APPENDIX I

SUMMARY OF THE PROPOSAL OF TERA

INDEX

APPENDIX I

SUMMARY OF THE PROPOSAL OF TERA

This document contains the interpretation that the Consortium has made of the proposal of TERA. It is not a subjective presentation, but it can have interpretation details that may be do not coincide with the TERA vision, because some issues can have more that one interpretation. This summary is necessary to establish a reference to the simulation process.

1. GENERAL CONCEPTION

TERA proposes an electricity wholesale market composed by three sub-markets:

- Options: that give long term signals to handle the problem of capacity expansion of electricity generation
- Future: that give medium term signals to handle the water resource management problem
- Spot: that give short term signals to handle the problem of plant's dispatch

2. OPTIONS MARKET

The reference is the chapter VII of the TERA Part 6 - Final Report (page 110).

Firm energy option definition: "The purpose of a firm energy option instrument is to provide Buyers with the right, but not the obligation to accept either physical energy or a financial guarantee for the seller".

Under the TERA proposal the options "can be either financially-settled or physically-settled instruments that are defined by a contracted amount, a price of exercise of the option (the strike price) and a certain amount of money that is the premium of the option". The option is European style, that means that the option may be exercised only on the date of expiration. Additionally, the "firm energy option" financial structure uses an amortizing premium paid at a fixed rate each month between the time of purchase and the start of the performance period.

The "firm energy option" is a more complicated financial structure than a single option because it corresponds to a multiple years strip of European options with daily exercise.

For each "firm energy option" placed in the system, "each seller is required to identify which unit is backing the offer, and a specific capacity/energy size that is behind it". On the other side, "each buyer is required to identify what set of customers and a specific capacity/energy size the bid is attached to".

The firm energy option market is composed by two markets: the primary market of low frequency and of long term impact, and the secondary market of high-frequency and of medium term impact that permits to adjust the risk hedging according to the fluctuations of the market and of the technical-economic environment.

2.1. PRIMARY MARKET

The main characteristics of this market are the following:

- Auctions with multi-annual frequency. In the Final TERA Report two frequencies are defined: two times in a year (page 118, June and November) and four times (page 121, March, June, September and December).

- Multiple years strip of European options are auctioned in each section. Initially the options have two years of duration, thereinafter five years. According to TERA, the standard performance period of five years "correspond to the average period between ENSO (EL NIÑO) events".

- The demand side is compelled to buy a percentage of its expected demand. As the moment of consumption is near, it must have options to cover 100% of the expected demand. The TERA proposal implies that lacking 18 months the demand side should be have bought 100%, and lacking 24 months 90%.

- There is a transition period that begins with an auction of 10% of the demand and with options with performance period of two years.

- Exercise of the option:

  - The options are exercised daily

  - The buyer manifests the desire of exercising or not the option, two days before the exercise date (European style options).

  - If the option is exercised, the seller manifests a day before energy delivery or money delivery

  - If energy delivery, the seller can dispatch its plant(s) or buy in the spot market.

2.2. SECONDARY MARKET

The secondary market allows participants to trade instruments outside of the multi-annual auction periods included in the primary market. According to the TERA Final Report, "a secondary market provides the opportunity to transfer contracted economic and physical obligations to another counter-party."

The main characteristics of this market are the following:

- Begins two years after the primary market

- Daily auctions in business days

- Details of the market are not provided nor specified in the TERA Final Report. TERA's report delivers the responsibility to some entity (called the NEESP) in the future. This implies that the negotiation conditions to be simulated for this market are not defined in TERA's Final report.

2.3. THE AUCTION

The TERA proposed auction for primary and secondary options market allows for iterative bidding between seller and buyers. Between the iteration the sellers and buyers have the chance to adjust their bid and offer prices.

According to TERA, activity rules can ensure that the auction converges to a suitable price and quantity. Next we summarize the main rules proposed by TERA, pointing out for each rule the two alternatives proposed by them for each process:

- Opening Rule: it describes how buyers and sellers initially submit transactions. Its purpose is to be sure that all quantities in the market are represented at the beginning of the auction.
  - First, to require all sellers in the first round to submit an offer for each strike price sequentially until option premium prices have been established for all strike prices;
  - Second, to introduce the offers by strike price range for a limited time (TERA said "for example 1 minute"). After all the windows are opened, the market is then simultaneously opened for all strike prices.
- Revision Rule: it describes how buyers and sellers vary the prices.
  - First, through the iterations the sellers must lower their offer prices while the buyers must increase their bid prices.
  - Second, time limits are used as a revision rule.
- Exclusion Rule: it describes what happens when revisions are not undertaken.
  - First, if the sellers do not lower their offer prices or if the buyers do not increase their bid prices, the price if kept still ("frozen") for that round.
  - Second, nothing, because sellers and buyers are free to increase or to decrease the prices.
- Withdrawal Rule: it allows a participant to remove its entire tender at the end of an operation.
  - First, a seller may pull his portfolio if prices are iterating to levels that may be insufficient to cover its cost; alternatively a buyer may pull its portfolio if prices are iterating at levels that impose too greater costs. All portions of the tender must be withdrawn and it cannot be re-offered in subsequent iterations. Further withdrawal can occur at the end of any iteration except for the final iteration. Once the auction has finished, no accepted offers can be withdrawn.
  - Second, no withdrawal exists because the prices offered are firm. However the participants are free to re-sell o re-purchase immediately after the price is discovered.
- Closing Rule: it governs when the auction terminates.
  - First, the iterative process is terminated when one or more of the following had occurred:
    - No notable improvement is made in the option premium from prior iterations
    - No valid bid revision is received from the previous iteration
    - A maximum number of iterations is reached
    - The time allotted for iterations elapsed

    Under the two last cases the auction may not have iterated to its equilibrium point.
  - Second, the iterative process is terminated when the time allotted for iterations elapsed. In this case, if the buyer is required to buy, the sellers have more market

power that the buyers when the time is near to the deadline (this is the case in the TERA proposal). As solution for this problem, TERA propose to allow buyers with unfilled positions at the end of the auctions to be filled "at index" or "at market". The price is calculated as the average price for the transactions over the last two to five minutes.

Two additional concepts must be reminded: the Circuit Breakers and the Last Resort Auction Process:

- Circuit Breakers: during the auction process, prices may experience high volatility in a very short period. Under these circumstances the operator may cause a pause in trading while the participants re-think and review the rationale of their positions. This type of situation can be used by the government to initiate the Last Resort Auction Process.

- Last Resort Auction Process: this mechanism allows the government/operator/administrator to call potential new sellers to participate in the auction to stop/limit the undefined growth in prices.

The duration of the auction in the primary market may last for various days, between 2 to 5 days.

2.4. SETTLEMENT

To settle the options TERA proposed four ways (literally):

- Firsts, to settle the option financially, an option sold into the market can be repurchased in the same or in a subsequent auction. This effectively cancels further obligation and causes the transactor to gain money, lose money, or break-even.

- Second, an option sold into the market can be settled financially by repurchasing it in the secondary market. Again, this effectively cancels further obligation and causes the transactor to gain money, lose money, or break-even.

- Third, an option sold into the market can be settled physically by holding it until the effective period commences. Through interaction with the seller, the buyer can choose to require performance, the seller can then choose to supply power and settle physically.

- Fourth, an option sold into the market can be settled financially by holding it until the effective period commences. Through interaction with the seller, the buyer can choose to require performance, The seller can then choose to supply cash and settled financially.

2.5. ASPECTS TO STUDY

In principle, the factors to study in this market would be:

- Effects of the physical structure of the options:
  - monthly versus annual
  - hourly blocks or not
  - for each plant (unit) versus for each agent
  - commitment horizon (the number of years: 2, 3, 4, 5, ...)

- Effects of the financial structure of the options
- Frequency of the auctions in the primary market (monthly, bimonthly, quarterly, semi-annual).
- Relationship between the percentage of estimated demand that the traders must buy and the premium price of the options
- Effect of the secondary market
- Market Power of the agents
- Effects of price caps and of floor prices
- Effect of the currency of the options
- Structure of the auctions
  - First approach
  - Second approach
  - Another approach
- Measurement of the risk of the agents
- To prove that the options can act as a long term signal

3. FUTURES MARKET

The reference is to chapter VIII of the TERA Part 6 - Final Report (page 129).

According to the TERA Final Report, "the purpose of a futures contract is to provide a forward instrument of firm energy".

Future contract definition: "Provide to the buyers the right and the obligation to accept either physical energy or a financial guarantee from the seller for a definen future time period".

The buyer of a future obtains a fixed price for the amount of energy purchased.

Future contracts can be combined into seasonal profiles through purchase or sale of consecutive periods simultaneously. This is referred as a "strip" of future contracts.

TERA proposed that the future contracts span for a period of 24 months. This means, that the agents "may experience price volatility at least once during the futures period coverage of 24 months".

3.1. MARKET

TERA proposed a futures market with the following characteristics:

- Monthly Futures (for every day of the month)
- Daily auctions in business days

3.2. THE AUCTION

The proposed auction for futures market allows for iterative bidding between seller and buyers. Between the iteration the sellers and the buyers have the chance to adjust their bid and offer prices.

According to TERA, activity rules can ensure that the auction converges to a suitable price and quantity. Below the main rules proposed by TERA are presented:

- Opening Rule: it describes how buyers and seller initially submit transactions. Its purpose is to be sure that all quantities in the market are represented at the beginning of the auction. The futures contracts are introduced into the market for strike prices with a limited time range (TERA said "for example 1 minute"). After all the windows are opened the market is then simultaneously opened for all strike prices.
- Revision Rule: it describes how buyers and seller vary the prices. Time limits are used as a revision rule.
- Exclusion Rule: it describes what happens when revisions are not undertaken. Nothing happens since sellers and buyers are free to increase or to decrease the prices.
- Withdrawal Rule: it allows a participant to remove its entire tender at the end of an operation. No withdrawal exists because the prices offered are firm. However the participants are free to re-sell o re-purchase immediately after the prices are discovered.
- Closing Rule: it governs when the auction finishes. The iterative process is finished when the time allotted for iterations elapsed.

3.3. SETTLEMENT

TERA proposed two ways for settling the futures:

- First, to settle the futures contract financially, a contract sold into the market can be repurchased in the same or in a subsequent auction. This effectively cancels additional obligations and causes the transactor to gain money, lose money, or break-even.
- Second, a futures contract sold into the market can be settled physically by holding it until the effective period commences. Through interaction with the seller, the buyer can choose to require performance. The seller can then choose to supply power and settle physically.

3.4. ASPECTS TO STUDY

In principle, the factors to study in this market would be:

- Effects of the physical structure of the futures contract:
  - Span period (12, 18, 24 months)
  - Hourly blocks or not
  - For each plant (unit) vs. for each agent
- Effects of the financial structure of the futures contract
- Market Power of the agents

- Effect of the currency of the futures contract
- Measurement of the risk of the agents
- To prove that the futures contract can act as a medium term signal

4. SPOT MARKET

The reference is to chapter IX of the TERA Part 6 - Final Report (page 144).

The proposal of TERA implies mandatory changes in the current spot market and in the process of consolidating accounts. These changes are:

- In the TERA Final Report are described at least four forms to settle the accounts, physically and financially. These alternatives were described previously in the Preliminary Report presented to the CREG.
- The form of reporting the spot price is affected. According to TERA, it is necessary to establish a new index for the spot price, mainly for the financial settlement of the financial instruments. In terms of timeless, an appropriate objective is to report the index within the 24 hours after the events have occurred. Additionally, TERA proposed that "the scheduled supply and demand components for firm energy options and futures are be removed from the calculation of the spot price market".
- As optional changes, are outlined:
  - Auto-dispatch plants ("must-run plants")
  - Restrictions based on a market model
  - Deviations based on deviation offers for auto-dispatch plants
  - "Vertical Auction" versus "Horizontal Auction" versus " Vertical Modified Auction"
  - Weekly Markets

5. MANAGEMENT OF CONTRAINTS

Though the issue of constraints in the system is outlined, as mentioned earlier, it is not solved. This is a very important issue in Colombia given the current conflict and the terrorist acts to the transmission lines.

The TERA Report differences between the known restrictions (those which can be anticipated) and the random restrictions (random events during a short period). For the known restrictions, the seller has the possibility of delivering money in exchange for energy the day before of the dispatch. For the random restrictions, TERA proposes:

- to compel the generator to have at least two exit ways for its energy, this reduces the risks of being blocked in case that it wishes to generate
- differential prices by deviations (positive or negative) with respect to the auto-dispatch plants

6. "MÍNIMOS OPERATIVOS"

The concept is "maintained" in the TERA proposal that considers some smaller modifications. The TERA Report proposes to eliminate the "mínimos operativos" during the final phase, given that the futures contracts will replace their functionality.

7. CAPACITY CHARGE

The concept is eliminated in the TERA proposal.

8. RATIONING

According to the TERA proposal, rationing would be handled fundamentally by the futures prices, which must produce the appropriate signals for managing the reservoirs.

For the final phase, interruptible demands are allowed.

TERA includes the concept of "triggers of the programmed shortage" that are related with:

- A high price event
- Analysis of medium and long term energy situation
- Emergency caused by a shortage of power which is extended for long periods