Chapter 13

Derivative Products and Accounting in Energy Markets

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Absract

Derivative products are products whose price is tied to another underlying asset. Many assets such as derivative products, interest rates, stocks, and financial assets such as foreign currency and commodities are regulated. These contracts are traded on organized exchanges and over-the-counter markets. It has four basic variants. These; Swap contracts, forward (flame) contracts, futures contracts and options contracts.

Derivative products traded in over-the-counter markets; Forward (live) contracts, options contracts, swap contracts. Derivative products traded in organized markets; Futures contracts are options contracts. In this study, derivative products used in energy markets and their accounting according to Turkey uniform chart of accounts will be discussed.

1. ENERGY MARKETS

Energy, as a word meaning, exists in matter and emerges in the form of heat and light. can be defined as the output power. When analyzed in economic terms, energy is an important element that shapes the competition due to its costs, since it can be counted among the basic production inputs. As a requirement of the technology used throughout the 19th century, only oil, coal and steam were considered the most important energy sources. However, with today's possibilities, the energy resources that find the widest area of use are oil, natural gas and electricity. In this sense, the markets created by these energy resources are financially acceptable as a new field of application. (TÜSİAD/OECD,2003, p.155).

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1.1. Oil Market

The first commercial oil exploration activity was carried out by a company called "Pennsylvania Rock Oil Company" in the state of Pennsylvania, USA, towards the end of the 1850s.

In 1960, the Organization of Petroleum Exporting Countries (OPEC) was established. As the world's most important producer organization, OPEC with 11 members owns 77% of the world's oil reserves and realizes 40% of the world's production (Gurkan, 2009).

1.1.1. Prices in the Oil Market

Oil is priced in US dollars in the international market. This puts OPEC (Organization of the Petroleum Exporting Countries) members into trouble when the dollar is weak. Weakness in the dollar causes crude oil prices to rise.

Oil prices fluctuate constantly due to various factors. This raises the price risk. Industries with high oil inputs are more exposed to this risk. Therefore, there is a significant need for hedging oil prices, and oil price risk management needs to be managed (Gurkan, 2009).

1.2. Natural Gas Market

After the oil crises of the 1970s, the energy sector began to gradually expand its links with the gas sector. Due to such a development, natural gas has become one of the most important energy resources of the world. Natural gas systems have high initial investment costs and low marginal costs. The general structure of these systems is determined by three main factors: supply sources, transmission and distribution system and market.

The natural gas system should show an integrity from the supply of gas to the delivery to the user in a way that can respond to the market structure. A good organizational structure and communication network must be established in order for the system to function efficiently both technically and economically (Füss et al., 2015, 34).

1.2.1. Prices in the Natural Gas Market

One of the reasons for price instability in the natural gas market is the imbalance in gas supply and demand. The four main factors causing imbalance can be listed as follows:

1. Unusual weather conditions affecting gas use (heating in winter, air conditioning in summer).

2. Industrial use (economic)
3. Inability to obtain information on reliability by the market constituents in a timely manner
4. Different buyers and sellers enter the market with sentiment or short-term expectations.

In addition to these effects, it is possible to specify three important factors affecting gas supply as follows:

- Stock levels
- Pipeline capacity
- Operational difficulties

Today, the amount of natural gas that is subject to international trade is at a very low level compared to oil. Today, approximately 70% of natural gas is not exported from the country where it is produced and is generally consumed locally. For a given energy value, the expenditures for the transportation of the desired amount of gas are several times higher than for oil. For this reason, it is seen that the share of natural gas in total energy consumption is higher in countries such as the CIS, USA and England, which have rich natural gas reserves (Karacor and Güvenek, 2010, 148).

1.3. Electricity Market

The electricity business in the USA was born in 1882 when Thomas Edison established the first commercial electricity generation and distribution system in New York. This market, free competition environment did not last long.

As the need and cost of infrastructure increased, coalitions emerged between companies and the industry started to show a natural monopoly character.

Production is the process of converting another type of energy (oil, natural gas, coal, nuclear power, waterpower, renewable fuel, wind turbines, etc.) into electrical energy. The main costs of electricity generation are fuel prices, capital costs, operating and maintenance costs. Another factor affecting the production cost is the production technology used (Kösedağlı and Aydoğş, 2014, 110).

1.3.1. Prices in the Electricity Market

Electricity has become a commodity that is bought, sold and traded in various markets around the world in today's conditions. Electricity is

distinguished from other goods because it cannot be stored as a commodity, that is, it must be consumed as soon as it is produced. Due to its non-storage feature, electricity prices exhibit features such as seasonality, tendency to return to the average, volatility, and sudden price increases. Changes in weather conditions such as temperature, precipitation, changes in water reserves and the variability of end-user demand play an important role in changing electricity price behavior. (Works and Utku, 2015, 184)

2. TYPES OF ENERGY DERIVATIVE PRODUCTS

Four basic types of derivatives regulated on energy products exists. These are energy futures, energy options, energy swaps and energy forward contracts.

2.1. Energy Futures Contracts

Energy futures contracts are futures contracts on energy products. In other words, an energy futures contract is a contract that gives an obligation to buy or sell an energy product such as crude oil or natural gas in a specified quantity or volume at a specified future date, at a price determined today. In futures contracts, both parties have to fulfill their obligations at the end of maturity. In the system, there is a guaranteed system and clearing center to ensure that the parties fulfill their obligations. Contracts can be terminated physically as well as in cash. In addition, the parties can close their positions before the maturity of the contract by making reverse transactions.

Futures contracts have important features (ALPAN, Fulya, 1999, p82). First, the party that chooses to hold the contract until maturity guarantees the price when it receives the contract. In a futures contract, the buyer can always request physical delivery; the seller may also insist on physical delivery. As a result, the futures contract price at maturity (December) will be the same as the market price. If the market price is low, profits will be made by selling futures contracts. If the market price is high, a futures contract will still be profitable by purchasing it. Only when (December futures price) and (December market price) are the same, no profit can be made.

The second feature of futures contracts is that the parties can buy and sell oil futures contracts even though they do not have oil. Speculators regularly buy and sell futures contracts, anticipating price changes. Speculators assume the price risk that producers and refiners do not want to face.

The third feature of futures contracts is that a large amount of crude oil can be bought or sold by paying a small initial margin. This is called the leverage feature.

Futures contracts on natural gas began trading on NYMEX on April 3, 1990 for the first time in the world. Natural gas contracts do not take as much space as crude oil contracts. About 20,000 natural gas futures contracts are traded daily. The maturity of natural gas fututes contracts is 18 months.(Bayraç, 2015)

The main reason for removing future contracts with different distribution points from NYMEX contracts is to provide hedging parties with a different geography alternative to reduce their base risks. For example, the east coast of the US may experience a heavy winter, while the west coast may experience a milder winter. Therefore, in the east, prices may be higher, while in the west prices may be lower. Thus, the west coast producer will be able to see the price gap between the NYMEX futures contract and the spot west coast market (Çonkar, Kayahan, Aydemir, & Elitaş, 2009).

2.2. Energy Forward Contracts

In the energy markets, forward contracts are used by refineries to protect themselves from price fluctuations in crude oil futures and for oil stocks in the long run.

In a forward contract, the type, quantity, quality, where and when the delivery will be made, as well as the price or pricing formula are clearly stated. It may also include the conditions to be applied in cases where one of the parties does not fulfill its obligation or fulfills it incompletely.

Forward contracts involve credit risk depending on pricing and delivery terms. Especially in long-term forward contracts, credit risk becomes more important. The parties to the contract should pay close attention to the situation of the other party when the value of the contract develops in favor of the other party. For example, a refinery contracting to purchase oil at $19 per barrel is concerned that the other party will withdraw from the contract when transportation and oil prices rise above $19 per barrel. The parties carefully examine the creditworthiness of the counterparty and make an agreement with the parties with a high credit rating in order to protect themselves from credit risk.(BARMAKY & ERSAN)

2.3. Energy Options Contracts

There are two parties in an option contract, the buyer and the seller. The option holder, who has the right to buy or sell, pays a certain premium to the other party for this. For example, a buyer wishing to purchase a 1000 ft (cubic feet) natural gas option dated December 2002 with a strike price of $3.40 would pay a premium of $0.14. If prices rise above $3.40 in

December, the buyer will exercise their right to buy. The option printer will pay the buyer the difference between the market price and the strike price. If the natural gas price is below $3.40 in December, the buyer will not exercise his right to purchase and will incur a loss equal to the premium he paid ($0.14). The termination of options in the form of cash delivery provides some advantages to many people in the market. First, after the option is exercised, it can be expensive to resell the asset to avoid a price increase. This can be especially true for illiquid products or even for crude oil options that are in profit. For example, let's say a refinery buys a put option on the stock market to hedge against price increases in crude oil. It is always possible for the refinery to sell this option at a reasonable price. If the options market were not liquid, the refinery would have to exercise its right with physical delivery at the strike price. However, the refinery may choose to purchase the oil from a different source or at a different date, by selling the right to purchase on the stock exchange (Başoğlu, 2005).

2.4. Energy Swap Contracts

In a swap transaction, usually the manufacturers are the sellers of the swap and the end users are the buyers of the swap. Intermediaries between buyers and sellers, on the other hand, play an important role in ensuring confidentiality, assuming credit risk and meeting market risk arising from contracts with different maturities. The swap buyer agrees with the swap seller on a fixed price and quantity for a certain period of time. If the variable price is below the fixed price, the buyer must pay the difference to the seller; If the variable price is above the fixed price, the seller agrees to pay the difference to the buyer. (Korkmaz and Ceylan, 2012, 365).

Swap contracts are increasingly used in energy markets. One of the reasons for this increase is the increase in technical knowledge about the market and available instruments. With the better understanding and adoption of the risk control mechanism by the end users, the interest of the end users in swap contracts is increasing. (Memiş and Tüm, 2015, 52).

The opportunities and benefits provided by swap transactions to users can be listed as follows :

- Manufacturers can offer fixed price products to their customers.
- Refineries can fix margins.
- In development projects, production margins can be guaranteed.
- When price risk is controlled, banks can offer more attractive financing opportunities.

- Pre-export financing can be attributed to the net present value of the swap cash flows.
- The risk associated with one petroleum product can be exchanged for another.
- Competitive advantage can be gained by fixing high/low prices.
- Certain limitations of exchanges (such as liquidity, maturity) are overcome.

3. ACCOUNTING APPLICATIONS

Example 1:

ABC industrial enterprise consumes electricity intensively. Since he predicted that electricity prices would increase, he made a forward contract on 01.11.2015 with a maturity date of 31.01.2016. The contract price has been determined as 100 TL/MW and the contract size is 100 TL x 24 hours x 20 days x 10 MW = 480.000 TL in TL. Spot prices; It was realized as 90 TL on 01.11.2015, 105 TL on 31.12.2015 and 108 TL on the maturity date.

In line with this information, the contract price will be traded as 480.000 TL on 31.01.2015. Spot prices are;

90 TL x 24 hours x 20 days x 10 MW = 432.000 TL on 01.11.2015, 105 TL on 31.12.2015 x 24 hours x 20 days x 10 MW = 504,000 TL,

It will reach 108 TL x 24 hours x 20 days x 10 MW = 518,400 TL on 31.01.2016.

EXPLANATION _ 01.11.2015	DEBT	RECEIVABLE
910 OFF-BALANCE SHEET FORWARD PROMISE.	480,000	
911 OFF-BALANCE SHEET FORWARD WORD.		480,000

EXPLANATION _ 31.12.2015	DEBT	RECEIVABLE
181 INCOME ACCOUNTS	24,000	
649 OTHER ORDINARY INCOME AND PROFITS		24,000

EXPLANATION _ 31.01.2016	DEBT	RECEIVABLE
180 EXPENDITURES FOR THE FOLLOWING MONTHS	518,400	
102 BANKS 181 INCOME ACCOUNTS 649 OTHER ORDINARY PROFIT.		480,000 24,000 14,400

EXPLANATION _ 31.01.2015	DEBT	RECEIVABLE
910 OFF-BALANCE SHEET FORWARD PROMISE.	480,000	
911 OFF-BALANCE SHEET FORWARD WORD.		480,000

Example 2:

The production cost of ABC thermal power plant, which is an electrical energy producer, is 100 TL/MWh. With a capacity of 20 MW, the power plant will be able to produce a total of 14,880 MWh of electrical energy as a result of 31 days x 24 hours x 20 MW for the period of January 2015. On 20.12.2014, while the electricity energy price in the spot market was 110 TL/MW, he predicted that the electricity prices would decrease and signed a futures contract over 120 TL / MW in the futures market. It was paid as 50,000 TL as initial guarantee. This guarantee is 80% complete. Spot electricity prices; It was realized as 115 TL/MW on 31.12.2014 and 122 TL/MW on the maturity date .

Contract value; 14,880 MW x 120 TL = 1,785,600 TL. Since the settlement price dated 31.12.2014 is 115 TL/MW, the futures contract value will decrease to 1.740.960 TL, and the loss will be accounted for as 44.640 TL. The settlement price on 31.01.2015, which is the expiry date, is 122 TL/MW. Generally, delivery is rare in futures markets. Positions are canceled and closed before or on the day of maturity. On the maturity date, the futures contract price will reach TL 1,815,360 and the profit will be recorded as TL 74,400. The net gain of the futures contract is 29,760 TL.

EXPLANATION _ 20.12.2014	DEBT	RECEIVABLE
910 OFF-BALANCE SHEET FUTURES PROMISE.	1,785,600	
911 OFF-BALANCE SHEET FUTURES PROMISE.		1,785,600

EXPLANATION _ 20.12.2014	DEBT	RECEIVABLE
126 DEPOSIT AND GUARANTEES GIVEN	50,000	
102 BANKS		50,000

EXPLANATION _ 20.12.2014	DEBT	RECEIVABLE
659 OTHER ORDINARY EXPENSES AND LOSSES	44,640	
126 GIVEN DEPOSIT AND TEM.		44,640

EXPLANATION _ 31.12.2014	DEBT	RECEIVABLE
126 DEPOSIT AND GUARANTEES GIVEN	34,640	
102 BANKS 50.000-44.640 = 5.360 + 34.640 TL is deposited to complete the guarantee to 50.000 x 0.80 = 40.000 TL.		34,640

EXPLANATION _ 31.01.2015	DEBT	RECEIVABLE
102 BANKS	114,400	
126 GIVEN DEPOSIT AND TEM. 649 OTHER ORDINARY INCOME AND PROFITS		40,000 74,400

EXPLANATION _ 31.01.2015	DEBT	RECEIVABLE
911 OFF-BALANCE SHEET FUTURES PROMISE.	1,785,600	
910 OFF-BALANCE SHEET FUTURES PROMISE.		1,785,600

Example 3:

Industrial Enterprise C estimates that the electricity prices, which are used extensively in its production activities, will increase in August 2015 when electricity consumption increases. On 01.05.2015, Industrial Enterprise C wanted to guarantee the maximum amount of electricity prices by signing a purchase option with Z electricity generation plant for August 2015. The option price is 120 TL, the hourly capacity is 50 MWh, and the option premium is 1 TL/MW. The size of the contract in TL is 50 MW x 31 days x 24 hours x 120 TL = 4.464.000 TL .

Having a long position by purchasing a call option contract, Industrial Enterprise C limited its electricity prices to 120 TL/MW for the period of August 2015. When 1 TL/MW option premium is taken into account for Industrial Enterprise C, the maximum hourly cost of electricity will be 121 TL/MW. In this case, when spot electricity prices exceed 121 TL/MW, Industrial Enterprise C uses the option contract and earns a profit equal to the difference. In case of spot electricity prices realized below this amount, Industrial Enterprise C does not use the option contract. Because it is more economical in terms of business to meet the required electrical energy from the spot market. The loss of Industrial Enterprise C is equal to the option premium paid.

Industrial Enterprise C will follow the contract amount in off-balance sheet accounts. He will pay the total option premium of 50 MW x 24 hours x 31 days x 1 TL = 37,200 TL.

EXPLANATION _ 01.05.2015	DEBT	RECEIVABLE
910 OFF-BALANCE SHEET OPTION PROMISE.	4,464,000	
911 OFF-BALANCE SHEET OPTION PROMISE.		4,464,000

EXPLANATION _ 01.05.2015	DEBT	RECEIVABLE
118 OTHER SECURITIES	37,200	
102 BANKS		37,200

A) If the spot electricity price is 125 TL/MW; option contract is used. Cost according to spot electricity prices; 50 MW x 31 days x 24 hours x 125 TL = 4.650.000 TL, when 37.200 TL of option premium is added, it is calculated as 4.687.200 TL. However, instead of the cost of 4.687.200 TL based on spot electrical energy prices, the enterprise will purchase electrical energy for a contract price of 4.464.000 TL and the option premium of 37.200 TL, so the gain from this option transaction will be 186,000 TL.

EXPLANATION _ 01.08.2015	DEBT	RECEIVABLE
180 EXPENSES FOR FUTURE MONTHS Electricity Cost	4,687,200	
102 BANKS 118 OTHER SECURITIES 649 OTHER ORDINARY INCOME AND PROFITS		4,464,000 37,200 186,000

EXPLANATION _ 01.08.2015	DEBT	RECEIVABLE
911 OFF-BALANCE SHEET OPTION PROMISE.	4,464,000	
910 OFF-BALANCE SHEET OPTION PROMISE.		4,464,000

B) If the spot electricity price is 117 TL/MW; It is not financially reasonable for Industrial Entity C to use the option contract.

EXPLANATION _ 01.08.2015	DEBT	RECEIVABLE
659 OTHER ORDINARY EXPENSES AND LOSSES	37,200	
118 OTHER SECURITIES		37,200

EXPLANATION _ 01.08.2015	DEBT	RECEIVABLE
911 OFF-BALANCE SHEET OPTION PROMISE.	4,464,000	
910 OFF-BALANCE SHEET OPTION PROMISE.		4,464,000

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