SCHEDULE H.4
FORECAST ENERGY CONSUMPTION and DEMAND

ENERGY AND DEMAND FORECAST METHODOLOGY

1. Energy Consumption Forecast

In forecasting the energy requirement of all customer classes, ILPI adopts two trending methodologies, namely the Polynomial Curve Fitting and the Averaging methods. These methods use historical data in projecting the energy consumption of the system.

- **Trending Using Polynomial Curve Fit Method**

Polynomial Curve Fitting has been used to forecast the energy consumption of all the customer segments except for Bulk Power Customers. It is because of the abnormality of the historical data of bulk power customers that significantly affects the polynomial curve.

The Polynomial Curve Fitting uses the equation $E_n = a_n t^3 + b_n t^2 + c_n t + d_n$ where *t* represents the number of years of the historical data that starts from 1 to *n* and a_n, b_n, c_n, and d_n are the coefficients for an area *n* that best fit the polynomial curve to the historical data. These coefficients are determined by the matrix equation

$$C_n = \left[\left[P\right]^T \left[P\right]\right]^{-1} \left[P\right]^T \left[E_n\right]$$

where,

[*P*] – Vandermonde Matrix whose number of columns is equal to the number of coefficients in the polynomial curve and the number of rows is equal to the number of the historical years.

$\left[P\right]^T$ - the transpose of the matrix [*P*] where the elements of the rows and the columns of matrix [*P*] are interchanged. Please see sample matrix below,

$$\left[P\right] = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 8 & 4 & 2 & 1 \\ 27 & 9 & 3 & 1 \\ . & . & . & 1 \\ . & . & . & 1 \\ . & . & . & 1 \\ t_n^3 & t_n^2 & t_n & 1 \end{bmatrix} \qquad \left[P\right]^T = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & . & . & . & t_n \\ 1 & 4 & 9 & . & . & . & t_n^2 \\ 1 & 8 & 27 & . & . & . & t_n^3 \end{bmatrix}$$

$\left[\left[P\right]^T \left[P\right]\right]^{-1}$ - the inverse of the product of matrices $\left[P\right]^T$ and [*P*].

$\left[E_n\right]$ - matrix with a column equals to one and rows equals the number of available historical data. The elements of which are value of the historical data.

- **Trending Using Averaging Method**

  This forecasting method uses the average increase or decrease of the historical data. This method was used to project the energy requirement of ILPI's existing Bulk Power customers. In deriving such increase or decrease, the following formula was used.

$$I_{n+1} = \frac{E_{n+1} - E_n}{E_n}$$

  where

  I_{n+1} - increase or decrease in annual energy consumption.
  E_{n+1} - annual energy consumption following the historical year *n*.
  E_n - annual energy consumption in historical year *n*.
  n - starts from year 2003 to year 2007.

  In determining the forecast energy consumption of the Bulk Power Consumers, the following formula was used.

$$E_{y+1} = \left(1 + \frac{\sum_{2003}^{2007} I_i}{x} \right) * E_y \qquad \text{in kWhr}$$

where

  E_n - value of energy in kWhr of the base year
  E_{n+1} - value of energy in kWhr following the base year and so on.
  I_i - historical value of increase or decrease in annual energy consumption.
  $\sum_{2002}^{2006} I_i$ - sum of the increase or decrease in annual energy consumption.
  x - number of historical years.
  y - starts from year 2008 up to year 2013.

Transferred TransCo's Directly-Connected Customers

ILPI projects to acquire TransCo's sub-transmission assets in year 2008 and assume its operation by second quarter of 2009. This acquisition will translate to additional customers for ILPI since the existing TransCo-directly connected customers will be transferred to ILPI's distribution system, and consequently lead to a significant increase in ILPI's energy requirement starting year regulatory 2010.

In deriving the aggregate energy consumption forecast of Bulk Power customers, ILPI added the ILPI's existing Bulk Power consumers' energy forecast to the energy projections of TransCo-directly connected customers based on available data provided by TransCo.

However, ILPI uses the average consumption of Treasure Steel Works Corporation (TSWC) based on its three (3) year historical data applied linearly for the whole regulatory period. Being a downstream industry of Global Steelmakers International, Incorporation where operation has not yet stabilized, ILPI is not comfortable with the high projection of TransCo. NPC also reveals that its contract with TSWC is only up to the end of 2010.

2. Forecast on Demand

In deriving the forecasted Demand of the System, ILPI uses the forecasted energy consumption and the average historical Load Factor of the system as basis for the forecast. The peak demand has been derived by dividing the total forecasted energy consumption of the system with the average Load Factor and total number of hours in one year period which is 8,760 hours, as expressed in the equation below:

$$Demand\ (kW) = \frac{Forecasted\ Energy\ (kWhr)}{(Average\ Load\ Factor) * (8760\ hrs)}$$

In order to forecast delivery at different substations and major distribution feeders of the system, ILPI uses the average percentage, based on historical data, of the contribution of each substation and major distribution feeders to the total energy consumption of the system.

- **Values Used in the Forecast**

1. Demand

   1.1. System Demand – the historical values used for the system demand were based on meter reading results on National Power Corporation (NPC) and the National Transmission Corporation (TransCo).

      1.1.1. The demands for Pala-o and Overton Substations are aggregated.
      1.1.2. The demand registrations for each substation are based on the Power Bills of NPC and TransCo.

   1.2. Substation Demand – based on Power Bills of NPC and TransCo.

      1.2.1. The percentage demand of each substation was derived from the demand registration at each substation against that of the total system demand.

   1.3. Feeder Demand – actual values from the monthly readings of the Schweitzer Engineering Laboratories (SEL) relays for each feeder.

2. Load Factor – the ratio of the average load supplied during a designated period to the peak or maximum load in kilowatts for that period.

   2.1. Data taken from the historical peak demand of each metering point as provided by the meter reading results from NPC and TransCo.

   2.2. Load factors for each historical year were derived using the historical peak demand.