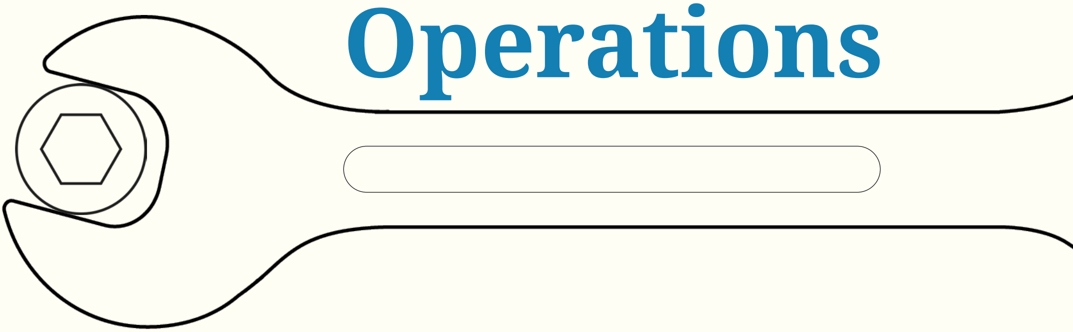
Operations



Operations

The electricity market is transitioning towards a competitive market model. The key drivers of this transition are the need for revival of the power sector, improving efficiency, increasing demand for reliable and affordable electricity, and policy shifts towards sustainability. Central to this transition are the concepts of market operations and system operations. These operations collectively ensure that electricity is produced, traded, and delivered in a manner that meets the economic, environmental, and reliability needs of modern societies.

First, let's try to understand what an operator does. Some familiar examples of different types of operators in everyday life include:

A telephone operator manages and connects phone calls between callers, ensuring the communication lines are properly connected and clear.

An air traffic controller coordinates the movement of airplanes, ensuring they take off, fly, and land safely by managing their routes and schedules.

An event coordinator organizes and manages events, ensuring all participants are registered, schedules are maintained, and the event runs smoothly.

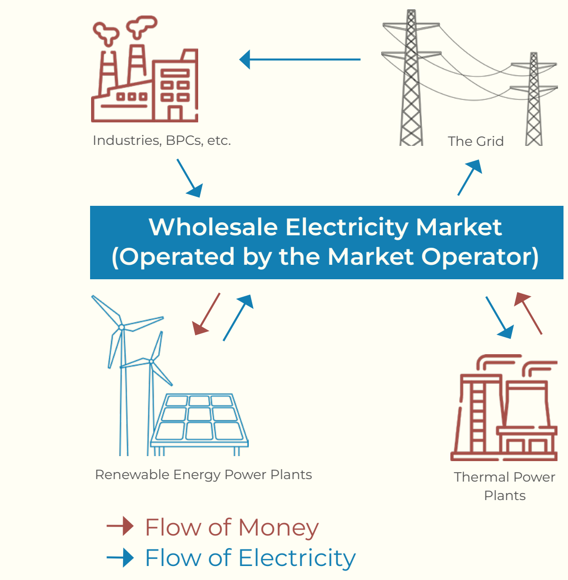
Operator in electricity sector:

- ◊ An operational body responsible for managing and overseeing various aspects of the electricity market and/or electric power system (grid).
- ◊ The role of operator involves highly technical functions including short-term decision-making (typically ranging from seconds to weeks), serving as an interface among various market participants, ensuring efficient and reliable operation of the grid etc.

In the new electricity market model (CTBCM), there are the two key types of operations; market operations and system operations, as described below.

1. Market Operations

Market operations involve managing the buying and selling of electricity. This includes enrolling participants and registering their contracts, registering trading and metering points (where transactions take place), calculating capacity obligation and firm capacity of power plants, and handling payments and settlements. The market operator (MO) also ensures that the payments for any differences between the contracted and actual amounts of electricity are taken care of as per their respective contracts. Additionally, the MO monitors the development of the market and suggests improvements.

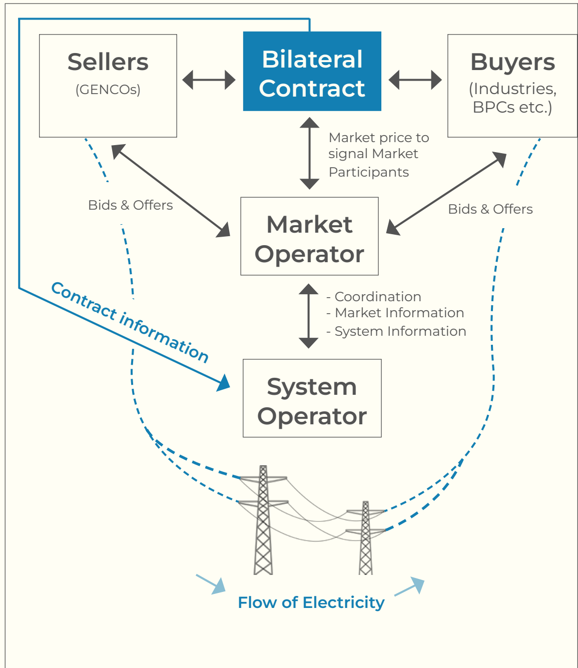


Under the framework of CTBCM, CPPA-G is licensed as the MO. Whereas, in the current single-buyer market model, CPPA-G's functions include power procurement and the settlement of Power Purchase Agreements (PPAs) and Energy Purchase Agreements (EPAs).

2. System Operations

System operations involve the secure and reliable management of the electricity grid and power system. This includes planning and dispatching all generation in a transpar ent and non-discriminatory manner. These operations are carried out by the system operator (SO).

The SO does not buy or sell electricity in the market. It ensures the system remains stable, reliable, and efficient. Key duties of the SO include long-term system planning, conducting reliable short- and medium-term operational planning, coordinating maintenance outages, calculating hourly system marginal prices, and economic dispatch of generators within system security and reliability constraints. In Pakistan, the National Transmission and Despatch Company (NTDC), through its National Power Control Centre (NPCC), serves as the System Operator as per NEPRA Act 1997.



Operational Components

It is important to explore the key components of the operations for understanding how operators ensure reliable, and efficient functioning of electricity market and power system within the competitive market framework. These are described in the following sections:

1. Balancing and Settlement

Balancing and settlement are critical functions of market operations, to ensure the continuous alignment of electricity supply and demand, smooth operation, stability, and reliability of the electricity market. The market operator is responsible for managing these functions.

Balancing Mechanism means the process or pricing mechanism of determining and clearing any imbalance between the contracted and actual quantities (of energy or capacity) at certain prices.

Settlement is the process of calculating charges to be paid by and to market participants (buyers and sellers) and service providers, and processing the financial transactions based on the imbalances (if any).

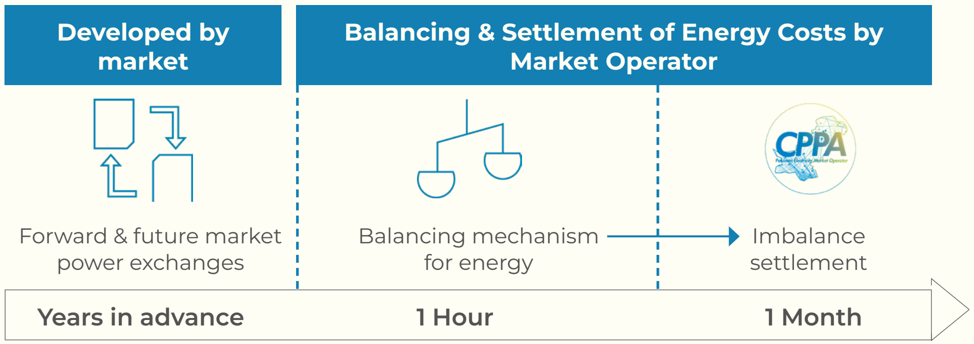
Balancing Period: It is the trading interval in which the imbalance in quantities and prices are determined. In CTBCM, balancing period for energy and capacity are hourly and yearly, respectively.

Settlement Period: In CTBCM, the settlement of the energy imbalances is done on monthly basis.

The market operator uses information such as data for all metering points,

contract quantities of market participants, and hourly system marginal prices to carry out these functions. By efficiently handling these tasks, the market operator maintains market stability and ensures fair financial adjustment among market participants.

The following diagram illustrates the timeline for these processes:



2. Capacity Obligations and Firm Capacity Certificates

In CTBCM, two primary products will be traded in the market:

i. Energy to meet electricity demand, and

ii. Firm Capacity to ensure medium & long-term security of supply through sufficient and adequate capacity.

Firm capacity is the guaranteed ability of a generator (generation unit) to produce electricity at a specific time. It is particularly important to ensure adequate firm capacity for critical conditions in the country, such as periods of high demand, low hydel (dry) season etc.households and vulnerable populations, targeted subsidies can ensure that essential services remain affordable for those who need them most. This approach prevents the wastage of government resources and reduces the fiscal burden associated with broad, untargeted subsidies. Additionally, targeted subsidies also encourage energy efficiency and responsible consumption, as they often come with measures to promote energy-saving practices.

Under CTBCM, Firm Capacity will be a certified product, and there are two types of agreements for capacity transactions:

i. **Guaranteed Capacity:** Where the **seller** is completely responsible for the capacity imbalances. In other words, both energy and firm capacity are being sold.

ii. **Non-guaranteed Capacity:** Where the **buyer** is completely responsible for the capacity imbalances. In other words, only the energy is being sold.

In CTBCM, generators can sell Firm Capacity through contracts and can also offer their any uncontracted available capacity in the Balancing Mechanism for Capacity (BMC) administered by the Market Operator.

On the other hand, each and all demand participants (e.g. competitive suppliers representing demand/consumers, or DISCOs as Supplier of Last Resort) will have capacity obligations. A demand participant can fulfill its capacity obligation by utilizing the firm capacity it owns or has contracted and buying any shortfall in the BMC.

The BMC will complement the capacity obligations of each market participant, providing a mean to settle the eventual differences that may exist between the capacity demanded and actually provided. The purpose of the balancing mechanism for capacity is to conciliate the difference between the capacity obligations of Demand Participants and the available capacity of Generators during critical hours, with the capacity contracted (bought or sold in contracts). Under CTBCM, the trading period for capacity will be 1 day while the BMC will be executed once a year, during the first two months of each fiscal year.

3. Marginal Price

Marginal price (or marginal cost) refers to the cost of producing one additional unit of electricity. It is the price at which the next unit of electricity can be generated and delivered, considering the most efficient and cost-effective means of production available at that time. Under the CTBCM scheme, this translates to the per unit cost of producing electricity from the least expensive idle generator at the time.

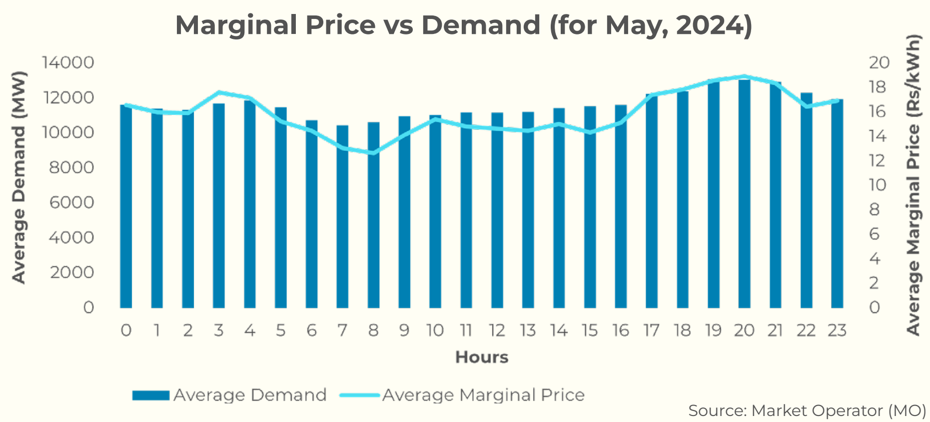
Types of marginal cost over different time horizons:

i. SRMC (Short-Run Marginal Cost) is the cost of producing one more unit of electricity considering only the variable costs and assuming the existing capital infrastructure remains unchanged. It primarily includes costs like fuel, variable operations, and maintenance.

ii. LRMC (Long-Run Marginal Cost) is the cost of producing one more unit of electricity when all inputs, including capital infrastructure, can be adjusted. It includes both variable costs and fixed costs associated with investments in new infrastructure.

Responsibility and application: In CTBCM, the calculation of the hourly marginal price is the responsibility of the System Operator. The SO provides this information to the Market Operator to settle any energy or capacity imbalances as part of its responsibility of administering the BME and BMC.

Importance of clarity on marginal cost: Clarity on marginal price is crucial for businesses to model the risk involved in their contracts accurately. If a contracted supplier fails to deliver, businesses will have to buy electricity from the supplier of last resort at the marginal price. This key figure in the CTBCM model is essential for participants to conduct costing and risk calculations. Without this information, potential market participants cannot confidently devise business and risk allocation plans, leading to market uncertainty and low investor confidence.

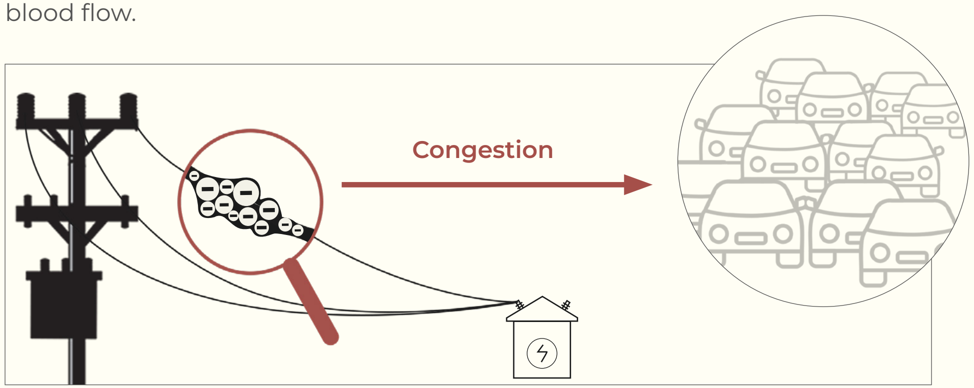


Source: Market Operator (MO)

4. Transmission and Distribution (T&D) Losses

The losses in transmission and distribution infrastructure refer to energy lost to the physical resistance in the T&D lines, as electricity flows from generation to load.

One of the primary reasons for these losses is congestion, just like a traffic jam on a road can delay vehicles, or blockages in the heart/an artery can restrict blood flow.



Congestion in transmission and distribution lines occurs when there is too much demand and not enough capacity to handle it efficiently. In Pakistan, the installed generation capacity is around 45000 MW against an annual peak demand of 28000 MW, whereas the transmission capacity limit of the transmission network is only 26000 MW.

This congestion can slow down or even halt the flow of electricity (causing brownouts/blackouts). These bottlenecks in the grid can lead to increased transmission and distribution system losses, as electricity faces resistance and loses energy while traveling through overburdened lines.

The losses are considered an inherent part of the electricity supply chain and are usually recognized as a component of the total supply cost. The total energy generated in the system is required to be recovered/paid which is equal to the actual load and the losses in the system.

Treatment of Losses in CTBCM:

i. The Metering Service Provider (MSP) will be responsible for determining the quantity of losses in the transmission network for each transmission licensee on hourly basis, as the difference between the energy injected into and withdrawn from its transmission network.

ii. A cap will be imposed on electricity losses in the grid beyond which the transmission and distribution licensees will not be allowed to transfer costs to the consumers.It includes both variable costs and fixed costs associated with investments in new infrastructure.

Renewables First (RF) is a think tank for energy and environment. Our work addresses critical energy and natural resource issues with the aim to make energy and climate transitions just and inclusive.

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