

Power Market Development Workshop CPPA-G

DAY 4

Your Commodities Risk Management Partner

Benefit from **25 years** of experience in the commodity industry

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Market Reform

- Power market reform is a process, not an event
 - ~ Long-term process that requires patience to achieve the desired outcomes
 - ~ Tentative and incomplete process
 - ~ Works in progress
- Initial transition stage critical to success reform

Change Management

- **People**
- Does the organisation currently have resources with the knowledge and skill sets to take on the new tasks?
- If so, do those resources have bandwidth to take on the new tasks and continue to successfully execute existing tasks?

Change Management

- **Process**
- How are the organisation's processes managed?
- Are the processes built around tools, organisation, regions or something else?
- Are current processes efficient enough to continue using in the future-state or do they need complete reengineering?

Change Management

- **Technology**
- How is our system's architecture structured?
- Which systems might be impacted, and what is the scope of those impacts -
- Will vendor support be required
- Will we need to recode internally, etc.?

Managing the change process

- *Vision*
- Effective vision should be supported by a business case that considers
 - ~ Opportunity
 - ~ Desired outcome
 - ~ Impact and scope of change
- If difficulties are encountered, resist rolling back your vision simply to create a false sense of success
- Purpose of visioning is to set lofty goals, and then strive to achieve them

Managing the change process

- ***Leadership***
- A leader or change sponsor must be identified to support and reinforce change throughout the entire process, from planning to implementation
- ***Planning***
- Eliminating potential obstacles, such as internal politics, lack of empowerment, budget constraints, etc
- Develop a detailed timeline and work plan with both short- and long-term goals

Managing the change process

- *Communication*
- One of the biggest mistakes an organisation undergoing change can make is relying on the trickledown effect to communicate the upcoming change
- Create robust communication plan that includes the “Who, What, Where, When, and How” messages to be communicated
- This approach will accurately inform your people about what they must do for the change to be successful
 - ~ Influence behaviour

Managing the change process

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Managing the change process

- *Viability*
- Common oversight; forget to identify and prioritise project milestones by their impact on the bottom line
 - ~ 80% of an organisation's profitability is usually managed in the simplest form and receives the least attention
 - ~ Business contributing 20% of profitability often receives the bulk of the budget and attention
- To ensure economic viability throughout the change process, prioritise the areas that make money early on!

Managing the change process

- *Engagement*
- Throughout the change process, it is important to reach consensus among all who will be impacted by the change
- If there is disagreement, it is important to vet issues early on
- To ensure adequate engagement from resources throughout the organisation, identify and reward behaviours in line with desired changes and participation in the change process.

Managing the change process

- *Measurement*
- Create results metrics that define success and develop a way to monitor them
- Measurement is the process of systematically identifying and monitoring the most effective measures for tracking implementation and progress towards your desired business outcomes

Managing the change process

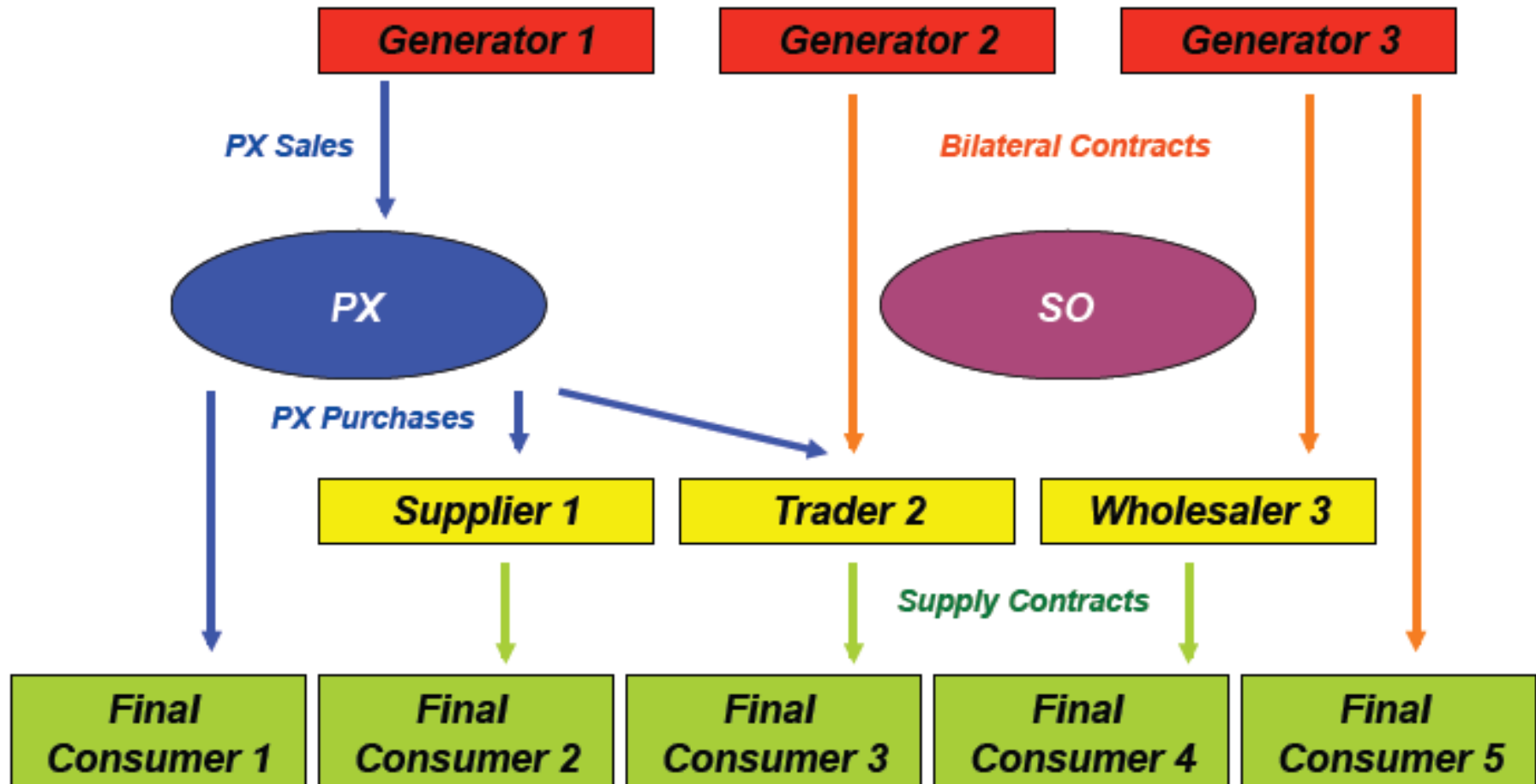
- *Going forward*
- Take the first step with your readiness plan in hand; then
- Be ready to adapt to obstacles you've anticipated
- For your own organisation, successful adaptation provides options and an advantage over less-adaptive competition
- Arming your organisation with a readiness plan and taking a structured approach to implementing changes will aid your organisation in weathering the next storm

Spot Market Models

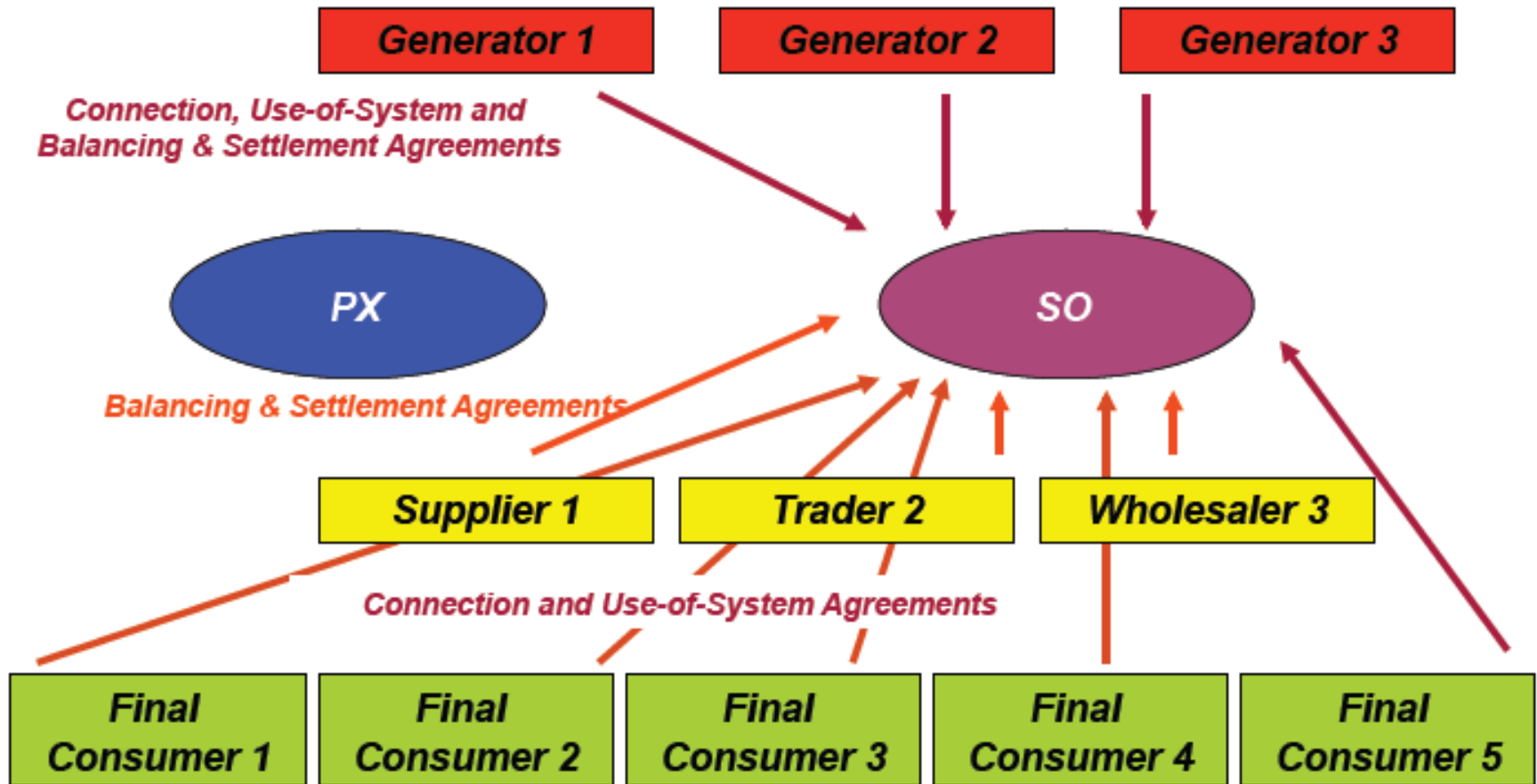
Roles Players

- *Deregulation doesn't change the way that electrons flow- only the money*
- System Operator - becomes a transport function
- “The Market”
 - ~ market assumes role of planner for realtime energy supplies as well as longer-term resource allocation and new plant addition.

Commercial Relationships



Physical Relationships



Roles Operators

Market operator (MO)

- Operate and/or facilitate the market
- Registration of market participants
- Receive bids/offers from market participants
- Market clearing
- Settlement and invoicing

System operator (SO)

- Operate or coordinate the system, ensure reliability and security
- Real-time dispatch to balance supply and demand
- Manage ancillary services to maintain system reliability
- Manage congestion

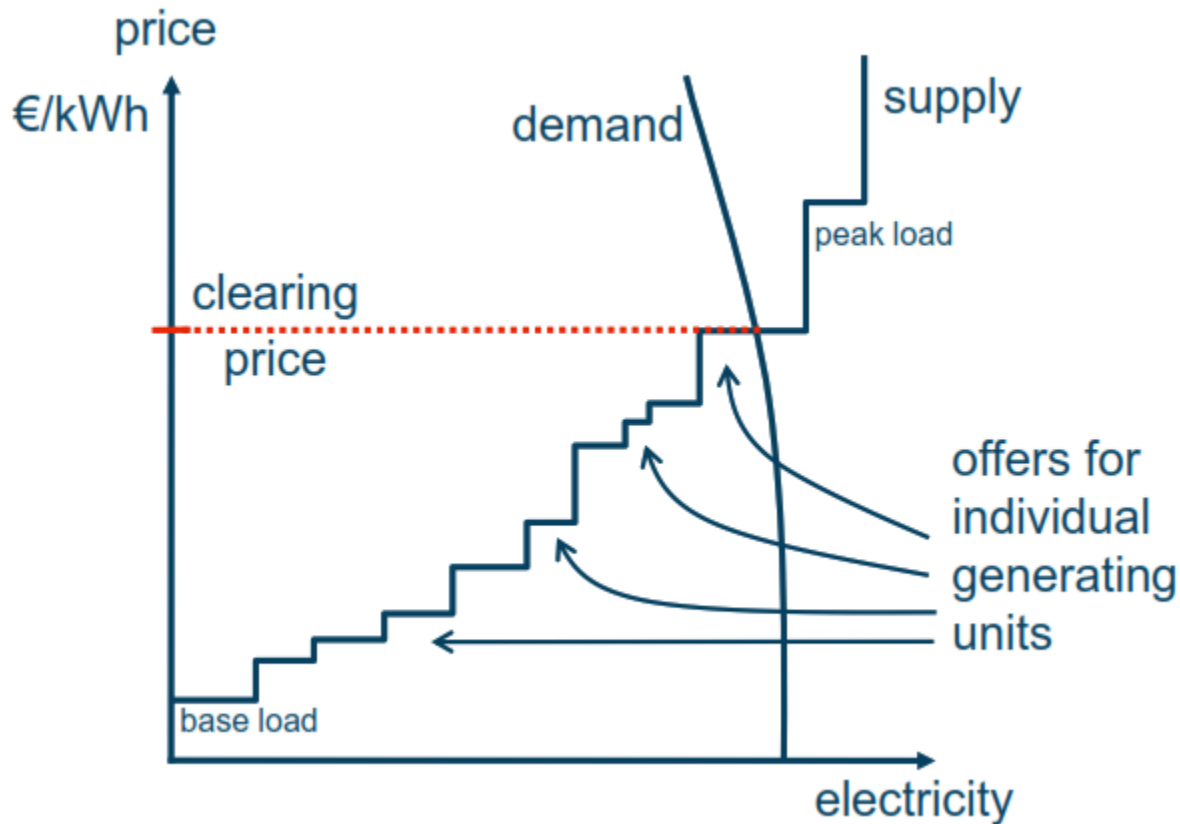
Transmission operator (TO)

- Plan, construct, maintain and own transmission lines

Vesting Contracts

- ◆ Established at privatisation or restructuring
 - Usually an obligation imposed by the regulator
- ◆ Make transition easier and less risky
 - Regulated price, which may be different from market conditions
 - Example: Transitory protection of high cost domestic fuel
- ◆ Reduce incentives for pool price manipulation
 - Since price manipulations can only affect the revenues for the non-contracted output
- ◆ Reduced over time to increase room for the market
 - For the market of contracts, since the spot market is not affected

Power Pool Price Setting



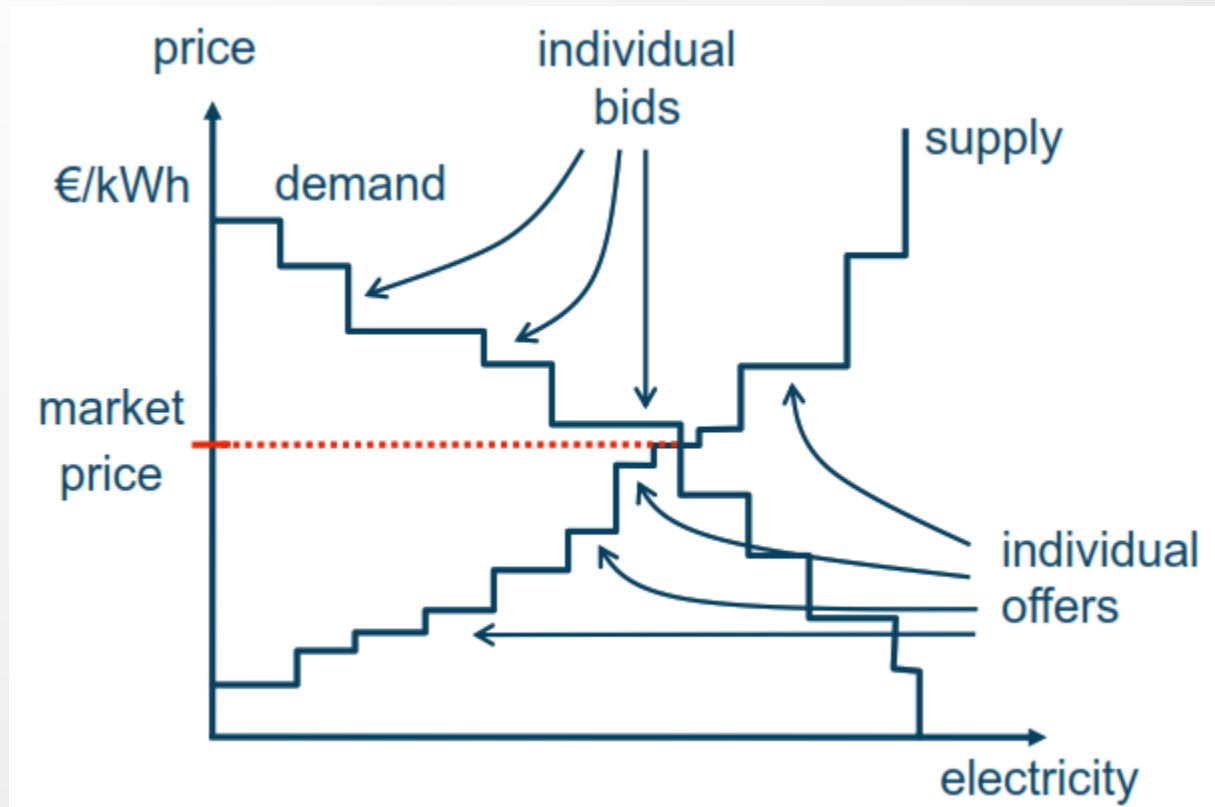
Contract for Differences

- The best known example of a risk hedging instrument are the CfD's
- Two way contract:
 - q amount of contracted energy
 - P_m spot price (pool price)
 - P_c contract price (strike price): the expected pool price
 - Option fee OF (risk premium), not needed in a CfD

	consumer	generator
<i>spot market (pool)</i>	$-q \cdot P_m$	$q \cdot P_m$
CfD for q at price P_c	$q \cdot (P_m - P_c)$	$q \cdot (P_c - P_m)$
total	$-q \cdot P_c$	$q \cdot P_c$

<the table shows directly the amount received by each agent.>

Power Exchange Price Setting



Case Study Power Market Reform Nigeria

State of the Nigerian Electricity System

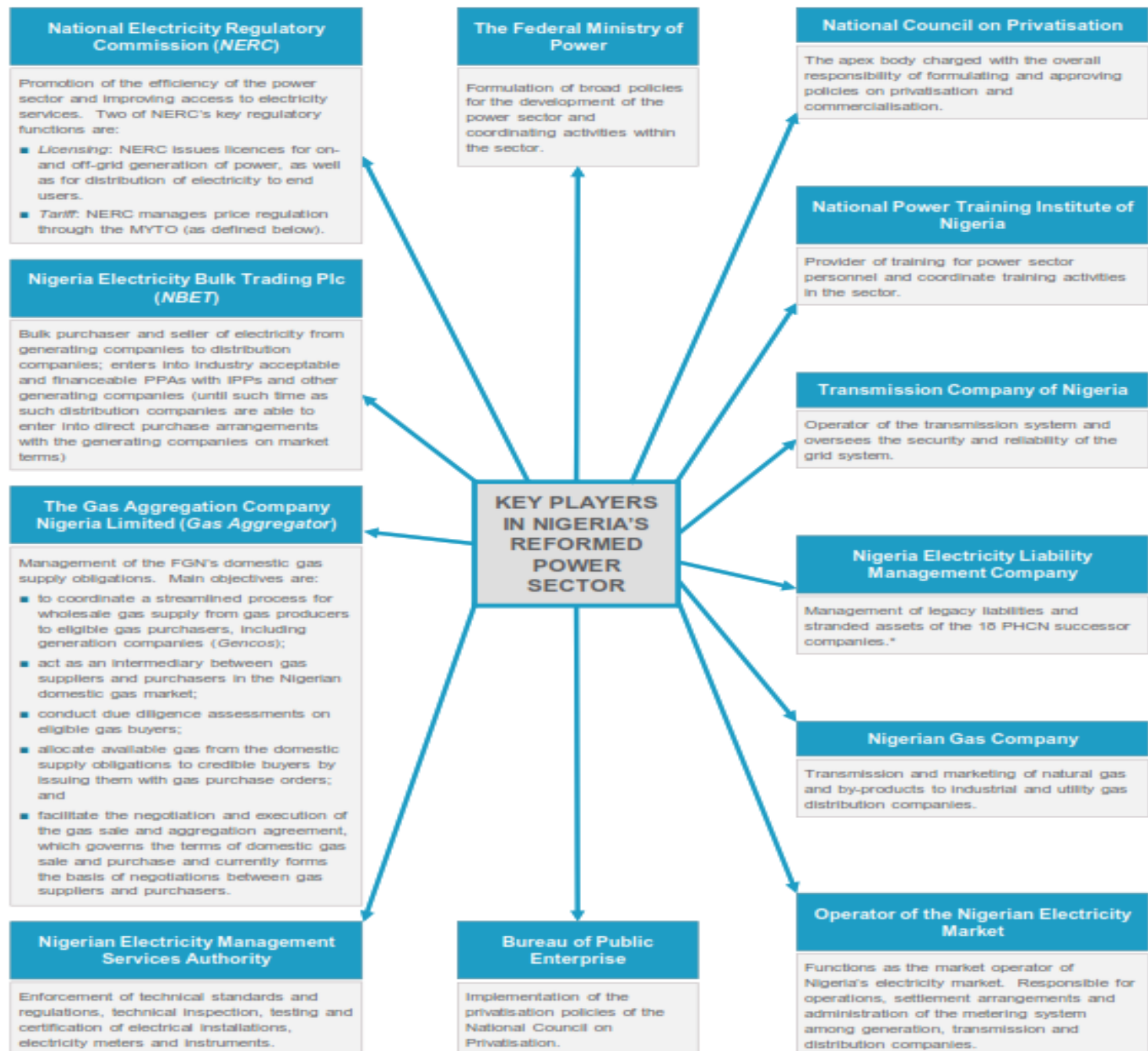
- Population of 155 million people
- Approximately 7,000 MW of installed capacity, but only 3,500 MW of available capacity
- 40% of the country connected to the grid
- Connected population experiences power problems 60% of the time
- Goal of 28,000 MW of generation by 2020

Nigeria Power Reform

- Electric Power Sector Reform Act of 2005
- Transition of national electric utility to
 - 11 distribution companies
 - 6 generating companies
 - transmission company
- Most of the \$2.6 billion privatization proceeds devoted to the settlement of staff benefits

Market Transition Challenges

- Distribution companies have new investors with little experience in the Nigerian market
- Distribution companies have not developed credit worthiness
- Poor capacity factor on existing generation
- Inadequate and unreliable transmission capacity



Key Players In Nigeria's Reformed Power Sector¹⁷

Key Players	Function
The Federal Ministry of Power	Formulate broad policies for developing the power sector, and coordinate activities within the sector.
National Electricity Regulatory Commission (NERC)	<ul style="list-style-type: none"> Promote power sector efficiency and improve access to electricity services. Two of NERC's key regulatory functions are: Licensing: NERC issues licenses for on- and off-grid generation of power, as well as for distribution of electricity to end users. Tariff: NERC manages price regulation through the MYTO (as defined below).
Nigeria Electricity Bulk Trading Plc (NBET)	Bulk purchaser and seller of electricity from generating companies to distribution companies; enters into industry acceptable and financeable PPAs with IPPs and other generating companies (until such distribution companies can enter into direct purchase arrangements with the generating companies on market terms) ¹⁸ .
The Gas Aggregation Company Nigeria Limited (Gas Aggregator)	<p>Manage the FGN's domestic gas supply obligations. Main objectives are:</p> <ul style="list-style-type: none"> To coordinate a streamlined process for wholesale gas supply from gas producers to eligible gas purchasers, including generation companies (Gencos) Act as an intermediary between gas suppliers and purchasers in the Nigerian domestic gas market Conduct due diligence assessments on eligible gas buyers Allocate available gas from the domestic supply obligations to credible buyers by issuing such buyers with gas purchase orders Facilitate the negotiation and execution of the gas sale and aggregation agreement, which governs the terms of domestic gas sale and purchase, and currently forms the basis of negotiations between gas suppliers and purchasers
Nigerian Electricity Management Services Authority	Enforce technical standards and regulations, technical inspection, testing and certification of electrical installations, electricity meters and instruments.
National Power Training Institute of Nigeria	Provide training for power sector personnel and coordinate training activities in the sector.

Key Players In Nigeria's Reformed Power Sector¹⁷

Key Players	Function
Bureau of Public Enterprises	Implement the privatization policies of the National Council on Privatization.
National Council on Privatization	The apex body charged with the overall responsibility of formulating and approving policies on privatization and commercialization.
Transmission Company of Nigeria	Operate the transmission system and oversee the security and reliability of the grid system.
Nigeria Electricity Liability Management Company	Manage legacy liabilities and stranded assets of the 18 PHCN successor companies.
Nigerian Gas Company	Transmit and market natural gas and by-products to industrial and utility gas distribution companies.
Operator of the Nigerian Electricity Market	Functions as the market operator of Nigeria's electricity market. Responsible for operations, settlement arrangements and administration of the metering system among generation, transmission and distribution companies.

Multi-Year Tariff Order

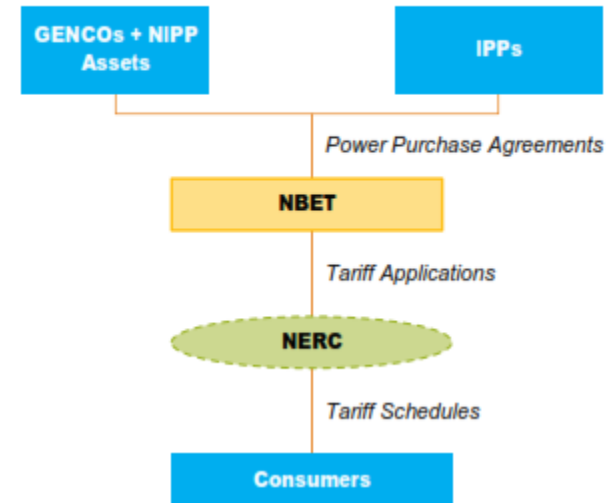
- First introduced in 2008
- Current incarnation known as MYTO II
- Provides a 15 year tariff path for the electricity industry
- Utilizes building block methodology
 - Return on capital
 - Return of capital (depreciation)
 - Operating expenditures
- Combines historical cost of service data with forward-looking incentives for efficiency improvement

Nigerian Pricing Dynamics

Regulatory Landscape

- The Nigerian Electricity Regulatory Commission ("**NERC**") sets electricity tariffs in consultation with key industry stakeholders, including generators, distributors, and consumer representatives
- Single buyer market model with the Nigerian Bulk Electricity Trading Company ("**NBET**") buying electricity from all generators and then reselling to eleven distribution companies
- The Transmission Company of Nigeria ("**TCN**") is responsible for transmitting all electricity in the country
- Tariff applications are approved by NERC following submissions by IPPs

Tariff Determination



Electricity Pricing: Key Drivers and Restraints

- Key Electricity Pricing Drivers:
 - MYTO with periodic reviews
 - Rising gas prices
 - Incentive based regulation
- Key Electricity Pricing Restraints:
 - Government interference in tariff setting
 - MYTO Methodology

Energy Charges Per End User Segment

	Consumption Charge (USc/kWh)	Fixed Charge (USc)
Residential	6.84	-
Industrial	10.78	-
Commercial	6.83	-
Other	-	-

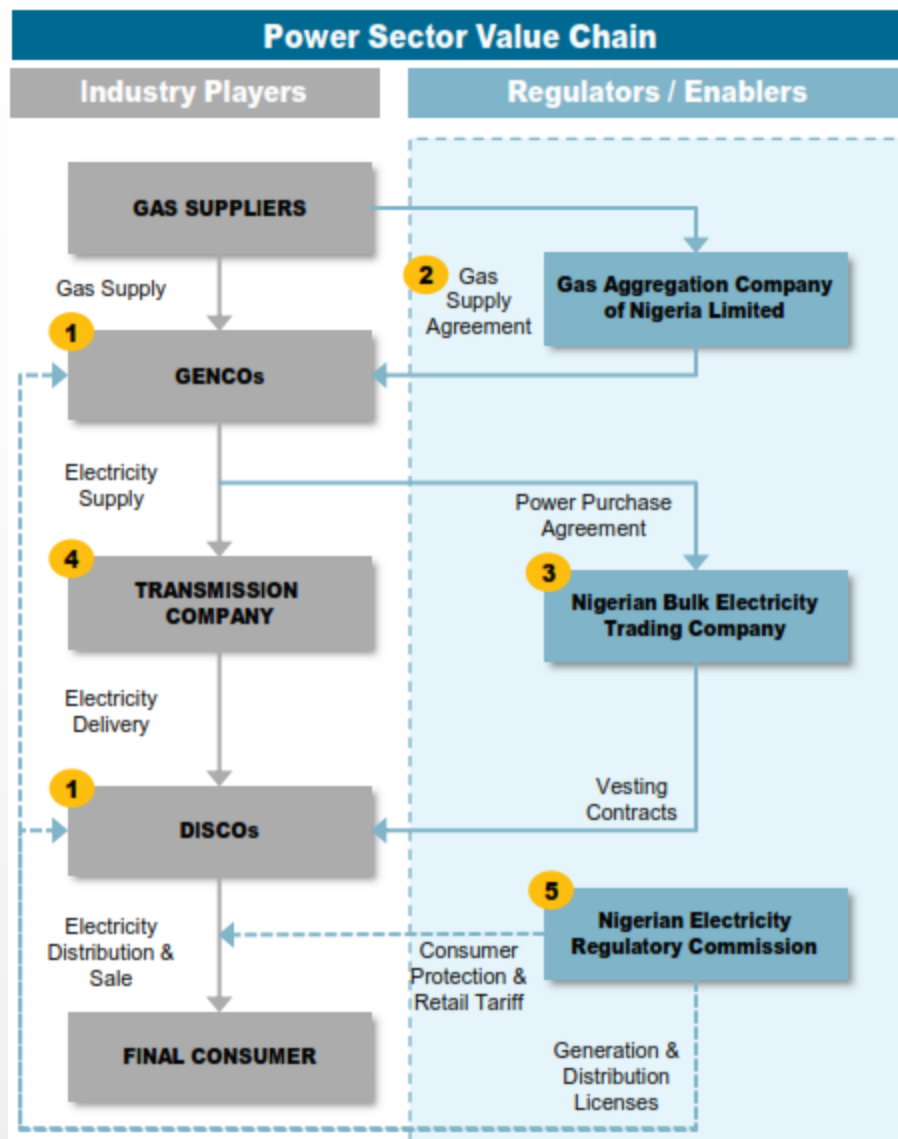
Transmission Company of Nigeria

- Currently under a 3 year management contract with Manitoba Hydro International
 - Manage system
 - Provide training to TCN staff
- Transition to ring-fenced Transmission Service Provider, Market Operator, and System Operator

Nigerian Bulk Electricity Trading PLC

- Responsible for buying power from IPPs and reselling to distribution companies and large consumers
- Not the sole authorized buyer – goal is to eventually phase out purchase responsibilities
- Empowered to enter into PPAs

Key Features Privatization



Key Arrangements	
1 Concession/ Share Sale Agreement	<ul style="list-style-type: none"> For the two hydroelectric power plants the Government entered into concession agreements with the successful bidders of the assets For the four thermal plants and the DISCOs the Government entered into share sale agreements with the successful bidders of the assets
2 Gas Supply Agreement	<ul style="list-style-type: none"> The Gas Aggregation Company of Nigeria ("GACNL") acts as a buyer intermediary and mitigates fuel risk by buying gas from gas producers and then re-selling to the GENCOS The thermal GENCOS are required to assume take-or-pay risk for fuel supply under their gas sale and purchase arrangements
3 Power Purchase Agreement/ Vesting Contracts	<ul style="list-style-type: none"> The Nigerian Bulk Electricity Trading Company ("NBET") buys all power generated by the GENCOS and then resells the power on an allocated basis to various DISCOs under individual but standard Vesting Contracts (existing PPAs between the distribution companies and the PHCN prior to privatisation)
4 Transmission Company	<ul style="list-style-type: none"> The TCN which is the monopoly transmission provider remains fully Government owned but full management of the TCN has been sub-contracted to a private sector entity under a management contract
5 NERC & Tariffs	<ul style="list-style-type: none"> The Nigeria Electricity Regulatory Commission ("NERC") issues licenses to the GENCOS and the DISCOs The NERC also determines and regulates the tariff to be paid to the GENCOS, the Transmission and Use of System ("TUOS") charges paid to the TCN as well as the retail tariffs paid to the DISCOs The tariff paths are outlined in the Nigerian Multi Year Tariff Order ("MYTO") which is a forward looking tariff plan for the electricity sector Over the last 10 years, the NERC has issued two tariff plans: MYTO 1 (2008 – 2012) and MYTO 2 (2012 – 2017) MYTO is reviewed bi-annually and variations effected thereto

Lessons to be learned

Despite the privatisation in 2013, Nigeria's electricity generation capacity has declined from the peak generation level of 4,517 MWs recorded in 2012 to a low of 3670 MW recorded in 2014

Key Challenges	
MYTO Model and Tariffs	<ul style="list-style-type: none"> Tariffs were driven by the MYTO model which was based on underestimated ATC&C losses. This led to: <ul style="list-style-type: none"> Inadequate revenue realised by DISCOs; The perception that bidders had perhaps overpaid for the assets; and Debt overhang as the borrowers struggled to service the debt
Limited Long Term Funding	<ul style="list-style-type: none"> Nigerian banks provided 70% of the funds required to pay for the purchase price for the generating and distribution assets Acquisition debt financing was provided at only short tenors ranging between 5 – 7 years There was little interest from the International debt market out of concern for tight bidding timeline and uncertainty around bankability issues
Inadequate Guarantee For Downside Risks for GENCOs	<ul style="list-style-type: none"> Lack of comfort that the Bulk Trader was sufficiently capitalised to guarantee payments to the GENCOs Situation has changed though with the injection of US\$700m from the World Bank and \$182m AfDB Partial Risk Guarantees
Lack of Clear Strategy for Solving Transmission Issues	<ul style="list-style-type: none"> The transmission system is potentially the weakest link in the chain and bottlenecks remain unresolved The Government is yet to outline plans to resolve the issues of transmission Capital requirements for the TCN are significant
GAS Supply	<ul style="list-style-type: none"> The power sector is inextricably linked to the gas market as Nigeria possesses the world's ninth largest gas reserves Theft and vandalism remain rife and have led to lost gas and lack of feedstock for new plants The Government has responded by adopting the gas master plan to reduce flaring (which has halved over the past 5 years)
NIPP	<ul style="list-style-type: none"> Delays from legal disputes over acquisition/bid results Stage of completion of assets Absence of gas supply evacuation infrastructure

Competitive Bidding

Competitive Bidding

- Request for Proposal/ Request for Qualification
- Identifying qualified vendors
- Timing of solicitation process
- Drafting RFP/RFQ
- Follow up Procedures

Competitive Bidding

Activity	Estimated Timeframe
Drafting The RFP/RFQ	Week 1-12
Identifying Qualified Vendors and Publicizing the Solicitation	Week 13-14
Release the RFP/RFQ	Week 15
Obtaining Notice of Intent to Respond	Week 17
Holding a Pre-Proposal Conference	Week 18
Proposer Responses Due	Week 20
Evaluating Responses	Week 21 - 24
Requesting Additional Information	Week 22
Notifying Short Listed Proposers	Week 23
Preparing and Conducting the Interviews	Week 24
Selecting a Vendor	Week 25
* Negotiating a Contract	Week 25-33
Drafting a Contract	Week 34-39

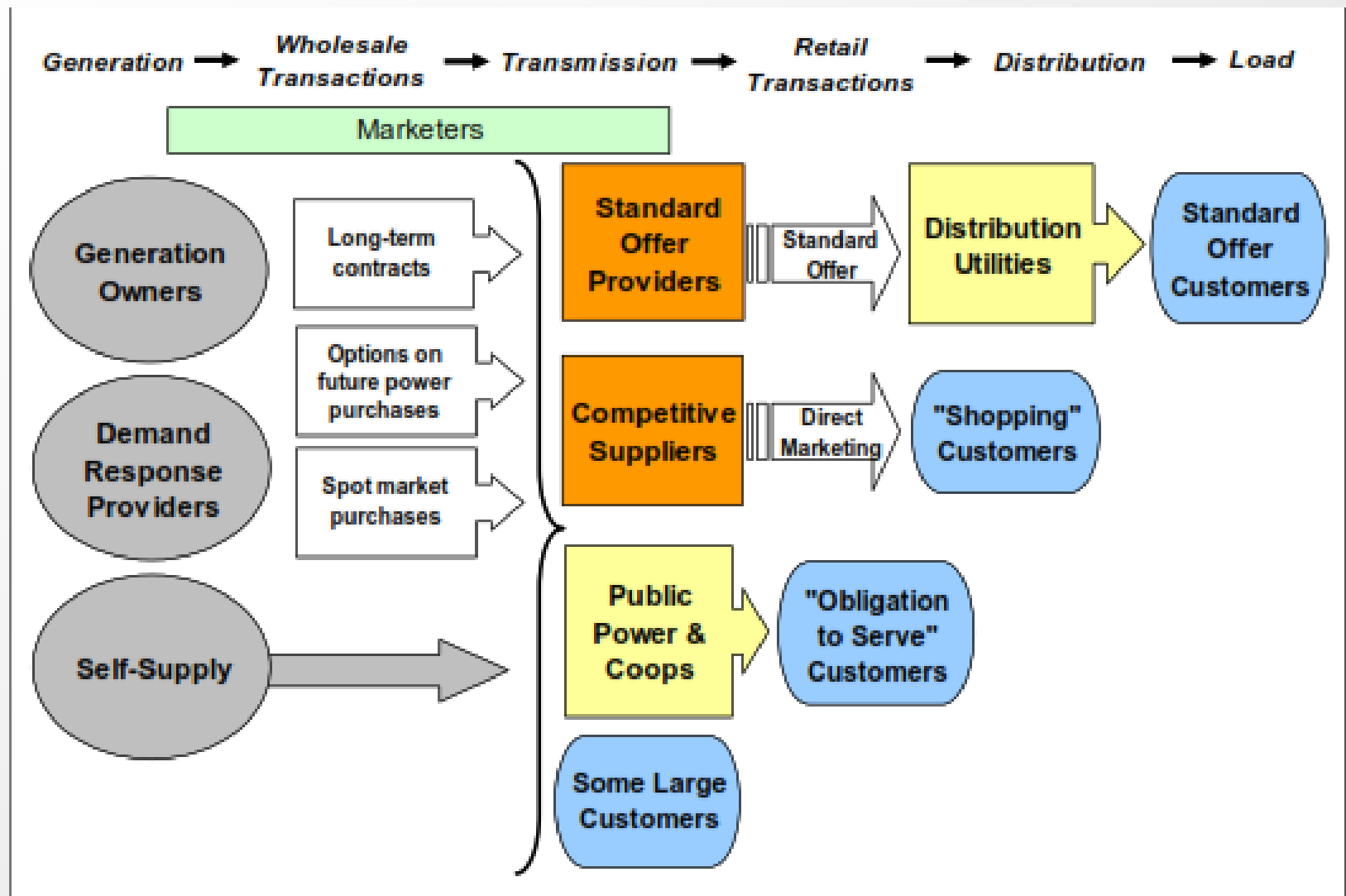
Competitive Bidding Negotiation Tips

- understand your assets as a potential customer (size of load, strategic load for market entry, attractive load profile, long term potential customer, etc.);
- know each supplier's target markets and historical marketing strategies so you can obtain assurance your interest will be a high priority;
- find out what issues are negotiable with the supplier;
- collect market information on offerings to comparable organizations; and
- identify areas where your organization has flexibility (term, qualifications, price, etc.)

Bilateral Contracts

Case Study EFET Standard Contract

Various Contracting Options



Bilateral Contracts; EFET standard

- ❑ General Agreement (GA) governing Individual Contracts (ICs)
- ❑ GA customisation through the Election Sheet (ES)
- ❑ IC could be:
 - Fixed price
 - Floating price
 - Call Option
 - Put Option
- ❑ ICs confirmed through a Confirmation of Individual Contract (CIC)
- ❑ Cross Border Annex (jurisdiction and taxation issues)

Case: spot trading



Producing a sample bid on the spot market

- A generator has two generating units
- **Unit 1**
 - ~ $P_{\max} = 500 \text{ MW}$
 - ~ Variable Cost = 25 Euro/ MWh
- **Unit 2**
 - ~ $P_{\max} = 1000 \text{ MW}$
 - ~ Variable Cost = 15 Euro/ MWh

The Generator

- The Generator has to cover a demand of 600 MW
- The Generator has a load management possibility of 100 MW when the purchase price is more than 29 Euro /MWh.
- The Generator has a sale contract with a fixed volume of 350 MW at a price of 28 Euro/MWh

The Generator

Two purchase contracts

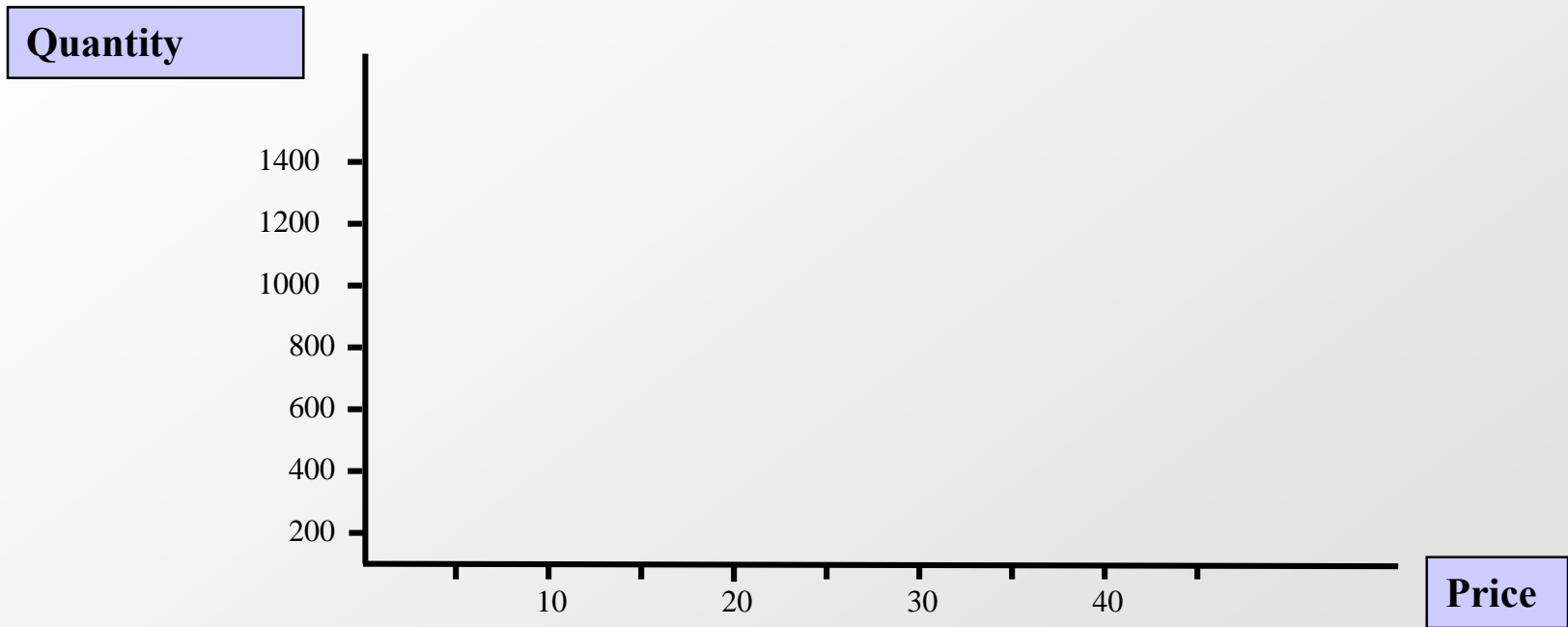
- One with a volume of 100 MW (option) at a price of 20 Euro/ MWh. At 8h00 he has to define whether he wants to use the option or not.
- Another with a volume between 0 - 200 MW and a price of 20 Euro/ MWh. The Generator has to define at 12h00 how much quantity he will buy.

The prices on the spot market are known at 11h00.

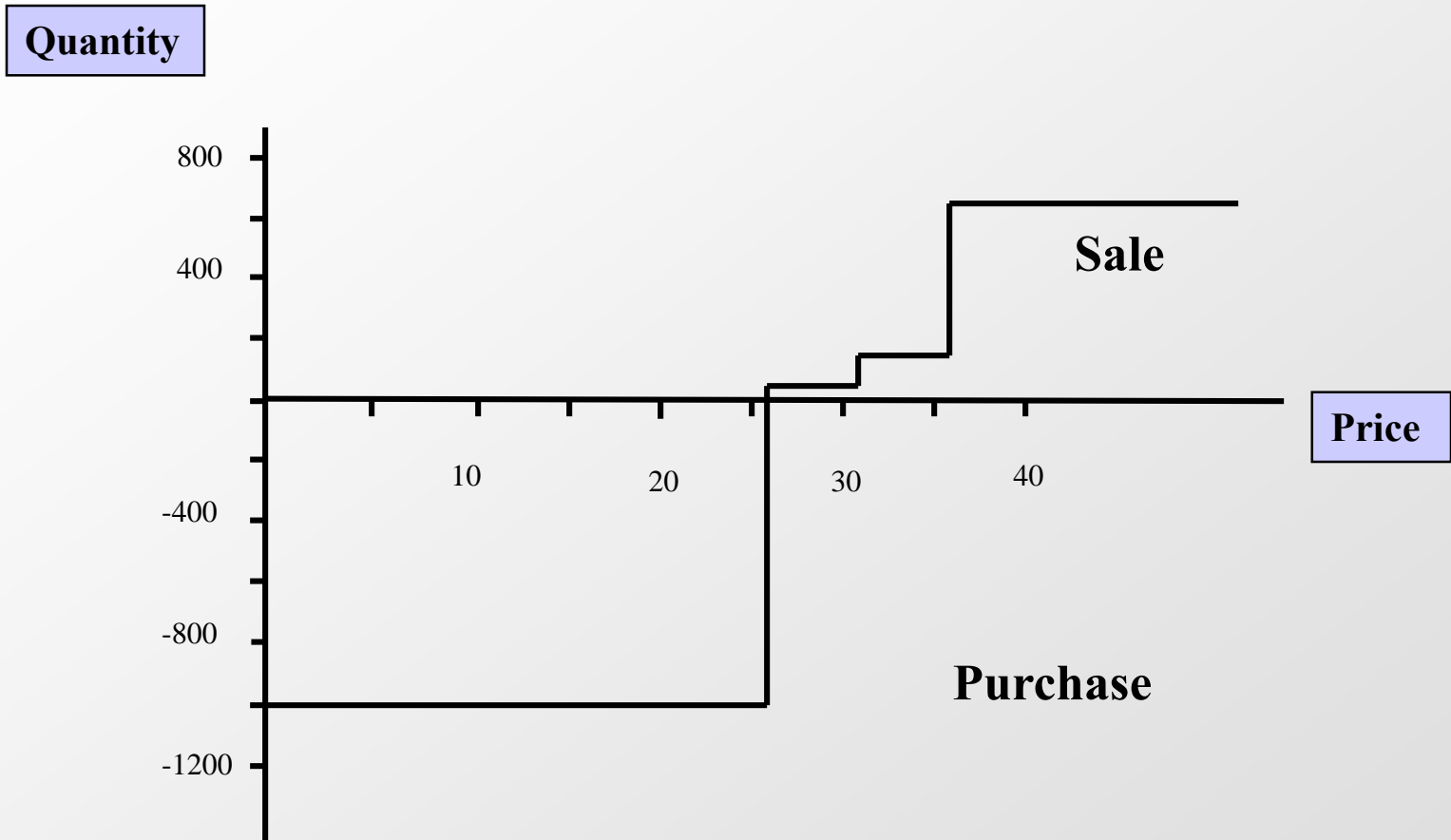
Tools

- 1) Put each position of the portfolio in a price (x) / quantity (y) curve, either as a supply position or as a demand -position.
- 2) So, construct two curves: supply curve and a demand curve.
- 3) Then calculate the difference between the demand and supply curve.
- 4) The result defines the quantity the Generator wants to buy or sell at the spot market for what price.

Example

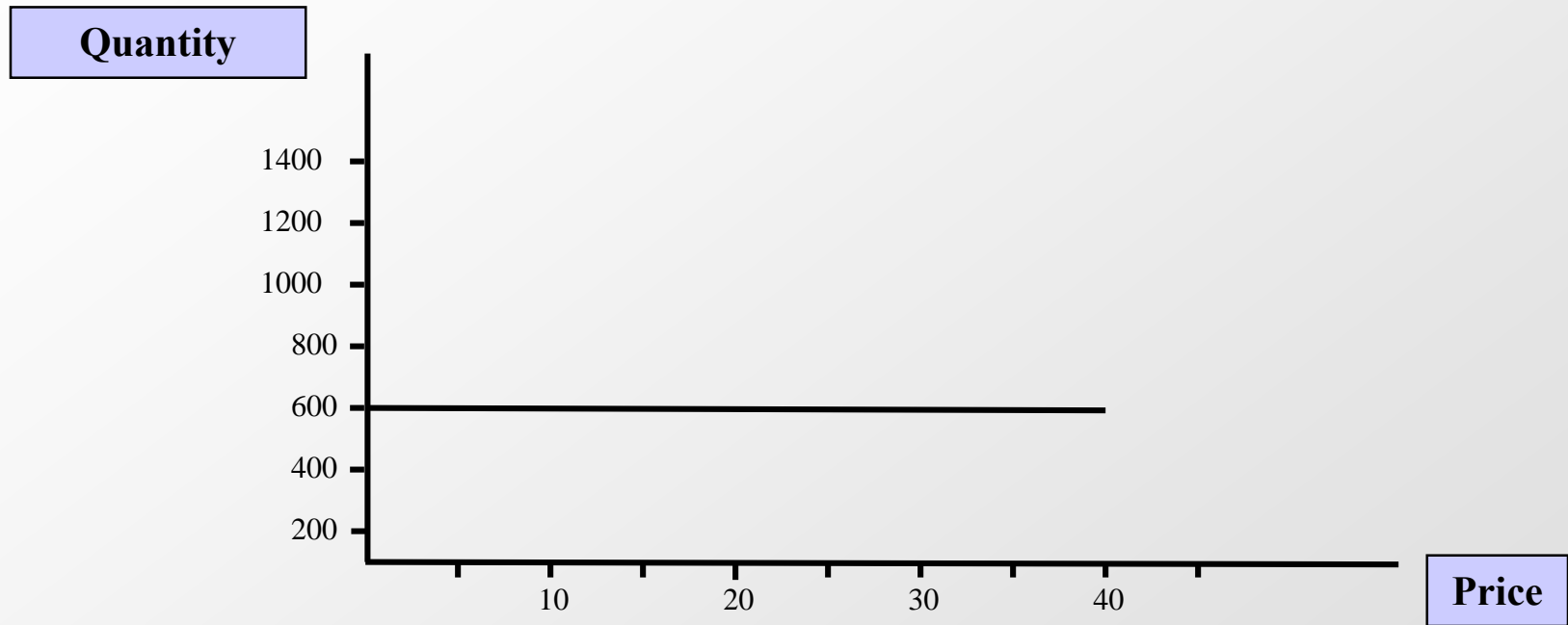


Example 2



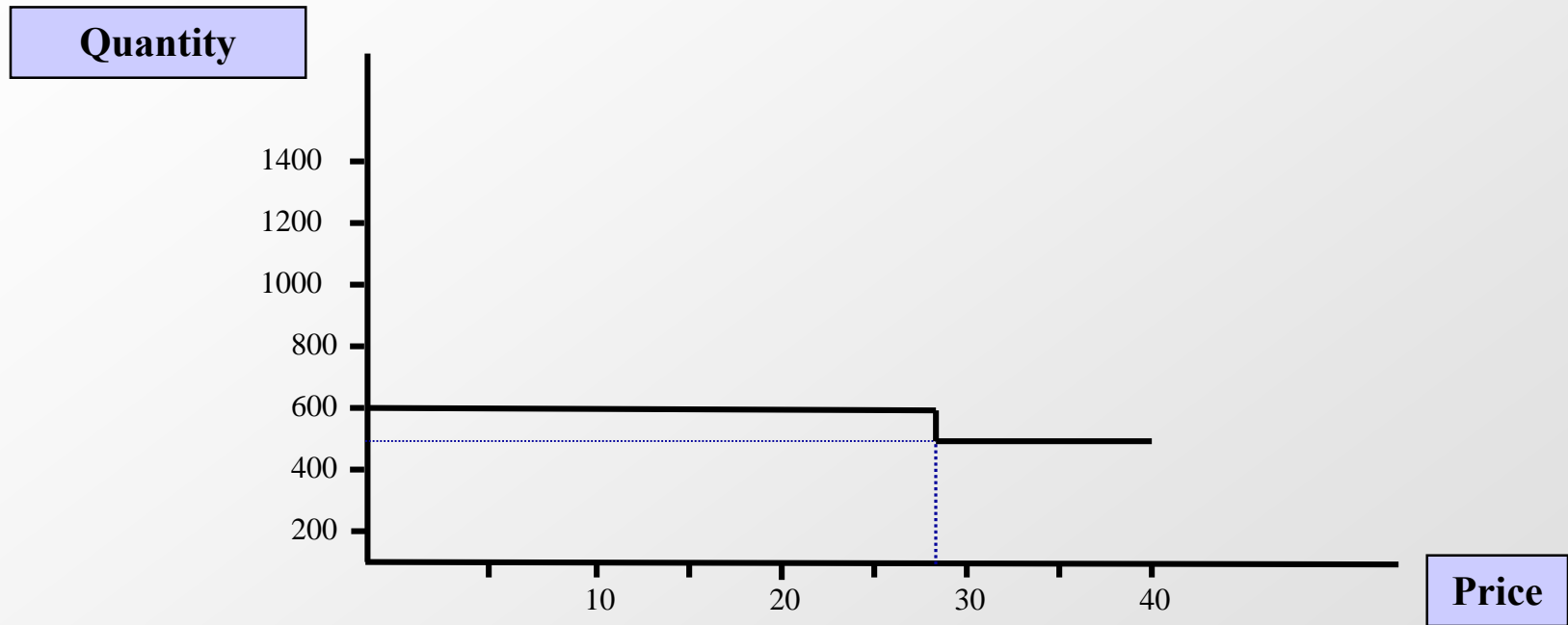
Exchange opportunity: difference

Producing a sample bid (1)



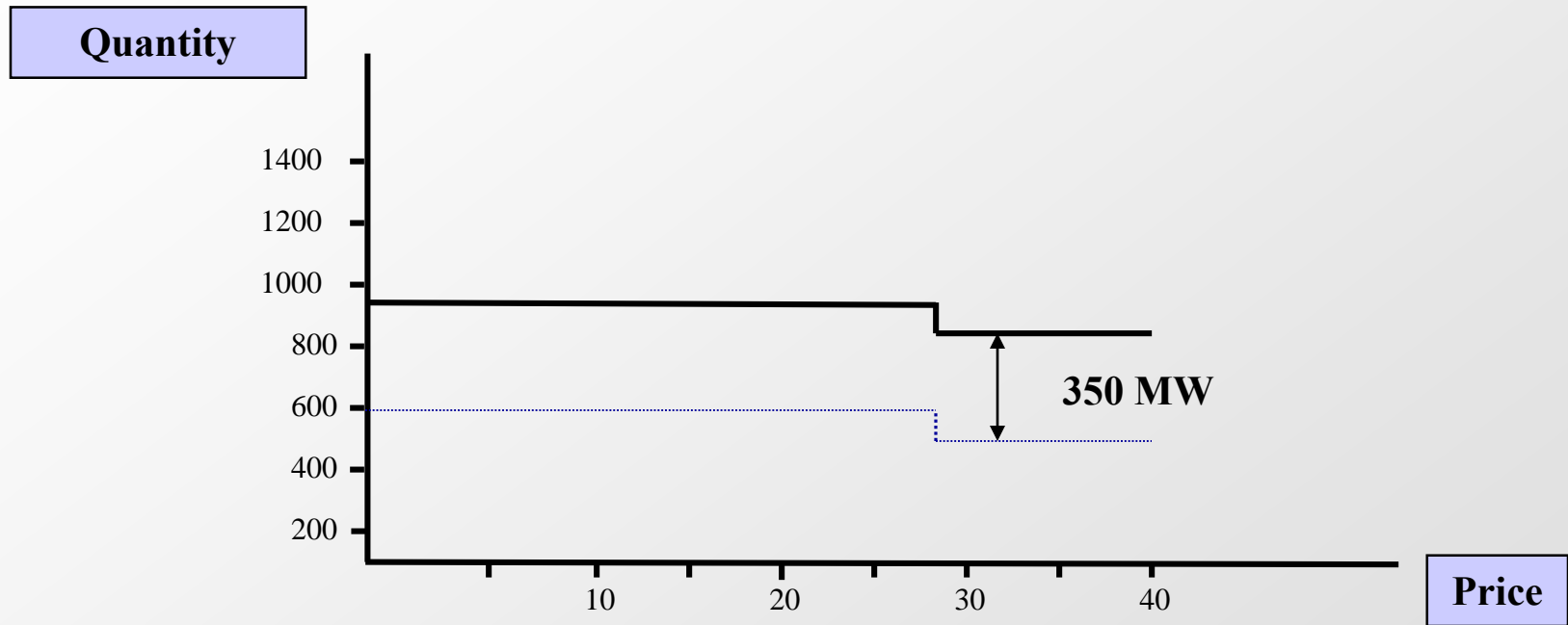
Generator has demand: 600 MW

Producing a sample bid (2)



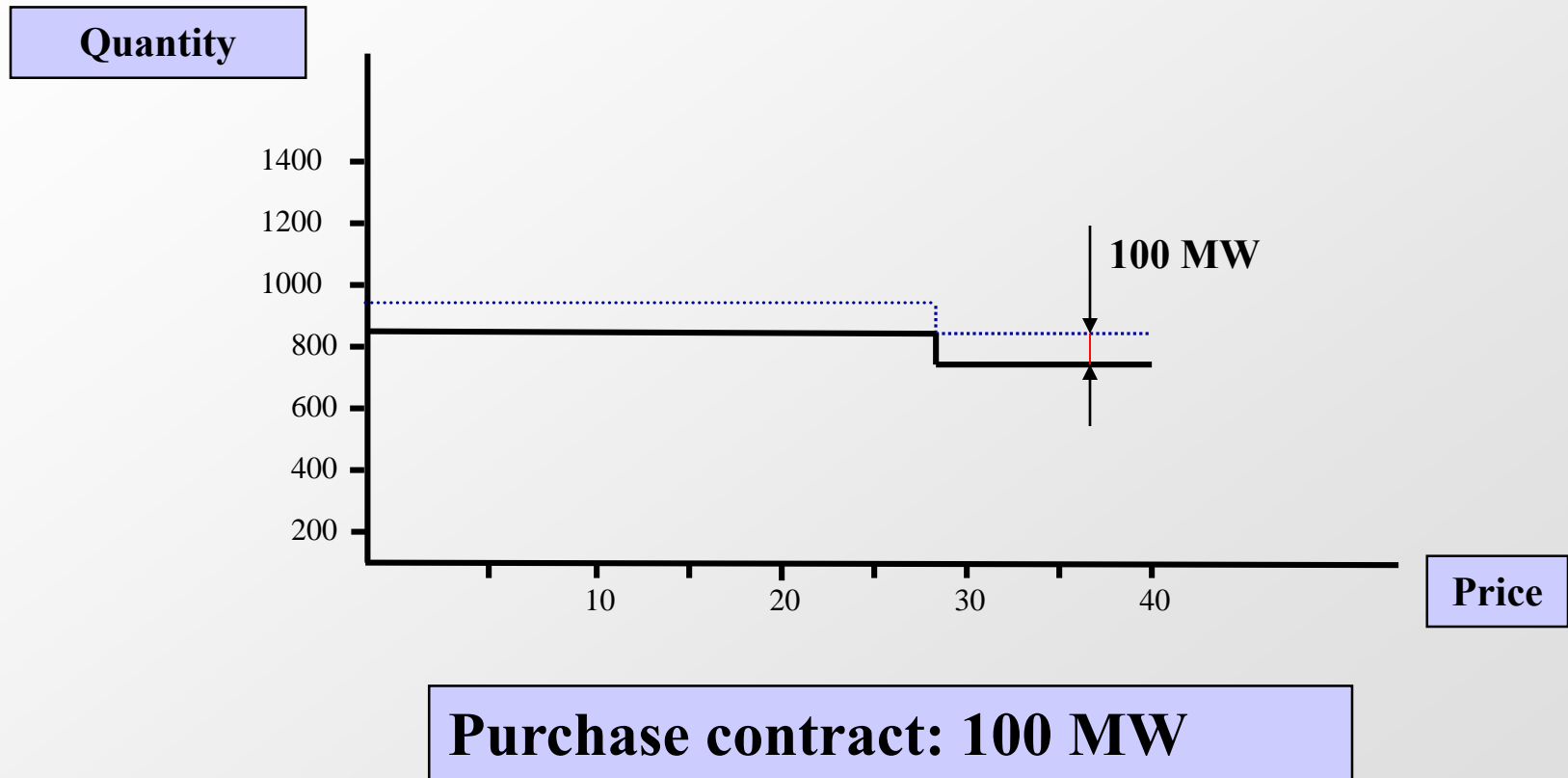
**Load management: 100 MW, 29
Euro/ MW**

Producing a sample bid (3)

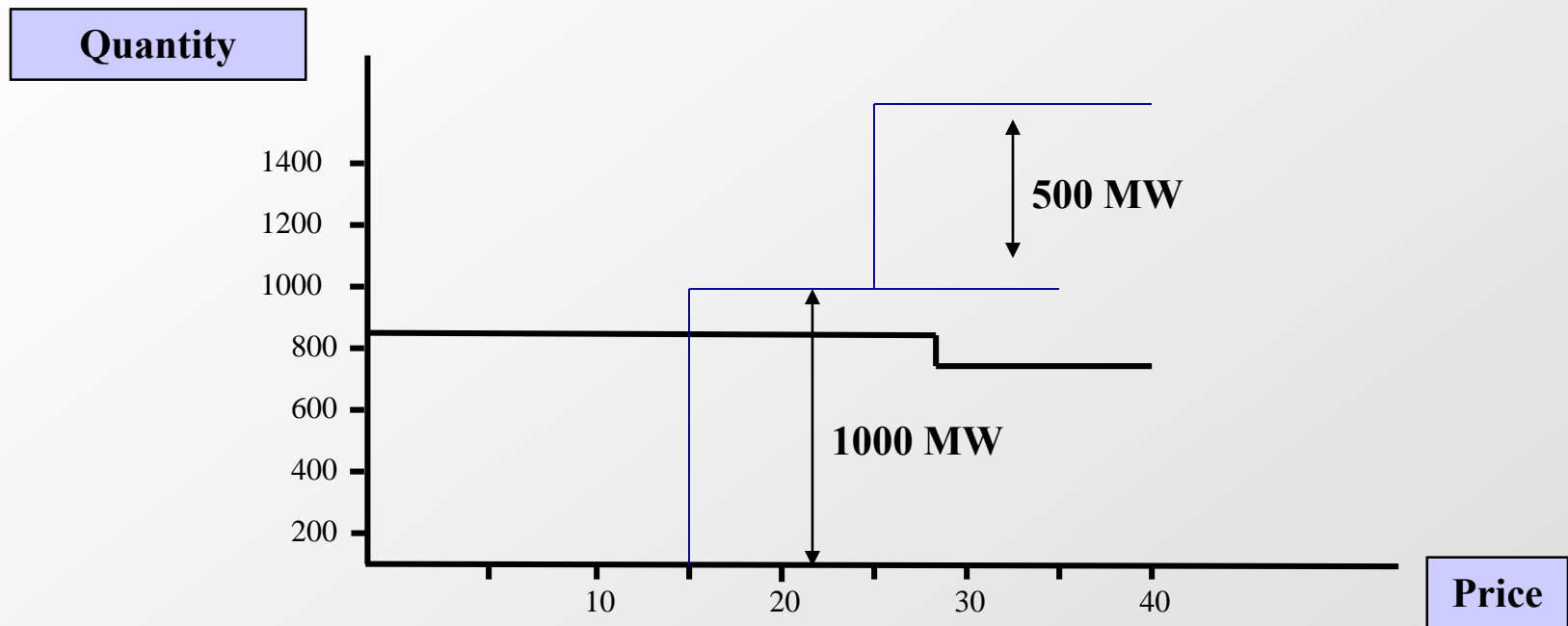


Sale contract: 350 MW

Producing a sample bid (4)



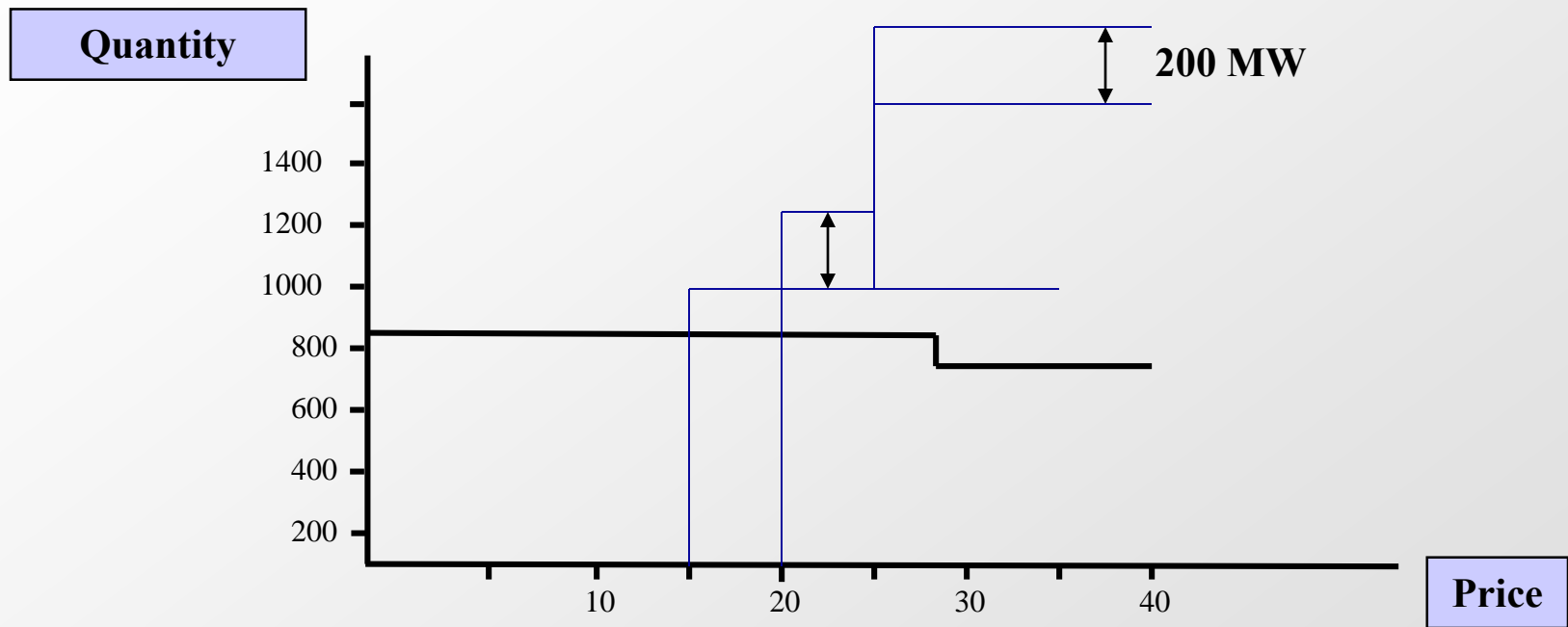
Producing a sample bid (5)



Unit 2: max 1000 MW, 15 Euro/ MWh

Unit 1: max 500 MW, 25 Euro/ MWh

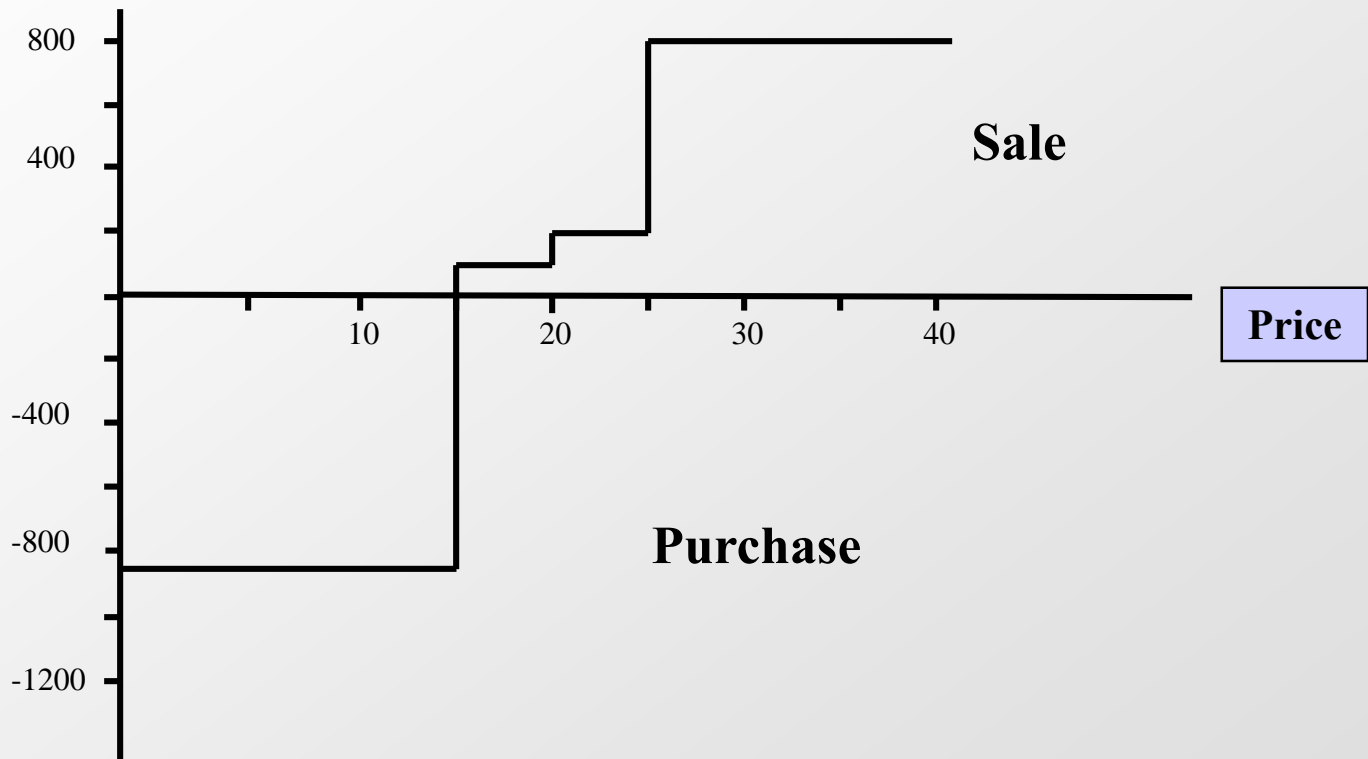
Producing a sample bid (6)



2nd purchase contract: 0-200 MW, 20 Euro/ MWh

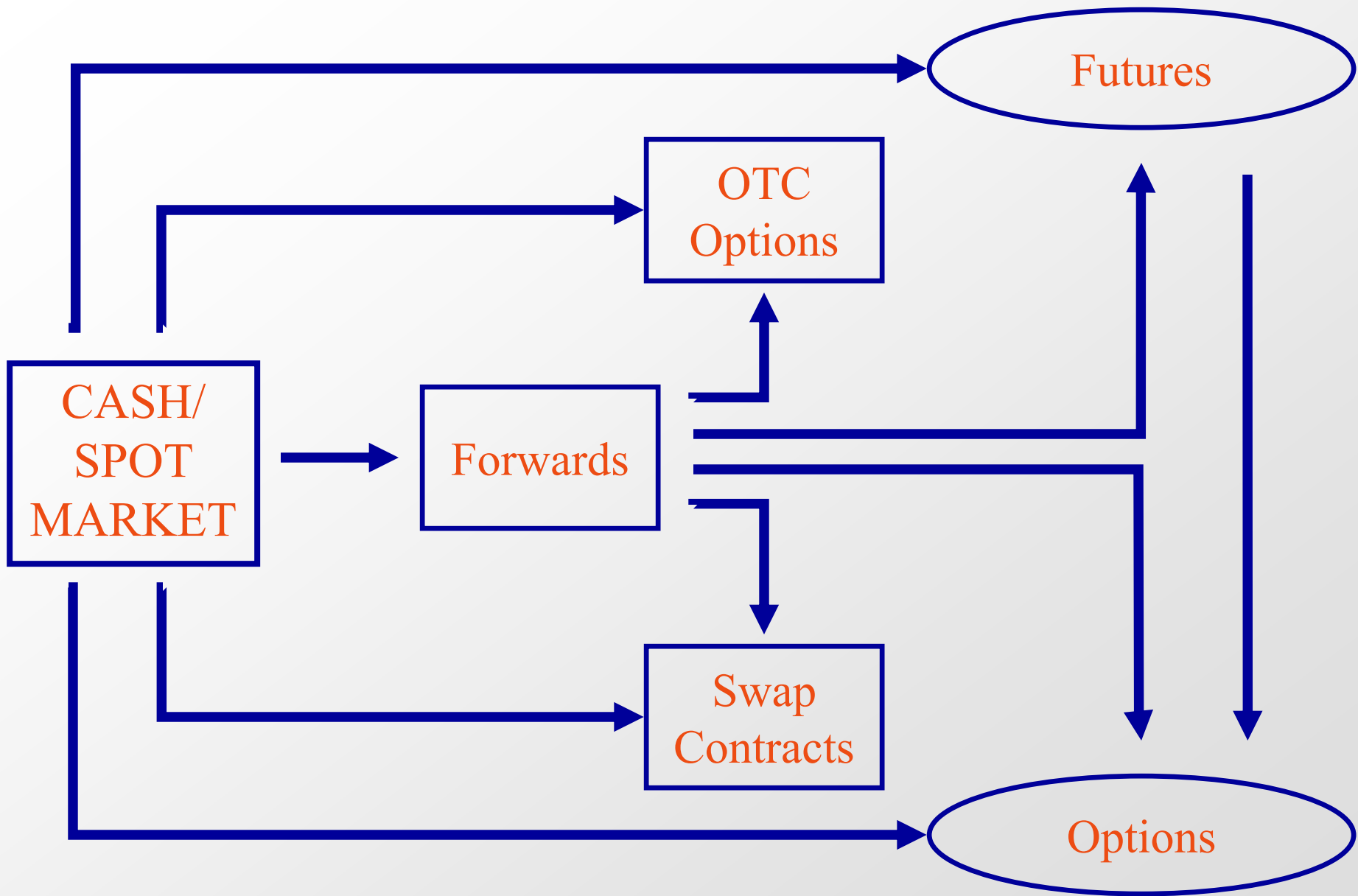
Producing a sample bid (Final)

Quantity



Exchange opportunity: difference

Essentials of Power Derivatives



Common Derivatives

- Futures
 - ~ Exchange traded
 - ~ Essentially financial
- Forwards
 - ~ Over the counter (OTC)
 - ~ Physicals
- Swaps
 - ~ OTC
 - ~ Financials
- Options
 - ~ Exchange traded or OTC
 - ~ Physical or financial

Two criteria for being a hedger

A presence in
the underlying
cash market

Use of
derivatives in
a manner that
reduces risk

An example

- A utility expects for January a higher demand than contracted
 - ~ Utility could buy spot in January for spot price; risk ?
- The utility could hedge by buying an electricity January future for Euro 25/MWh
- The utility does not buy failing power for January on OTC market

An example

- In January the prices have actually risen to Euro 27/MWh
- Utility buys needed electricity on spot market and simultaneously sells January future for 27/MWh

Example result

- September buy January future Euro 25
- January sell January future Euro 27
- Profit Euro +2

- Physical transaction January Euro 27
- Net result Euro 25

Forwards and Futures

Example: gas fired generation

Asset scenario - fixed low profit, low risk in normal operation, major exposure to outage

Buy gas forward, generate power, sell power forward ... lock-in a profit



Gas Forward
purchase
contract
\$18/MWh



Generation
12,000 MWh
per day



Power Forward
sales contract
\$25/MWh

Cost

Buy Fixed Gas \$ 216,000

Revenue

Sell Fixed Power \$ 300,000

Gross Profit \$84,000

Market scenario – variable higher profit, higher risk in normal operation, reduced exposure to outage

Buy gas forward, sell spot gas ... buy spot power, sell power forward



Gas Forward
purchase
contract
\$18/MWh



No
Generation



Power Forward
sales contract
\$25/MWh



Sell Spot
Gas
\$50/MWh*



Buy Spot
Power
\$30/MWh*



Cost

Buy Fixed Gas \$ 216,000

Buy Spot Power \$ 360,000*

Revenue

Sell Fixed Power \$ 300,000

Sell Spot Gas \$ 600,000*

Gross Profit \$324,000

* at risk to market price movements

Example: Processing

Process scenario - fixed low profit, low risk

Buy power forward, produce commodity, sell commodity forward ... lock-in a profit



Power Forward
purchase contract
\$25/MWh



Processing
consumes
12,000 MWh
per day



Commodity Forward
sales contract
\$30/MWh

Cost

Buy Power \$ 300,000

Revenue

Sell Commodity \$ 360,000

Profit

\$60,000

Cut Process scenario – variable higher profit, higher risk (spot price)

Buy power forward, sell spot power ... buy spot commodity, sell commodity forward



Power Forward
purchase contract
\$25/MWh



No
Processing



Commodity
Forward sales
contract \$30/MWh

Cost

Buy Power \$ 300,000

Buy Spot Commodity \$ 480,000 *

Revenue

Sell Commodity \$ 360,000

Sell Spot Power \$ 900,000 *

Profit

\$480,000



Sell Spot
Power
\$75/MWh *



Buy Spot
Commodity
\$40/MWh *



* at risk to market price movements

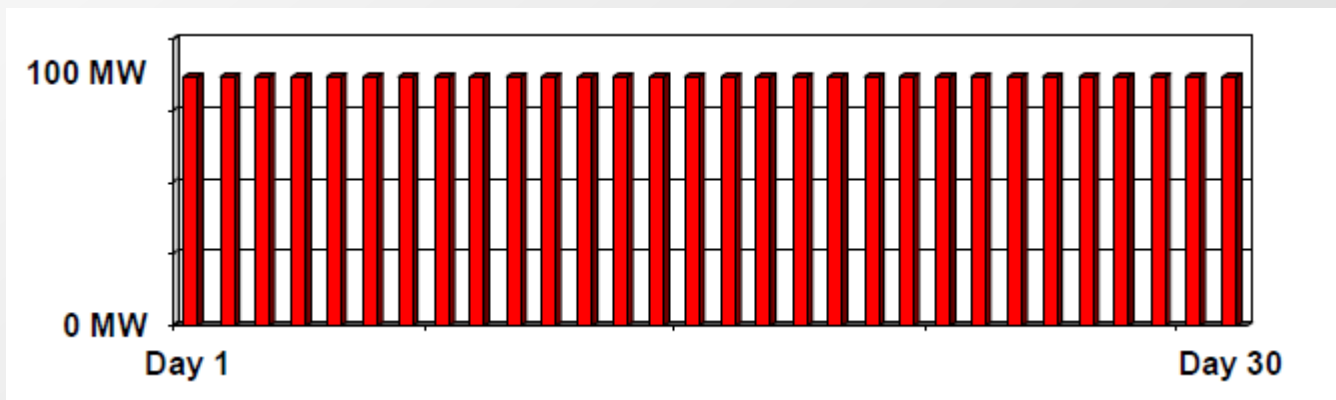
Hedging using Futures

Exemplary situation:

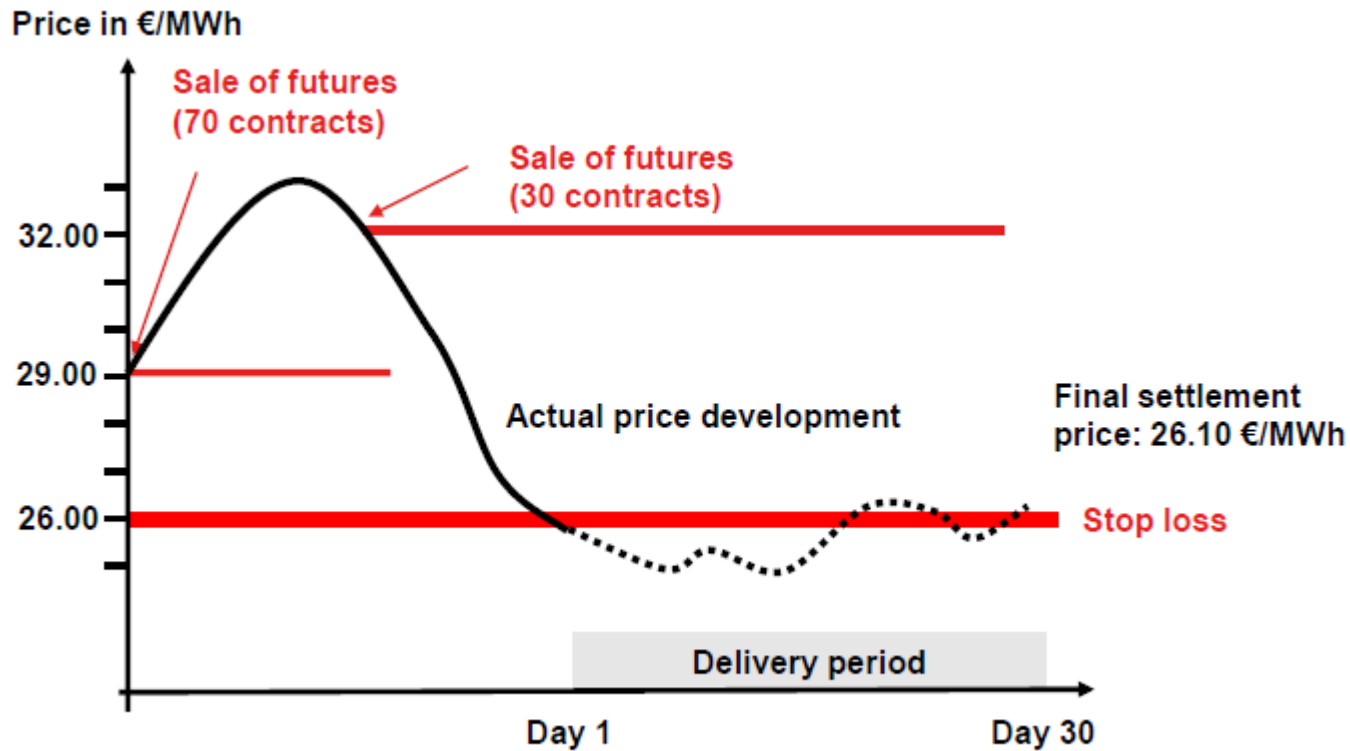
- A power company plans to sell 100 MW base load of the electricity it generates on the spot market during a given (future) month at an average price of 29 USD/MWh.

Exemplary risk management:

- 70% are hedged immediately,
- 30% are hedged at a later stage in the expectation of higher prices; however the price should not fall below the marginal costs of (e.g.) 26 USD/MWh.
- Planned revenue: $100 \text{ MW} \times 24 \text{ h/day} \times 30 \text{ days} \times 29 \text{ USD/MWh} = 2,088,000 \text{ USD}$



Hedging using Futures

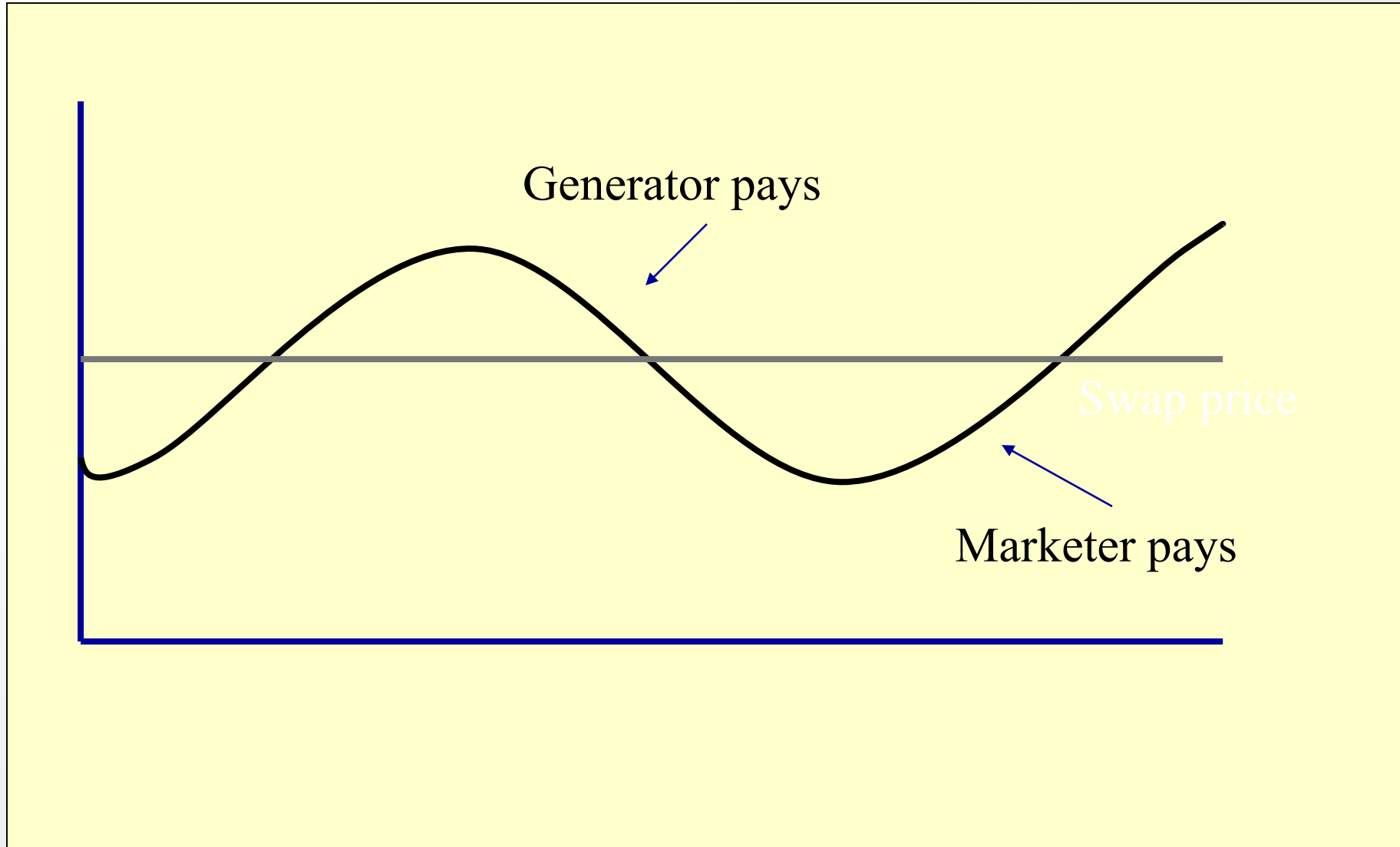


Swap Contracts

Swaps

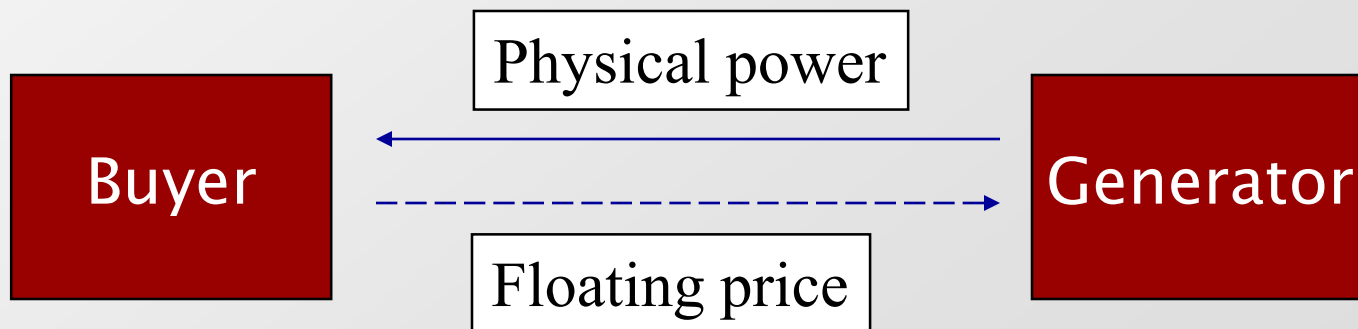
- Contracts between two parties to exchange a stream of cashflows, based on a predetermined notional amount over a period of time.
- Cash settled - no physical exchange
- Portfolio of forwards.
- Each forward is an agreement to buy the same asset , usually at the same price, but at different points in time

Example Swap



Example Power Swap

- Imagine it is November 2017 and a generator enters into a contract to sell 50 MW of electricity for the period of December 2017 at a daily floating price. The power can be generated at 23 €/MWh
- What is the market risk?



Supply unhedged

- Basis: APX baseload
- Volume: 50 MW
- Period: 01/12/17 - 31/12/17
(31 days)
- Fixed Price: None
- Floating Price: ???
- Prod. costs: 23 Euro

Example Power Swap

- Bank agrees to pay Generator € 25/MWh for 50 MW of power during December 2017
- Generator agrees to pay Bank cash flows equal to a floating price on the same quantity of electricity for one year.
- By combining this swap with the indexed electricity supply contract, a Generator can lock in a fixed income and sell to APX

Cash flows hedged

