Competition

Competition

Competition

What is Competition ?

Definition

Dictionary:
A struggle with others for victory or supremacy

Adam Smith (1759):
"Competiton is a simple process driven by selfisness and rapacity"

An alternative definition:
A (fair) struggle among market suppliers for a better price and quality

Competition

What is Competition ?

Definition

Economics:
Improvement of market performance of the suppliers in order to reduce prices to **"Fair Level"**, in order to improve the generation quality and market efficiency

Competition

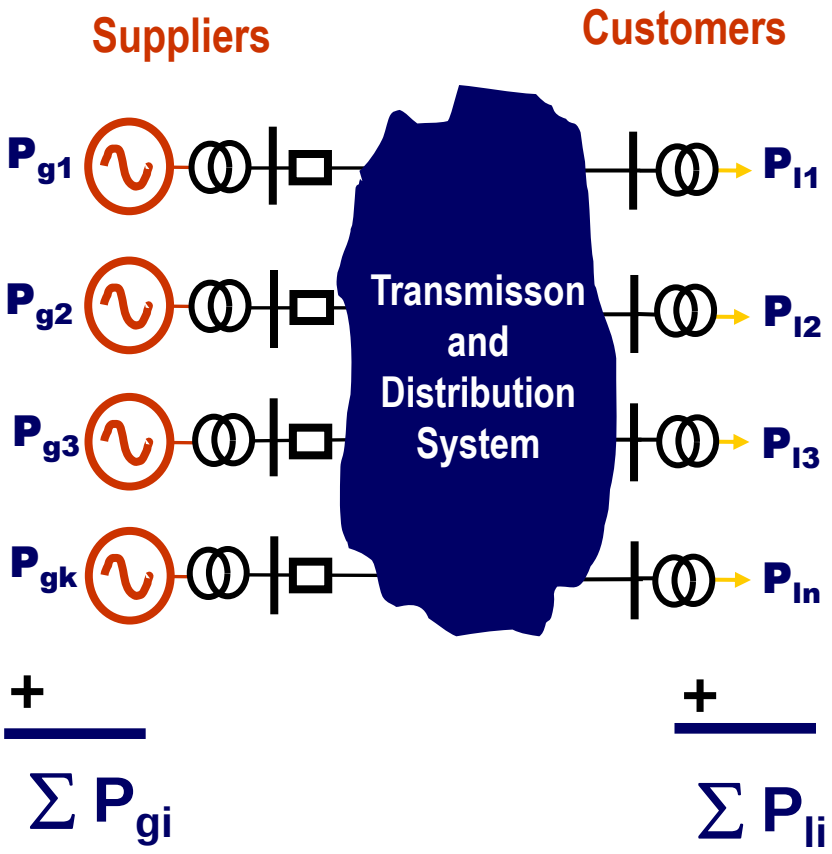
Parties in Competition

The two parties subject to competition are suppliers and customers

Competition is a struggle among;

- suppliers, when the supply is has surplus, i.e. supply is greater than demand, suppliers tend to reduce their prices in order to be able to sell their generation,
- customers, when the supply is scarce, customers tend to increase their prices in order to be able to satisfy their demands

Competition is not a struggle between those who want a higher price, i.e. suppliers and those who want a lower price, i.e. customers



Competition

Fairness in Competition

Greek Godddess of Justice: Themis

A doughter of Zeus, Themis, known as the "Goddess of Justice" wore a blindfolded mask, which implies her impartiality and hold a set of scales and sword in her hands, one for fairness and the other for the execution of justice

Competition

Fairness in Competition

"Let the Market do it" Principle

General Principle on the Fairness of Prices:

- Ensure that *"the playing field is level for all participants"*,
- Then, employ the *"Let the market do (the rest) it"* principle in order to establish a competitive environment

RED Electrica De Espana – Control Center

Competition

Role of the Regulator on Fairness of Prices

Fairness Principle

The main role of the regulator is to:

- design, control and follow the operation of the market on the principle of *"fairness",*
- make arbitration and judgement on the *"fairness"* of the mechanism which determines the prices in the market,
- apply sanctions to those parties who violates the above *"Fairness Principle"*

Competition

Major Aim of Deregulation and Competition

Major aim of;

- Deregulation in electricity markets is to establish a "competitive structure",
- Competition in electricity markets is to achieve "Market Efficiency"

"Market Efficiency" is the maximization of total market surplus, i.e. the sum of "Supplier Surplus" and "Customer Surplus"

Competition

Why is Competition Good for Customers ?

Major Aims of Competition

Competition among small suppliers works by suppliers undercutting each other's price in order to capture the others' customers

- Competition minimizes the Long-run costs of suppliers,
- Pays suppliers only enough to cover these costs at minimum level,
- Hence, reduces the cost term in prices

Competition drives the prices down to marginal cost level

Competition minimizes the long-run average costs of generation and long-run average costs to customers

Competition

Condition for Perfect Competition

Condition for Perfect Competition

Basic condition for perfect competition in the market is that all competitors should be "price taking", i.e. no competitor should have "market power"

Competitors with small market shares in order not to have any discernable influence against the prices are called "price taking"

Lipsey and Steiner 1966 (*)
There is enough number of buyers and sellers so that none of them has any appreciable influence on prices

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(*) Economics, Lipsey & Steiner, Harper & Row Weather Hill, 1966

Competition

Price Taking Supplier

Definition

A suppliers (competitor) is said to be "Price Taking" or not having "Market Power" if:

- It takes the market price as given,
- It does not have a large market share,
- the market price does not depend on the volume of its generation,
- i.e. it does not have the power of raising market prices profitably by reducing its generation

A competitive market satisfying the above conditions is called "stiff"

A supplier with the power of influencing prices is called "Price Determining Supplier"

Competition

Classic Competitive Market Equilibrium

Conditions

Three conditions to be met to achieve classic competitive market equilibrium

1. Suppliers must all be "price taking", i.e. they should not have "market power",
2. Correct and up to date information must be provided to public knowledge about market prices,
3. Marginal cost function must be well-behaved

A market satisfying the above conditions is said to be at "competitive equilibrium" state

Gas Fired Plant in Texas

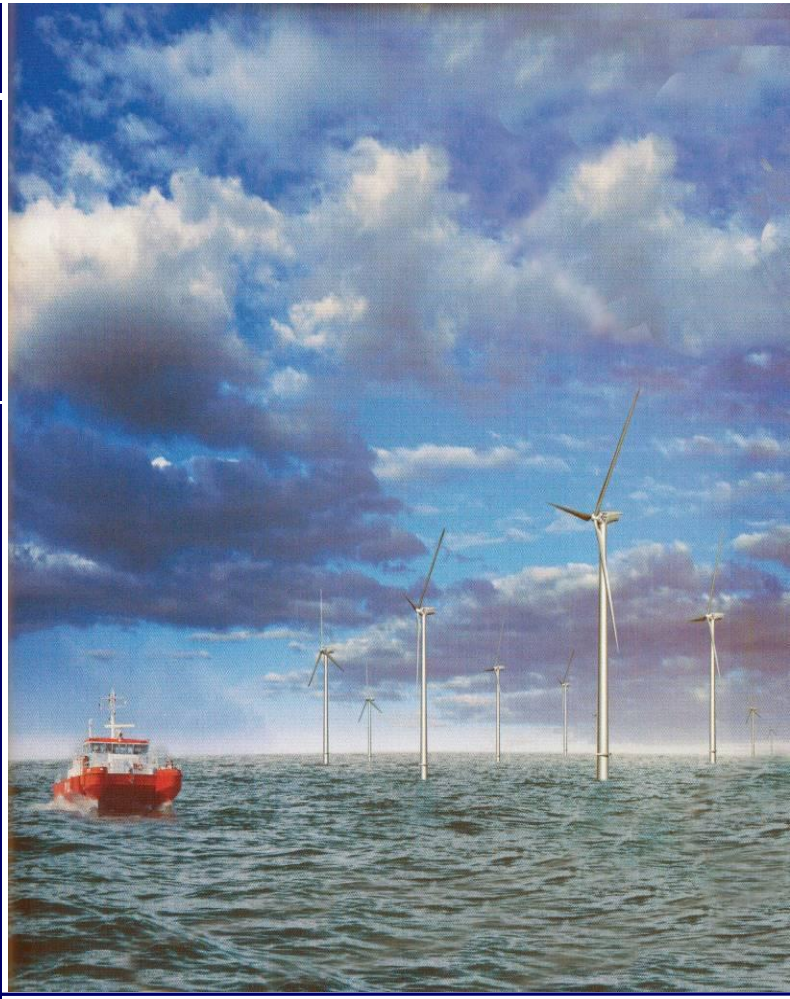
Competition

Well-Behaved Marginal Cost Function

Conditions on Marginal Cost Function

In order Competitive Market equilibrium state exist, Marginal Cost Function must be well-behaved, i.e. must satisfy the following conditions:

- Marginal Cost Function should be increasing with the generated electricity, i.e. it should be a convex function,
- Generation cost curve should stop decreasing when the market share of supplier reaches a moderate level,
- The effect of plant start-up and no-load costs should not disturb the convexity of Short-Run Marginal Cost Function



Competition

Ill-Behaved Marginal Cost Curve

Conditions Disturbing Competitive Equilibrium State

- Price determining suppliers,
- Nonconvex marginal cost function,
- Lack of correct and up to date information about market prices

Nonconvex Marginal Cost Function

Conditions Disturbing Convexity

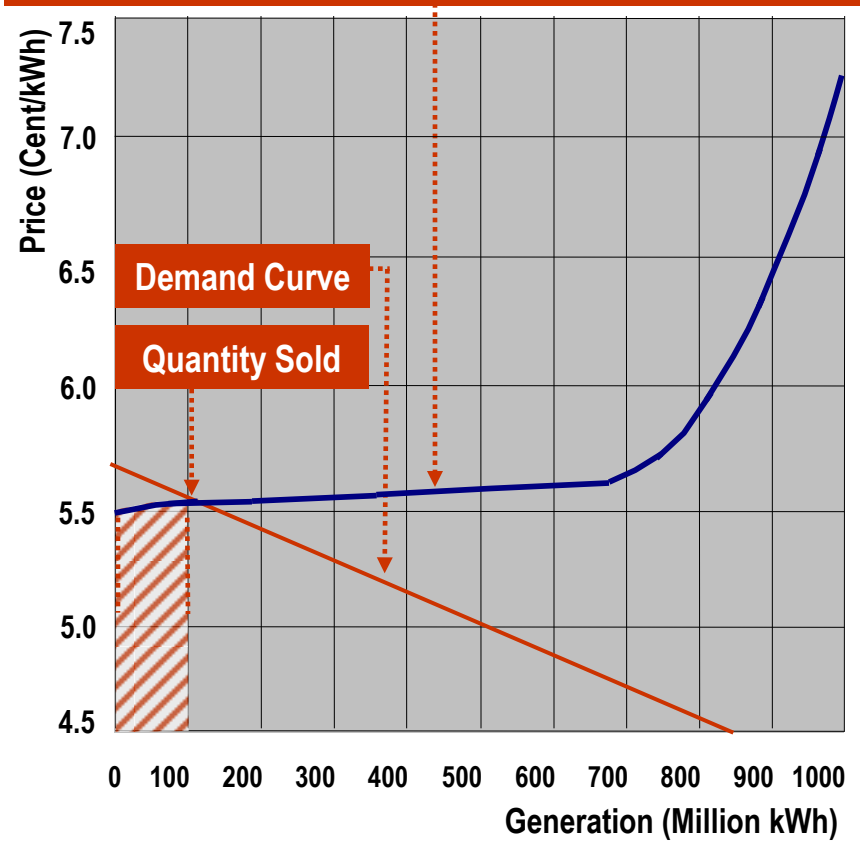
Marginal Cost Function may lose its convexity due to the following reasons:

- Nonconvex operating costs,
- High fixed costs,
- High start-up or no-load costs,
- Very large decrease in the total generation cost due to very large scales of generation(*)

(*) This is an indication of supplier being natural monopoly

A nonconvex cost function may have a small intersection with the demand curve or may not have any intersection at all, implying that the solution does not exist

Please note that marginal cost remains flat for a rather long range of generation *(Indication of being natural monoply)*



Competition

Natural Monopoly

Definition

A supplier with unlimited cheap input compared to other suppliers, such as hydroelectric or geothermal energy resources, is called **"Natural Monopoly"**

In natural monopolies, very large decreases in the total generation cost occur due to very large scales of generation

Natural monopolies disturb the convexity of the cost function and hence, the competitive market structure

Itaipu HPP Amazon, Brasil (12600 MW)
World's Largest Dam (Natural Monopoly)
(12.5 MW / 41.0 MW = 30.5 % of Total Installed Power of Turkey)

Competition

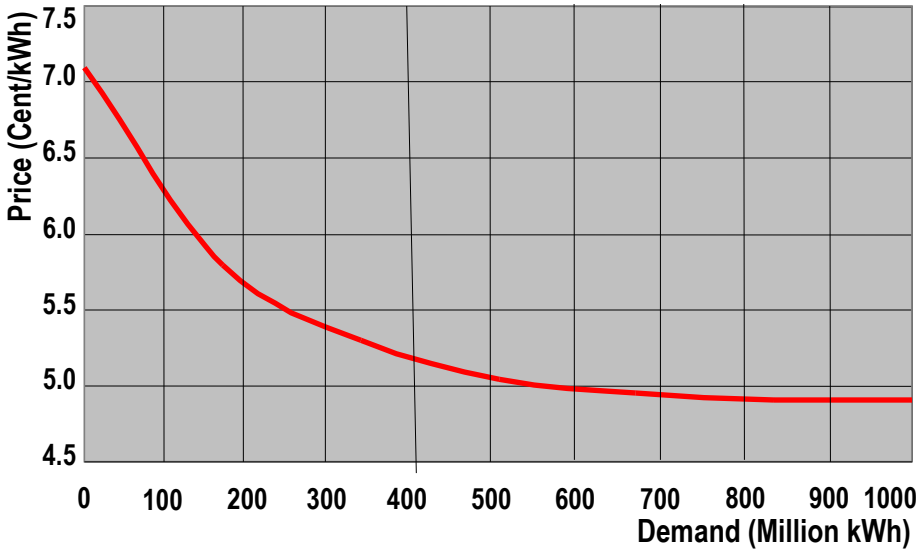
Price Elasticity of Demand Curve

Elasticity of Demand

Price Elasticity Curve or Demand Curve is the curve showing the sensitivity of electric consumption or customer demand on price

Demand Curve;

- shows how much a customer agrees to pay for the first kWh consumed, and for the second, and so on
- depends on type and nature of the load



Itaipu HPP Brasil – Control Center

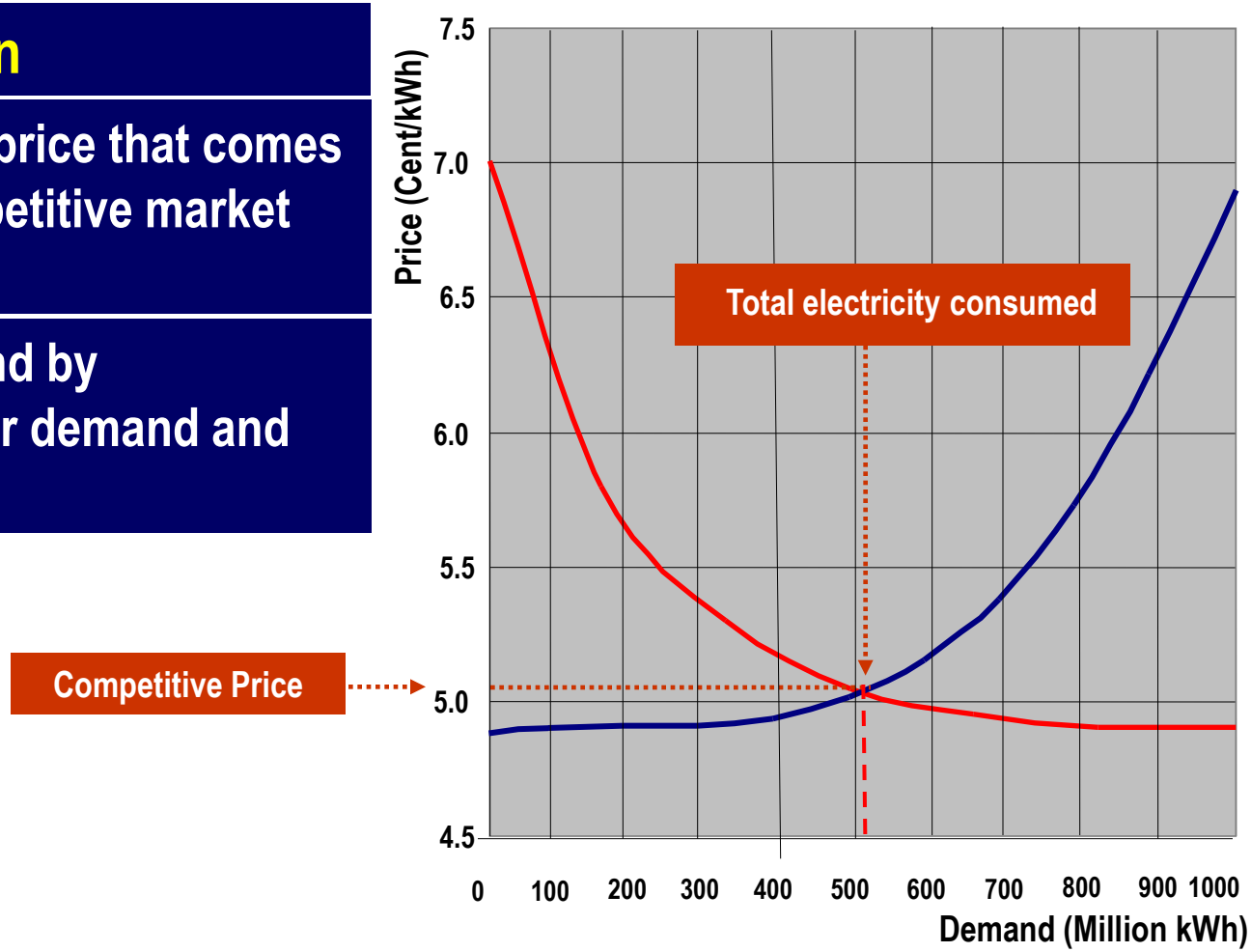
Competition

Competitive Price

Definition

Competitive Price is the price that comes out from the actual competitive market equilibrium condition

Competitive Price is found by intersecting the customer demand and marginal cost curves



Competition

Demand Curve

Total Electricity Demand

Area under the demand curve is the total payment that the customer agrees to pay (*) for the total electricity purchased

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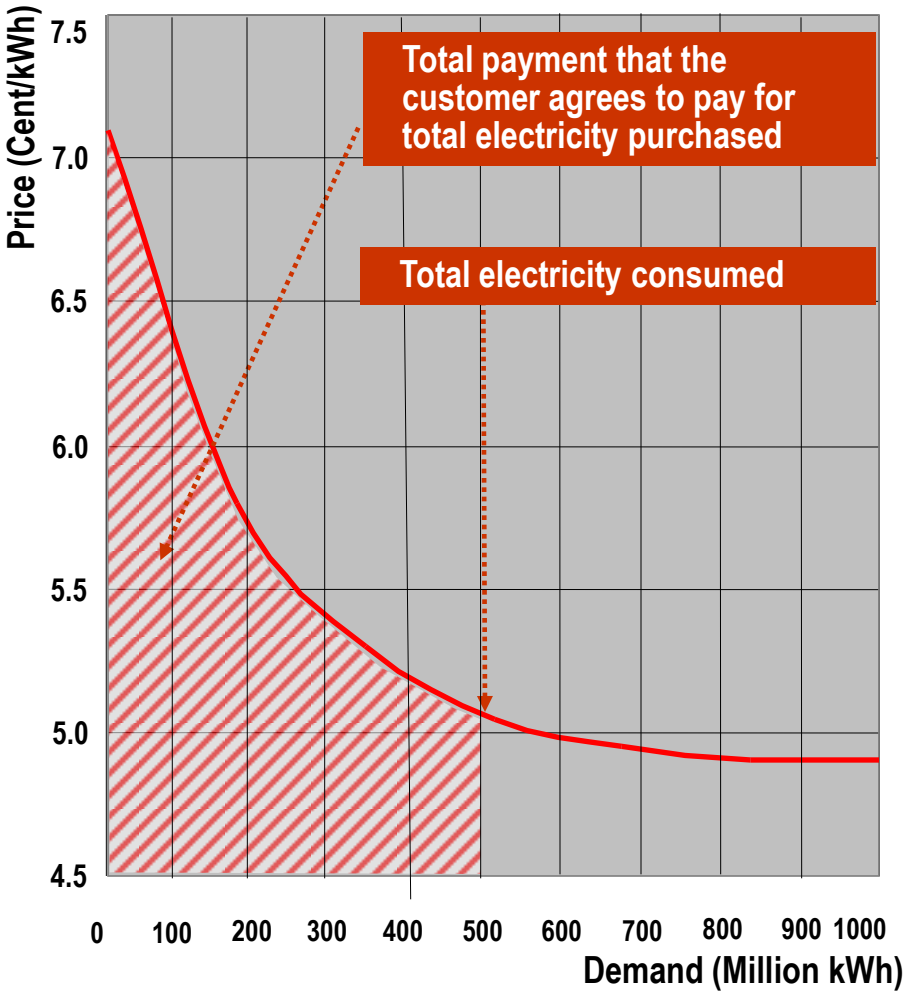
(*) This is not the actually payment, but only the amount that the customer agrees to pay for the total electricity to be purchased



Competition

Customer Surplus

Definiton

The difference between the "red-hatched" and "red-uniform" areas is the Customer Surplus.

Customer Surplus is the difference between the total payment that the customer agrees to pay (*) and the actual amount that the customer pays for the total electricity purchased

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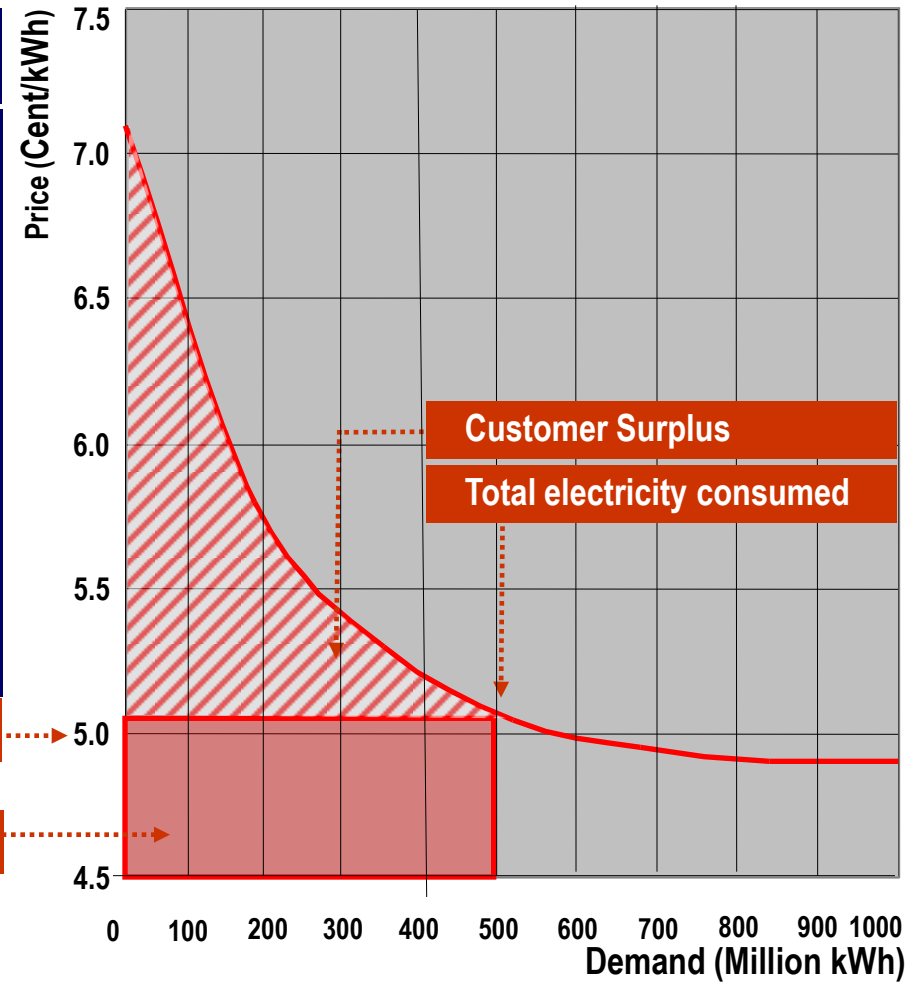
(*) This is not the actually payment, but only the amount that the customer agrees to pay for the total electricity to be purchased



Competition

Customer Surplus

Definition

"Customer Surplus" comprises the following three conditions:

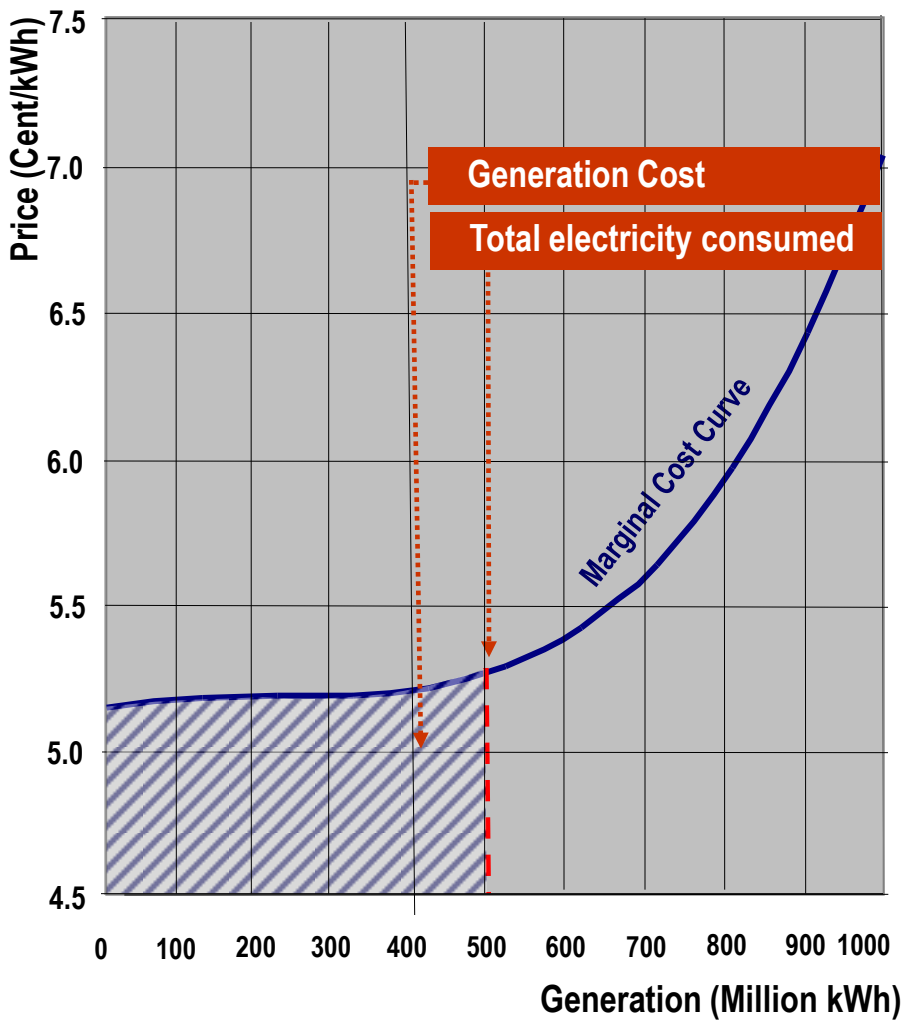
- The output is produced by the cheapest suppliers,
- It is consumed by those, most willing to pay for it, i.e. the highest possible price,
- The right amount of output is produced

Competition

Generation Cost

Definition

Area under the Marginal Cost Curve is the generation cost (total cost of the supplier) for the first kWh produced, and the second, and so on

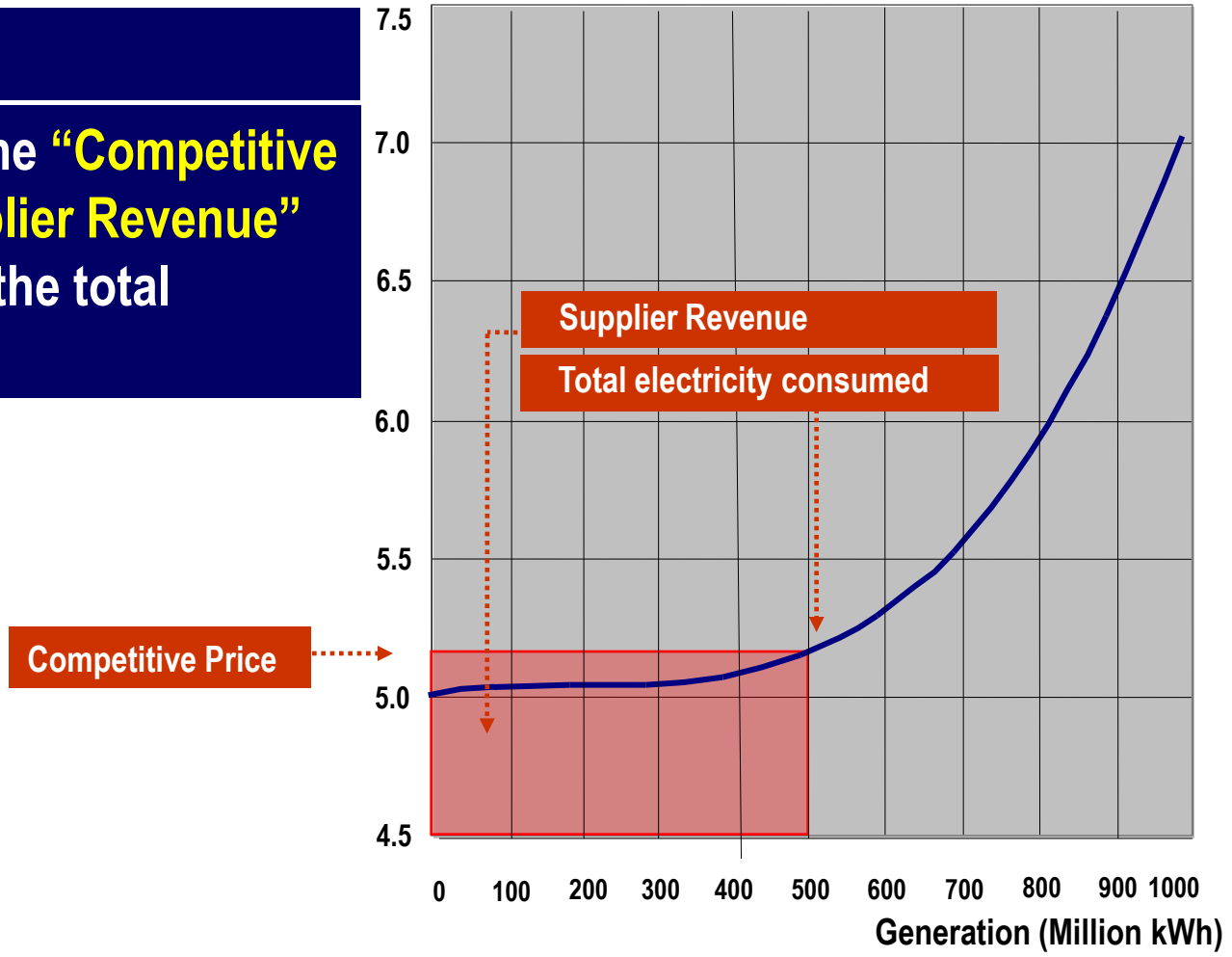


Competition

Supplier Revenue

Definition

Rectangular area under the "Competitive Price Curve" is the "Supplier Revenue" paid by the customer for the total electricity purchased



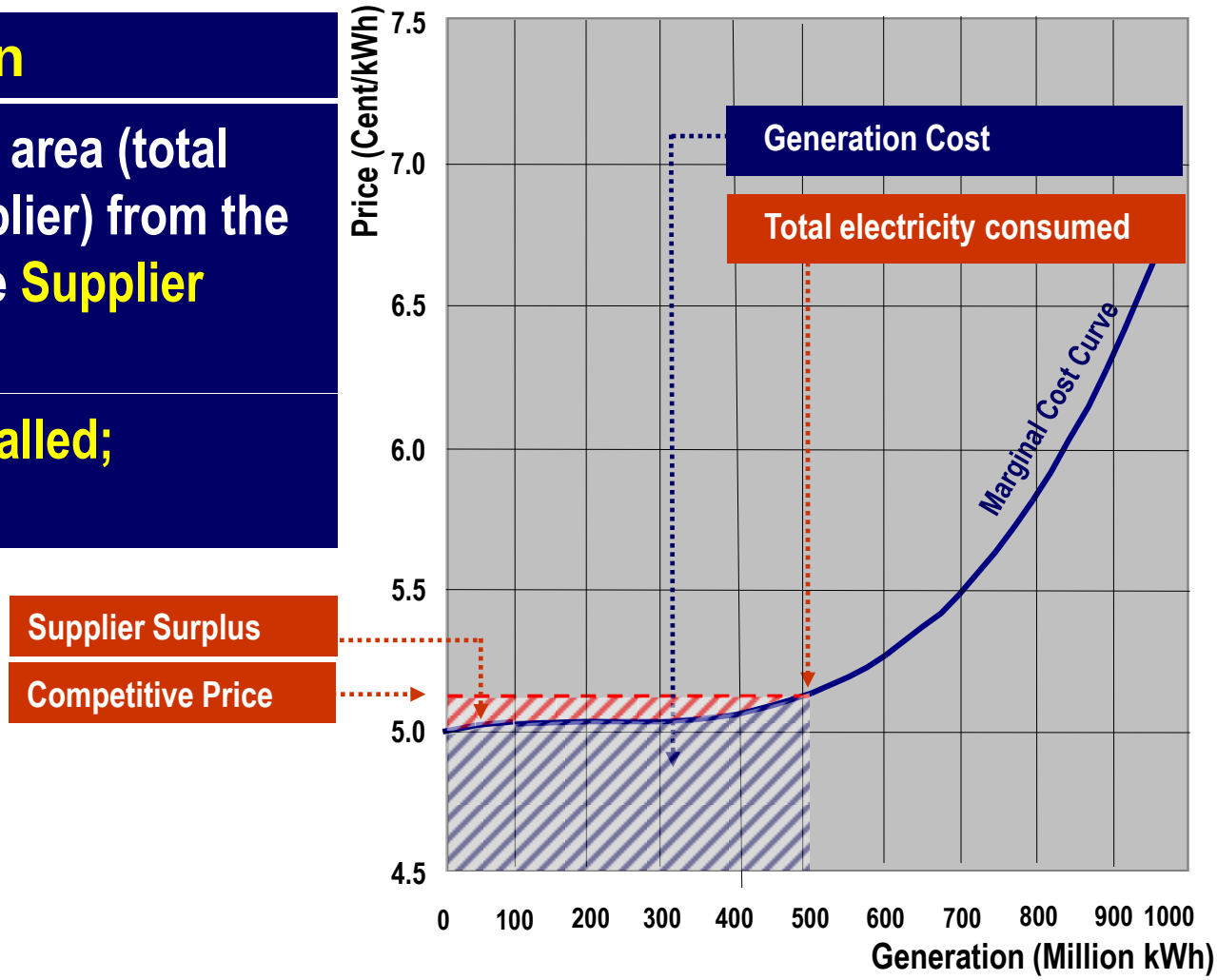
Competition

Supplier Surplus

Definition

Subtraction of the "blue" area (total marginal cost of the supplier) from the total area (renevue) is the Supplier Surplus (red area)

Supplier Surplus is also called; "Supplier Profit"



Competition

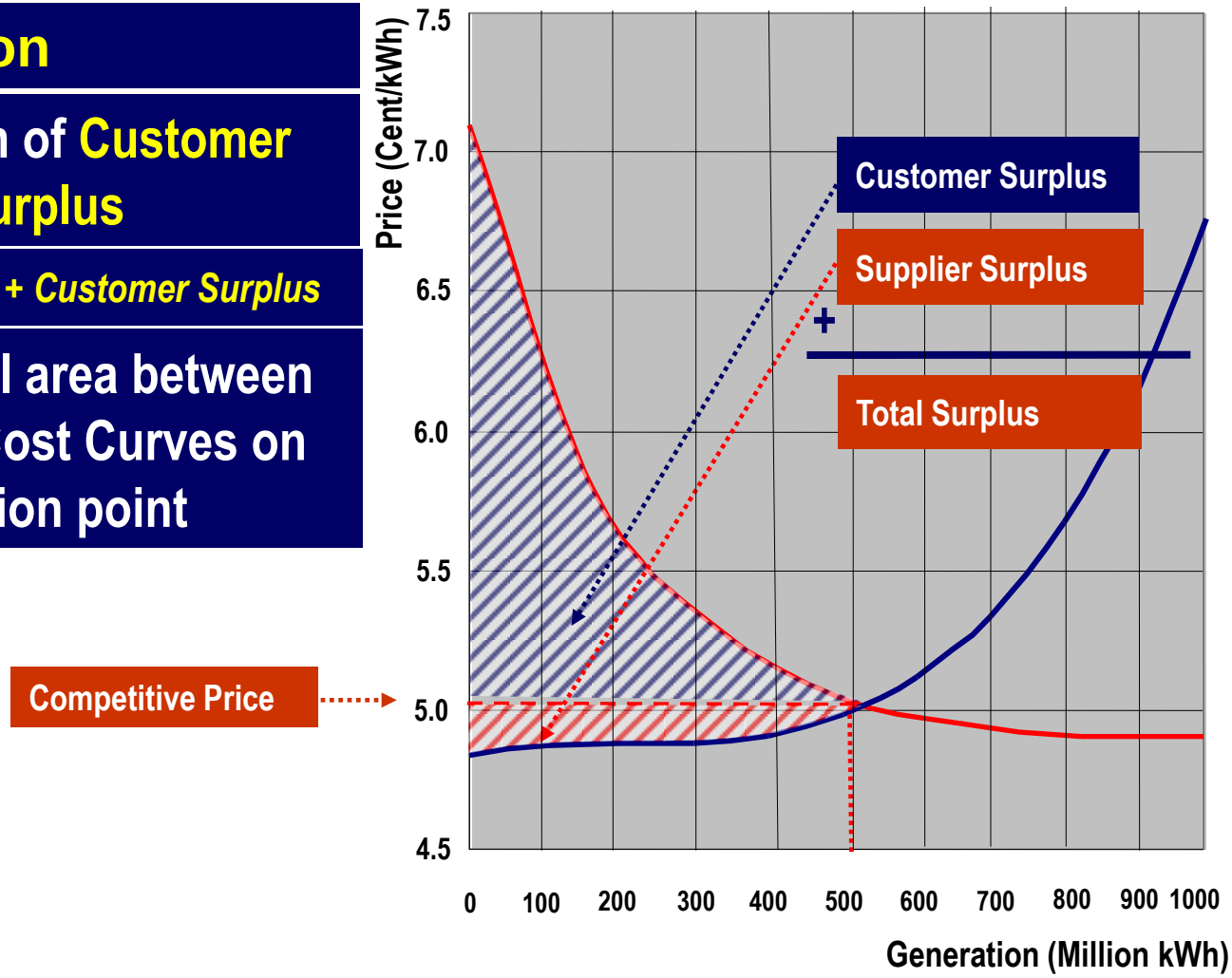
Total Surplus

Definition

Total Surplus is the sum of **Customer Surplus** and **Supplier Surplus**

Total Surplus = Supplier Surplus + Customer Surplus

Total Surplus is the total area between Demand and Marginal Cost Curves on the LHS of the intersection point

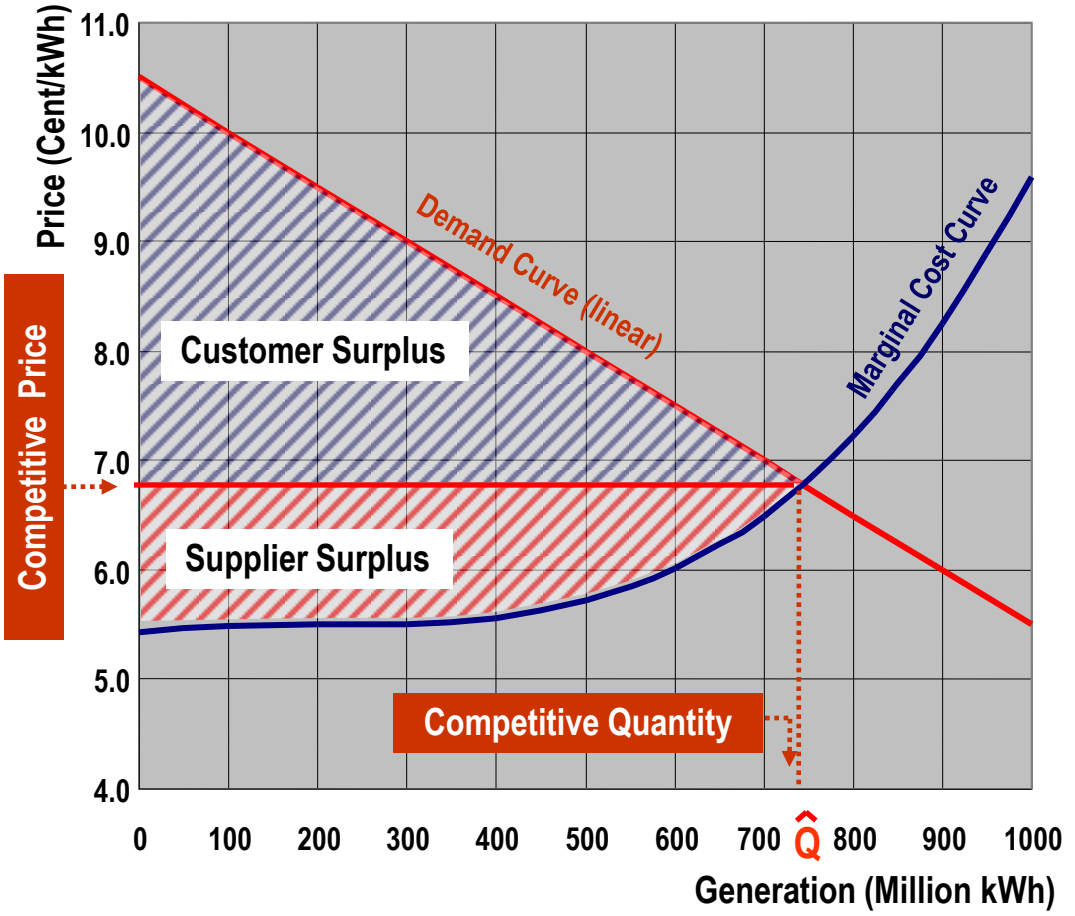


Competition

Market Equilibrium Condition

Sugözü Coal PP (1210 MW)

Demand and Marginal Cost Curves



Competition

Market Efficiency

Definition

"Market Efficiency" is defined as the generation at the least possible cost

Market Efficiency is the maximization of Total Surplus:

Total Surplus = Supplier Surplus + Customer Surplus
Supplier Surplus is also called "Profit"

Markets have two types efficiency:

- Short-run market efficiency,
- Long-run market efficiency

Itaipu HPP Brasil (12600 MW)

Competition

Short-Run Market Efficiency

Definition

Short-Run Market Efficiency

- A competitive market must be established,
- Competitors must all be "price taking suppliers", i.e. they should not have any "market power"
- Correct and up to date information must be provided to public knowledge about market prices,
- Marginal Cost Curve must be well-behaved

Enka Intergen, Izmir Natural Gas PP, 1520 MW

Competition

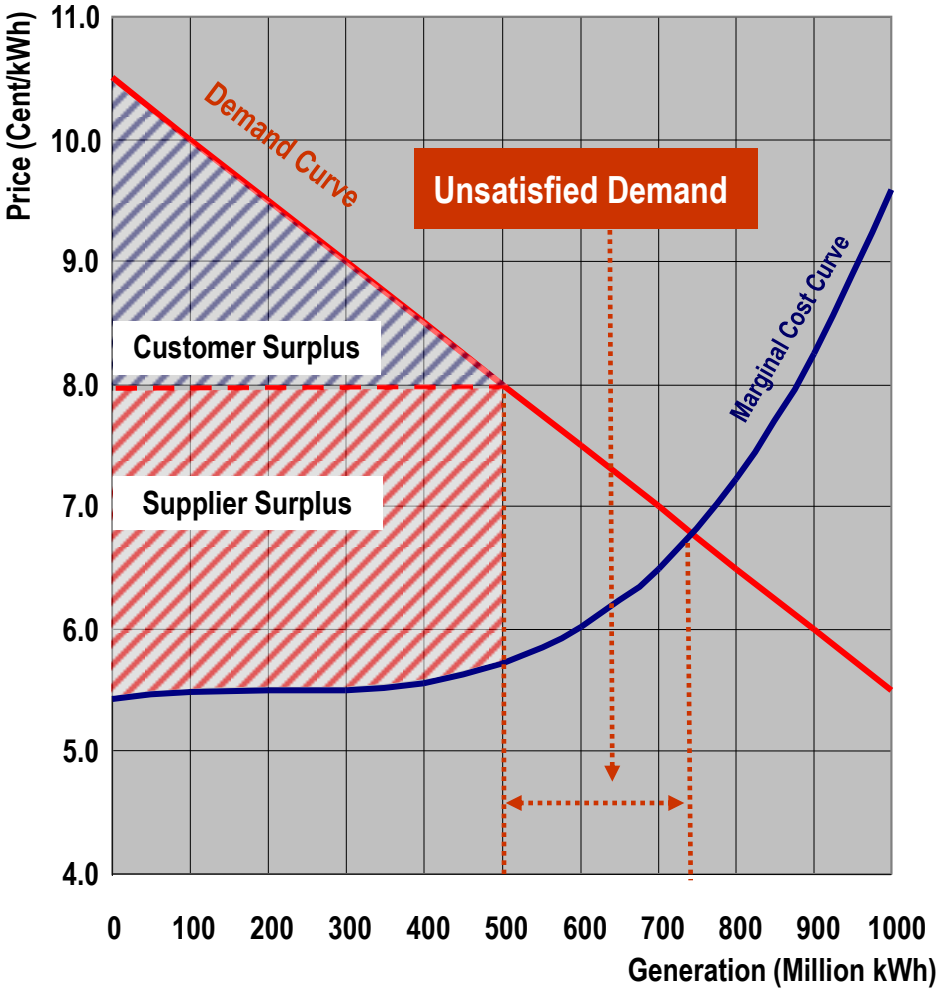
Mechanisms for Short-Run Market Equilibrium

Adjustment Mechanisms

To bring a market Short-Run Equilibrium Condition, two dynamic adjustment mechanisms are needed;

(1) Price adjustment
(2) Quantity adjustment

In most markets, suppliers adjust both, in some, buyers set the price

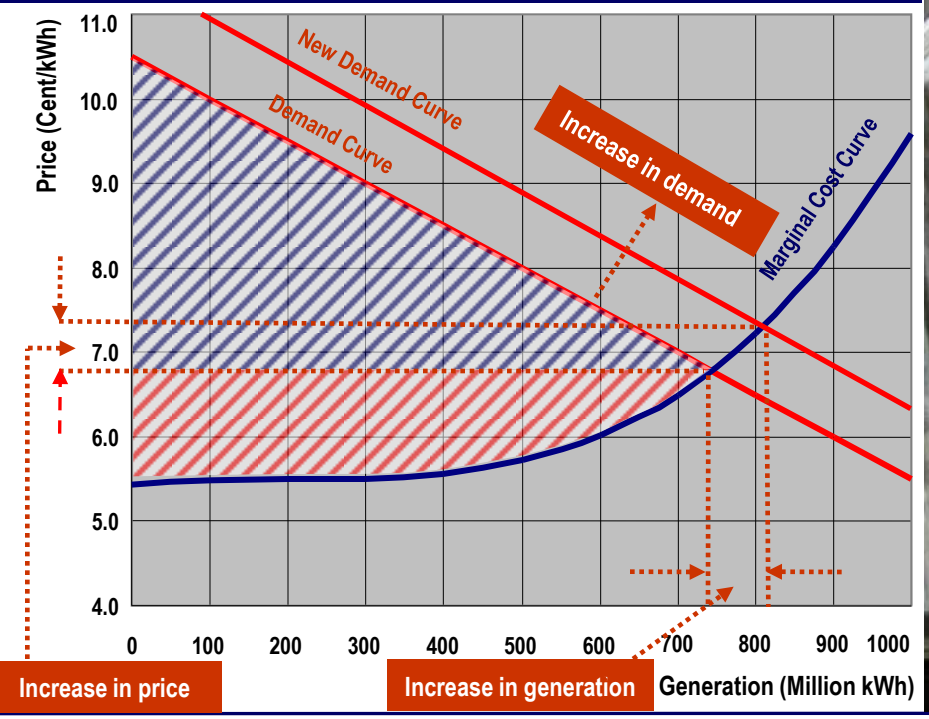


Competition

Mechanisms for Short-Run Market Equilibrium

Price Adjustment

Whenever demand exceed supply, suppliers will raise their prices, and vica versa



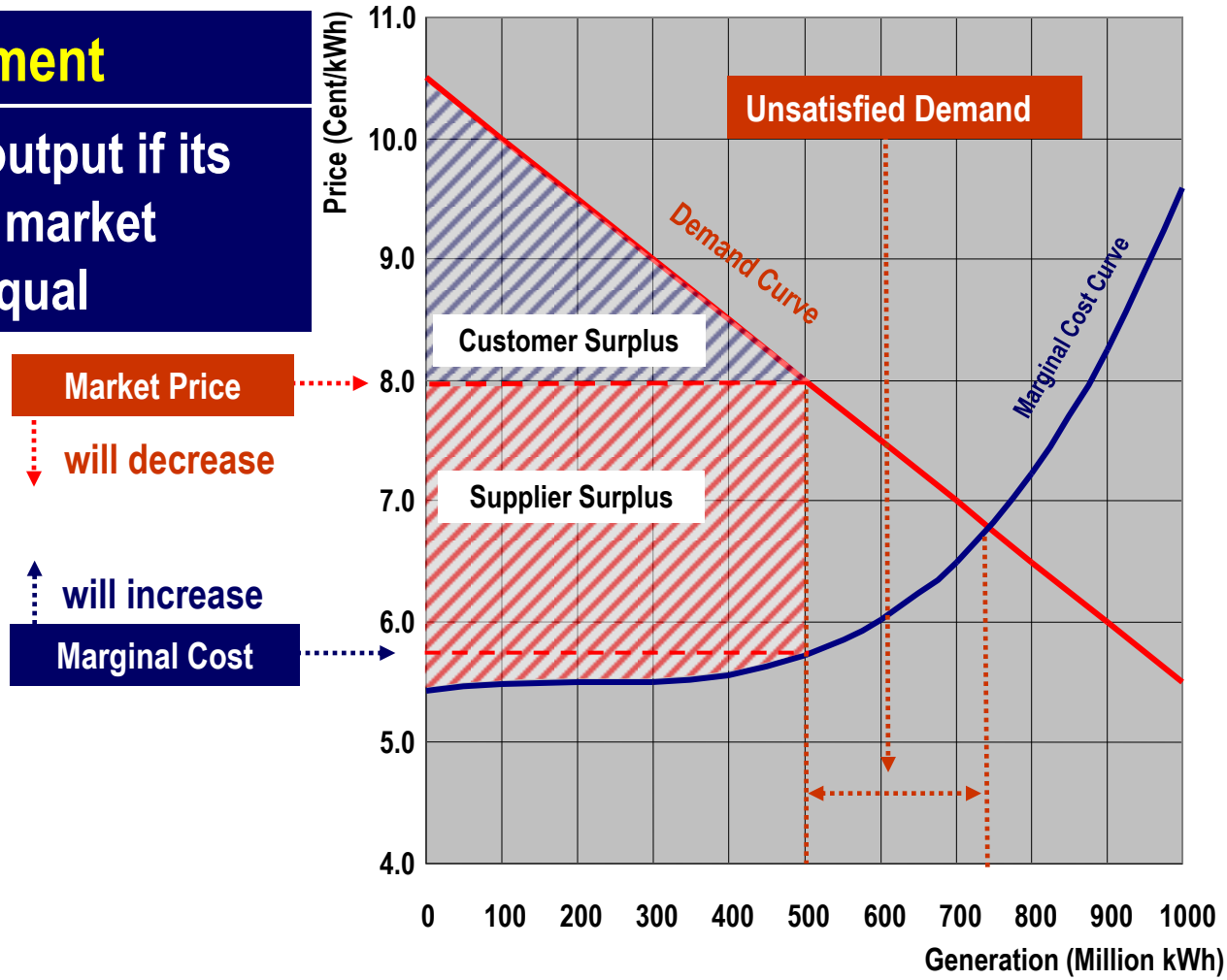
Itaipu HPP Brasil (12600 MW)

Competition

Mechanisms for Short-Run Market Equilibrium

Quantitiy Adjustment

Supplier will increase its output if its marginal cost is less than market price, until they become equal



Competition

Long-Run Market Efficiency

Definition: Long-Run Market Efficiency

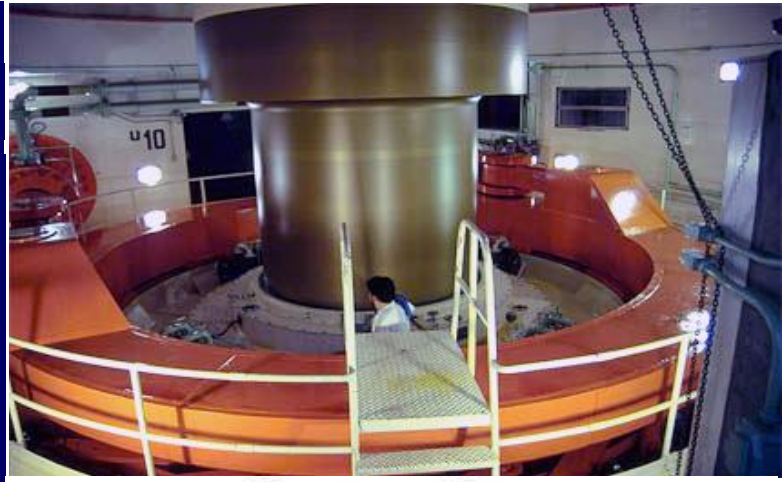
In addition to the following conditions for Short-Run Market Efficiency:

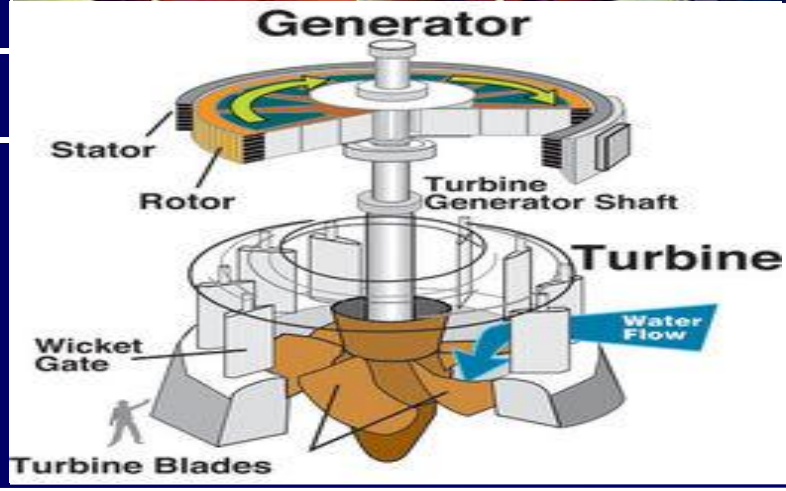
- *A competitive market must be established,*
- *Competitors must all be "price taking suppliers", i.e. they should not have any "market power",*
- *Correct and up to date information must be provided to public knowledge about market prices,*
- *Marginal Cost Curve must be well-behaved*

the following two conditions must be satisfied:

- *"Free-entry right"* to market must be granted to new competitors, i.e. There will be no barriers to entry,
- generation costs must not possess the conditions for being a natural monopoly

Itaipu HPP Brasil (12600 MW)





Competition

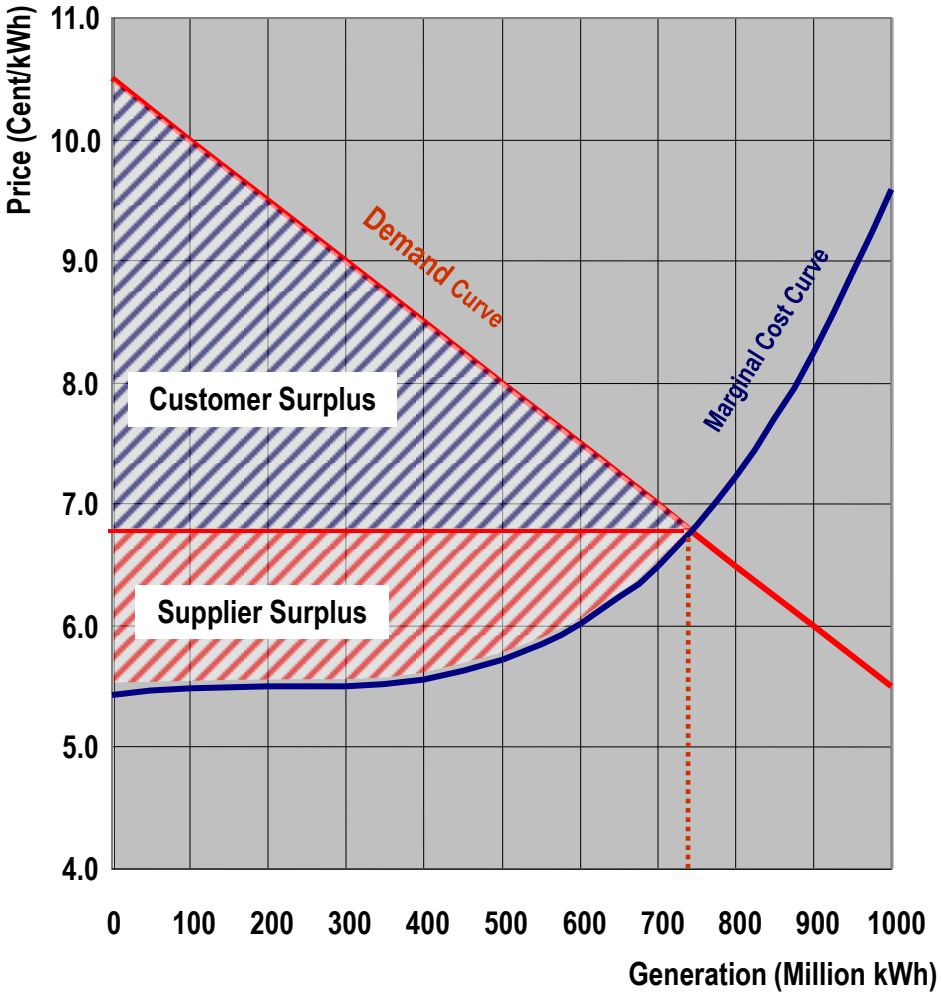
Clearing of Market

Definition

Market is said to be "cleared", when supply becomes equal to demand, i.e. demand is satisfied and an agreement on price between the supplier and customer is reached

The resulting price is called "Market Clearing Price"

Supplier strategy is simply to adjust the outputs until the marginal cost equals to the market price and adjust price until market "clears"



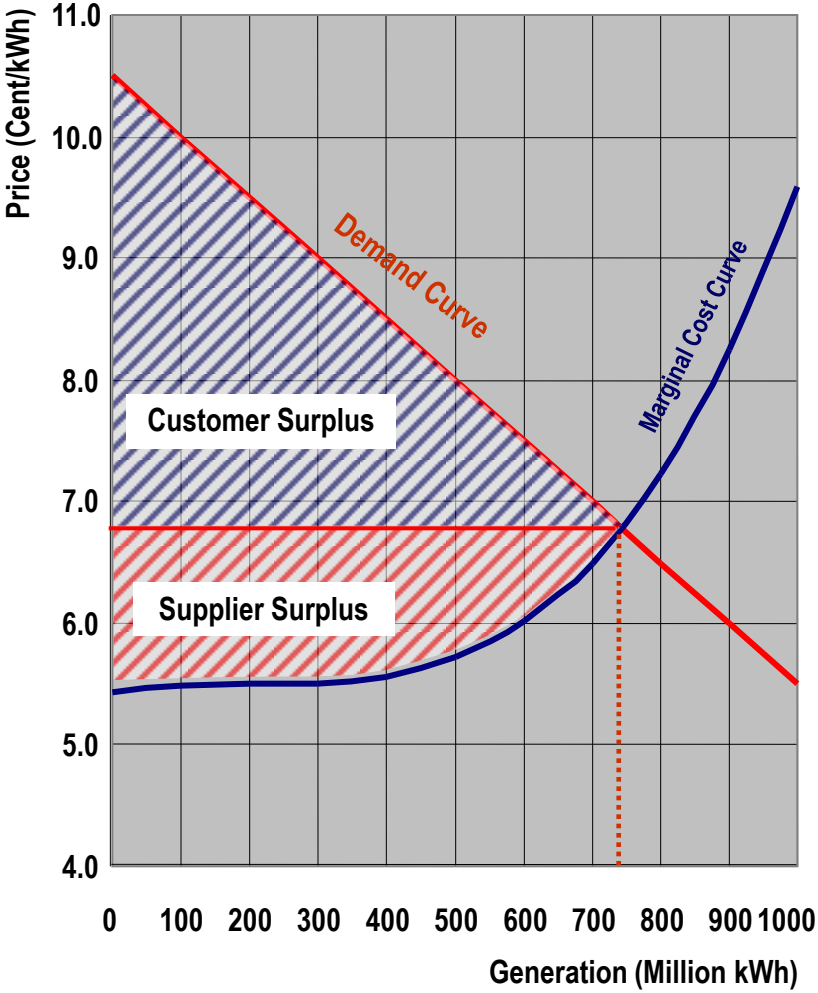
Competition

Long-Run Equilibrium Condition

Long-Run Economic Profit (LREP)

Long-run competition process involves not only adjusting the output of existing plants, but also;

- a normal return on capital including all investments (i.e. fixed costs),
- an appropriate risk premium



Competition

Long-Run Equilibrium Condition

Long-Run Economic Profit (LREP)

LREP = Revenue – Long-Run Cost (LRC)

LRC = Normal Return on Capital (NRC) + Risk Premium

Hence,

LREP = Revenue –(NRC + Risk Premium)

Thus, if,

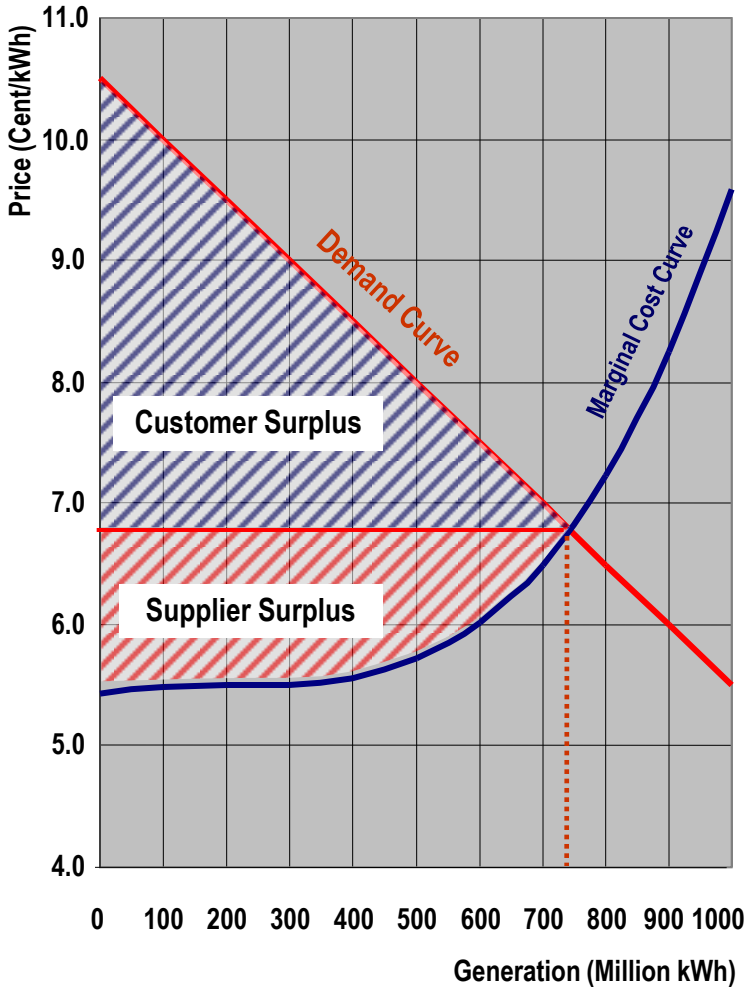
LREP = 0

Then

Revenue = LRC

= NRC + Risk Premium

Then, the investor will cover all of its investment costs in the long-run



Competition

Long-Run Equilibrium Condition

Long-Run Economic Profit (LREP)

If

LREP > 0

Then, new suppliers will enter in market and make new investments

If

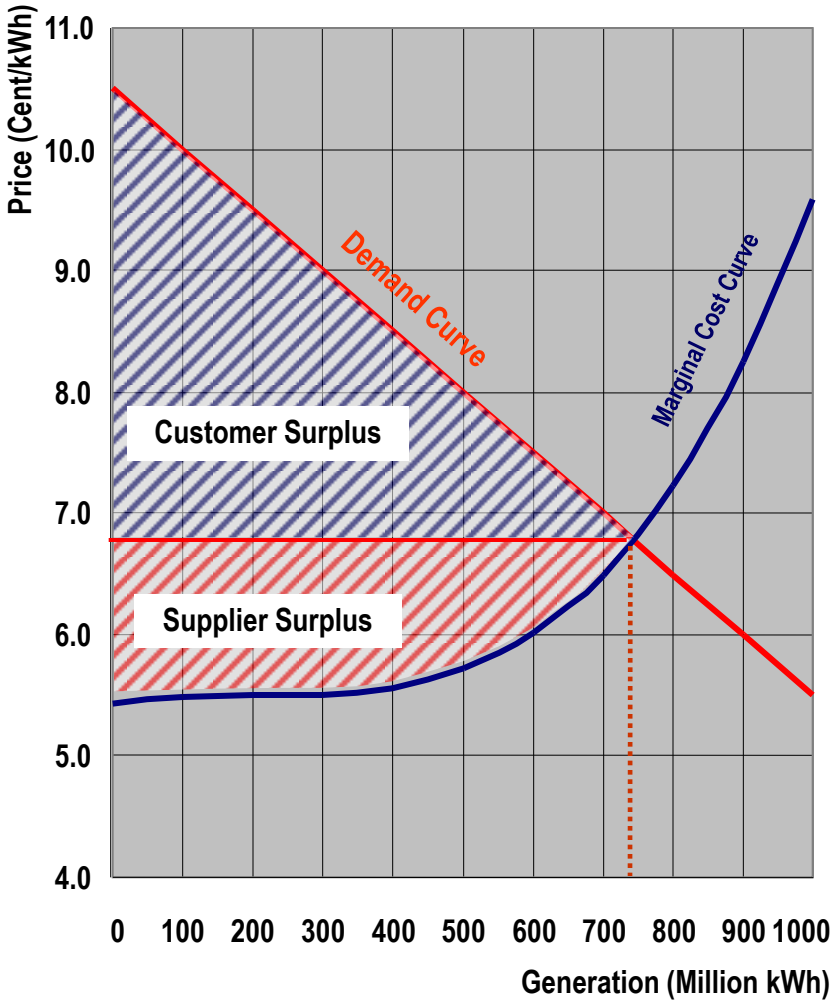
LREP < 0

Then, the investor will lose money

Since,

LREP = Revenue – Total Cost < 0

a normally profitable supplier earns zero profit



Competition

The Case: Long-Run Economic Profit (LREP) < 0

Long-Run Economic Profit (LREP)

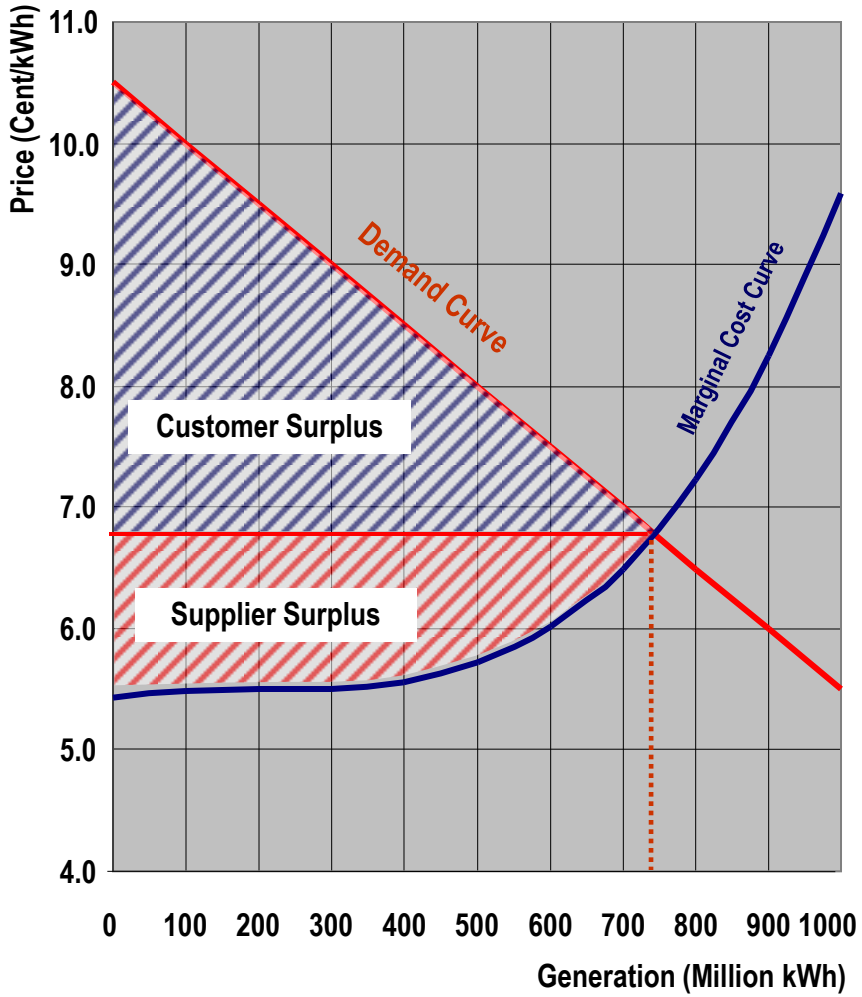
If

LREP = Revenue - Total Cost < 0

Then, the investor will lose money

Since, the investor cannot cover its investments;

- No new supplier will enter in market,
- No new plants will be built,
- Supply will eventually diminish, due to retirement of old plants,



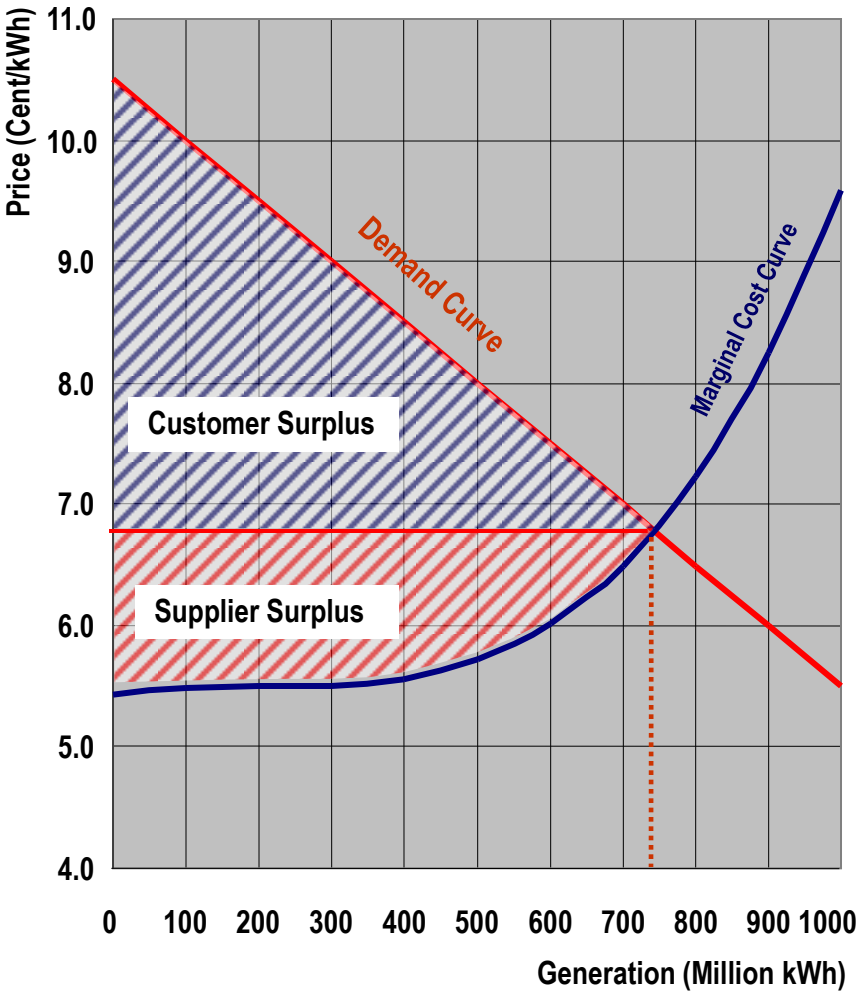
Competition

The Case: Long-Run Economic Profit (LREP) < 0

Long-Run Economic Profit (LREP)

- Resulting in a tight market structure causing the prices to rise,
- and eventually causing the prices so rise that they become attractive enough to cover all costs of the new investors,
- New suppliers enter in market,
- Prices again tends to fall

The above procedure is known as; "Long-Run Equilibrium"



Competition

Profit

Definition

In principle two types of profit may be defined:

Long-Run Economic Profit (LREP):

LREP = Revenue – Total Cost

Long-Run Economic Profit includes;

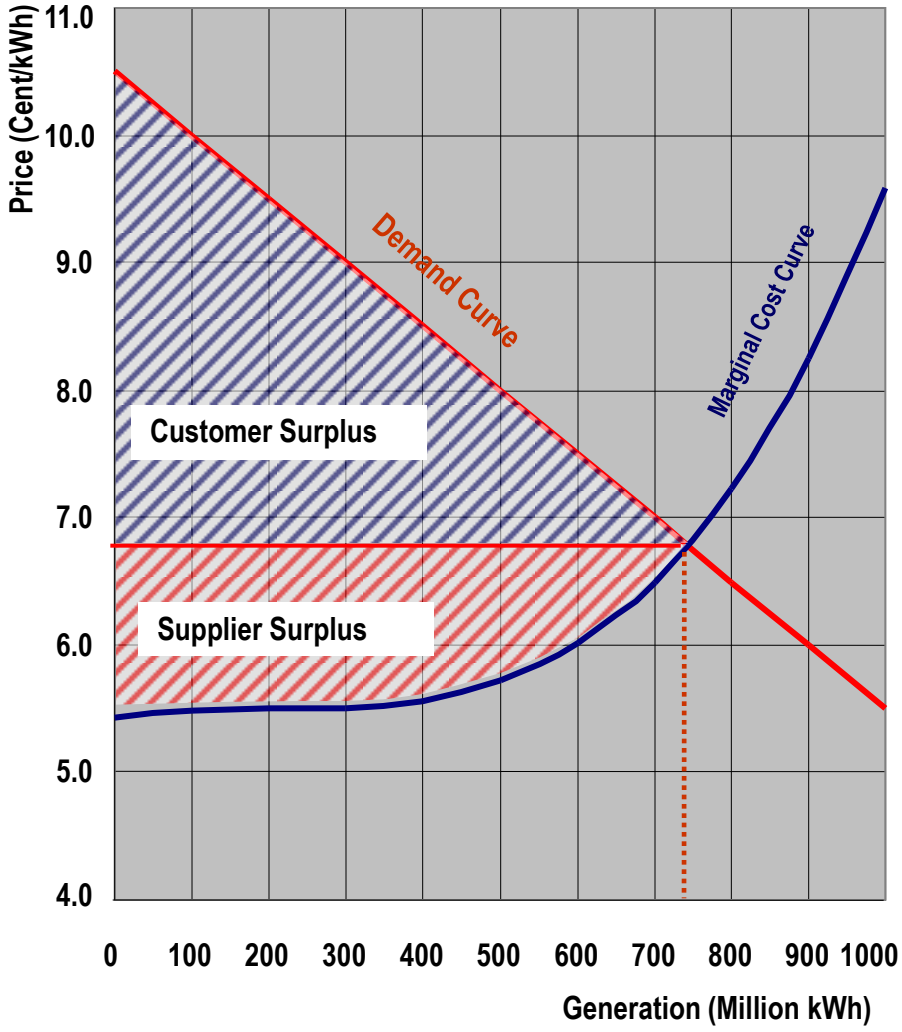
- a normal return on capital including all investments, i.e. including fixed costs
- an appropriate risk premium

Short-Run Economic Profit (SREP):

SREP = Revenue – Total Cost

Short-run competition process involves;

- variable costs,
- start-up and no-load costs



Competition

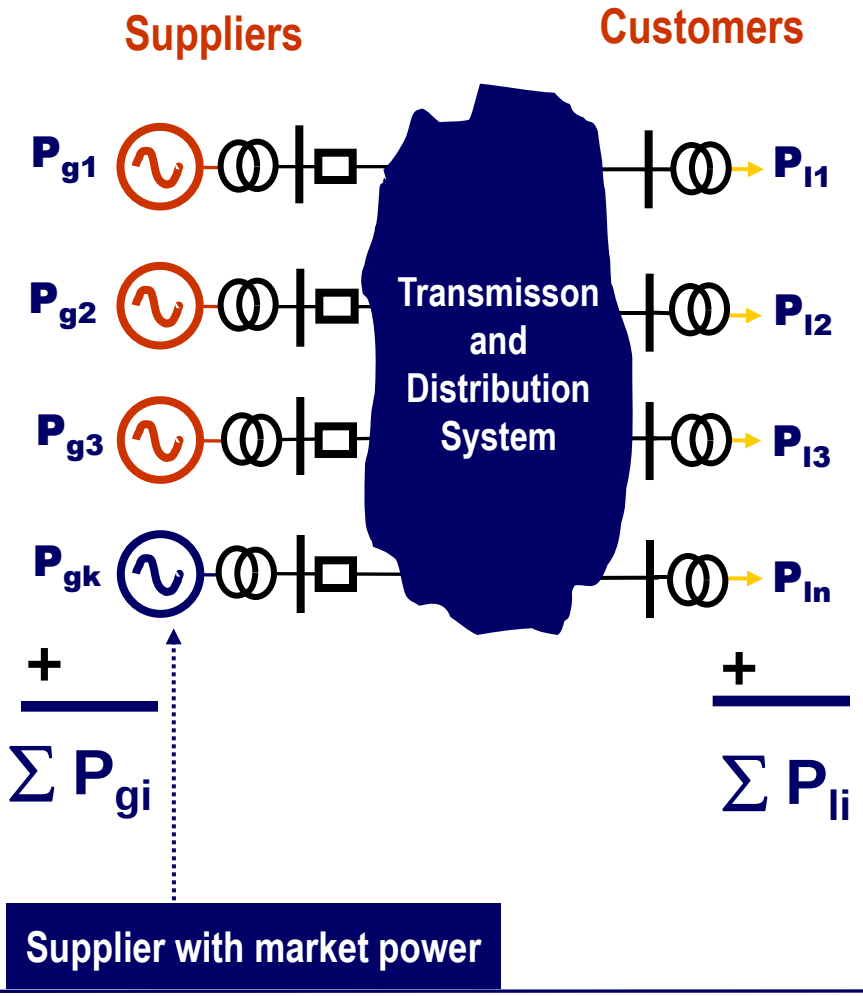
Market Power

Definition

Suppliers (competitors) are said to have "Market Power" if:

- they have a significant market share,
- they have power of raising market price by lowering their output, i.e. market price is sensitive to the amount of their output

In a market with the above property, suppliers with market power are likely to have the ability to profitably drive-up the market price by lowering their output and affecting the supply-demand balance



Competition

Calculation of Market Power

Definition

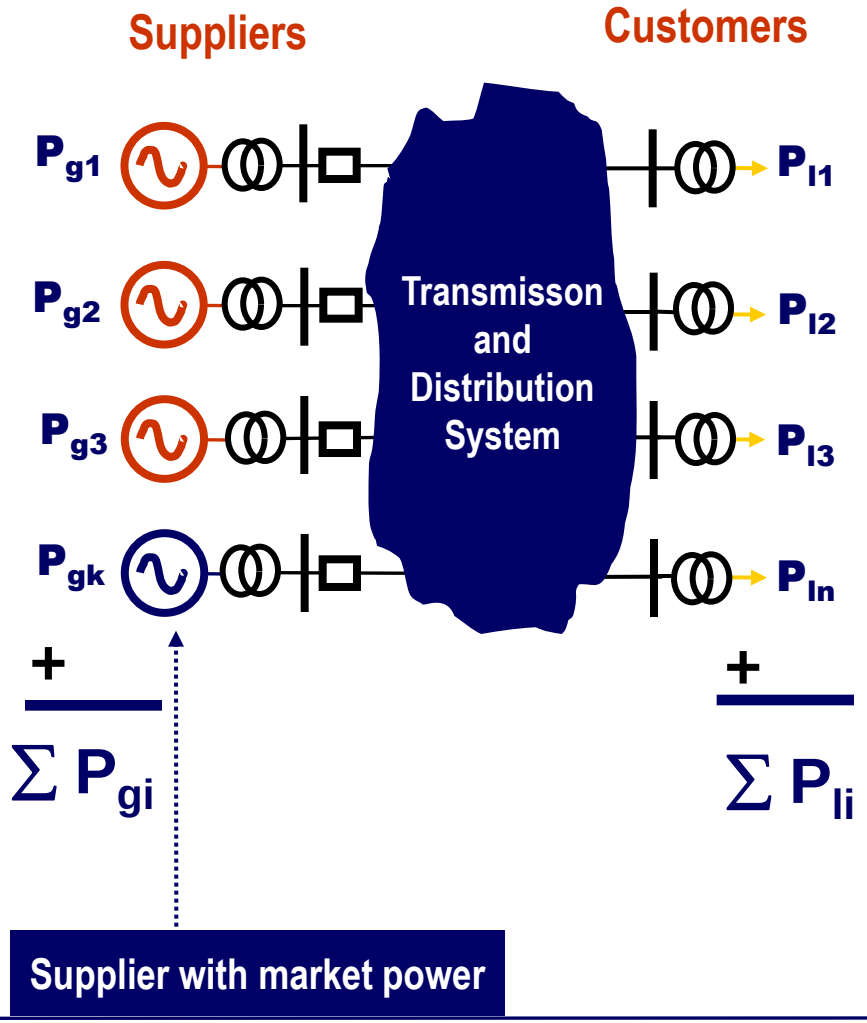
Market power of a supplier is defined as the dependency of market price to the market share of that supplier

This dependency may be calculated as;

$$\text{Market Power} = -\Delta P / \Delta Q_s = -dP / dQ_s$$

where, ΔP *or* dP *is the increase in market price,* ΔQ_s *or* dQ_s *is the intentional reduction in the generation of the supplier with market power*

A supplier with market power may exploit its advantage to earn enough to cover fixed costs in a short-run time period



Competition

Calculation of Market Power

Definition

Market Power $= - dP / dQ_s$

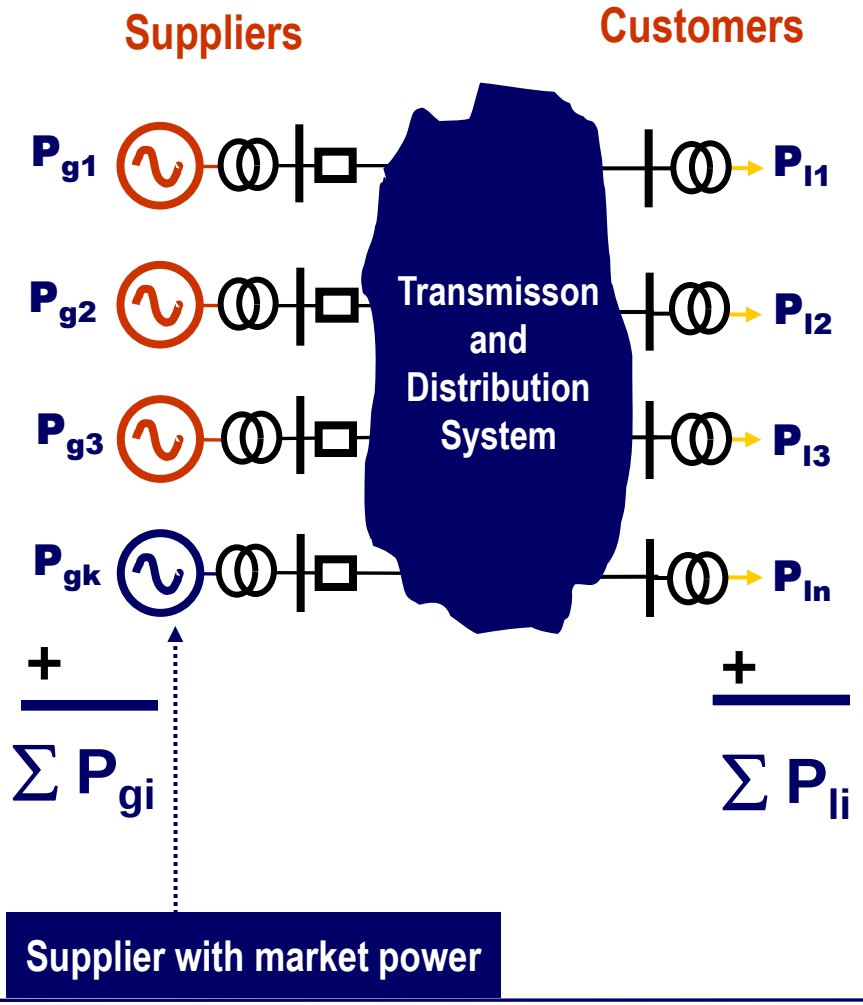
Now, employing the Chain Rule,

$= - dP / dQ \; . \; dQ / dQ_s$

The first term $- dP / dQ$ is the derivative of the demand curve $f(Q)$, the other term dQ / dQ_s on the other hand, is the ratio of the decrease dQ in the overall market to a decrease dQ_s in the output of the supplier.

Let this ratio be $\alpha \in [0,1]$, then, Market power becomes;

Market Power $= - \alpha \; . \; d f(Q) / dQ$



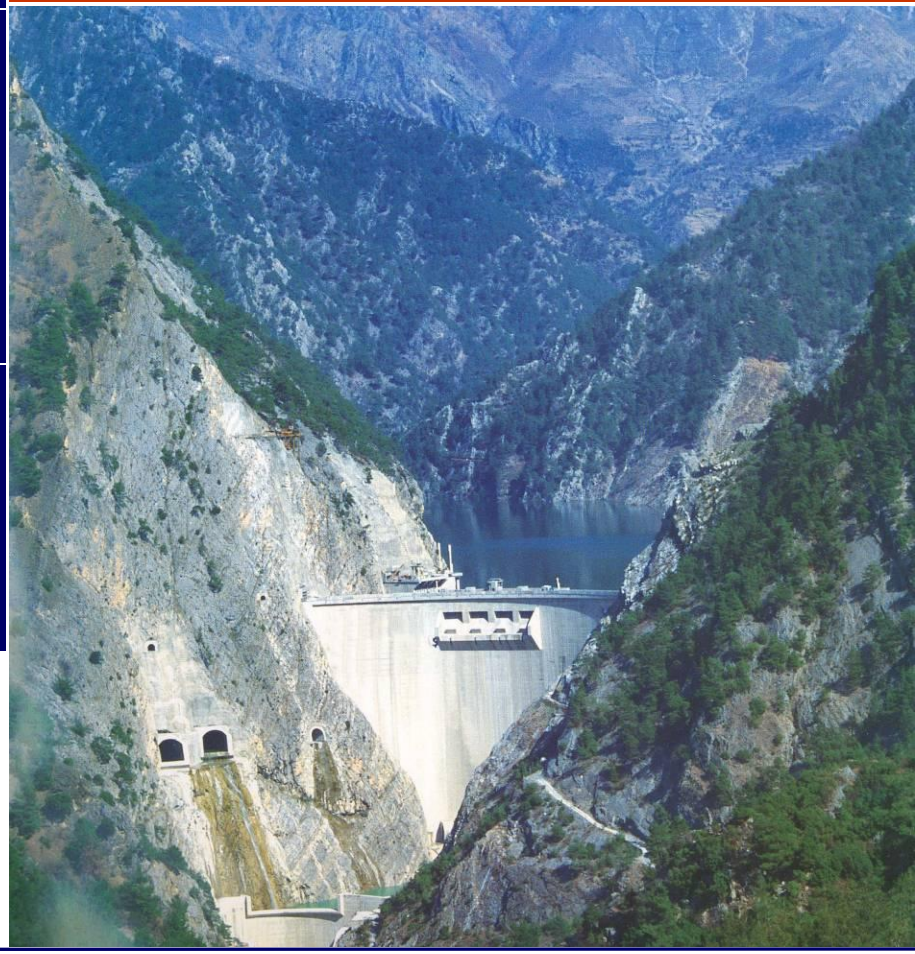
Measurement of Market Power-Supply Concentration

Herfindahl-Hirschman Index (HHI)

Definition:
Supply Concentration is the situation that a large percentage of the of the generating capacity is owned and/or operated by a single investor

Main effect of Supply Concentration is increase of Market Power
Supply Concentration is a measure for Market Power

Berke HPP (EUAS) – Ceyhan 550 MW



Competition

Herfindahl-Hirschman Index (HHI)

Herfindahl-Hirschman Index (HHI)

Supply concentration is measured in terms of the Classic Structural Index;

Herfindahl-Hirschman Index (HHI)

is a measure of supply concentration

$$HHI = \sum_{i=1}^{n} q_i^2$$

where,

- *HHI is the Herfindahl-Hirschman Index , with a value varying between 0 and 1, smaller values preferrable,*
- *n is the number of market participants,*
- *q_i is the percentage market share of the i-th participant / 100*

Competition

Market Power, Market Concentration

Herfindahl-Hirschman Index (HHI)

- Fully Monopolistic Structure, HHI = 1.0,
- Four Company model with the market shares,

$40\ \%, \quad q_1 = 0.40$
$20\ \%, \quad q_2 = 0.20$
$25\ \%, \quad q_3 = 0.25$
$15\ \%, \quad q_4 = 0.15$

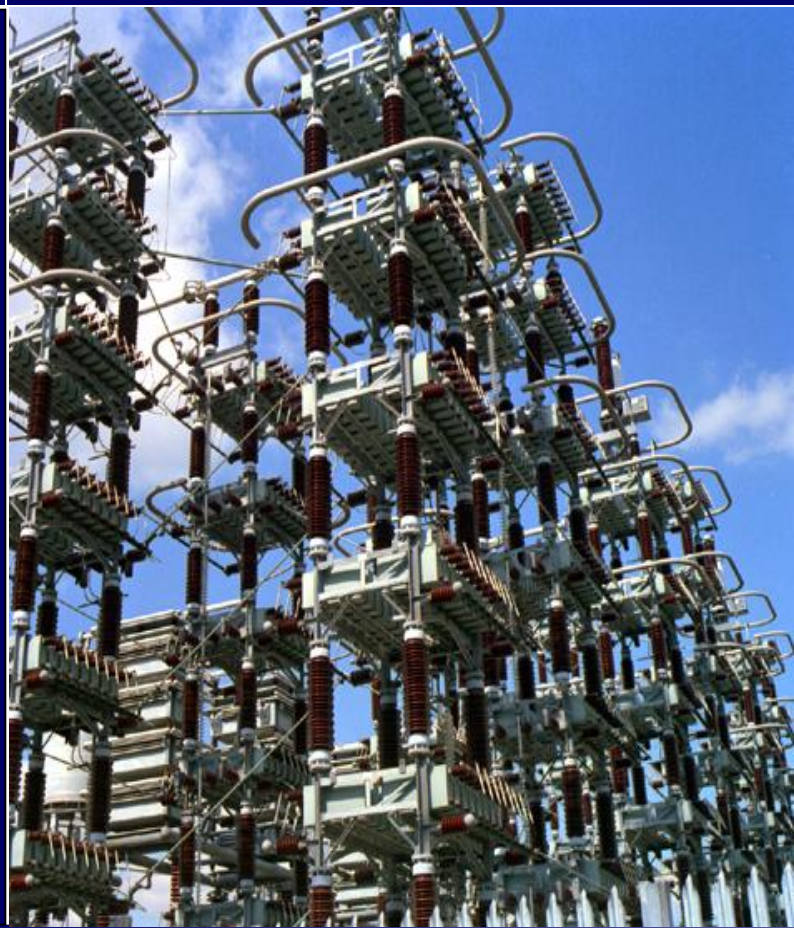
Herfindahl-Hirschman Index (HHI) becomes;

$$HHI = \sum q_i^2 = 0.4^2 + 0.2^2 + 0.25^2 + 0.15^2 = 0.285$$

- Example: in USA Federal Energy Regulatory Commission (FERC) imposes a regulation that;

  There should be no supply concentration above HHI = 0.1

Example



Competition

Remedies for Reducing Supply Concentration

Supply concentration may be reduced by;

- increasing the volume of divestiture from the company with supply concentration, i.e. by transferring plants to purchasers by specifying the price of long-term power sale from this plant to the regulated utility,
- limiting the percentage of ownership of the generating capacity in the market,
- limiting the mergers among the generating companies

Competition

Remedies for Reducing Supply Concentration

Supply concentration may be reduced by limiting the percentage of total generating capacity of a company by 5 % of the total capacity in a market

Exercising market power is more difficult for those companies with small market share

In small markets, however, total generation capacity of the market may be so small that even a moderate size plant, i.e. a plant with 500 MW capacity, may exceed the 5 % limit, hence it may be necessary to exemplify these companies from this condiiton

Competition

Relation between Market Size and Price of Plant

Price of a plant to be divested depends not only on its rating and capacity, but also on its market share

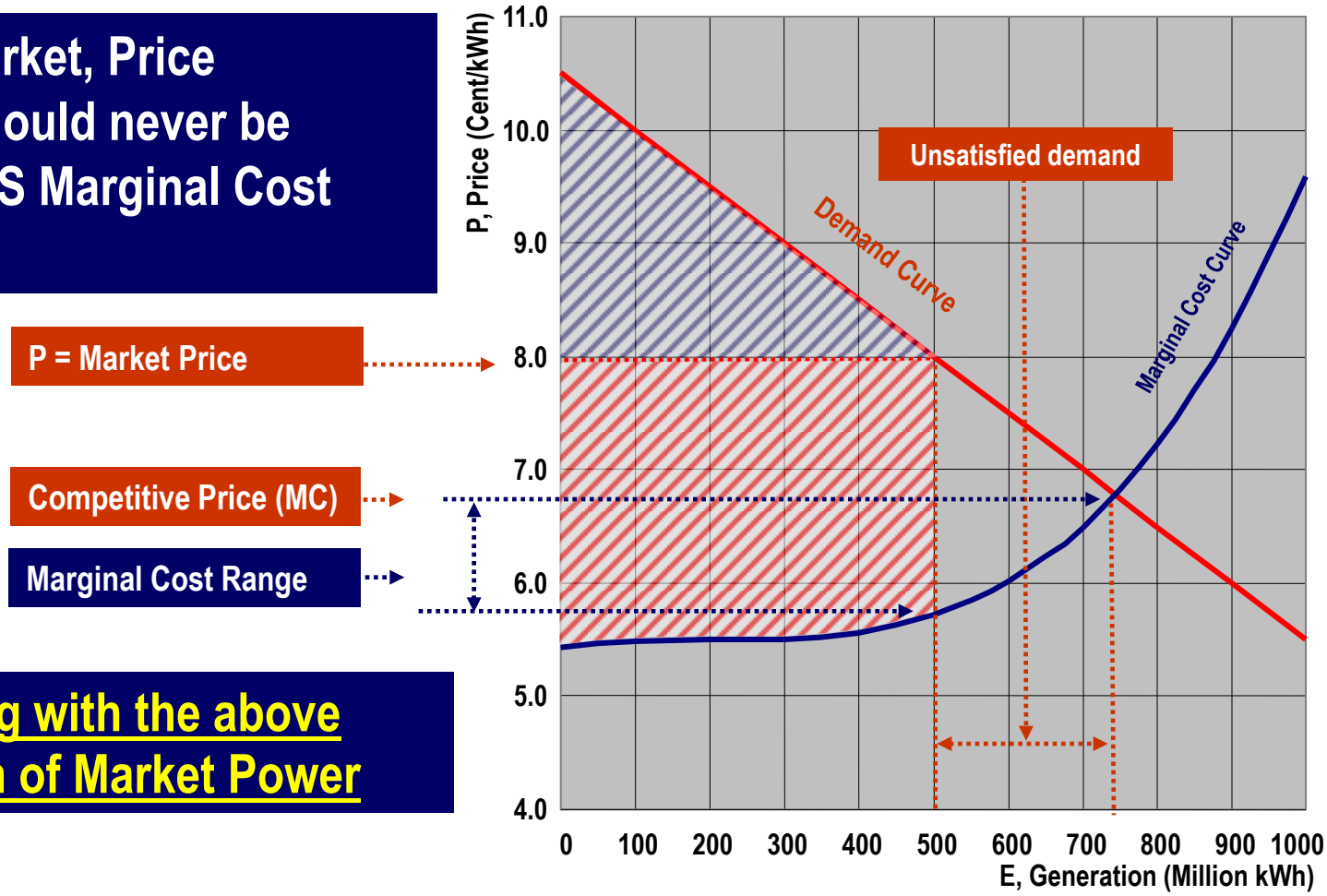
A plant with a higher market share will be more valuable than those with less, altough the other parameters are the same

Economies of scale may also force the parties in divesture procedure to exemplify the company from this upper limit and increase the market share in order to increase the operational efficiency and attain lower the prices, but this is a controversial issue with no clear answer

Competition

A Basic Rule

In a competitive market, Price (P=Market Price) should never be greater than the LHS Marginal Cost MC_{Left}



Any case conflicting with the above rule is an indication of Market Power

Competition

An Alternative Definition of Market Power

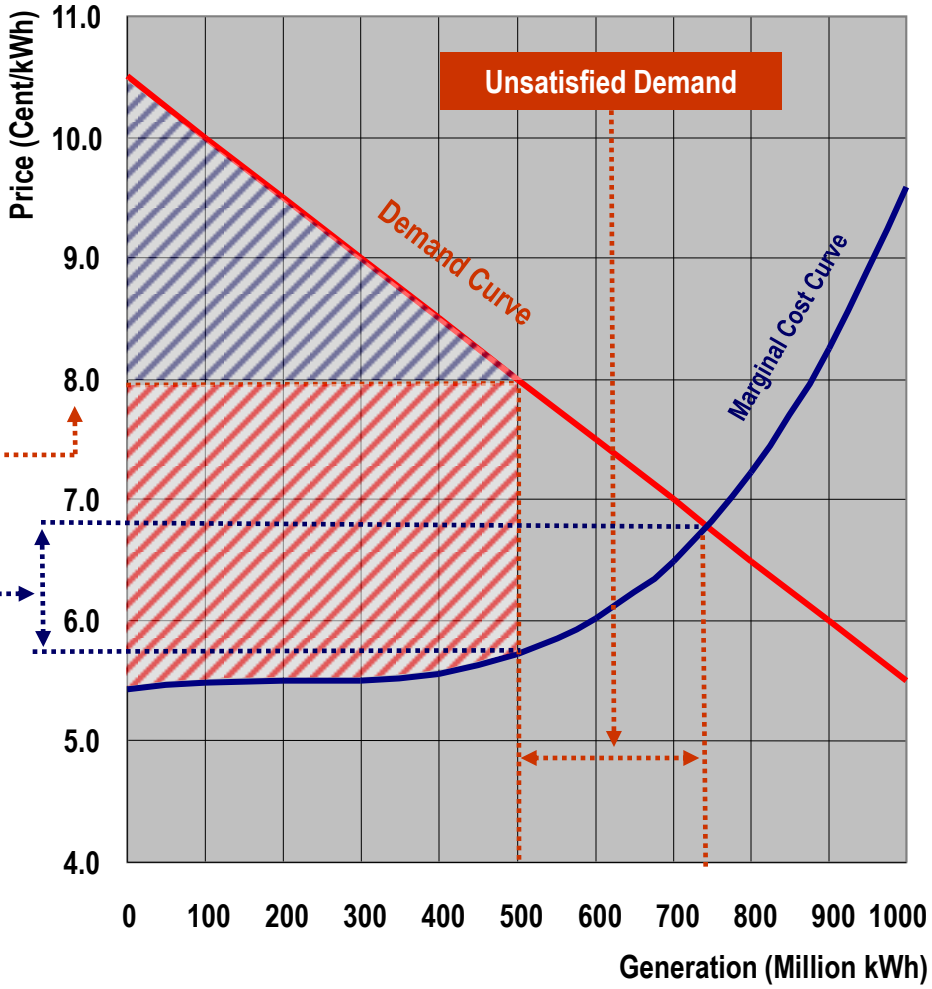
Definition

A market is said to have suppliers with market power, if the market price is higher than marginal cost found by intersecting the two curves

Market Price = 8.0 Cents/kWh

Competitive Price =6.8 Cents /kWh

Marginal Price Range



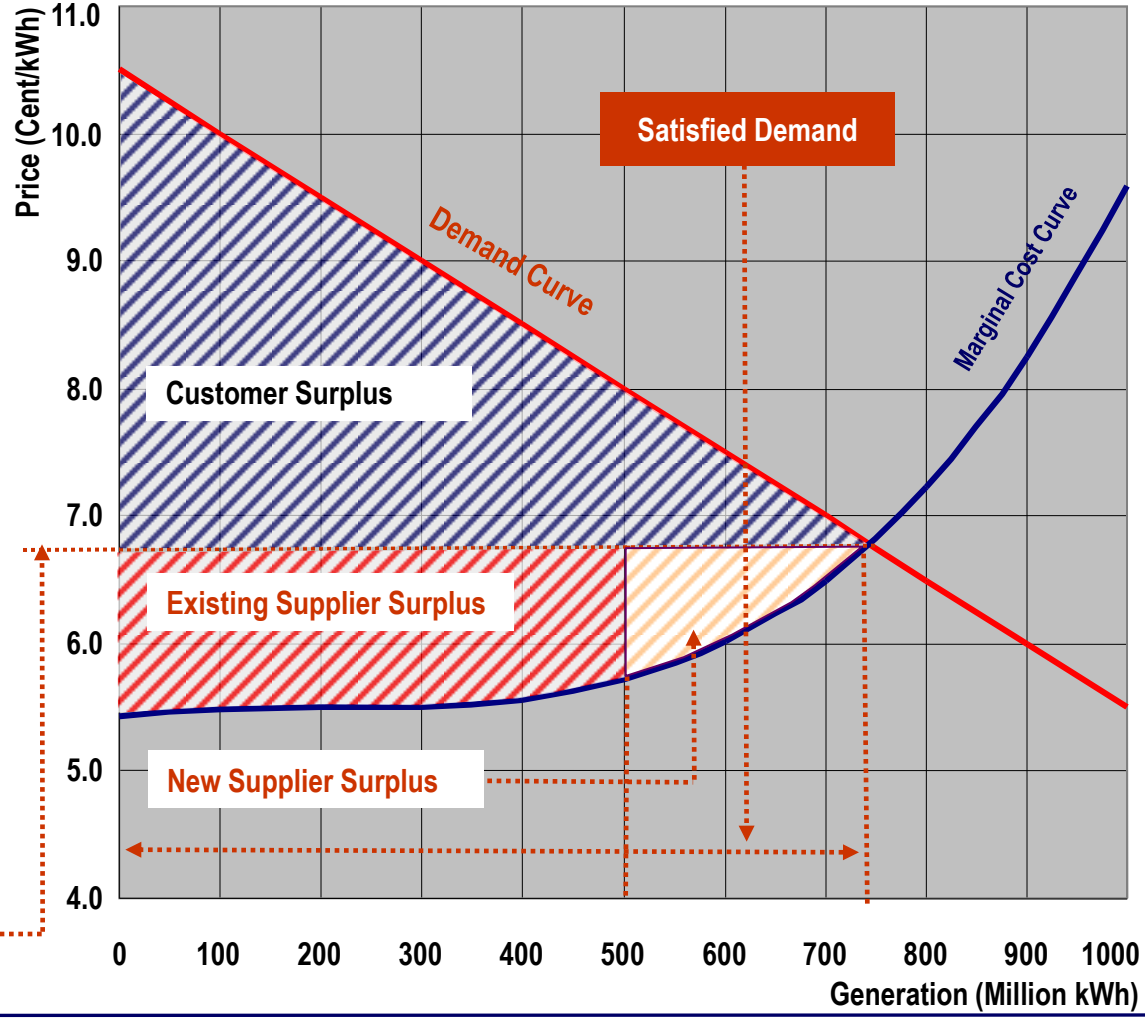
Competition

New Entry in Market (Full Competition)

New Entry in Market

With new entry,

- Demand is fully satisfied,
- Price falls down to competitive price level,
- Customer Surplus is reduced,
- Supplier Surplus is reduced,
- Existing and new suppliers share the surplus (Please note that the suppliers are "Price Taking" as the Competitive Price is not influenced by the entry of the new supplier



Competition

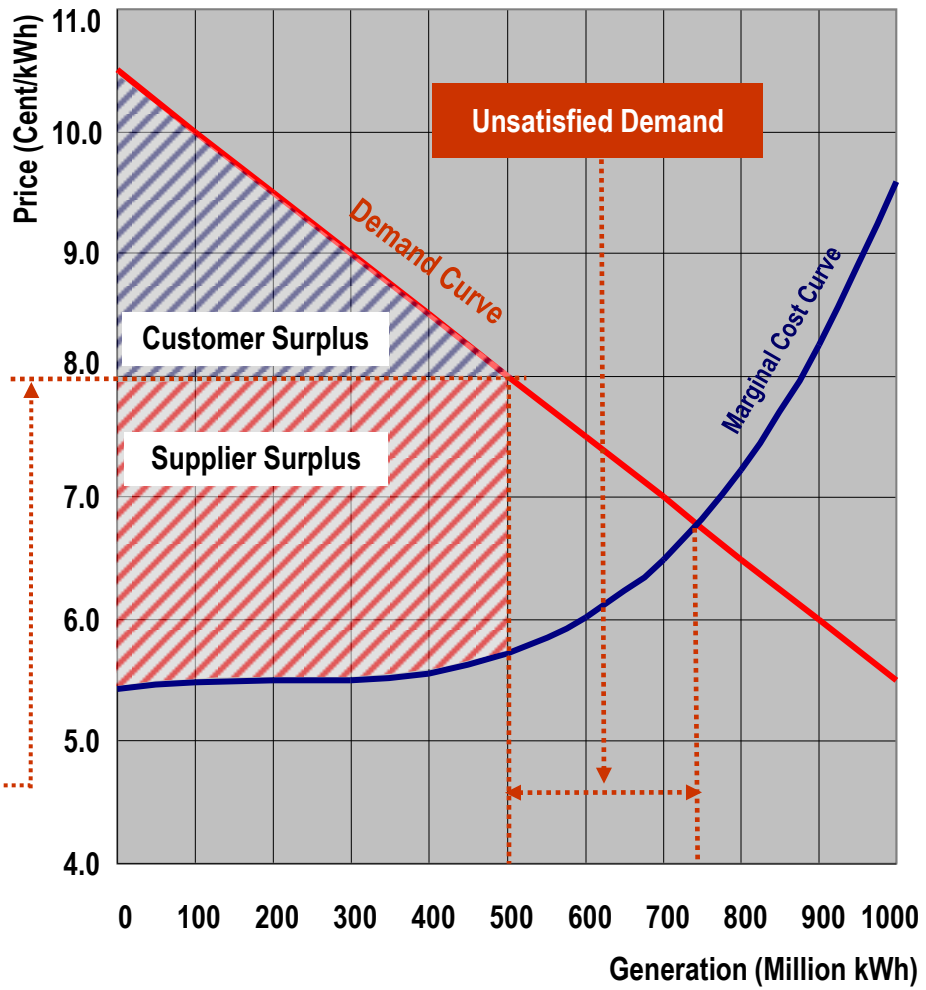
Exploitation of Market Power (Weak Competition)

Long-Run Economic Profit (LREP)

Please note that the supplier is "Price Determining"

LREP > 0

means that the market is not fully satisfied, i.e. supplier intentionally avoids satisfying the demand, hence the Long Run Equilibrium State has not yet been achieved



Competition

Exploitation of Market Power (Weak Competition)

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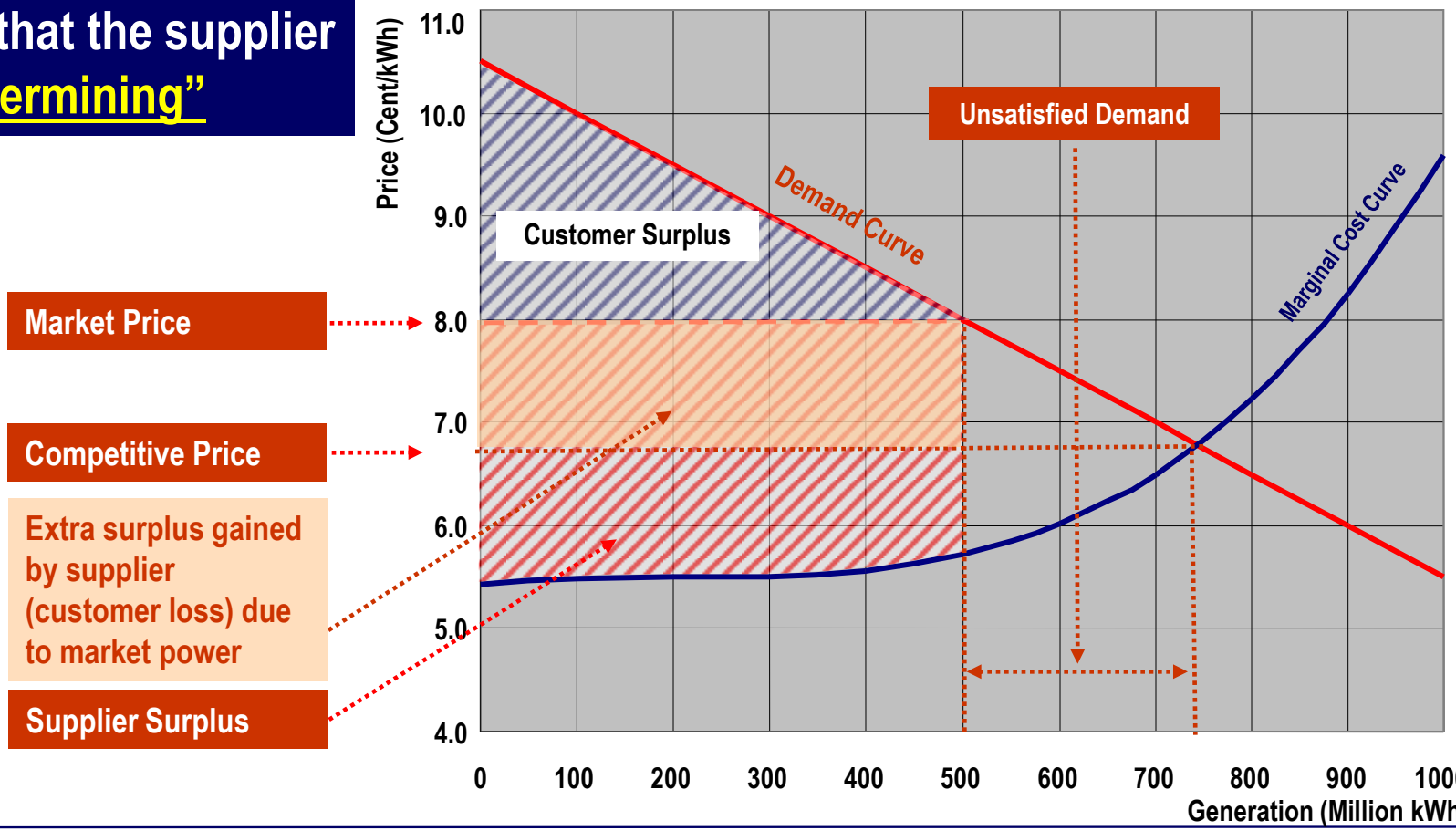


Competition

Remedy against Market Power
Turkish Electricity Market Law: 4628

Turkish Electricity Market Law: 4628
Section 2. Article 2.2

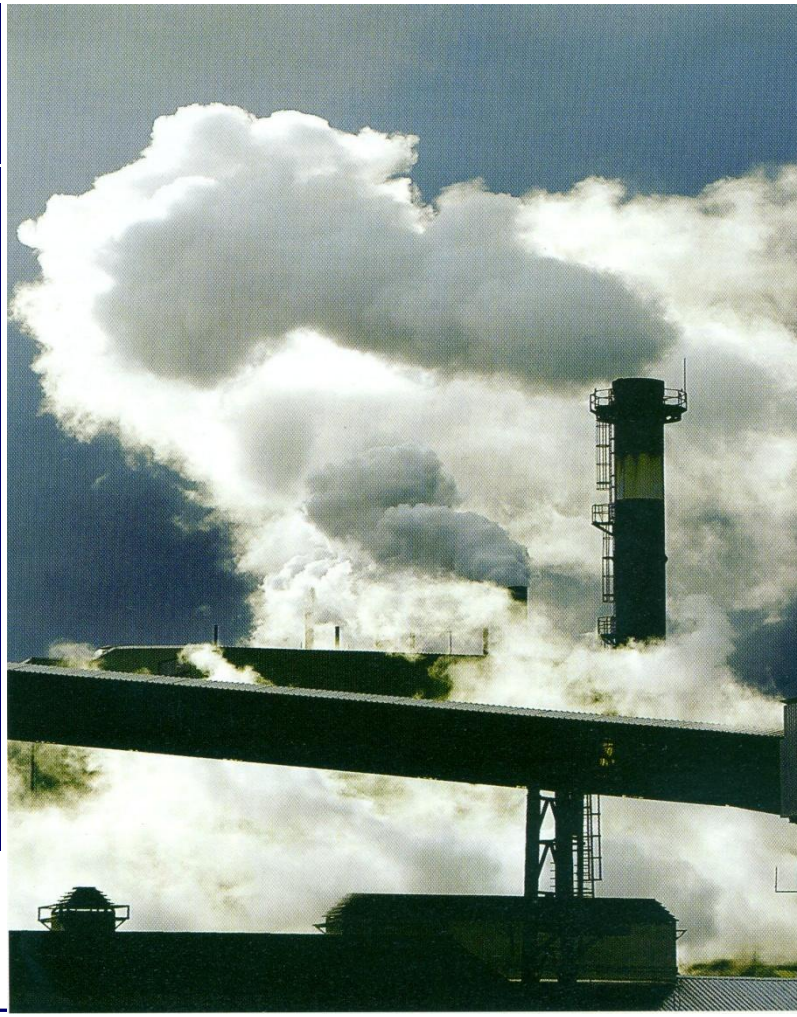
The total share a private sector generation company in the market through the generation facilities, which it operates together with its partnerships, cannot exceed the twenty percent of the Turkey total electricity energy installed capacity, which has been announced in the preceding year

Competition

Remedy against Market Power
Turkish Electricity Market Law: 4628

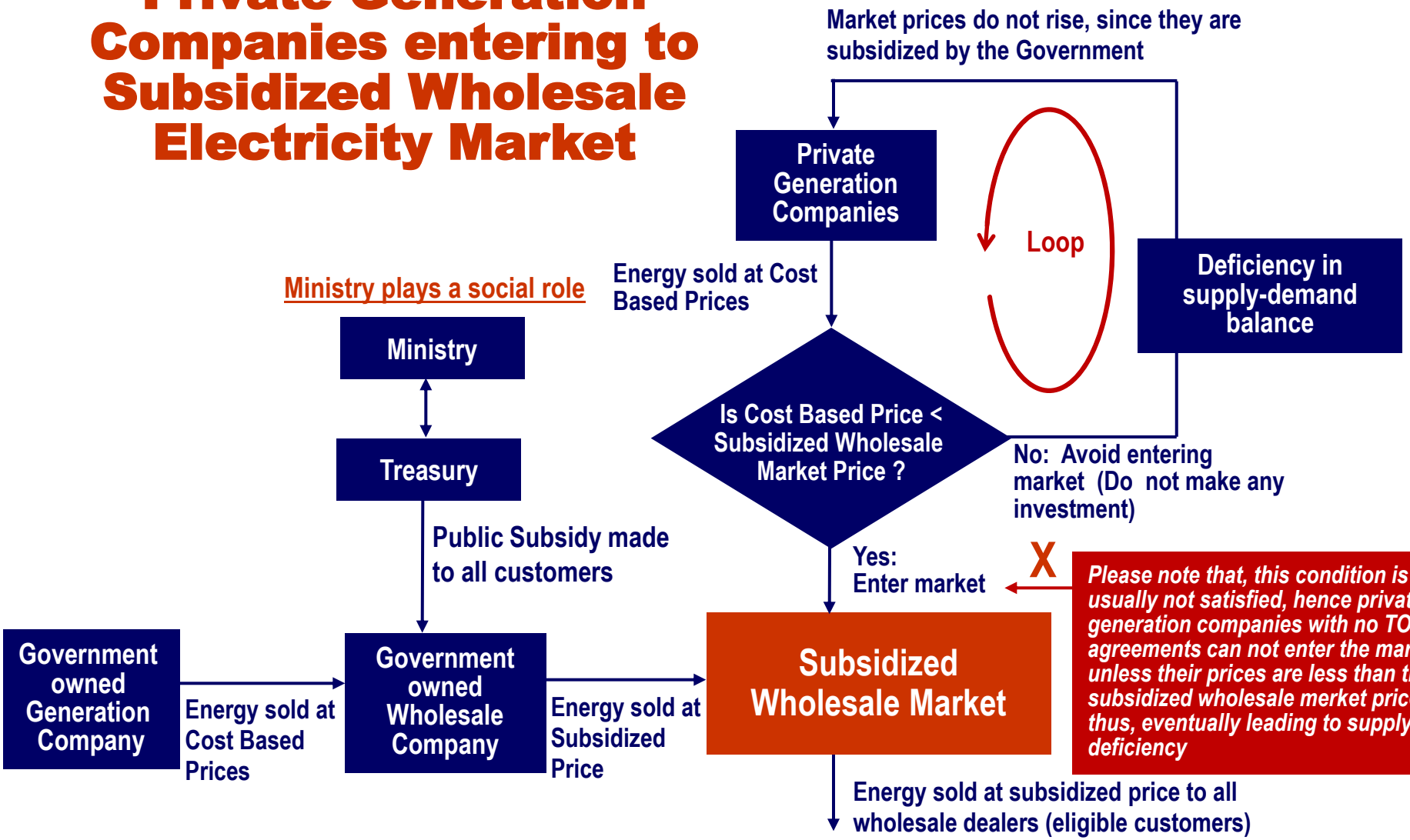
Turkish Electricity Market Law: 4628
Section 2. Article 3.3

In addition to regular distribution and retail trading activities, private sector distribution companies may be granted license for installing generation facilities within the region specified in their licenses, provided that their annual electrical energy generation does not exceed twenty percent of the total annual electricity energy supplied for consumption within their region in the preceding year



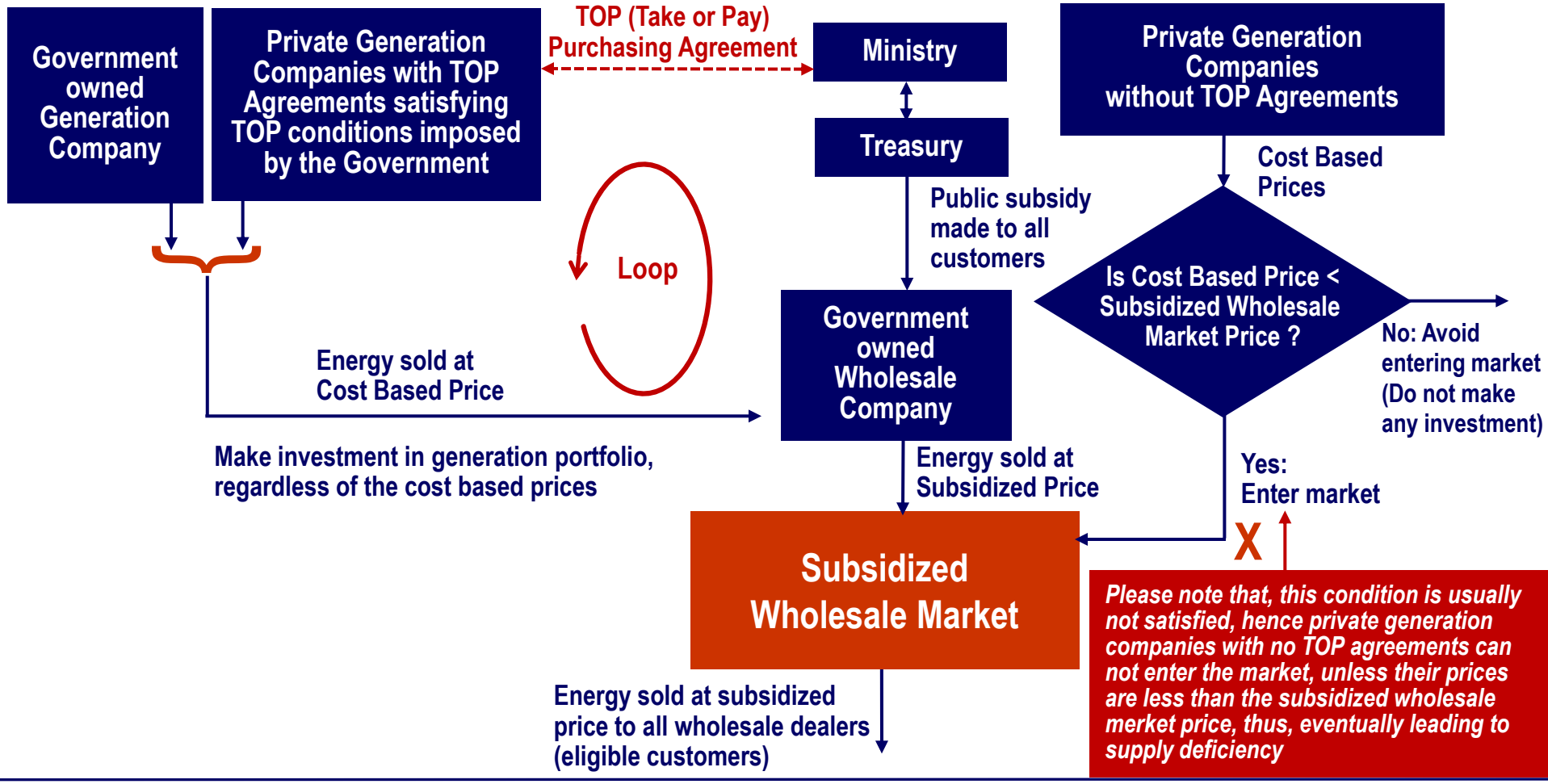
Competition

Private Generation Companies entering to Subsidized Wholesale Electricity Market



Competition

Wholesale Electricity Market with TOP (Take or Pay) Agreements



Competition

Competition-Based Wholesale Electricity Market (Cost Based Tariff Model)