customers have reduced their bills by responding to the price signal. In addition, a discount can be justified because it is desirable that as many customers as possible migrate to the TOU tariff. However, the magnitude of the current differential is responsible for a significant portion of the cross-

subsidy household customers are receiving from customers of the entity class. It should be a priority of the ERA to reduce this subsidy over time.

A number of changes should be made to the TOU tariff designs for households and Streetlights, as follows:

- The time periods should be made consistent with those for the entity customer class. This does not necessarily mean that the tariff should be re-designed to include three time periods. In fact, TOU tariffs with two time periods are generally easier for the smaller, less sophisticated customers in the household class to understand. In any regard, if the TOU tariff for households and Streetlights are revised to include three time periods, the periods should be defined consistent with those for the entity customer class. If two time periods are maintained, they should include daytime defined as the hours from 6:00 to 22:00, and nighttime defined as the hours from 22:00 to 6:00.
- If revised to include three time periods, rates for each period should be derived using the same methodology described above for the entity customer class, but based on the floor price and revenue requirement specific to the household and Streetlight customer classes.
- If two time periods are to be maintained, the off-peak rate for households and Streetlights should be set at the floor price of 28.43 MNT/kWh (includes the generation heat subsidy), and the peak period price should be established to recover the remainder of the revenue requirement assigned to the class. Based on the 2008 forecast sales and revenues, setting the off-peak rate at 28.43 MNT/kWh would result in a peak period tariff of 47.5 MNT/kWh for households.
- Regardless of whether a two- or three-period TOU tariff is chosen, the peak and off-peak period prices should be increased over time to reduce the price differential between the TOU and non time-varying tariffs in a manner that is consistent with efforts to reduce the cross-subsidy currently being paid by Entities on behalf of households and Streetlights.

E. Lifeline tariffs

E.1. Background

As has been discussed, there are significant subsidies built into the current tariff regime. For example, households are being subsidized by entities, Small Entity customers are being subsidized by Large Entity customers, customers of distribution companies are subsidizing customers of other distribution companies owing to the national uniform tariff, there are subsidies from electricity to heat customers, and because the Government is not receiving a return on its investment as owner of the various power companies (i.e., tariffs do not recover the full cost of supply), the Government is providing a subsidy to the power sector as a whole[18]. Reforming the tariff regime to address these subsidies will result in significant tariff increases in the future, particularly for households. As a result, there is a need to ensure the truly needy (i.e., low income) consumers are protected. Lifeline tariffs are a typical means for passing such subsidies on to the poor.

[18] Arguably, electricity consumers are paying this subsidy because tariffs are so low that power companies are unable to perform proper maintenance, leading to reduced quality and reliability of electricity supply. Likewise, if the Government were receiving a reasonable return on its investment in the power sector, it would have additional funds to put toward other social initiatives such as roads, schools, hospitals, etc.

Political and social objectives are the key drivers of lifeline tariffs. Because the primary purpose is to convey a subsidy, lifeline tariffs tend to be contrary to the primary tariff design objectives including revenue recovery, market efficiency and fairness. In spite of the adverse impacts on the tariff design objectives most developing countries and donor agencies recognize the need to provide subsidies to the poor.

Once the decision has been made to offer a lifeline tariff, the issues become:

- Who is the target of the subsidy?
- How much subsidy is warranted?
- Who will fund the subsidy?

Lifeline tariffs for the poor reflect social policy which is clearly the responsibility of the Government of Mongolia. The intent of this section of the report is to identify the issues that must be addressed and the decisions that must be made if the GoM is intent on providing a subsidy to the poor. The ERA and EPRC remain ready to assist with development and implementation of a lifeline tariff if requested by the Government of Mongolia.

E.2. Targeting the subsidy

Mongolia does not currently have a Government social agency that has identified the poor. In the absence of such an agency, it has been left to the ERA to make the determination itself. In order to make this determination, the ERA has used the definitions stipulated in "Mongolian Law on Social Care and Assistance", specifically, a person who is unable to live alone and does not have the support of relatives, including veterans, invalids, single parents with children, and the very poor with income 40% lower than the approved living standard. The ERA has determined that people falling within this category are "vulnerable consumers with the right to the lifeline tariff".

The problem with the methodology chosen by the ERA to identify "vulnerable" consumers is that it tends to be quite expensive to administer. In addition, it is targeting only a minimum number of households, currently less than 700. Countries like Mongolia that do not have a government agency that has defined the poor often simplify the administrative process by defining the poor as those having monthly consumption below a threshold level (i.e., 50 kWh/month). A discount is applied to consumption up to the specified threshold, and subsequent blocks of power might be priced above costs in order to fund the subsidy. In this manner, all customers receive the discount on the first block of power. However, those consuming power in excess of the first block would return at least a portion of the subsidy owing to the higher cost of subsequent blocks of power. Provided consumption of the target group is truly below the threshold the tariff design will meet its objective. Unfortunately, it is not always true that the target group consumes minimal amounts of electricity. The ERA has determined that a consumer with very low income living in Ulaanbaatar City can "get by" with 75 kWh/month. This is consistent with levels used in other countries. For example, Jordan discounts the tariff for the first 160 kWh/month; Pakistan discounts the first 50 kWh/month, while Algeria discounts the first 41.6 kWh/month.

E.3. Amount and payment of subsidy

The next issue is to determine how much subsidy is warranted. This is a function of the revenue requirement, the impact on those funding the subsidy (i.e., other customers or Government), recent tariff increases (i.e., how quickly tariffs have been rising), and the ability of the poor to pay.

The most efficient mechanism for conveying the subsidy is direct payment by the Government. This leaves the primary tariff design objectives relating to revenue recovery, efficiency and fairness intact. Conversely, if the subsidy is paid for through higher tariffs on other customers, the subsidy must be designed in a way that impacts the tariff design objectives as little as possible. If the subsidy is funded by industrial customers, they can become less competitive in global markets leading to job loss. If funded by commercial customers, inflation may increase as the commercial entities pass the increased costs of electricity through to their customers. If funded by residential customers, intra-class cross-subsidization results, but design objectives remain intact for all other customer groups.

E.4. Lifeline tariff design considerations

Generally, lifeline tariff designs should distort the tariff design objectives to the least extent possible and should confine the distortion to as few customers as possible. Two potential lifeline tariff designs follow:

A two-part tariff with monthly customer charge and an energy charge: The customer charge is waived for the poor, and the energy charge is set to recover the remaining revenue allocated to the residential (household) class. The advantage of this tariff design is that all customers have the same incentive to consume the appropriate amounts of power. The disadvantages are that the poor must be identified, and the discounts tend to be small.

A one-part, block energy tariff structure: The first block is priced at a discount, and the second block is set to recover the remaining revenue allocated to residential class. The advantages of this tariff design are: 1) the tariff for consumption above the threshold level promotes efficient consumption decisions, and 2) there is no need to identify the poor. The disadvantage is that all customers receive the discount rather than only the poor; however, if the second block is priced above costs the discount for higher consumption customers is reduced or eliminated altogether.

A potential block tariff design for Mongolia would be to establish 0 – 50 kWh/month as the target subsidy consumption level and discount the price by 25%. Consumption above 50 kWh/month would be priced at a level that recovers the remaining revenue allocated to the class. As stated earlier, there is a need to determine who will pay the subsidy and how much subsidy is appropriate. It is noted that Mongolia's current lifeline tariff does not represent a huge subsidy to the poor. The average tariff paid by lifeline customers is 40.5 MNT/kWh. This compares to the flat energy tariff of 53.2 MNT/kWh for Apartments and 51.0 MT/kWh for Ger Districts. However, the average TOU tariff for households is 42.2 MNT/kWh, about 4% greater than the lifeline tariff. In addition, sales under the Lifeline Tariff are quite small, forecast to be only 775.4 MWh in 2008. Therefore, the Lifeline Tariff represents a subsidy of about 9.3 Million MNT (12 MNT/kWh * 775.4 MWh = 9.3 Million MNT), representing only 0.007% of the total revenues forecast for the CES in 2008 (135,809 Million MNT).

A final consideration with regard to lifeline tariffs in Mongolia relates to the success of the TOU tariff for households. The TOU tariff has high penetration levels, representing close to 1/3 of forecast sales to the household customer class in 2008. Further increases in penetration levels are expected by year-end 2008. The GoM does not want to present a barrier to the success of the TOU tariff by providing incentives to the poor to remain, or convert, to a non time-varying block tariff. Therefore, it may be appropriate to use the TOU tariff as the lifeline tariff, and design it to include block charges in each of the time periods. The disadvantage of this approach is that block charges will make the TOU tariff more complicated for the household consumers.

F. Summary

The analysis of Mongolia's retail tariff designs on the CES has identified a number of issues that should be taken into consideration in the development of the tariff reform plan, as follows.

- It is politically difficult to eliminate the uniform national tariff at this time, but Mongolia should commit to moving to a tariff regime with separate retail tariffs for each individual distribution company. This will eliminate cross-subsidization between customers of different distribution companies and increase transparency, providing incentive for distribution companies to reduce costs and improve efficiency. This will be a requirement when Mongolia introduces the competitive bilateral contracts market in the future.
- In order to improve the fairness of the tariff regime, the entity class should be split into three classes, including Small Entity served from the LV network, Medium Entity served from the MV network and Large Entity served from the HV network. These classes would be in addition to the household classes. As costs increase at lower voltage supply levels, tariffs would likewise increase as they progress from supply at the HV level to supply at the LV level.
- As there is currently no load research data relating to demand contributions, it is difficult to accurately allocate demand costs to different customer classes. Mongolia should embark on a load research program in order to obtain such information.
- Adding a customer charge in the form of a fixed monthly charge in tariffs for households and Entities would ensure recovery of the basic costs of hooking a customer up to the system and the ongoing costs of billing, metering and the provision of other customer services offered by the utility such as energy efficiency and demand management programs. It would therefore improve the fairness of the tariff regime.
- Although the current TOU tariff for the entity customer class is providing reasonably efficient price signals, a design methodology should be adopted that sets the nighttime off-peak period price at a floor price recovering as a minimum the variable cost of power, and perhaps the generation heat subsidy component, the daytime shoulder period price at the average tariff for the class, and the evening peak period price at a level necessary to recover the remainder of the revenue requirement assigned to the class.
- A number of improvements could be made to the TOU tariff designs for households and Streetlights, including:
    - The time periods should be made consistent with those for the entity customer class. This does not necessarily mean that the tariff should be re-designed to include three time periods. In fact, TOU tariffs with two time periods are generally easier for smaller, less sophisticated customers such as those in the household class to understand. In any regard, if the TOU tariff for households and Streetlights are revised to include three time periods, the periods should be defined consistent with those for the entity customer class. If two time periods are maintained, they should include daytime defined as the hours from 6:00 to 22:00, and nighttime defined as the hours from 22:00 to 6:00.
    - If revised to include three time periods, rates for each period should be derived using the same methodology described for the entity customer class, but based on the floor price and revenue requirement specific to the household and Streetlight customer classes.

- If two time periods are to be maintained, the off-peak tariff for households and Streetlight should be set at the floor price of 28.43 MNT/kWh (includes the generation heat subsidy), and the peak period price should be established to recover the remainder of the revenue requirement assigned to the class. Based on the 2008 forecast sales and revenues, setting the off-peak rate at 28.43 MNT/kWh would result in a peak period tariff of 47.5 MNT/kWh for households.
- Regardless of whether a two- or three-period TOU tariff is chosen, the peak and off-peak period prices should be increased over time to reduce the price differential between the TOU and non time-varying tariffs in a manner that is consistent with efforts to reduce the cross-subsidy currently being paid by Entities on behalf of households and Streetlights.

- If the Government of Mongolia is indeed interested in providing a subsidy to "vulnerable customers" through the electricity sector, it should develop a clear policy outlining the target subsidy group, the level of subsidy to be provided, who is to pay for the subsidy and how the subsidy is to be conveyed to the target group.

SECTION V: SUMMARY OF ISSUES AND PRIORITIES

This section of the report identifies the primary issues relating to Mongolia's retail tariff regime and assigns a priority to each; i.e., high, medium or low priority. The issues and priorities that have been agreed to with the ERA are shown in ***Exhibit 18***.

Exhibit 18. Issues and priorities

Issue	Priority
Increase average retail tariff to levels enabling financial self-sufficiency of power companies	High
Reduce and make transparent cross-subsidies between customer classes	High
Develop social policy relating to lifeline tariffs for the poor and implement lifeline tariff[19]	High
Increase customer classes to reduce and make transparent cross-subsidies within entity customer class	High
Rationalize time-of-use tariffs including time periods and charges for each time period for each customer class	High
Continue to improve accounting standards, financial reporting and tariff submissions by Power Companies	Medium
Add customer charges to retail tariffs	Low
Add demand charges to retail tariffs, particularly those served from HV network	Low
Eliminate National Uniform Tariff	Low
Design and implement load research program	Low
Develop automatic pass-through mechanism (i.e., fuel adjustment clause)[20]	Low

[19] The ERA feels that a lifeline tariff is high priority. The author's view is that although important, the lifeline tariff should have lower priority given that tariffs for Domestic customers are currently far below the cost of supply and will remain so in the near future.

[20] Development of an automatic pass-through mechanism such as a fuel-adjustment clause is considered a high priority by the ERA. However, owing to the need for very large tariff increases in the short term, it was decided that an automatic pass-through mechanism would be better left until the period immediately following the tariff reform plan. The pass-through mechanism might take the form of a purchased power cost pass-through following implementation of the competitive bilateral contracts market.

SECTION VI: PROPOSED RETAIL TARIFF REFORM PLAN

In this section of the report, a retail tariff reform plan is presented based on the issues and priorities identified in the previous section. This tariff reform plan has been prepared in cooperation with the ERA and is proposed for discussion with industry stakeholders including the GoM.

A key consideration in the development of the tariff reform plan relates to the time frame over which it will be implemented. The required tariff increase is very large, of the order of 50 to 60% in real terms and Mongolia's inflation rate is in the double digits (about 14% in 2007). If double digit inflation continues, tariffs will have to double (i.e. a 100% increase) over the next four years if the power companies are to become financially self-sufficient and the GoM is to receive a reasonable return as principal shareholder. It is desirable to spread such large increases over a period of years in order to smooth the impact on consumers. Conversely, the time period should not be too long because it sends the wrong signal to potential investors (i.e., they will not take it seriously and will be less likely to invest), and because it is necessary to fund much needed capital expenditures in the near term, particularly if Power Plant #5 proceeds as planned. On this basis, four years has been selected as the period over which tariffs will be rationalized. This equates to tariff increases of the order of 20% in each of the four years of the plan.

The proposed tariff reform plan based on a four-year period is outlined below, and shown graphically in ***Exhibit 19***. The tariff reform plan identifies the issues that will be addressed in each year of the plan. The issues would be addressed at the same time that the tariff increase is implemented. For example, in 2008 the new entity customer classes would be introduced at the same time the 2008 tariff increase is imposed. Further, the date of the tariff increase should be approximately the same each year; i.e., October 1. There was some discussion about having two tariff increases each year resulting in smaller and more gradual increases, but it was decided that it is difficult enough to impose a single increase in a year let alone two such increases, so biannual tariff increases were rejected.

Finally, the tariff reform plan shows tariff increases tied to specific actions, for example, the incorporation of asset revaluation in tariffs. The intent is to show progress on accounting issues. However, if it is determined that an annual tariff increase resulting from the new accounting treatment and input price increase is significantly above or below 20%, it is recommended that 20% be used as the target increase, and serve as the minimum annual tariff increases during the first three years of the plan. If in the fourth year of the plan the increase necessary to bring tariffs to full cost recovery is significantly above 20%, the plan might be extended to a fifth year. The goal is to increase tariffs steadily over the next three years, and in the fourth year, increase tariffs by the remaining amount necessary to enable full recovery of the cost of supply.

Proposed retail tariff reform plan

In 2008:

- Retail tariffs will be increased to incorporate outcome of asset revaluation and power company input price increases (average tariff increase will be no less than 20%);
- A greater portion of the revenue increase will be applied to households and Streetlights than Entities in order to reduce inter-class cross-subsidization. For example, if an overall average tariff increase of 20% is implemented, the average tariff for households might be increased by 25% while the average tariff for Entities might be increased 18%;
- In order to decrease the cross-subsidy between household customers on the TOU tariff and household customers on the non-TOU tariff, and in order to ensure recovery of costs in the off-peak period of the TOU tariff, a greater portion of the revenue assigned to households will be collected in the TOU tariff, and in particular, the off-peak period rate;
- A greater portion of the revenue assigned to Streetlights will be assigned to the off-peak period price to ensure recovery of costs in the off-peak period;
- The entity class will be split into three classes on the basis of voltage supply level (i.e., Large, Medium and Small Entity classes supplied at HV, MV and LV, respectively) and the tariffs for each class will be set in proportion to the marginal cost of supply for each class. In order to smooth tariff impacts, it may be necessary to move toward marginal cost proportions over two or three years;
- The GoM policy on subsidies for the poor will be developed; and
- A lifeline tariff consistent with the GoM policy will be implemented, probably in the form of a block tariff.

The plan for 2008 will make progress on all issues identified as high priority, and on the medium priority issue including improved accounting standards, financial reporting and tariff submissions by power companies.

In 2009:

- Retail tariffs will be increased to incorporate outcome of expensing (rather than capitalizing) maintenance costs and power company input price increases (average tariff increase will be no less than 20%);
- A greater portion of the revenue increase will be applied to households and Streetlights than Entities in order to continue reducing inter-class cross-subsidies;
- A greater portion of the revenue increase assigned to households will be applied to the TOU tariff in order to further rationalize the TOU tariff (as described in Section 4.4.2) and continue to decrease the cross-subsidy between TOU and non-TOU household customers;
- Adjustments will be made as necessary to the TOU tariff for Streetlights to further rationalize the tariff;
- The revenue increase will be assigned to the new entity classes (High, Medium and Low Voltage entity classes) so that tariffs proportionally reflect the marginal costs of supply;
- The lifeline tariff will be adjusted consistent with GoM policy on subsidies for the poor; and
- The load research program will be initiated.

This will continue progress on all issues identified as high and medium priority, and initiate work on low priority issues including the load research program.

In 2010:

- Retail tariffs will be increased to incorporate appropriate "profit" levels for power companies, recover costs of GoM social initiatives such as Newcom wind project and connection of Soums, and power company input price increases (average tariff increase will be no less than 20%);
- A greater portion of the revenue increase will be applied to households and Streetlights than Entities in order to continue reducing inter-class cross-subsidies;
- Rationalization of the TOU and non-TOU tariffs for households, Streetlights and the entity classes will be continued as necessary;
- The lifeline tariff will be adjusted consistent with the GoM policy on subsidies for the poor;
- The load research program will be continued;
- Customer charges and demand charges will be incorporated into tariff designs as appropriate and consistent with information gained from load research study; and
- The national uniform tariff will be eliminated (this may coincide with introduction of the competitive bilateral contracts market).

This will continue progress on all issues identified as high and medium priority, and on low priority issues including the load research program, and initiate work on other low priority issues including the addition of customer charges and demand charges, and elimination of the national uniform tariff.

In 2011:

- Retail tariffs will be increased to recover the full cost of supply including capital requirements for new facilities such as Power Plant #5 (if the required tariff increase is significantly in excess of 20%, the plan might be extended to a fifth year);
- Tariffs for households, Streetlights and all entity classes will fully recover the costs allocated to each class so inter-class cross subsidies are eliminated (or at least reduced to acceptable levels; i.e., within 5%);
- All TOU and non-TOU tariffs will be fully rationalized;
- An automatic pass-through mechanism (i.e., fuel adjustment or purchase power cost clause) will be developed and implemented. This may coincide with introduction of the competitive bilateral contracts market;
- The lifeline tariff will be consistent with GoM policy on subsidies for the poor; and
- The load research program will be continued as necessary.

This will address all issues according to the priorities identified in ***Exhibit 18*** and complete the retail tariff reform plan.

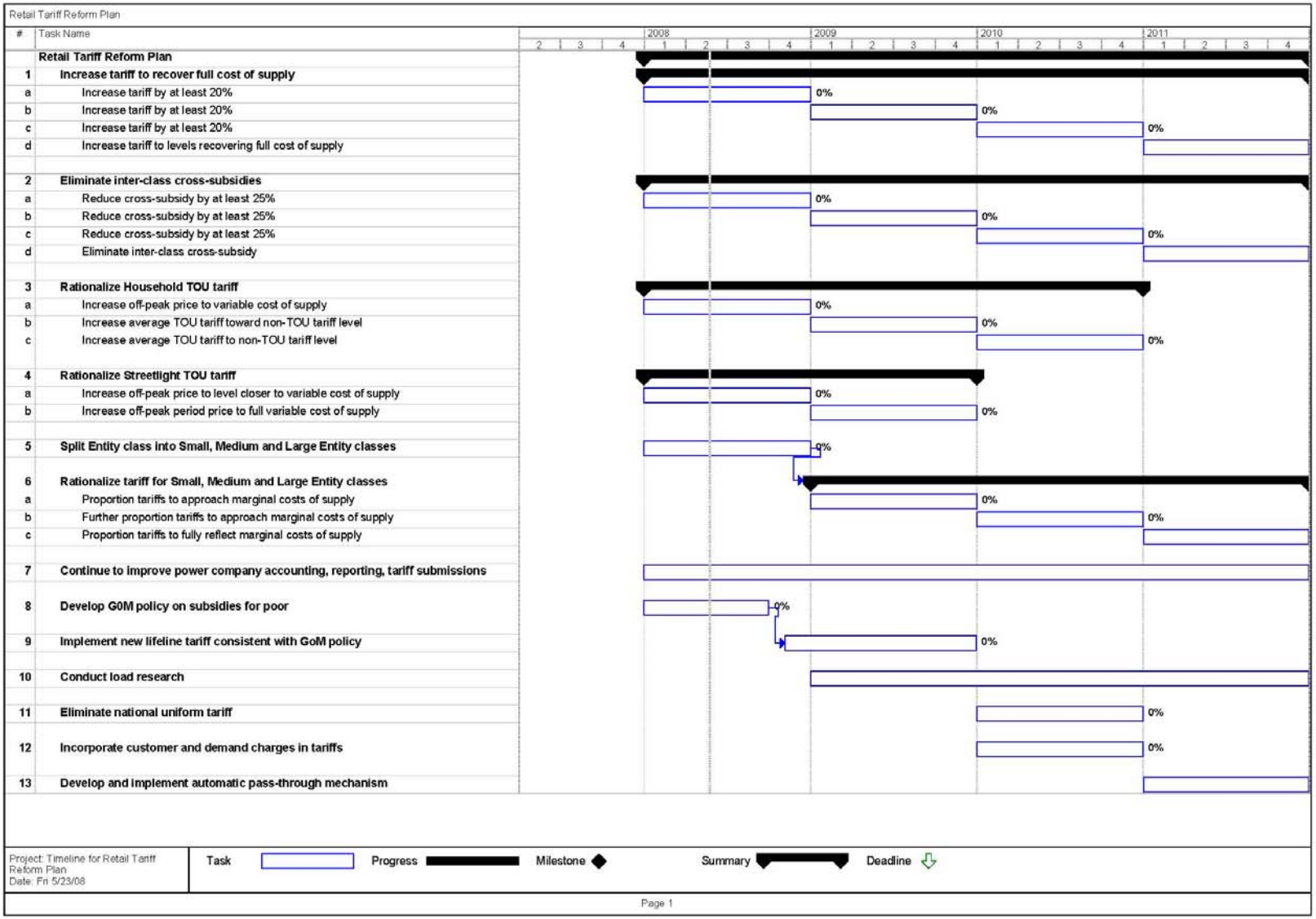



Exhibit 19. Retail tariff reform plan