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Establishing Financial Market in Iran

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Abstract :
After restructuring the electricity industry and establishment of power market in Iran, in purpose of increasing efficiency of the system, decreasing the prices and encouraging private investors for investment, not only were the traditional structure changed but also new actors and new risks appeared on the scene. In order to hedge the risks, enhance the efficiency and economic development establishing financial market in Iran is proposed. In this paper, the proposed plan for establishment of financial market in Iran is presented.

I. INTRODUCTION

There is an on-going liberalization andderegulation process in the electricity markets worldwide. Until 1990s, electricity was provided by vertically integrated monopolies, worked under the government control or regulation. Following the liberalization of electricity markets, responsibilities have been redefined and the operators of generation assets and transmission and distribution network become now competitors with different incentives.

One of the most significant new actors created by the electricity market liberalization is the concentrated electricity market place, such as power exchange or power pool. The participants can act on different markets such as: Day-ahead market, where the bids are submitted and the market is cleared on the day before the actual dispatch. Intra-day / Adjustment / Hour-ahead market, which closes a few hours before delivery and enables the participants to improve their balance of physical contracts in the short term [1]. For balancing power generation to load at any time during real-time operations, system operator (SO) uses a balancing or real-time market, while it is responsible for physical realities of the network and the securities of the supplies as well.

Besides, apart from exchange, they can traditionally trade electricity bilaterally on the over-the-counter market (OTC).

The competitive environment has a lot of vital advantages in comparison with the previous structure based on monopolies, which include: reducing losses, reducing costs which would result in increasing efficiency and lower costs, improving transparency,

increasing services, customer choices and innovation.

Besides these advantages, new risks have been entered in the market. The risks mainly consist of the price risk, volatility risk, basis risk, volume risk and other unpredicted risks that involved with the system. Hedging methods available at the moment are the financial instruments (futures, forwards, options and CFD), using these financial instruments in financial markets would lead to the further increase of efficiency in electricity trading.

In section II of this paper, we will have an overview over the financial instruments used in financial markets and the effect of auctions in the markets and through the next sections the comprehensive scheme of establishing financial market in Iran, is presented.

II. FINANCIAL INSTRUMENTS

A derivative is a financial instrument (Contract) between two parties, who are willing to exchange certain risks [2] .Many derivative instruments are used in electricity trading, but the most common ones applied to energy risk management strategies are future, forward and option contracts which will be described as follow.

A. Future Contracts

Future contracts include an obligation to buy or sell a specified quantity of an asset at a certain future time for a certain price. Future contracts usually consist of daily and weekly (often base load) contracts. These are standardized contracts, which allow buyers to receive/pay the price difference between the strike price and the spot price, if the strike price is below/above the spot price [3].To understand the privileges of future contracts assume that two parties have made a future contract upon a 500MW weekly energy package at the appointed time in three month later with the strike price of 10$/MW. Three month later, assume that the price of electricity at daily market is 15$/MW. The buyer will purchase the electricity at daily market with 15$/MW (15$/MW-10$/MW=5$/MW loss in comparison with the price at three month ago) and the seller will sell his electricity at 15$/MW (15$/MW – 10$/MW=5$/MW gains profit). Therefore we have a buyer who has had a loss in profit with the increase of electricity price during three months and a seller who has gained profit, selling his electricity with higher price. However since they had made a future contract before, now seller has to pay buyer the difference between strike price and spot price (15-10=5$/MW) so that the risk of variation of price has been hedged and the buyer has bought his electricity with 10$/MW and the seller has sold it with the same price, in other words, the strike price is the hedged-price.

B. Forward Contracts

Forward contracts are in many aspects similar to future contracts. However, unlike the future contracts, they can not be sold mark to market. They consist of monthly, quarter and yearly (Often base load) contracts. The settlement through out the delivery period is carried out in the same way as for futures.

C. Option Contracts

An option contract includes a right (not obligation) to buy or sell a specified quantity of an asset at a certain future time for a certain price [2]. There are two types of options: call option (also known as a cap) and put option (also known as floor). In call option buyer of the option contract pays a premium to the seller and will have the right to purchase the underlying asset at some future date. In put option the seller pays the premium to the buyer and instead receives the right to sell the underlying asset at some future date. Option contracts are tradable, therefore the buyer of the option contract have the flexibility to sell the contract in secondary market.

D. Contract For Difference (CFDs)

A CFD can be either one-way or two-way [2]. A two-way CFD is similar to financial future contract, while a one-way contract is a forward contract with reference to the

difference between the area price and the spot price. The difference is due to the congestion of the grid and that contract is for hedging the mentioned risk.

To specify a two-way CFD assume one forward contract which is going to be cleared at the appointed time, based on the difference between the strike price (the price of the contract) and spot price, and with assuming that spot price is above the strike price, at one hand we have a buyer who has bought the electrical energy from spot market with the price above the strike price and in another hand a seller who has sold its energy with higher price in spot market, so the seller has obtained benefits equal with the difference between two prices and buyer has lost the equal amount, so in clearing the contract seller has to pay the buyer the difference and the hedged-price will be the strike price for both of the parties. Note that this happens when the spot price is equal for both the seller and buyer or in other words we have the daily market with Uniform Clearing-Price (UCP) auction.

In a market that provides a uniform price for buying and selling, the buyer and seller would submit bids with maximum and minimum price in respect, in order to make sure that they would definitely win the market. The uniform price, Market Clearing Price (MCP), is determined at the intersection of aggregated demand and supply curves. In this case the generator is certain that regardless of the price he had submitted, he would receive the MCP and the buyer also would buy the electricity at MCP price, therefore both parties can make a financial contract and clear it at the maturity time based on the MCP of the spot market. Note that, what was mentioned is the case in which, we have ignored the effect of congestion of the grids. Otherwise, the contracts might not be physically feasible.

However, if the market operates based on Pay-As-Bid auction, as in Iran Power Market, considering the fact that, in Pay-as-bid auctions, generators are paid what they bid, no longer the generator can bid in minimum price so that to certainly win the market, while the buyer would buy the power at the average price of the market. Therefore there is no unique price for both seller and buyer and clearing such contracts is not possible.

However, as will be discussed in the next section, the pay-as-bid market structure can be compatible with bilateral market attributes to the financial bilateral contracts which would not be considered in plans of the spot market and will be cleared in financial market.

III. IRAN POWER INDUSTRY

In Iran, restructuring the power industry started following the establishment of power market in late 2003, by which the power generation and sales have become ever more competitive. Trading in an electricity market is a risky task due to the fact that electricity is much different from other commodities due to its special nature such as non-storable, supply-demand balance, limited demand elasticity, transmission constraints and electricity price which is determined by stochastic supply and demand functions [2]. Therefore, there would be a strong need for risk hedging, using financial instruments in financial markets. Risk hedging is one of the answers to this question that principally, why do we need to establish a financial market in Iran? Besides hedging risks, there are other reasons such as:

- Improving demand curve of the distribution companies to become more flat due to the lower price of electricity in financial market.
- Avoiding penalty for units that must work because of their constraint
- Avoiding turning on/off the units
- Encouraging private investors for investing
- And fundamentally improving the privatization of power industry.

When designing a scheme for establishing financial market, one should first notice some factors, which will be discussed in the next section.

IV. Designing the Structure of Financial Market in Iran

In designing the structure of financial market in Iran, one should consider the principle based on which the price is determined in the wholesale electricity market, Uniform Clearing-Price (UCP) auction or Pay-As-Bid auction? Due to the Pay-As-Bid structure of Iran power market, and since the bilateral contracts are customized contracts which can be compatible with this structure, the proposed scheme is based on this principle that financial contracts are bilateral contracts which will not be considered in spot market programs and financial market is independent of physical market.

dditionally, two important factors should be considered which are, congestion of the grids and the fair of market.

In Iran, some of the generation units such as Steam and combined cycle units (S & CC) are Must-run units so that their minimum generation would be definitely dispatched and as a result, the financial contracts made upon them, can certainly be exercised, neither would be any problem due to the congestion of the grids nor to the fair of market.

To analyze this theory, let us first study the significant congestion regions of Iran. There are actually, 6 significant congestion regions.

1. Congestion in Khorasan state to the network and vice versa.
2. Congestion in Sistan state to the network and vice versa.
3. Congestion in Khorasan state plus Salimi plant to the network.
4. Congestion in the North part to the network.
5. Congestion in the South part to the network.
6. Congestion in network to the south-eastern part of it.

Figure-1 demonstrates Sistan congestion situation in 2005. The figure consists of Minimum generation of steam and combined cycle units (S & CC), the amount of Must-run Units and total amount of dispatched power during year of 2005.

Similar studies have been done for 5 other regions.

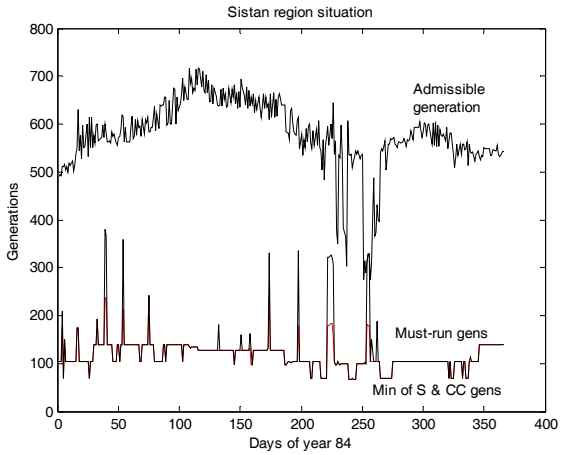

Fig-1
Sistan congestion situation in 2005

In conclusion, the parts of generation which can be transacted in financial market without penalizing the fair of market or causing problem to the congestion of the grids are minimum generation of steam and combined cycle units (S & CC) and some parts of hydro-units.

The same studies have been done in concern with each province, estimating the amount of mentioned units, which can participate in financial market. Fig-2 illustrates diagrams consist of Minimum generation of steam and combined cycle units (S & CC), Must-run generation Units and admissible generation of the Khoozestan state in 2005, as an example.

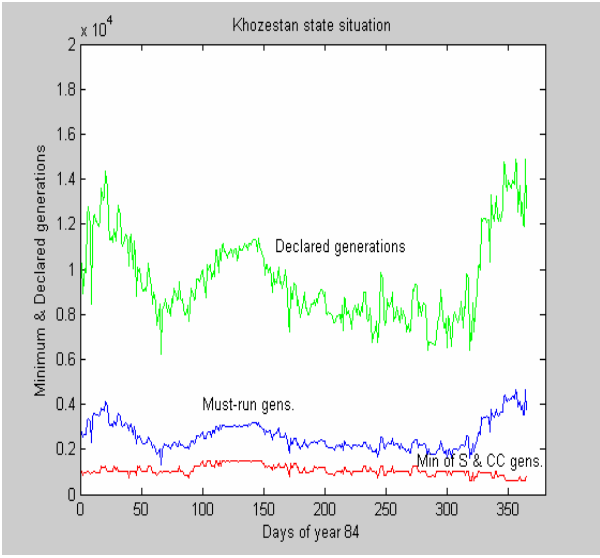

Fig-2
Generation of Khoozestan State in 2005

IV. Proposed scheme of establishing financial market in Iran

For simplicity and also feasibility of the project at the beginning of the process we assume that:

- Only Steam and combined cycle units (S & CC) and 30 % of hydro-Units of Khoozestan are participating in financial market. As mentioned before, since these units are Must-run units, the financial contracts made, are certainly exercised, neither would be any problem due to the congestion of the grids nor to the fair of market. This volume is approximately 37% of the total generation capacity in Iran. Table-1 shows the power, which can be transacted, through financial market for each regional electricity center of the provinces.
- The Contracts are bilateral contracts; buyers are regional electricity centers or distribution companies (after being privatized) while sellers are utilities.
- The price bided by generators consists of the cost of generation energy plus the price of capacity cost. Besides, additional to this price, buyer must pay the transportation cost, which will be considered while making a contract. The bilateral contracts that are made in financial market will not be considered in supply and demand estimation of the spot market.
- Energy packages, achieved by multiplying time and constant power, will be offered in the form of daily, weekly and monthly packages.
- Hydro-production of hydro-generators in Khozestan can be transacted in the form of daily and weekly packages while only 30 % of the total amount of hydro-generation can be transacted in monthly packages due to the limitation of the volume of water stored behind the dam.
- Minimum generation of combinational cycle (s& cc) units can be transacted in the form of daily, weekly and monthly packages.

The appointed time for registration of new energy packages by generators is:

Daily Energy Packages: These packages are presented for the days of the next week, and the time for registration a new package or omitting one is from 0800 A.M on Saturday up to 1400 PM on Wednesday. Note that, adding or omitting a new package on Thursday and Friday is not possible.

Weekly Energy Packages: These packages are presented for at most 3 future weeks, and the time for registration a new package or omitting one is from 0800 A.M on Saturday up to 1400 P.M on Wednesday. Note that, adding or omitting a new package on Thursday and Friday is not possible.

Monthly Energy Packages: These packages are presented for at most 3 Future months and the time for registration a new package or omitting one is from 0800 A.M on Saturday up to 1400 PM on Wednesday, during the last week before the first month.

- The appointed time for buying an energy package is at least 96 hours before the maturity time of that energy package.
- The Energy packages which haven't been transacted until the appointed deadline will be automatically omitted from the financial market energy packages.
- The proposed feature of the energy packages traded in financial market has been designed as a code consists of 15 characters, starting with IFEM which stands for Iran Financial Energy Market and depending of the type of energy packages whether daily, weekly or monthly, the following character will be D, W and M, in respect. The following characters would indicate the starting date of the contract and the last 4 characters represent the code of the unit participated in financial market. An example is given: The code "IFEMM0501060242" represents a monthly energy package which starts at 0000 A.M of the day 5/01/2006 the character "0" indicate that this unit has participated in financial market as a seller wile character "1" is for buyers and the package belongs to the unit number 242 of

Toos plant of Mashhad. Table-2 illustrates the information provided by the proposed financial market web site for the energy packages.

- If ever, due to any reason, one of the two parties of the contract would not fulfill its promises, the requested amount of energy would be sold/bought via the daily market but the responsible counterparty have to pay for the appointed punishments.

VI. CONCLUSION

This paper addresses a comprehensive scheme for establishing financial market in Iran which would play an important role in providing higher efficiency of the total system.

At first level, the proposed plan lets the minimum generation of Steam and Combined cycle units and 30% of hydro-generation to be transacted in financial market. The mentioned amounts include the 37% of total generation of power in Iran.The details of the scheme have been mentioned while financial instruments used in risk-hedging trades have been introduced. In future, with using the bilaterally congestion treatment methods considering the pay-as-bid system of Iran power market, the proposed scheme would be extended.

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Table-1: power that can be transacted in financial market for each regional electricity company

	Regional Electricity Company	Total generation of steam and combined cycle units	Number of (S & cc) units	Sum of Minimum generation of steam and combined cycle units (Mw)	Total hydro-generation	30% of total hydro-generation participating in FM	Number of Hydro-Units	Total generation of Gas Units	Total generation of Dizel (Mw)	Total amount of generation	Percentage of generation participate in FM	Minimum generation of steam and combined cycle units
1	Tehran	4063	22	2402	249	0	7	3048	0	7360	33	8
2	Semnan	0	0	0	0	0	0	22	11	33	0	__
3	Gilan	1530	5	810	85	0	5	112	0	1727	47	60
4	Mazandaran	1760	4	880	0	0	0	278	0	2038	43	220
5	Khoozestan	2120	8	1480	0	0	0	630	0	2750	54	80
6	Electricity company of khoozestan	0	0	0	5949	1785	33	0	0	5949	30	___
7	Esfehan	2925	22	1890	93	0	6	322.5	32	3372.5	56	3
8	Azarbayejan	1670	5	950	40	0	6	214	25	1949	49	170
9	Kerman	164	9	51	30	0	2	1056	35	1285	4	3
10	Hormozgan	1280	4	640	0	0	0	1060	17	2357	27	160
11	Yazd	0	0	0	0	0	0	410	15	425	0	__
12	śistan	256	4	128	0	0	0	275	55	586	22	32
13	khorasan	1664	9	1000	0	0	0	820	55	2539	39	35
14	Bakhtar	2260	8	1180	13	0	3	52	0	2325	51	125
15	Gharb	640	2	320	0	0	0	900	35.4	1575.4	20	160
16	Fars	912	3	630	10	0	2	1168	30	2120	30	210
17	Zanjan	0	0	0	0	0	0	0	0	0	0	__
	Total	21244	105	12361	6469	1785	64	10367.5	310.4	38390.9	37	

Table2- Information Table of the Energy Packages

Code	Row	No.of unit	Name Of the Plant	The amount of power registered	Type of energy Package	Start Day of the contract	Expiration day	The proposed price (per MW) in Rials	The price per Mw considering transmission costs	Condition of the energy package	Buyer
IFEM01050600242	1	151	Toos	20	Daily	2006-05-01	2006-05-01	114000	154000	Un transacted	
IFEMW0206060078	2	105	Beheshti	80	Weekly	2006-06-02	2006-06-09	104000	144000	Transacted	Kerman electricity company
IFEMM0104060243	3	258	Sade Shariati	100	Monthly	2006-04-01	2006-05-01	98500	138500	Un transacted	