Power Market Development Workshop CPPA-G

DAY 3

Your Commodities Risk Management Partner

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

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Summary Day 2

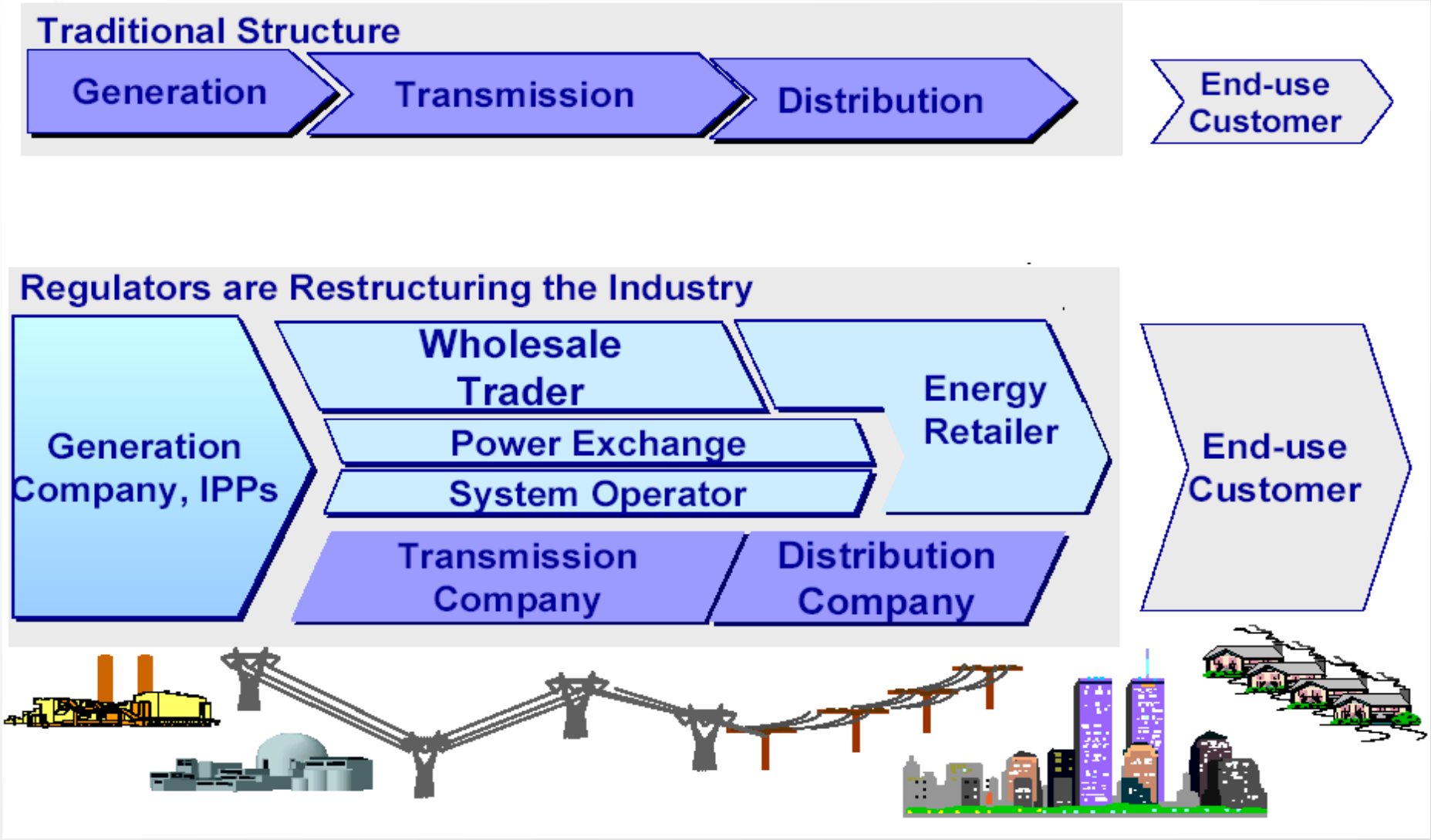
Development energy markets

- **Phase 1**
  - ~ long term contracts and exclusive selling rights
- **Phase 2**
  - ~ bilateral trade
- **Phase 3**
  - ~ growing price transparency
  - ~ sophisticated contracts to hedge risks

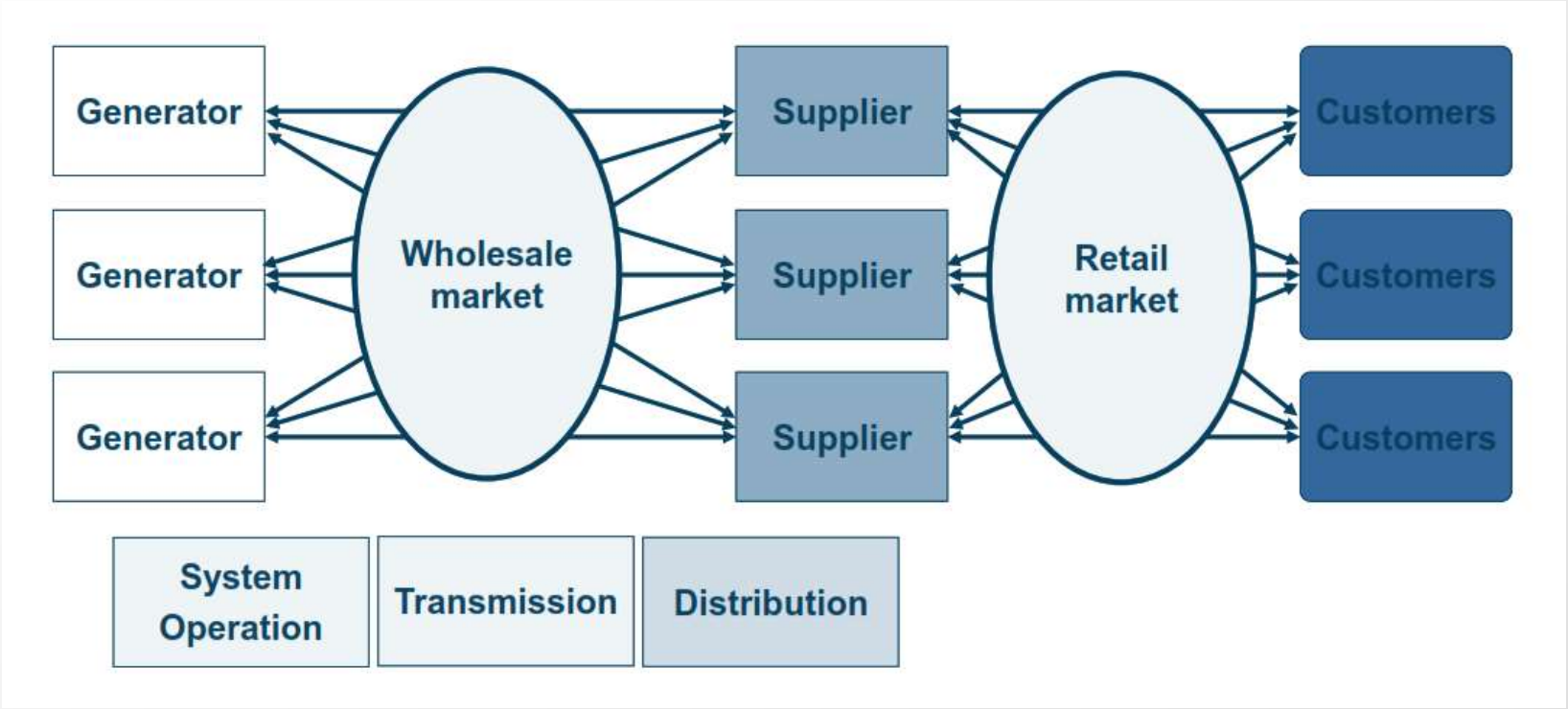
Development energy markets

- **Phase 4**
  - ~ growing competition
- **Phase 5**
  - ~ growing price volatility, need for risk management

Value Chain after reform



Retail Market Competition



Retail Market Competition

End-users eligible to choose their supplier freely in %

	1997	1999	2000	2003	2005	2007
Austria	0%	33%	100%	100%	100%	100%
Belgium	0%	35%	35%	52%	90%	100%
Denmark	0%	35%	90%	100%	100%	100%
Finland	40%	100%	100%	100%	100%	100%
France	0%	30%	30%	37%	70%	100%
Germany	0%	100%	100%	100%	100%	100%
Greece	0%	0%	30%	34%	62%	100%
Ireland	0%	0%	30%	56%	100%	100%
Italy	0%	45%	45%	70%	79%	100%
Luxembourg	0%	30%	n/a	57%	84%	100%
Netherlands	0%	33%	33%	63%	100%	100%
Portugal	0%	30%	30%	45%	100%	100%
Spain	0%	54%	54%	100%	100%	100%
Sweden	40%	100%	100%	100%	100%	100%
UK	50%	100%	100%	100%	100%	100%
Norway	100%	100%	100%	100%	100%	100%
Estonia					12%	n/a
Latvia					76%	100%
Lithuania					74%	100%
Poland					80%	100%
Czech Republic					74%	100%
Slovakia					79%	100%
Hungary					67%	100%
Slovenia					77%	100%

Lessons from California Crisis

- If the structure of an industry or market changes, predictions of likely or unlikely market extremes can be far from the mark;
- It's often the interaction between market, credit, liquidity, regulatory risks that turns a survivable incident into a crisis;
- In a competitive market, players behave selfishly at critical moments: profit and self-preservation are the only real motivators;

Lessons from California Crisis

- Don’t rely on regulatory action as a form of worst-case market risk management
- Gaps can open up between the motivations and powers of key regulators
- Regulators' actions may be too little, too late

Assumptions proven wrong

- **Capping retail prices will protect consumers, but it is not necessary to restrict wholesale prices.**
  - ~ Trapped retailers when wholesale prices rose above figure used to calculate retail rate caps
  - ~ Consumers prices were set based on belief that wholesale prices would not rise above $55/MWh
    - * During crisis average price was more than $200
    - * Even as high as $1,900
  - ~ Power retailers could not pass thru this increase
    - * Expected to absorb difference between wholesale costs and their retail intake

Assumptions proven wrong

- **Wholesale prices will fall if power plants are sold to competitive, independent generators**
- Divesting power plants left utilities with few defenses against rising wholesale prices
  - ~ Still controlled nuclear and hydroelectric plants,
  - ~ Could not produce enough electricity to meet demand, particularly in times of peak demand
- So, when companies that had bought gas-driven power plants raised their prices, retailers had no choice but to continue buying power from them

Assumptions proven wrong

- ***Long-term contracts between producers and retailers are not needed; utilities can buy their power on the spot market.***
- If wholesale electricity market truly competitive, spot market might have worked this way
- Utilities dependent upon generators that had bought their gas-fired power plants, and demand proved much more flexible than supply; a sellers' market developed
- Rather than keeping prices low, wholesalers behaved in the way for-profit companies usually behave: they tried to make a profit!

Assumptions proven wrong

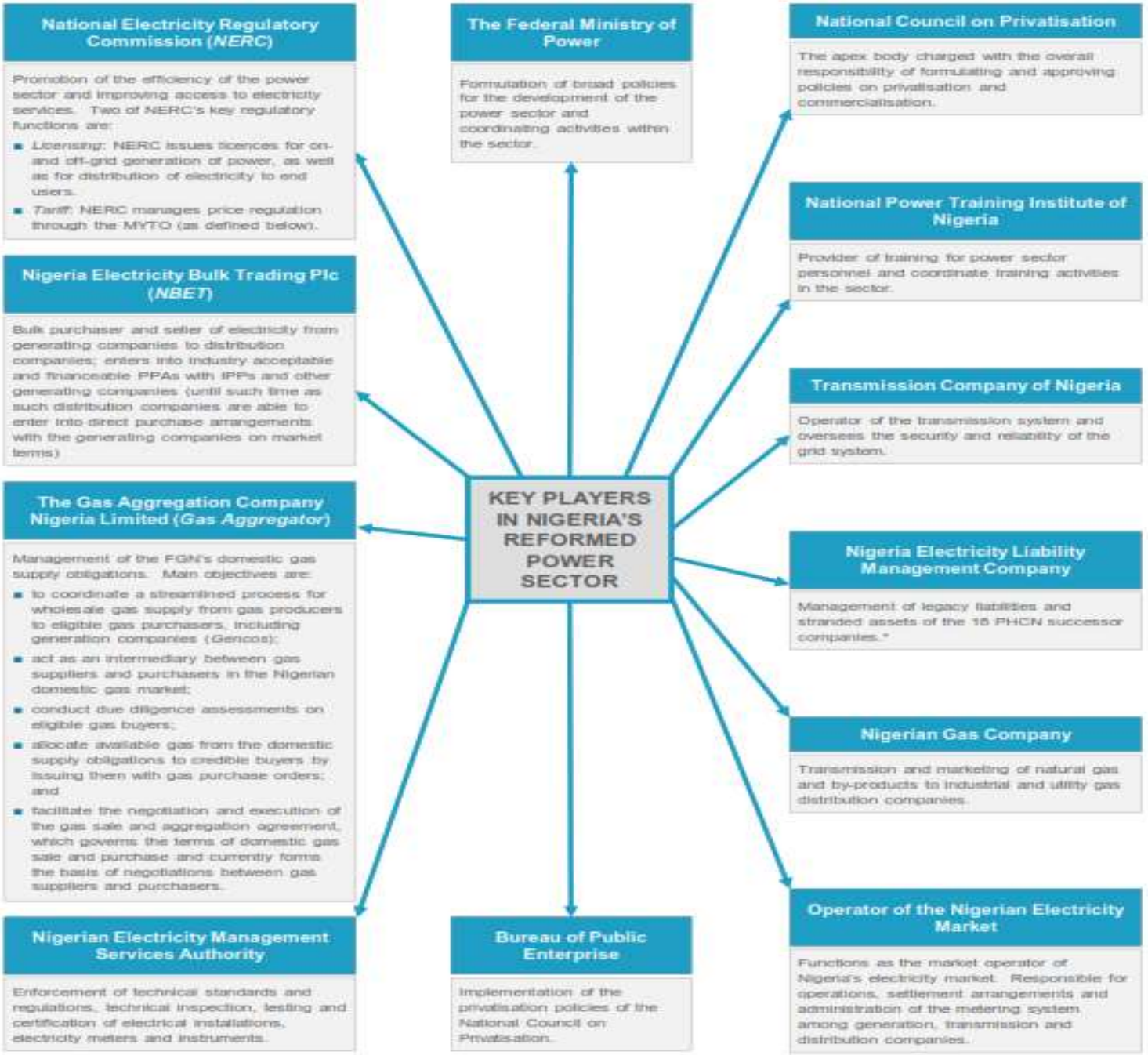
- ***Long-term contracts between producers and retailers are not needed; utilities can buy their power on the spot market.***
- Controversy continues over whether they made use of their position in the market their market power in an inappropriate manner
  - Producers that now owned California power plants were not constrained to sell their power only to the California market
  - If they could get a better price in a different location, they would sell their power to retailers in the other location

Assumptions proven wrong

- **Cutting retail prices will benefit consumers.**
- Rate reduction did have a short-term economic benefit for consumers
  - In the long term, retail price cuts had the negative effect of encouraging higher consumption of electricity
    - Consumers have little financial incentive to control their use of inexpensive resources and, in this case, demand for power rose to a level that has been very difficult to sustain.

Assumptions proven wrong

- Other factors why the deregulation plan went so spectacularly wrong
- Inadequacy of California's present generation facilities
- State does not have enough power plants to keep up with rising demand
- Constructing new power plants is nearly as difficult as recreating dinosaurs from fossilized DNA


KEY PLAYERS IN NIGERIA'S REFORMED POWER SECTOR
National Electricity Regulatory Commission (NERC)
Promotion of the efficiency of the power sector and improving access to electricity services. Two of NERC's key regulatory functions are:
Licensing: NERC issues licences 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 time as such distribution companies are able to enter into direct purchase arrangements with the generating companies on market terms)
The Gas Aggregation Company Nigeria Limited (Gas Aggregator)
Management of the FGN's domestic gas supply obligations. Main objectives are:
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 them with gas purchase orders; and
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
Enforcement of technical standards and regulations, technical inspection, testing and certification of electrical installations, electricity meters and instruments.
The Federal Ministry of Power
Formulation of broad policies for the development of the power sector and coordinating activities within the sector.
Bureau of Public Enterprise
Implementation of the privatisation policies of the National Council on Privatisation.
National Council on Privatisation
The apex body charged with the overall responsibility of formulating and approving policies on privatisation and commercialisation.
National Power Training Institute of Nigeria
Provider of training for power sector personnel and coordinate training activities in the sector.
Transmission Company of Nigeria
Operator of the transmission system and oversees the security and reliability of the grid system.
Nigeria Electricity Liability Management Company
Management of legacy liabilities and stranded assets of the 18 PHCN successor companies.*
Nigerian Gas Company
Transmission and marketing of 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.

Key Players in Nigeria's Reformed Power Sector[17]	
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)	• 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)	Manage the FGN's domestic gas supply obligations. Main objectives are: • 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.

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

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

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 Players in Nigeria's Reformed Power Sector[17]	
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.

Case Studies Power Markets Deregulation

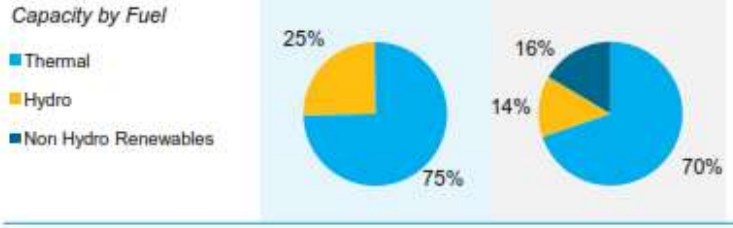
Nigerian Power Market

The Nigerian Government has set an ambitious target of achieving 40,000 MW of electricity generation by 2020

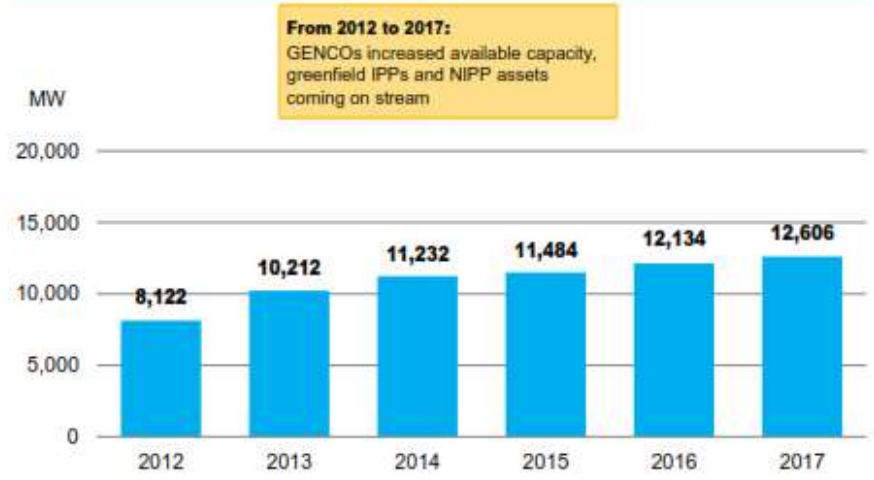
Key Statistics

	2012A	2017E	CAGR12-17
Installed Capacity (MW)	8,122	12,606	9.2%
Net Capacity Addition (MW)	-	4,484	-
Electrification rate	50%	-	-

Capacity by Fuel



Capacity Evolution



Market Overview

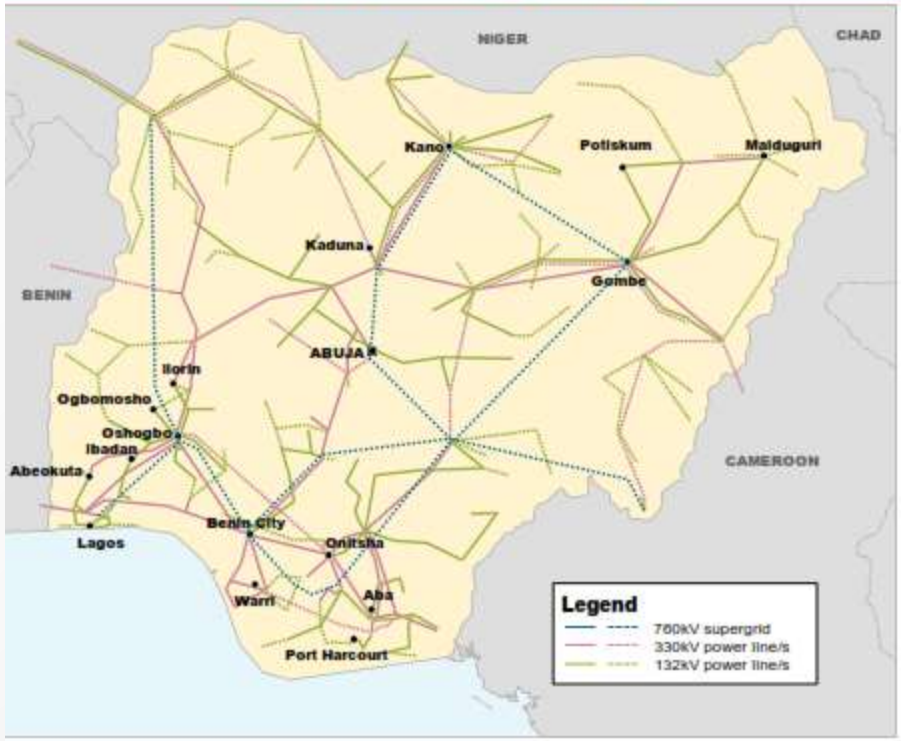
Governing bodies	• The Federal Ministry of Power and the Nigerian Electricity Regulatory Commission ("NERC") are responsible for setting energy policies and regulation of the energy sector respectively • They coordinate activities of the power sector and regulate pricing regimes
Market	• Single buyer 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
Energy Agenda	• The Government initiated power sector reforms in 2005 with the unbundling of the state-owned power company, the National Electric Power Authority ("NEPA") into separate entities for generation, transmission and distribution • The government successfully privatised the PHCN generation and transmission assets in November 2013 with shares in six generating companies (2 hydro and 4 thermal plants) and eleven distribution companies being sold to successful bidders • The Government is in the next phase of privatisation and has announced the preferred bidders for 10 newly built National Integrated Power Projects ("NIPP") • Under the NIPP privatisation process, the Government will sell an 80% stake in each of ten newly built generation companies that were built under a Government initiative launched in 2004 to fast-track new generation capacity to Nigeria's electricity supply system • The Government has set an ambitious target of 40 000 MWs of electricity generation by 2020 and has established the Presidential Task Force on Power ("PTFP") in 2010 to drive the agenda • The role of the PTFP will be to coordinate the activities of the various agencies charged with ensuring the removal of legal and regulatory obstacles to private sector investment in the power industry
Natural Resources	• Nigeria is endowed with nearly 3 billion tonnes of indicated coal reserves in 17 identified fields with over 600 million tonnes of proven reserves • Petroleum sector accounts for 35% of Nigeria's GDP, as the country is endowed with abundant petroleum resources including 37 billion barrels of oil and 5 trillion cubic meters of gas reserves • There are over 3 billion metric tonnes of iron ore in deposits found in Kogi, Enugu and Niger States as well as the Federal Capital Territory of Nigeria • Additionally, mineral reserves for gold, lead/zinc, bitumen, bentonite, gypsum, rock salt, gemstones among others are also present in large abundance

Nigerian Power Market

	Generation	Transmission/ Distribution	Wholesale / Retail
Overview	• The generation landscape has gradually shifted towards a make up of successor PHCN generation companies ("GENCOs"), NIPP generation companies and other IPPs	• Single buyer model – NBET buys all electricity produced by electricity generators • TCN transmits all the power produced by the electricity generators	• The successor PHCN distribution companies ("DISCOs") distribute electricity to residential, commercial and industrial consumers
Participants	**GENCOs** • Six generation assets (two hydro and 4 thermal) ▪ Kainji- hydro – 1 338 MW ▪ Shiroro – hydro – 600 MW ▪ Geregu – thermal - 414 MW ▪ Ugheli – thermal - 1020 MW ▪ Sapele – thermal - 900 MW ▪ Egbin – thermal - 776 MW		**TCN** • TCN transmits all electricity produced by the electricity generators ▪ Grid length: 11,000 km of 330 kV and 132 kV lines, plus 24,000 km of 33 kV sub-transmission lines and 23,000 substations
	NIPP Assets • Ten thermal generation assets (Still under construction but preferred bidders selected) ▪ Alaoji – 1 131 MW ▪ Olorunsogo – 754 MW ▪ Calabar – 634 MW ▪ Omotosho II – 513 MW ▪ Benin - 508 MW ▪ Geregu - 506 MW ▪ Ogorode - 508 MW ▪ Egbema - 381 MW ▪ Omoku – 250 MW ▪ Gbarain – 254 MW		**DISCOs** • The eleven distribution companies distributing electricity to residential, commercial and industrial companies include: ▪ Enegu – 768 245 registered customers ▪ Eko - 317 750 registered customers ▪ Ikeja – 657 444 registered customers ▪ Jos – 301 462 registered customers ▪ Kano – 286 622 registered customers ▪ Port Harcourt – 373 993 registered customers ▪ Yola – 218 418 registered customers ▪ Ibadani – 636 593 registered customers ▪ Benin – 665 313 registered customers ▪ Abuja – 277 293 registered customers ▪ Kaduna – 161 741 registered customers
	Other IPPs • Notable IPPs being developed include: ▪ AES – 270 MW ▪ Afam V- VI – 894 MW (Afam VI: 624 MW) ▪ Okpai – 480 MW ▪ Ibom Power – 132 MW ▪ Azura – Edo IPP – 450 MW		

Nigerian Power Market

Nigerian Electricity Network



Grid Interconnection

- The TCN manages the transmission grid of the power sector. However, it has been historically inadequate power transmission infrastructure and can currently only wheel approx 6,000 MW of power due to several years of under investment and poor maintenance.
- The TCN has 3 major departments:
  - The **System Operator ("SO")** is responsible for grid reliability by implementing the Grid Code to ensure an orderly operation of the market.
  - The **Market Operator ("MO")** or Operator of the **Nigerian Electricity Market ("ONEM")** is responsible for operation of the market and settlement arrangements. This includes:
    - Administration of the metering system between generation, transmission and distribution companies;
    - Settlement of matching energy generated by source to energy delivered to each distribution company and then estimate the payments to/from the involved entities; and
    - Administration of collection from distribution companies and payments to generation companies.
  - The **Transmission Service Provider ("TSP")** is the Grid which is responsible for wheeling power from generation to distribution.
- To attract additional investment into Nigeria transmission system, in September 2014 the Minister of State for Power announced that the Nigerian government is devising a public-partnership mechanism for the development of the sector
- Nigeria currently doesn't trade electricity with its neighbours
- However, according to the Minister of State for Power, Nigeria is involved at various stages in multilateral and bilateral relationships with other governments for future import and export of electricity (most notably with the Democratic Republic of Congo)

Nigerian Renewable Power Market

Renewable Energy Market Overview

- Nigeria has plentiful renewable energy resources, led by solar energy, biomass and wind, and potential exists for geothermal and tidal power.
- There is growing interest in solar power in particular, in a bid to diversify the country's generation mix away from natural gas and hydropower and take advantage of the country's underdeveloped power infrastructure and low electrification rate
- The NERC announced in November 2014 that it would target the installation of **7.2 GW of renewable energy by 2020** - although this target includes large hydropower projects
- At this stage in the development of Nigeria's power sector, however, renewable power generation is negligible and there is no established policy and regulatory and institutional framework to stimulate demand and attract investors
- Another key barrier to the successful commissioning of utility-scale renewable projects in Nigeria is the country's underdeveloped power grid and inefficient T&D network
- Such deficiencies mean that connecting large scale renewable energy project to the grid will be difficult, and large line losses are likely
- That said, the push for renewables and greater energy efficiency within the country's electricity sector falls in line with Nigeria's aspirations to diversify away from its heavy reliance on hydropower and natural gas
- The country adopted its **'Renewable Energy Master Plan'** in 2006, which examined the potential for different renewable energy technologies and outlined the various funding opportunities available to help encourage the development of the industry
- It was announced in February 2013 that the Climate Investment Funds (CIF) had agreed to provide Nigeria with USD50mn of funding, channelled into an African Development Bank (AfDB)-supported programme aimed at boosting energy efficiency and renewable energy within the country

Renewable Energy Projects Map

Nigerian Projects

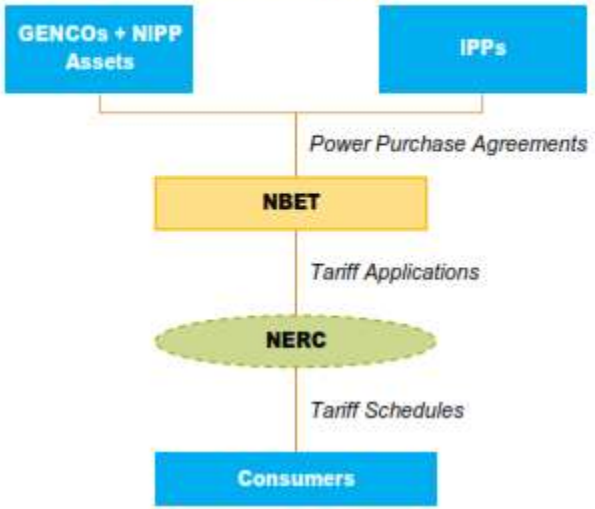
Project	Fuel	MW	Estimated COD	Constr. Cost ($m)	Involved Companies	Comments / Status
Azura-Edo Independent Power Plant (IPP) in Edo State	Gas	450	2016	1,000	World Bank (Financier), Azura Power (Construction)	• Construction to start in 2015
Gas-fired power plant in Okija, Anambra State	Gas	1,500	2018	Not available	Daewoo Engineering & Construction Company (Construction), Century Power Generation (Operator), General Electric (Equipment)	• The project will be completed in phases with the first phase delivering 495MW by 2015
Zungeru hydropower plant	Hydro	700	2017	1,293	Sinohydro Corporation, China National Electric Engineering (CNEEC)	• Project being developed
Mambilla hydropower project	Hydro	3,050	2018	3,200	Sinohydro Corporation, Gezhouba Group Electric Power	• Project being developed
Gurara II Project	Hydro	360	2017	420	Sinohydro Corporation, Gezhouba Group Electric Power	• Project being developed
Lafarge Natural Gas Power Plant	Gas	220	2017	400	International Finance Corporation (IFC) (Financier), Lafarge S.A. (Consultant / Project Management), Wartsila (Construction)	• The project involves the addition of a 220MW power plant to Lafarge's existing 90MW plant in Nigeria
Oferekpe/ Akahuwhu	Hydro	270	2017	520	Hodges Real Estate (Operator, 40%), Bakers Field (Operator, 40%), Ebonyi State Government (Sponsor, 20%)	• Project being developed
Utility-Scale Solar PV Projects	Solar	3,000	2017	5,000	SkyPower (Operator), FAS Energy (Operator)	• SkyPower FAS Energy signed agreements with the Federal Republic of Nigeria Government and the Delta State of Nigeria Government

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	-	-

Nigerian Power Market Reform

Power Sector Reform

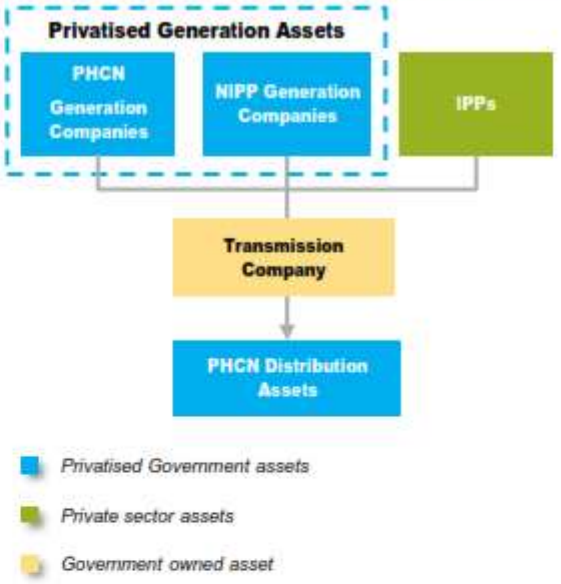
Operational Government Assets (PHCN privatisation)

- The Government launched power sector reforms in 2005 with the enactment of the Electric Power Sector Reform Act that among other reforms, outlined a process to unbundle the state-owned power company, the National Electric Power Authority ("NEPA") into separate entities for generation, transmission and distribution
- The NEPA assets were unbundled into the Power Holding Company of Nigeria ("PHCN") and the Government set a timeline for investors to bid to acquire the separate generating companies (each owning a single power plant) and distribution companies (each servicing a particular region within Nigeria).The Government retained ownership and control of the Transmission Company of Nigeria ("TCN")
- The PHCN privatisation process was completed in November 2013 with shares in six generating companies (2 hydro & 4 thermal plants) and eleven distribution companies being sold to successful bidders

Newly Built Government Assets (NIPP privatisation)

- The Government is in the next phase of privatisation and has announced the preferred bidders for 10 newly built National Integrated Power Projects ("NIPP")
- Under the NIPP privatisation process, the Government will sell an 80% stake in each of ten newly built generation companies that were built under a Government initiative launched in 2004 to fast-track new generation capacity to Nigeria's electricity supply system

Power Sector Post Reform



Timeline of Power Sector Reform

2004
- The National Integrated Power Project was conceived in 2004 to stabilise Nigeria's electricity supply system

2005
- National Electric Power Authority transformed into the Power Holding Company of Nigeria

2013
- Preferred bidders for 15 successor companies (GENCOs & DISCOs) completed payment for the assets purchased

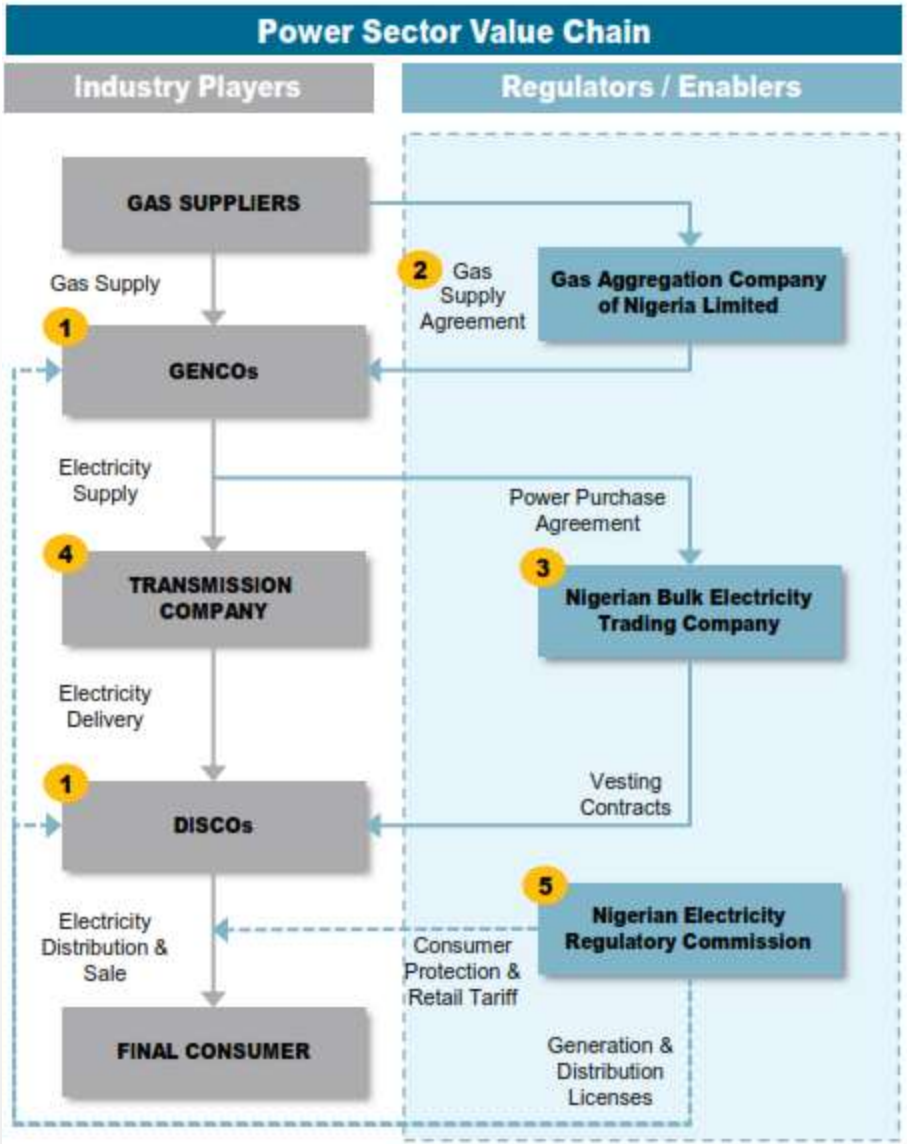
...2000 - 2005 | **2006 - 2010** | **2011 - 2014**

2005
- The National Electric Power Reform Act of 2005 (EPSRA) was adopted

2010
- New Power roadmap launched in 2010 with goal of achieving Government's vision 20 target of 40 000 MW by 2020

2013
- Privatisation of NIPP power plants ongoing
- Award of management contract of the TCN to Manitoba hydro of Canada

Key Features Privatization

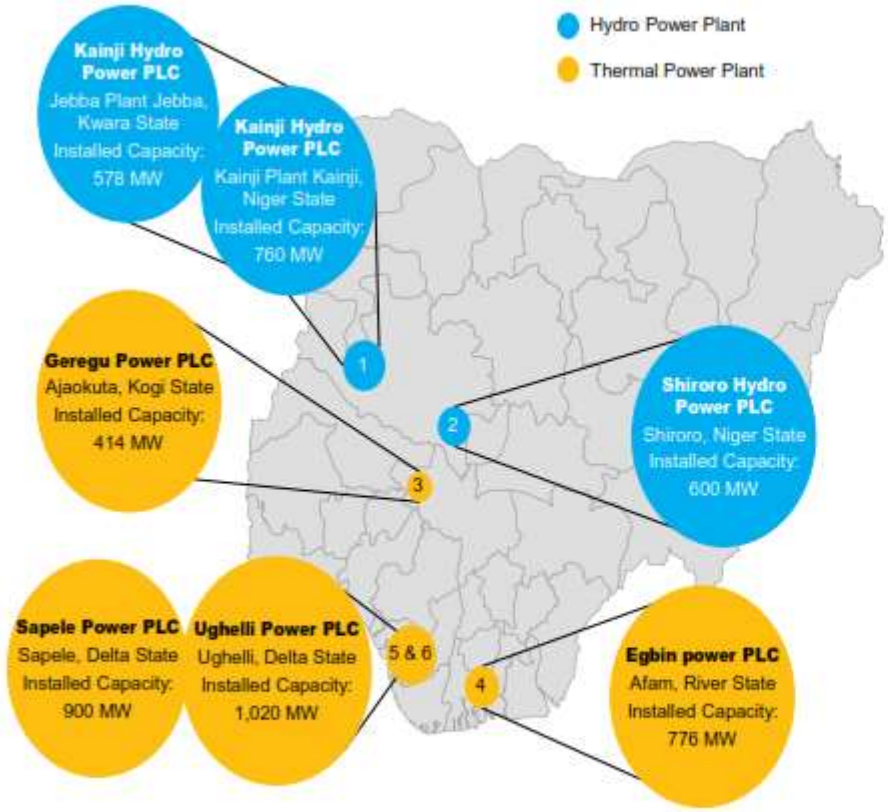


Key Arrangements

1 Concession/ Share Sale Agreement	• 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	• 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	• 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	• 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	• 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

Privatization Gencos

Hydro and Thermal Generation Asset Locations



Commentary

- Five out of the six assets initially offered for privatisation received compliant bids
- Egbin, Nigeria's largest generating plant and one of its best performing was not competitively bid for under the first round of privatisation
- The Government agreed to sell Egbin to NEDC/KEPCO consortium (JV between Korean Electric Power Corporation and Nigeria-owned Sahara Energy) in an inconclusive round in 2007
  I. Post- negotiations review in 2010 NEDC/KEPCO is understood to have made an offer of $407m for 70% of Egbin in April 2012
- The table below provides list of preferred bidders for the six GENCOs as well as the price paid for each asset

Power Plant	Technology	Preferred Bidder	Price Paid
Kainji	Hydro	Mainstream Energy Solutions Ltd	Concession - Annual Fee USD50.8mn,
Shiroro	Hydro	North-South Power Company Ltd	Concession - Annual Fee USD111.6mn
Ughelli	Thermal	TransCorp, PSL Engineering, Madea Development SA, Symbion Power	USD300mn (100% of the Company)
Geregu	Thermal	Amperion Power Ltd	USD132mn (51% of the Company)
Sapele	Thermal	CMEC/EURAF RIC Energy Consortium	USD201mn (100% of the Company)
Egbin	Thermal	NEDC/KEPCO Consortium	USD407.3mn (70% of the Company)

Privatization Discos

Preferred Bidders

Power Plant	Preferred Bidder	Price Paid ($m)	Equity Stake (%)	Registered Customers	Km's of 33KV lines
Enegu	Interstate Electric Nigeria Ltd	126	60	766 245	6 596
Eko	West Power & Gas Ltd	135	60	317 750	2 635
Ikeja	NEDC/KEPCO	131	60	657 444	4 540
Jos	Aura Integrated Energy resources Ltd	82	60	301 462	4 540
Kano	Sahelian Power SPV Ltd	137	60	266 622	4 145
Port Harcourt	4 Power Consortium	124	60	373 993	6 109
Yola	Integrated Energy Distribution & Marketing Ltd	59	60	216 416	3 740
Ibadani	Integrated Energy Distribution & Marketing Ltd	169	60	636 593	4 734
Benin	Vigeo Power Consortium	129	60	665 313	4 603
Abuja	Kann Consortium Utility Company Ltd	164	60	277 293	5 021
Kaduna	North West Power Ltd	N/A	60	161 741	4 151

Source: . Dealogic; Thompson; www.naptin.org

Kaduna

Preferred Bidder: North West Power Ltd

Kano

Preferred Bidder: Sahelian Power SPV Ltd

Jos

Preferred Bidder: Aura Integrated Energy Resources Ltd

Yola

Preferred Bidder: Integrated Energy Distribution & Marketing Ltd

Port Harcourt

Preferred Bidder: 4 Power Consortium

Enugu

Preferred Bidder: Interstate Electric Nigeria Ltd

Benin

Preferred Bidder: Vigeo Power Consortium

Eko

Preferred Bidder: West Power & Gas Ltd

Abuja

Preferred Bidder: Kann Consortium Utility Company Ltd

Ibadani

Preferred Bidder: Integrated Energy Distribution & Marketing Ltd

Ikeja

Preferred Bidder: NEDC / KEPCO

Privatization Discos

Preferred Bidders have been selected for next round of the privatisation program

Privatisation Programme Phase II – NIPP						
Power Plant	**Preferred Bidders**	**Technology**	**Financial Offer**	**Technical Partner**	**Capacity, MW**	**Status**
Alaoji	AITEO Consortium	Combined cycle gas turbine	$902 000 000	Steag Encotec	1, 131	Q1 2015
Olorunsogo*	ENL Consortium Limited	Combined cycle gas turbines	$751 240 000	SEPCOIII China	754	Under construction
Calabar	EMA Consortium	Open cycle gas turbines	$625 000 000	Steag Encotec	634	Q1 2015
Omotosho II	Omotosho Electric Power	Open cycle gas turbines	$659 999 000	CMEC	513	Completed
Benin	EMAS Consortium	Open cycle gas turbines	$580 000 000	Marubeni	508	Under construction
Geregu	Yellowstone Electric Power Limited	Open cycle gas turbines	$613 111 113	Siemens	506	Completed
Ogorode	Daniel Power Consortium	Open cycle gas turbines	$531 240 000	Rockson Engineering	508	Under construction
Egbema	Dozzy Integrated Power Limited	Open cycle gas turbines	$415 075 000	Rockson Engineering	381	Under construction
Omoku*	Shayobe International Limited Consortium	Open cycle gas turbines	$318 710 840	Rockson Engineering	250	Under construction
Gbarain*	KDI Energy Resources	Open cycle gas turbines	$340 000	Rockson Engineering	254	Under construction

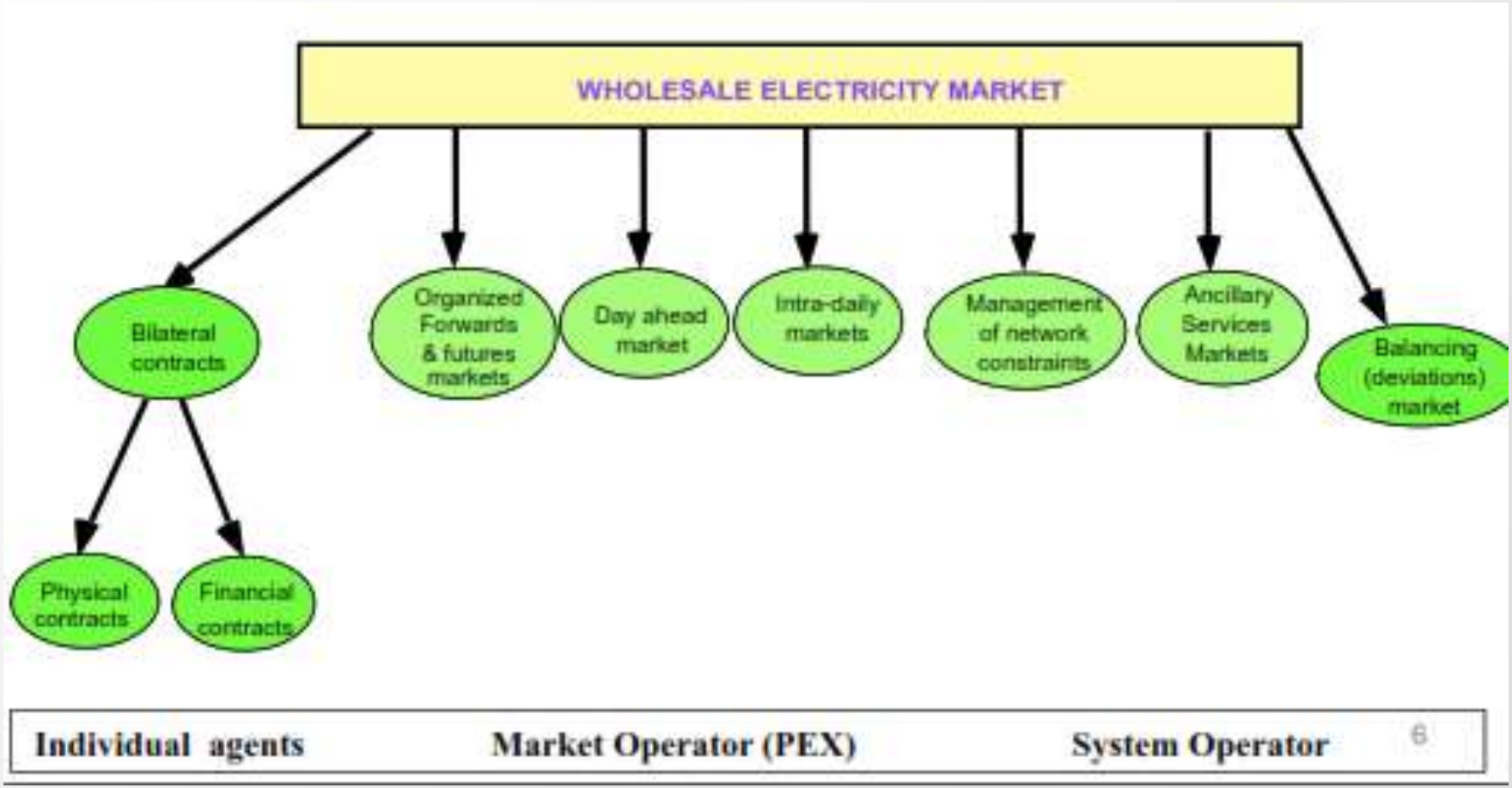
The privatisations are due to be completed in 2015 and will see 80% of the assets moved to private hands, while the government will retain 20% in an attempt to boost investor confidence

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	• Tariffs were driven by the MYTO model which was based on underestimated ATC&C losses. This led to: ▪ 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	• 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 Fro Downside Risks for GENCOs	• 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	• 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	• The power sector is inextricably linked to the gas market as Nigeria posses 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	• Delays from legal disputes over acquisition/bid results • Stage of completion of assets • Absence of gas supply evacuation infrastructure

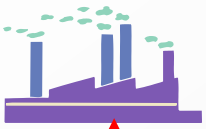
Sequence & possibilities transactions



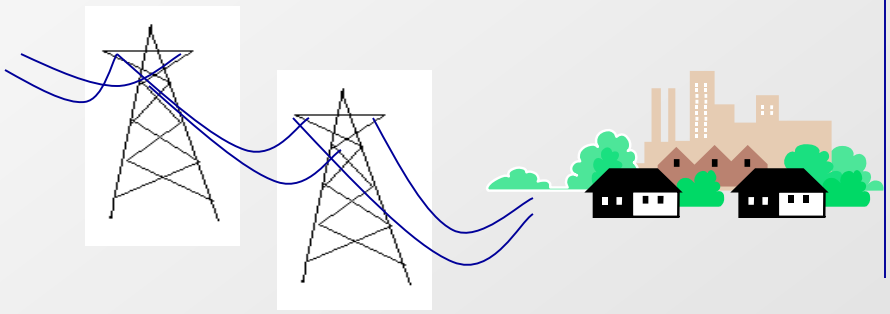
Spot Market Models

TWO BASIC SPOT MARKET MODELS

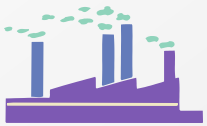
Mandatory Pool



System Operator / Market Operator

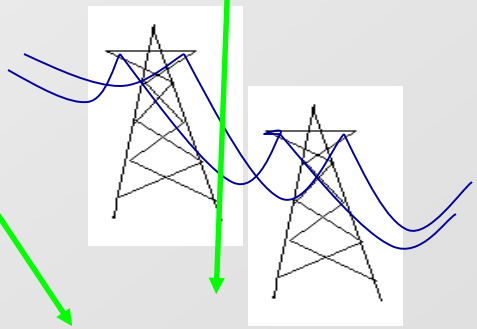


Voluntary Pool



Bilaterals

Exchanges



System Operator

Power Schedules

Commercial Arrangements

Roles Operators

Market operator (MO)	System operator (SO)	Transmission operator (TO)
– Operate and/or facilitate the market – Registration of market participants – Receive bids/offers from market participants – Market clearing – Settlement and invoicing	– 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	– Plan, construct, maintain and own transmission lines

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.

Market Models

- The "mandatory pool" model
  - Simple or complex bids
  - Audited costs or free bids
  - Optional financial contracts
- The "open trade" model
  - Bilateral contracts that typically coexist *(not in the UK)* with a PX offering an organized day-ahead spot market & organized long-term contracts of different formats
- All models include the SO providing *(with or w/o ad hoc markets)* operating reserves, network constraint management & some balancing mechanism

From commercial to physical

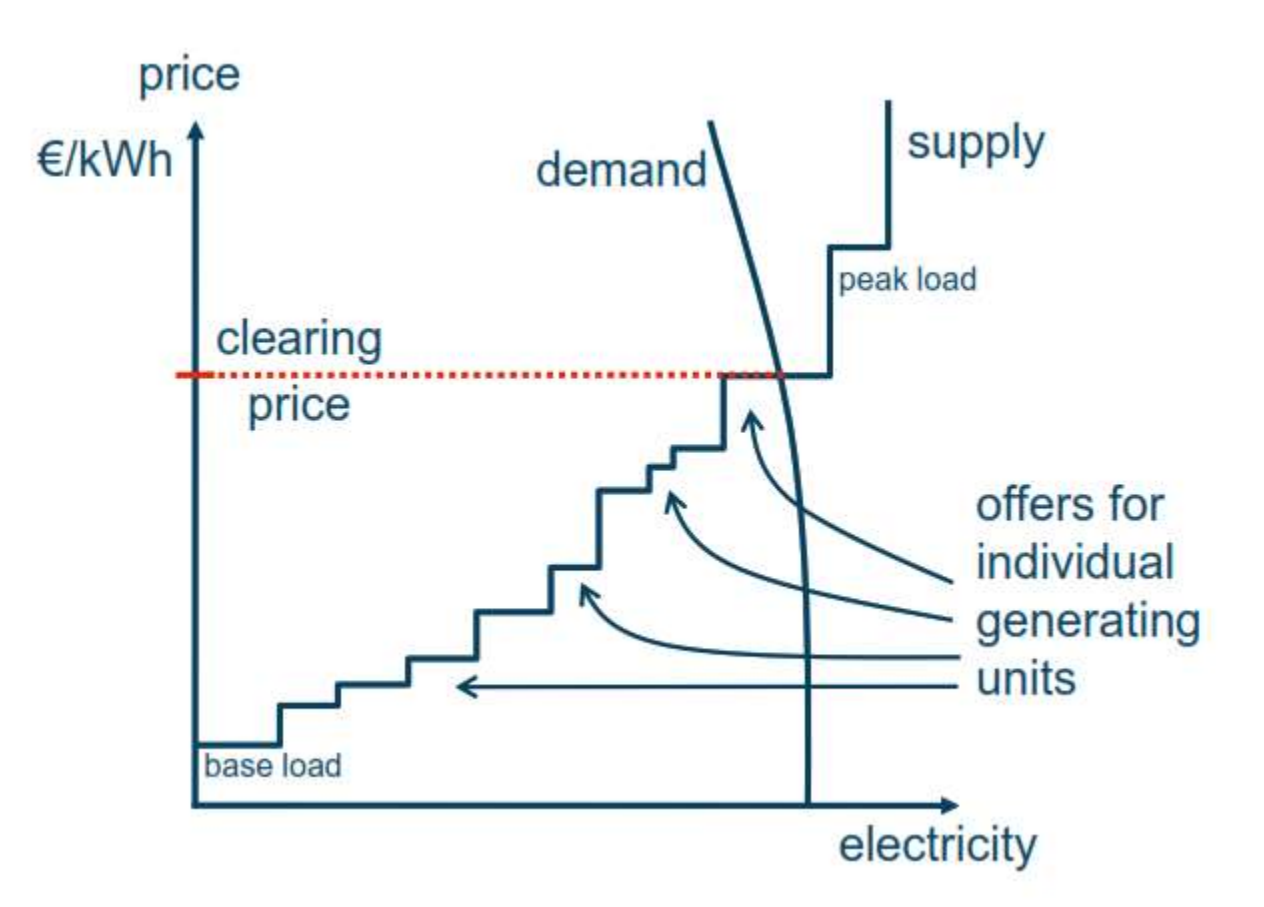
- "Gate Closure" is the deadline for trading electricity to be delivered in a specified period
- Gate Closure could be from one or more days to one hour or less before delivery time
- By Gate Closure, balanced *(injections and withdrawals)* positions are declared *(possibly through balance responsible agents)* to the relevant TSO for scheduling *(the PX may itself be a balance responsible agent)*
- At Gate Closure the TSO takes over the management of electricity flows over the network
- Deviations of actual injections/withdrawals from positions attract imbalance charges and are settled with the TSO

Short Term Markets

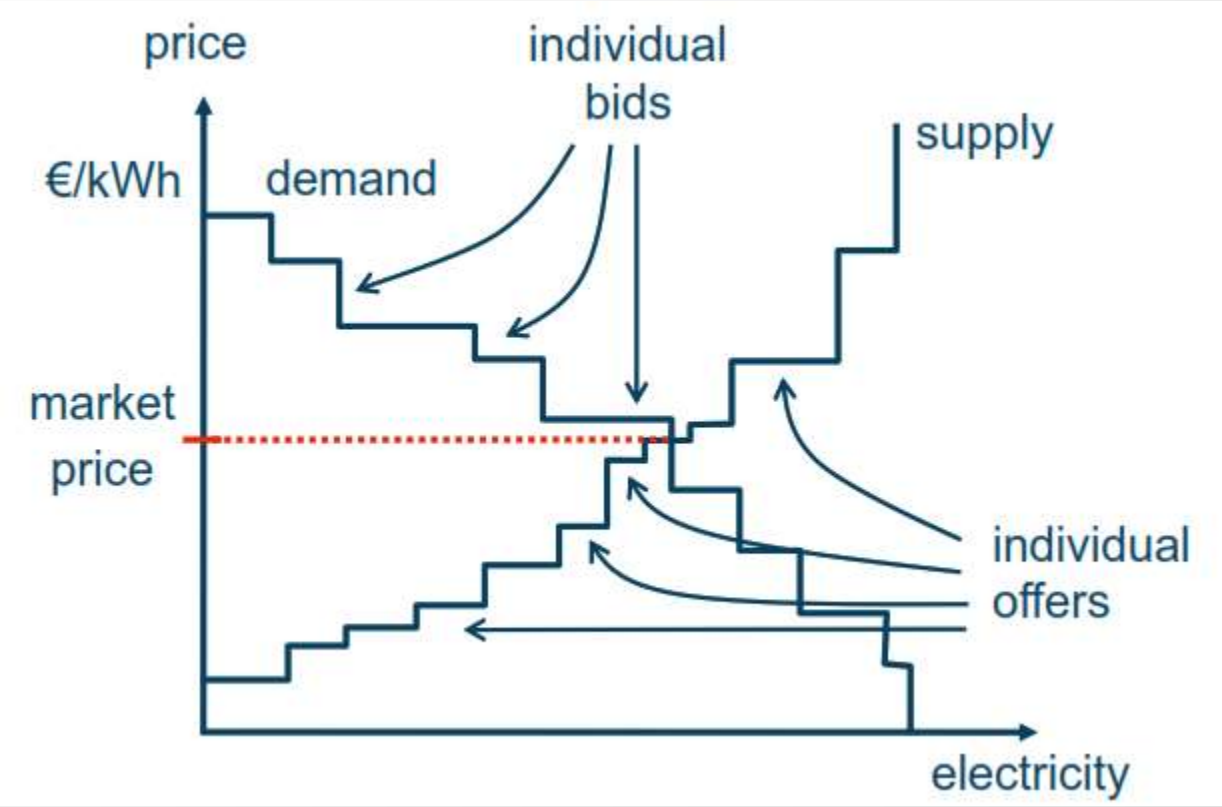
- In most market models there is a short-term (typically day-ahead) market that provides the reference price for the remaining transactions
  - Key issue is the potential for arbitraging between markets
- Why such a diversity of auction formats?
  - Bids: simple, complex, continuous, iterative
  - Dispatch: self-committed, centralized, zoom
  - Network: single node, zonal, nodal

➔Trade-off in market design: simplicity & transparency *versus* efficiency & avoidance of risk

Power Pool Price Setting



Power Exchange Price Setting



Case: spot trading

Producing a sample bid on the spot market

- A generator has two generating units
- **Unit 1**
  - Pmax = 500 MW
  - Variable Cost = 25 Euro/ MWh
- **Unit 2**
  - Pmax = 1000 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

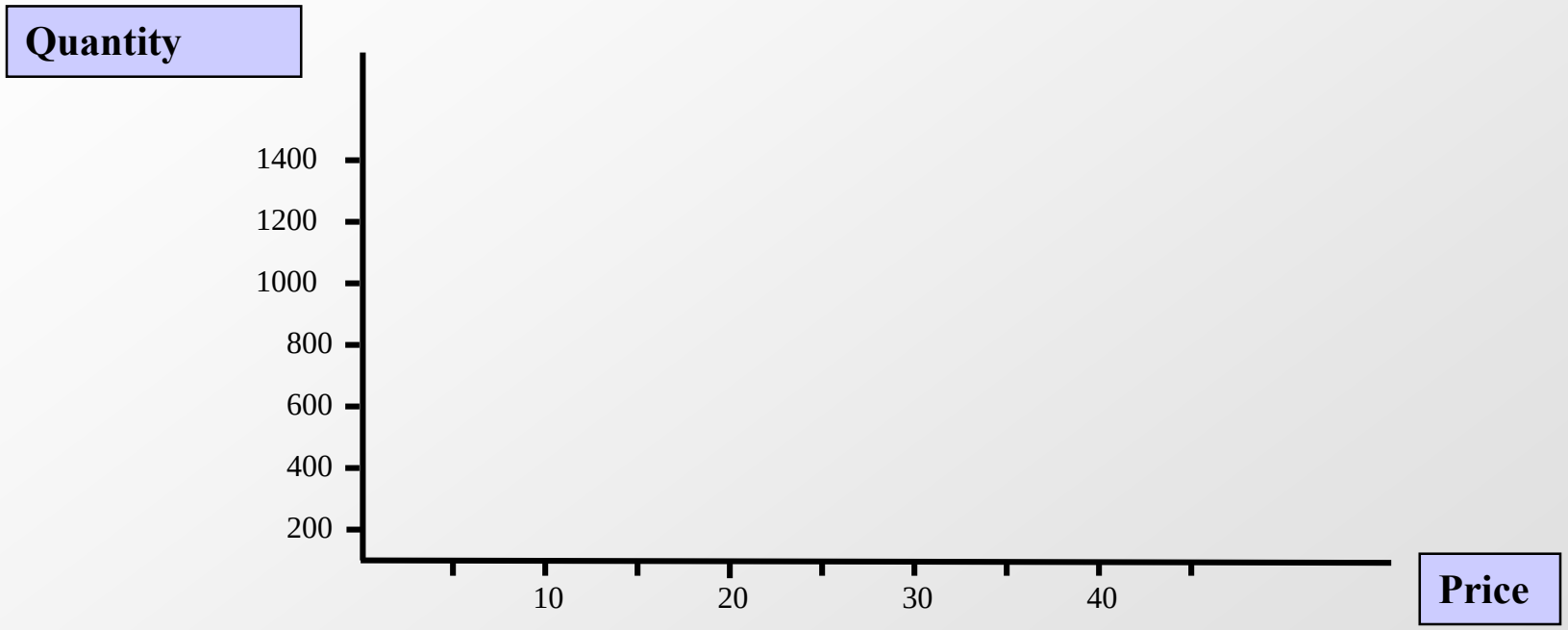
- One with a volume of 100 MW (option) at a price of 20 Euro/ MWh. At 8h00 he has to define whether he wants to use the option or not.
- Another with a volume between 0 – 200 MW and a price of 20 Euro/ MWh. The Generator has to define at 12h00 how much quantity he will buy.

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

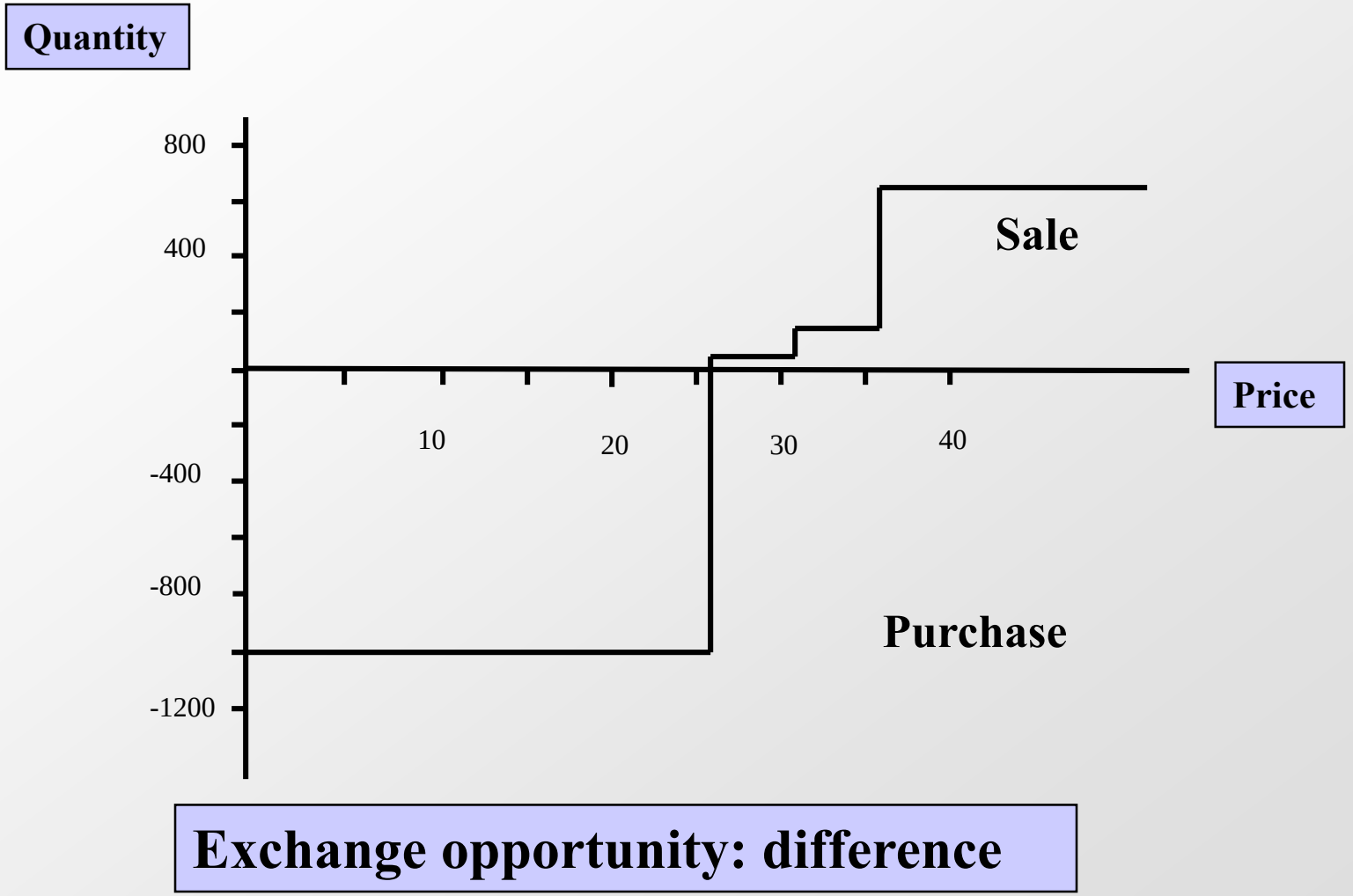
Tools

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

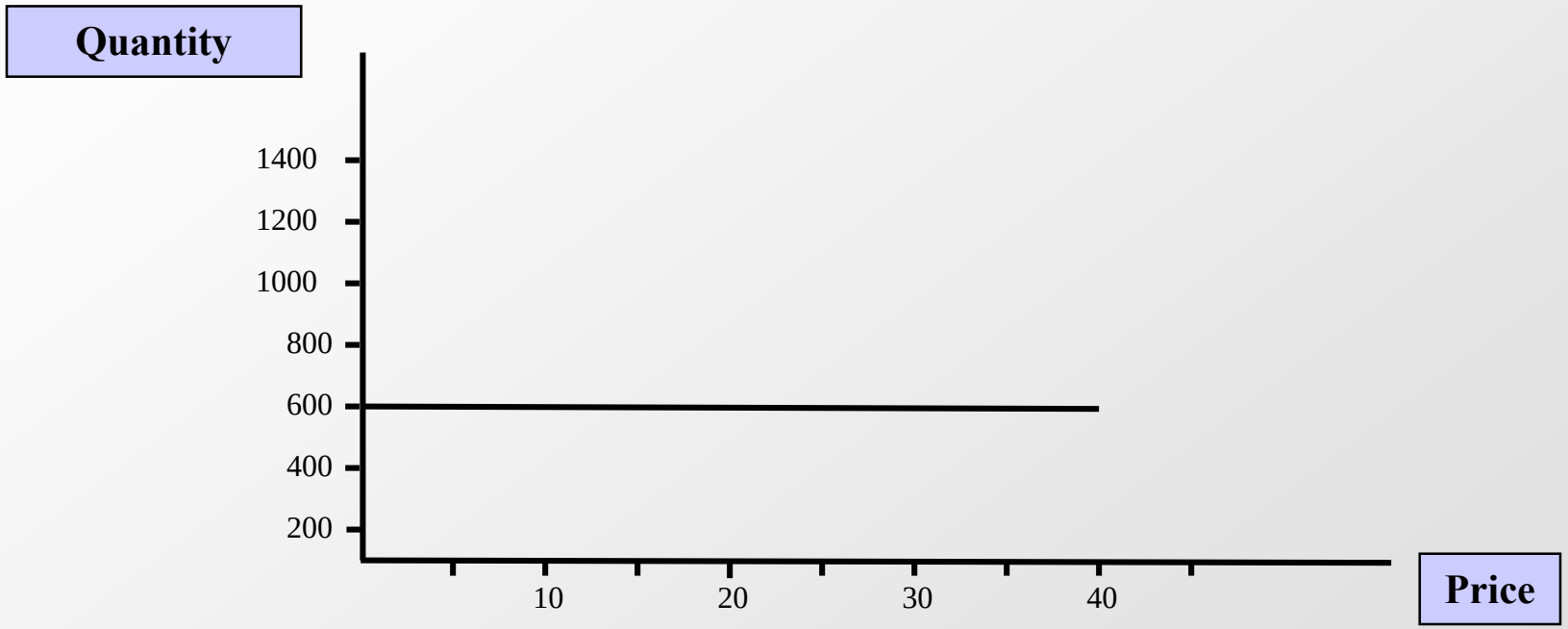


Example 2



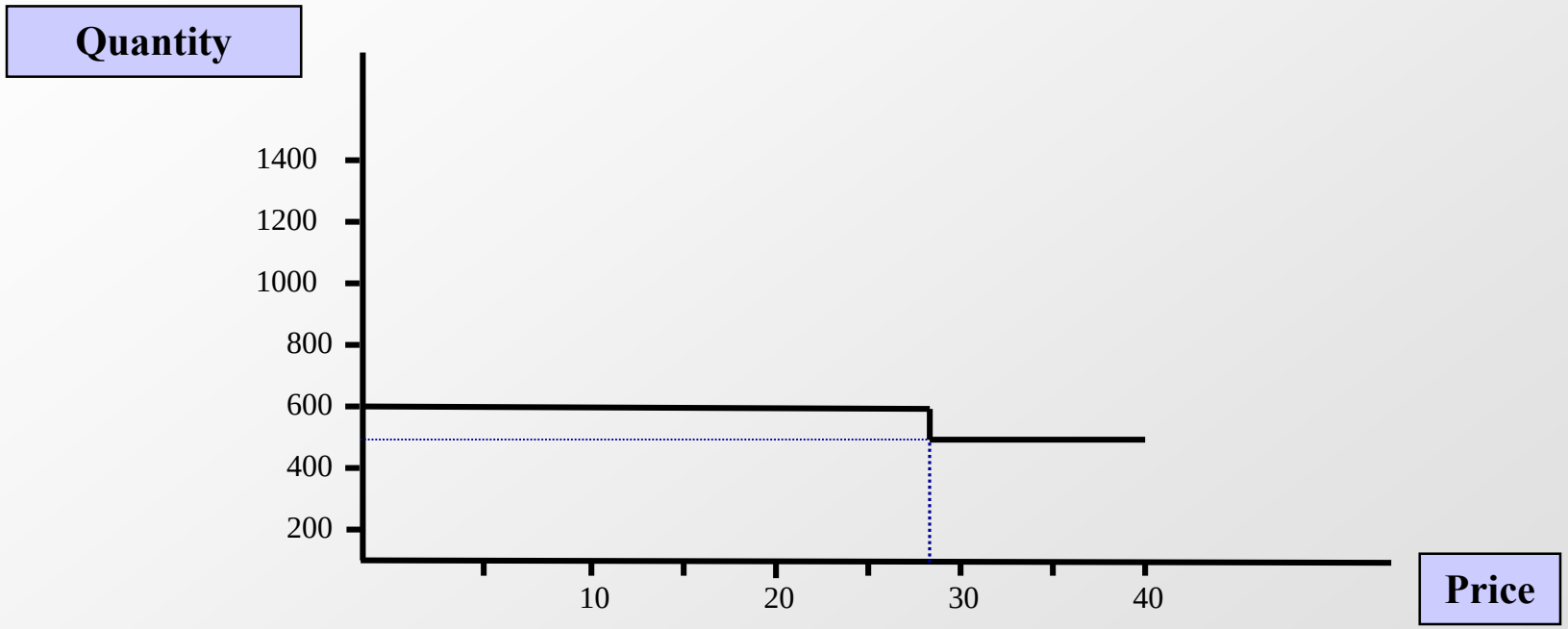
Exchange opportunity: difference

Producing a sample bid (1)



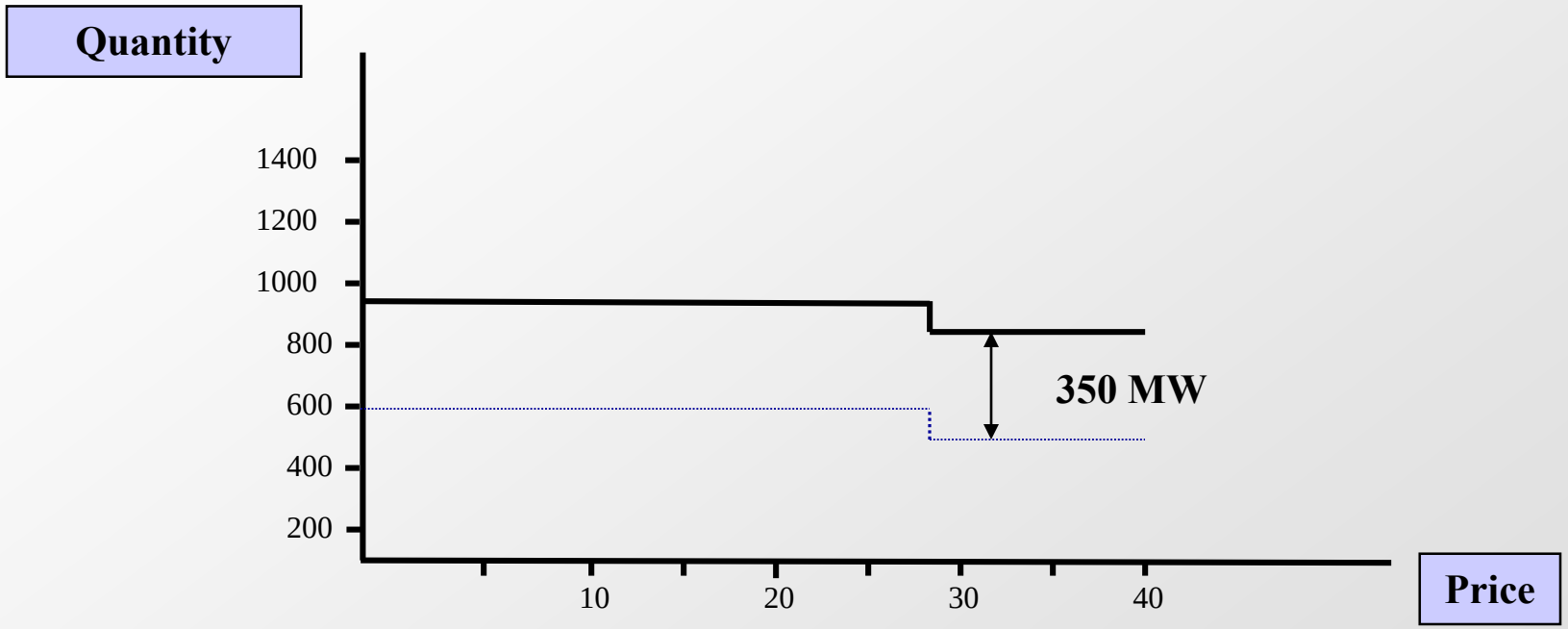
Generator has demand: 600 MW

Producing a sample bid (2)



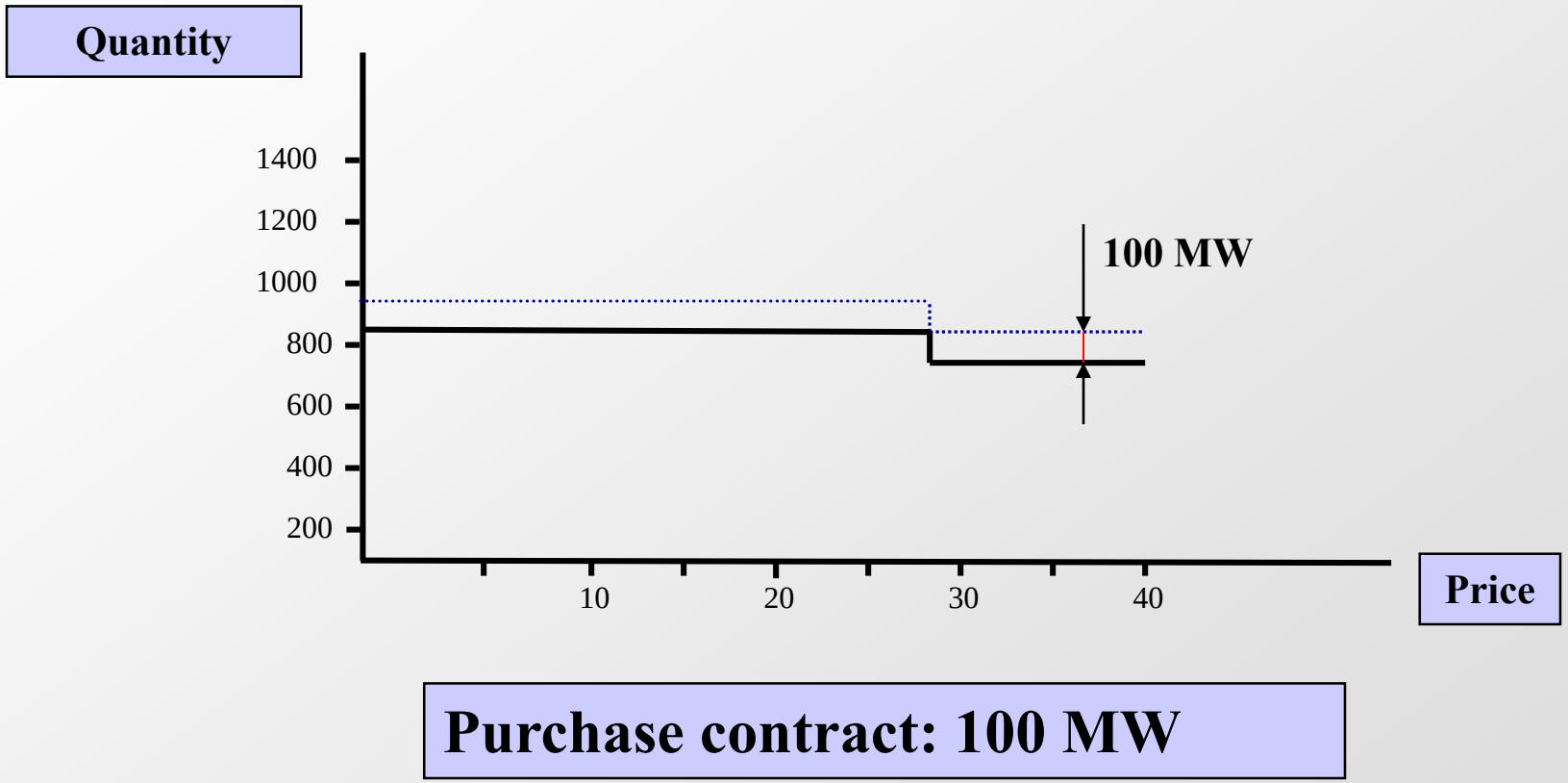
Load management: 100 MW, 29 Euro/ MW

Producing a sample bid (3)



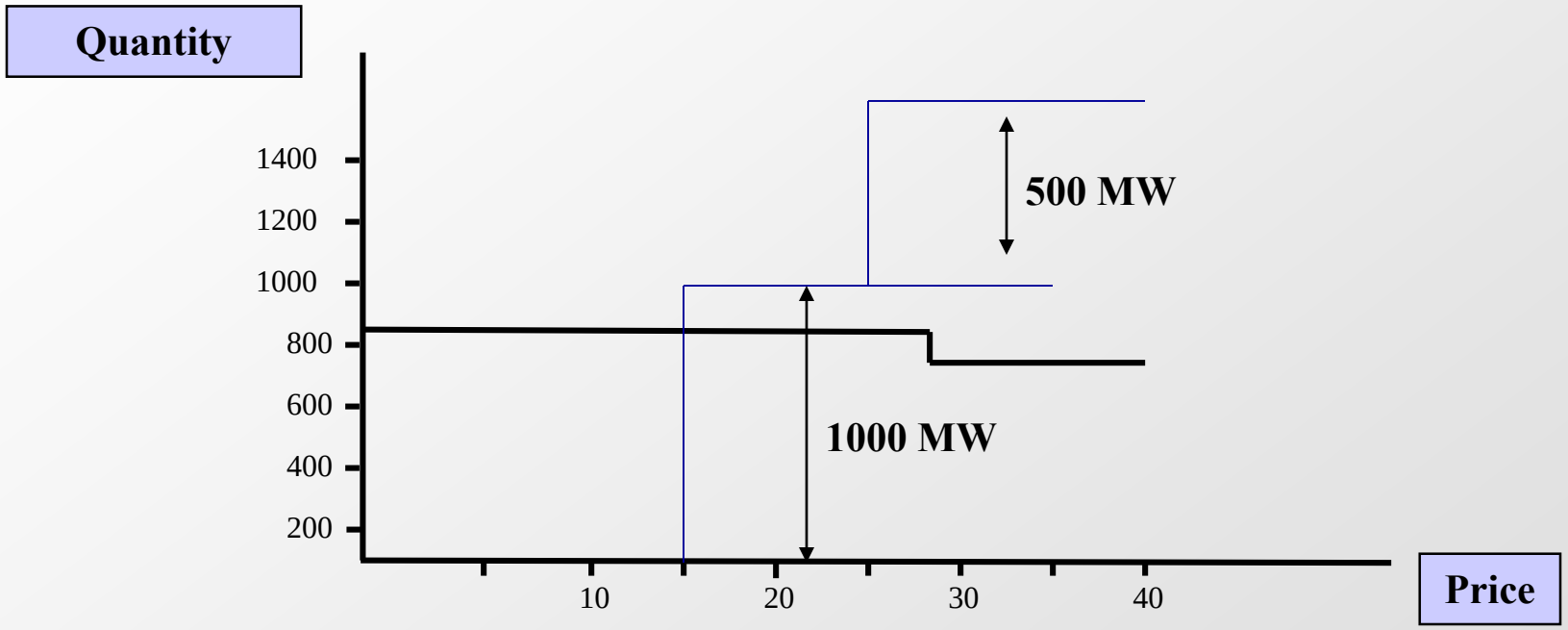
Sale contract: 350 MW

Producing a sample bid (4)



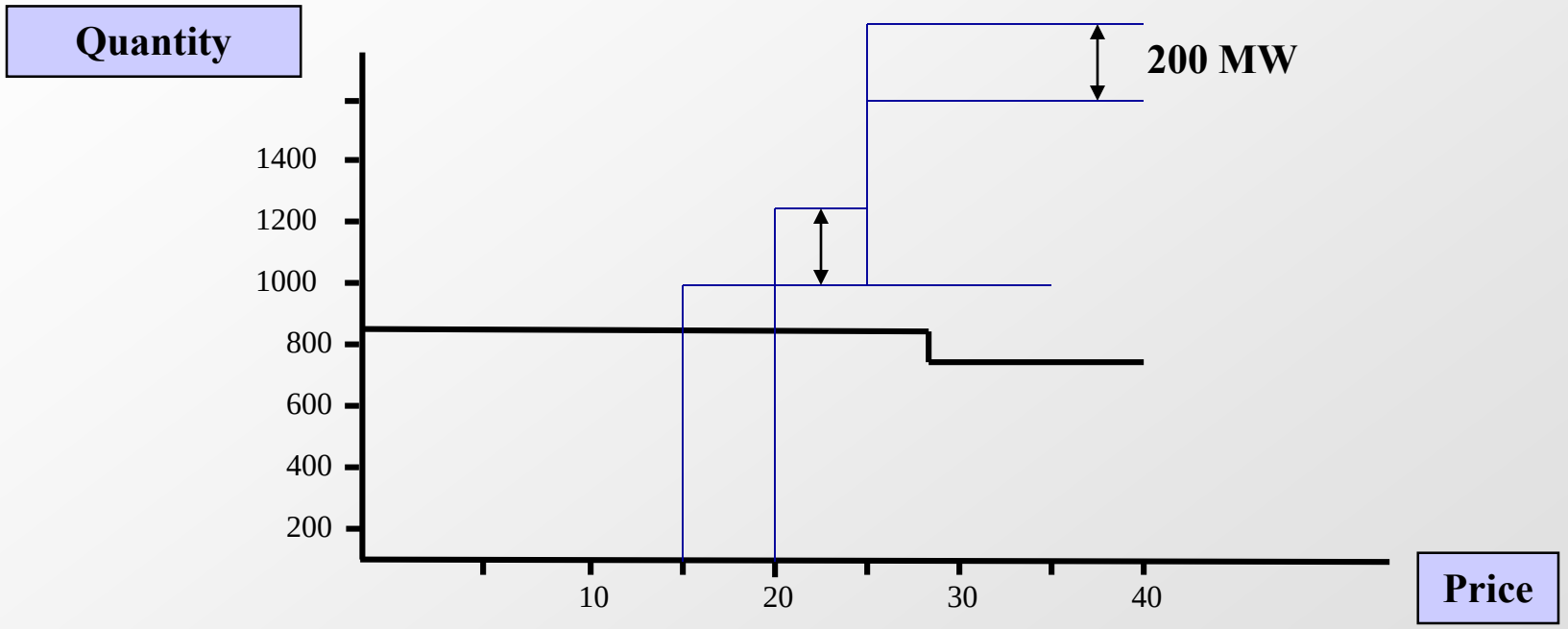
Purchase contract: 100 MW

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

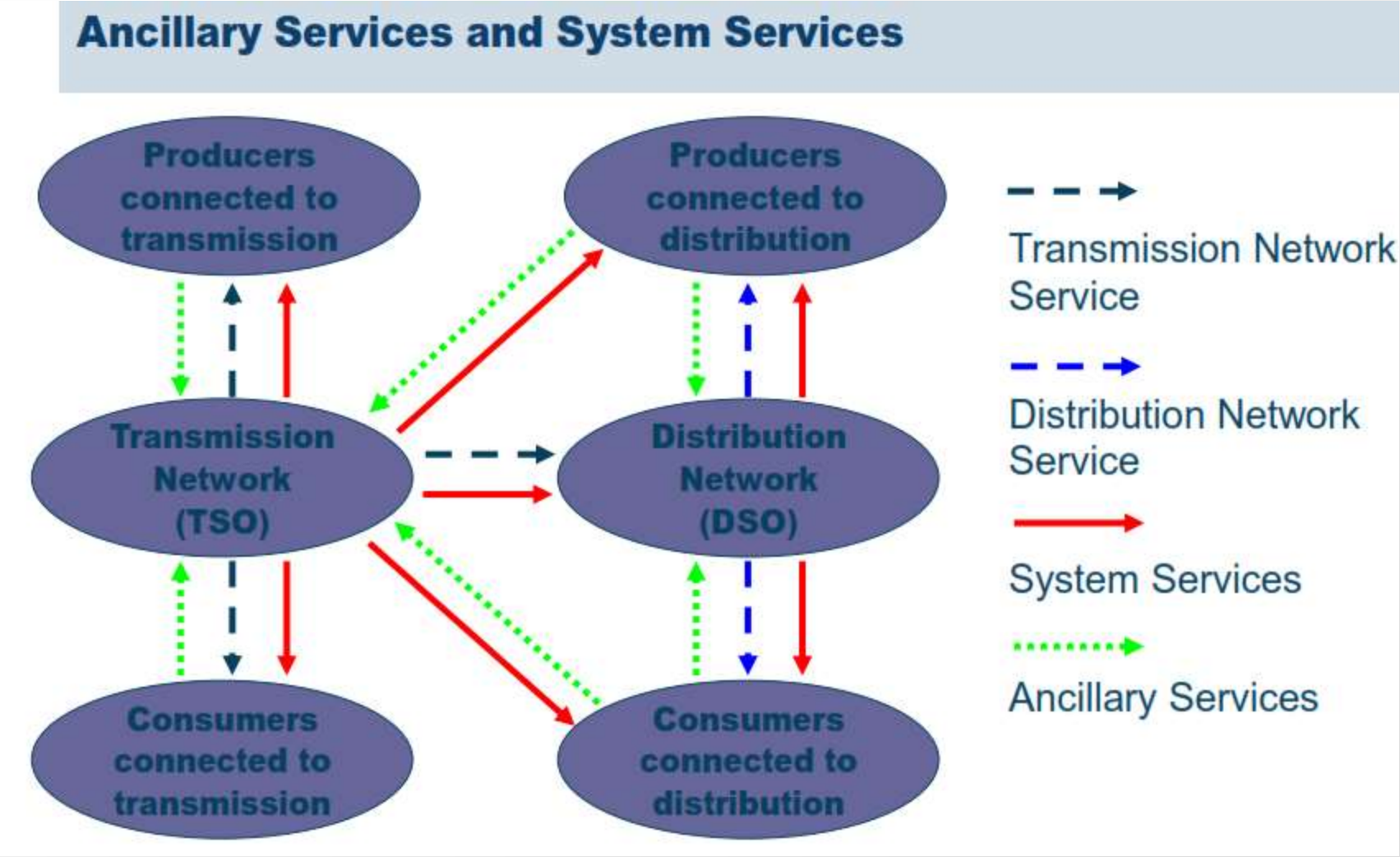
Producing a sample bid (Final)

Exchange opportunity: difference

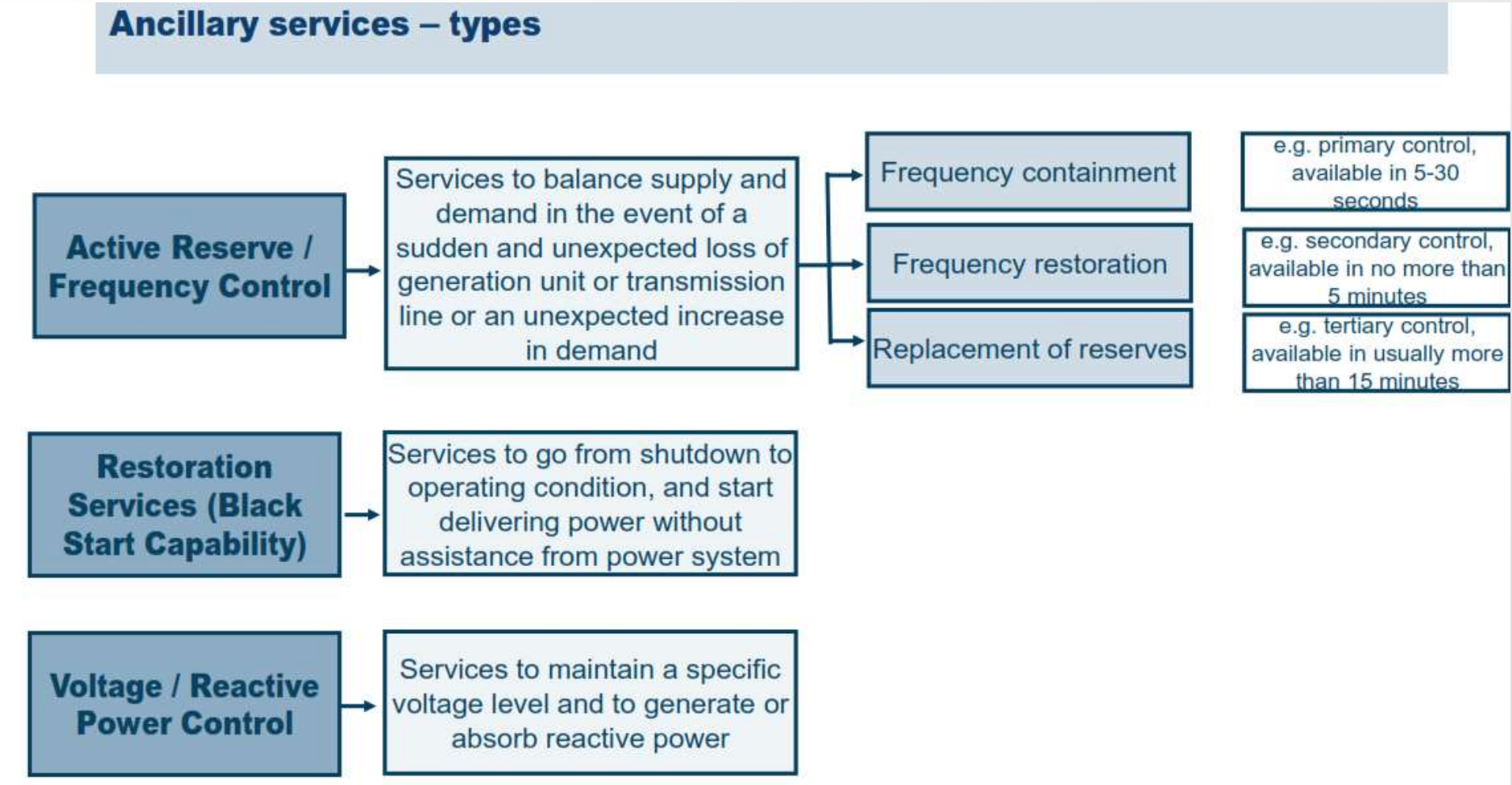
Competitive Power Markets

- Generators, suppliers and large customers trade electricity bilaterally, conditions and price not public
- Planned delivery and consumption schedules notified to system operator
- Voluntary power exchanges (PX) for day-ahead and intra-day trading
- Balancing markets to ensure energy balance in real-time
- Costs of imbalances allocated to parties that caused the imbalances

Competitive Power Markets



Competitive Power Markets



Intraday Markets

- Intraday markets make it possible to adjust *(by adding new transactions, without modifying the previous ones)* the contracted positions in the daily market
  - In case of occurrence of unexpected events *(generator failure, demand deviation)*
  - In case of difficulty in following the schedule of the daily program
  - Arbitrage between markets *(although the regulator may want to reduce it to a minimum)*

Ancillary Services

- Use market mechanisms whenever possible
  - Typically mandatory: frequency response (primary reserve)
  - Markets typically: secondary & tertiary reserves
  - Possible limited markets: reactive power, system restoration

  Wide diversity of contracting time horizons
- Secondary & tertiary reserves:
  - separate prices for capacity & energy use
  - may provide resources for balancing market

Balancing Market

- The criticality & volume of this market may be reduced with a zoom of short-term markets
- The price could be related to the use of secondary & tertiary reserves
- Most powers markets rely much on it (UK) while others basically avoid it (Spain, *just a penalty applied to deviations*)
- ISO may adopt emergency measures *(e.g. ad hoc markets)* whenever considered necessary

Demand side Bidding

- Demand participation is a basic ingredient of the second generation of power exchanges, but it is still mostly passive
- Incentives & mechanisms are needed so that purchasers
  - estimate the demand correctly
  - buy as economically as possible
  - experience the uncertainty of the pool price and want to hedge against it
  - have the means of hedging the risk of lack of supply, if they so wish

Firmness

- A series of markets converging to the real time, each of them with firm transactions, seems to be the currently preferred option
  - All accepted transactions are firm in quantity & price
  - Successive markets allow the agents to approximate their buy/sell positions to their current best estimates
  - Same firmness rule applies in all (long-term, short-term, real time) markets
    - The energy actually bought or sold by an agent in a given period of time is composed of several transactions, each one of them with its quantity & price

LT Security of Supply

The questions

- Can system short-term marginal prices remunerate the total costs of all plants?
- Can consumers choose their level of reliability of supply?

The proposed solutions

- Leave it to the market
- Regulated capacity payments
- Capacity markets
- Price risk-hedging contracts

Information disclosure

- Market information must be accessible to all interested parties without discrimination
- Trade-off between
  - availability of complete market information
    - example: disclosure on the following day of all accepted & non accepted bids
  - potential for collusion

Contract for Differences

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

	consumer	**generator**
spot market (pool)	$-q.P_m$	$q.P_m$
CfD for q at price P_c	$q.(P_m-P_c)$	$q.(P_c-P_m)$
total	$-q.P_c$	$q.P_c$

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

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

Bilateral Markets

Bilateral Markets

- **Long-term planning for adequacy and reliability**
- Most important task for a traditionally, vertically-integrated utility operating with an obligation to serve franchise utility customers
  - Planning generation, transmission and distribution in concert to ensure that power will be delivered to customers reliably when and where they need it
  - At the lowest reasonable cost
- ***Generation adequacy***
  - Determine how much generation needed for planning horizon, incl.generation capacity to be held in reserve to ensure supply adequacy under most conditions

Bilateral Markets

- **Short-Term**
- In short-term, all assets available to vertically-integrated utility (including available purchases from third parties) are optimized using economic or “merit order” dispatch
- Security constrained economic dispatch designed to weigh all factors that affect the incremental costs of reliably operating each available generation source in order to determine which units will be committed for use and how those units should be dispatched in real time

Bilateral Markets

- ***Unit Commitment***
- Utilities develop a unit commitment plan to optimize the use of available generation resources to economically and reliably serve their customers.
- Identifies generation resources to be committed for economic dispatch during the next day
- The generation resources are selected from available resources (including purchased power opportunities) such that total production cost to serve the expected load is minimized
  - Taking into account any transmission constraints, environmental requirements, fuel supply constraints or other limitations

Bilateral Markets

- Weather conditions
  - Impact on forecasted load, hydroelectric status, and unit operations
- Variable costs incurred in the production of electricity
  - Thermal efficiency (*i.e., heat rate)*
  - Fuel costs, including associated transportation costs,
  - In-plant fuel handling expenses
  - Variable operations and maintenance expenses
  - Emission allowance replacement costs
  - Transmission losses;

Bilateral Markets

- Power, fuel, and emissions markets
- Transmission availability and costs associated with purchases
- Operating characteristics and limits of generation facilities
  - Minimum and maximum operating limits,
  - Ramp time
  - Cycle times
  - Compliance with environmental requirements,
  - Start-up costs (*i.e., the costs to bring the generating unit on-line)*
  - Fuel inventory levels

Bilateral Markets

- Known operational limits of transmission facilities
- Availability of demand-side resources and costs
- Reliability standards
- State and federal regulatory requirements, including environmental limitations on any resources

Retail and Wholesale markets

- Free transactions between distributors & generators, thus sharing risks
- Distributors (now multiple purchasing agencies) maintain a monopoly over final consumers ➔ regulated tariffs
- Social policy obligations must be charged via regulated tariffs
- No central planning of generation, free entry
- Generation stranded costs & benefits appear

Retail and Wholesale markets

- Trading arrangements
  - open access & ancillary services ➔ system operator
  - organized markets (spot, derivatives) ➔ market operator (not a single buyer, but an auctioneer)
  - bilateral wholesale contracts
  - IPPs may choose between contracts & the spot market
  - regulated network access charges

Retail and Wholesale markets

- IPPs may / may not be vertically integrated with distributors (risk of self dealing)
- Issues of market power are now relevant
- Long term guarantee of supply is in principle left to the market: *will it work*?
- Strong incentive to efficiency in generation
- Any pressure from consumers to arrive at retail competition : *depends level regulated tariffs*

Wholesale market Architecture

- Electricity =

  Energy (Day-ahead and intraday)

  + Congestion pricing

  + Reserves (and Generation Capacity mechanisms)

  + Real Time Balancing

Day Ahead Market Design

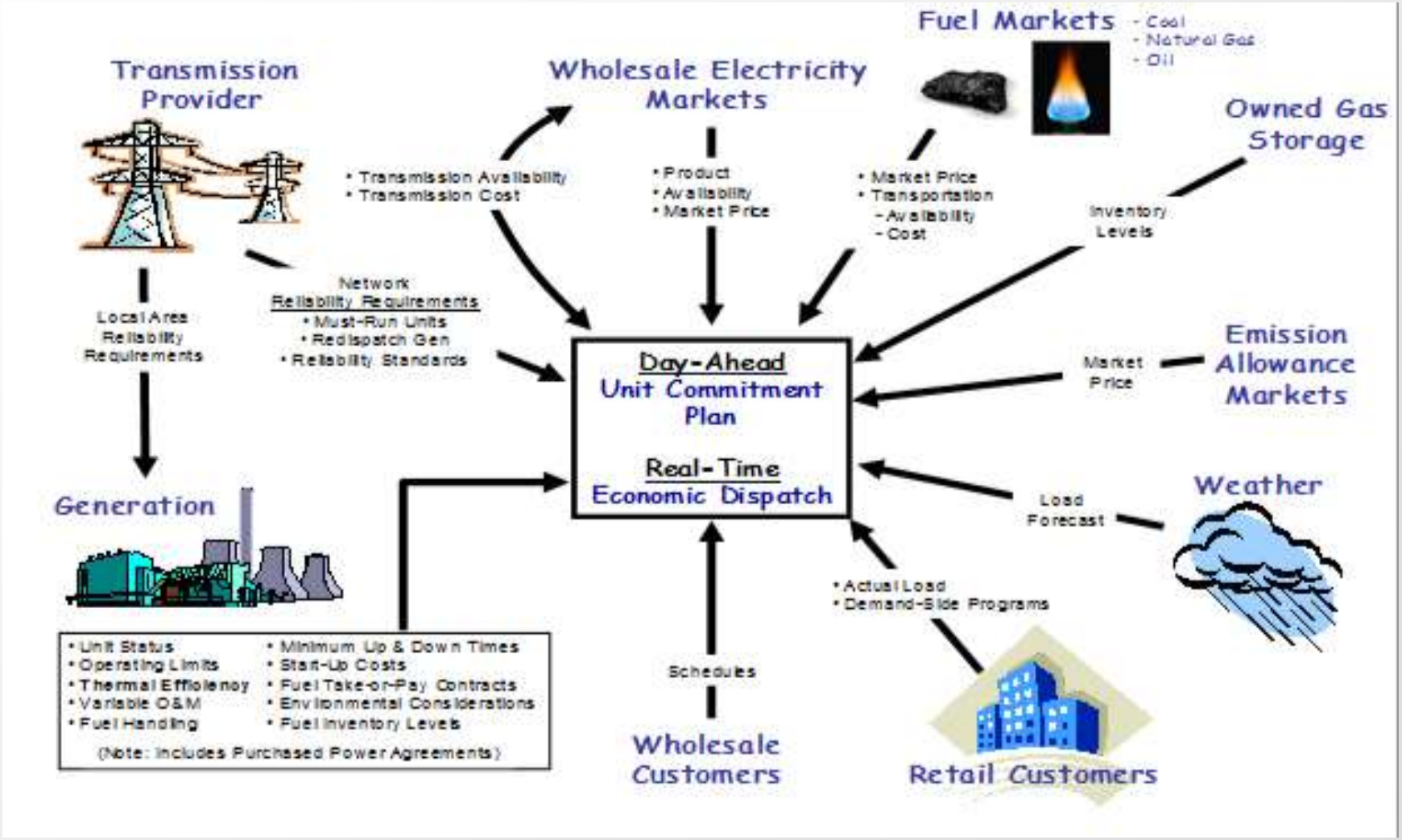
- Options :
  - Centralization (organized: Pool & PX) vs. Decentralization (bilateral/OTC)
- Differences :
  - Available Information
  - Liquidity
  - Speed for finding a market equilibrium
  - Flexibility of decision and actions

Bilateral Trading

- Bilateral contracts may be:
  - Customised
    - Respond to the requirements of the counterparties
    - Reduce basis risk ...
    - But requirements of the counterparties may not always be compatible
  - Standardised
    - Standard features and clauses
    - Easier to negotiate
    - Easier to trade in a secondary market

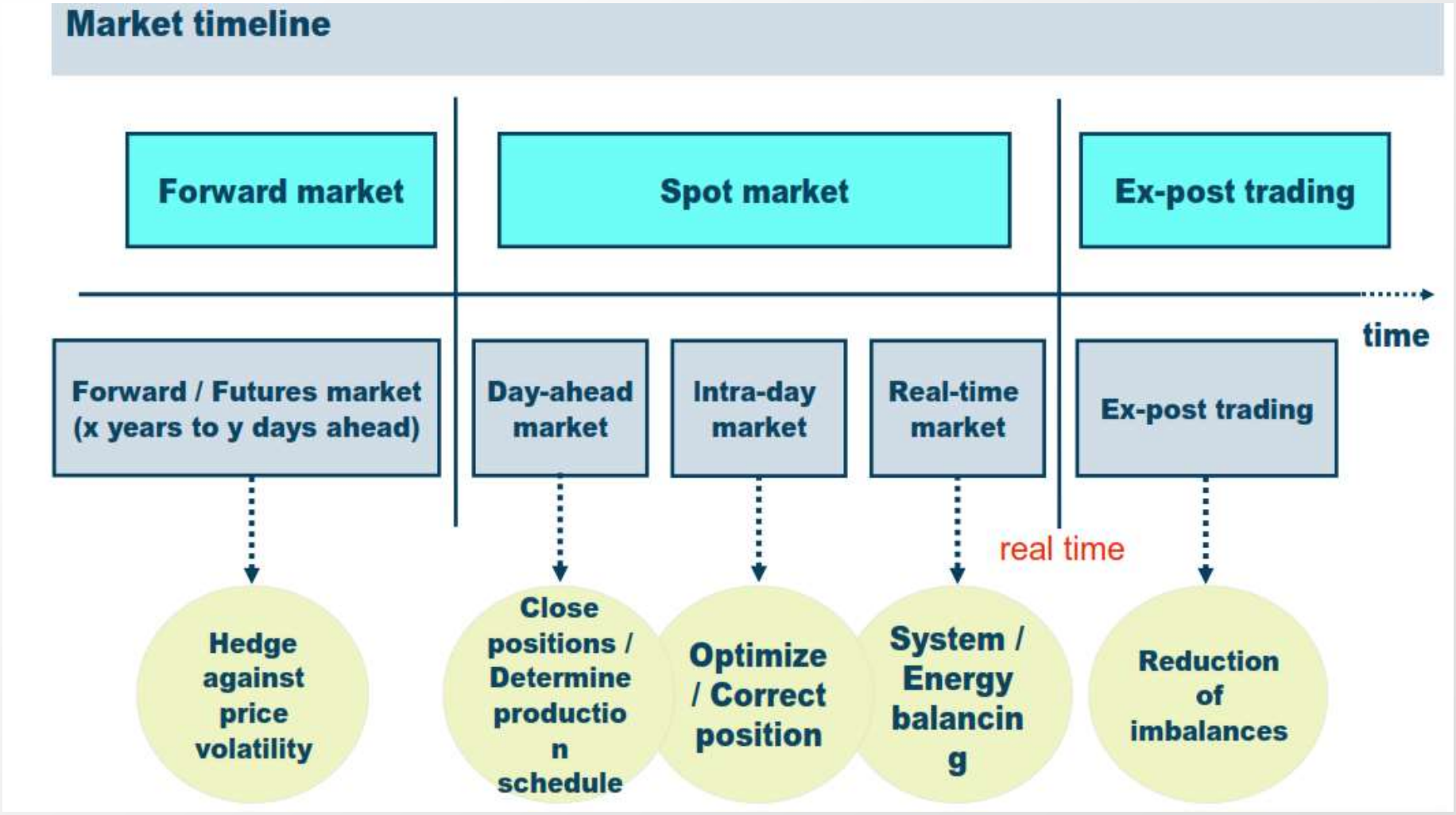
- Brokers may facilitate the conclusion of bilateral contracts by matching counterparties with compatible requirements

Optimizing assets through Economic Dispatch Process



Electricity Trading Markets

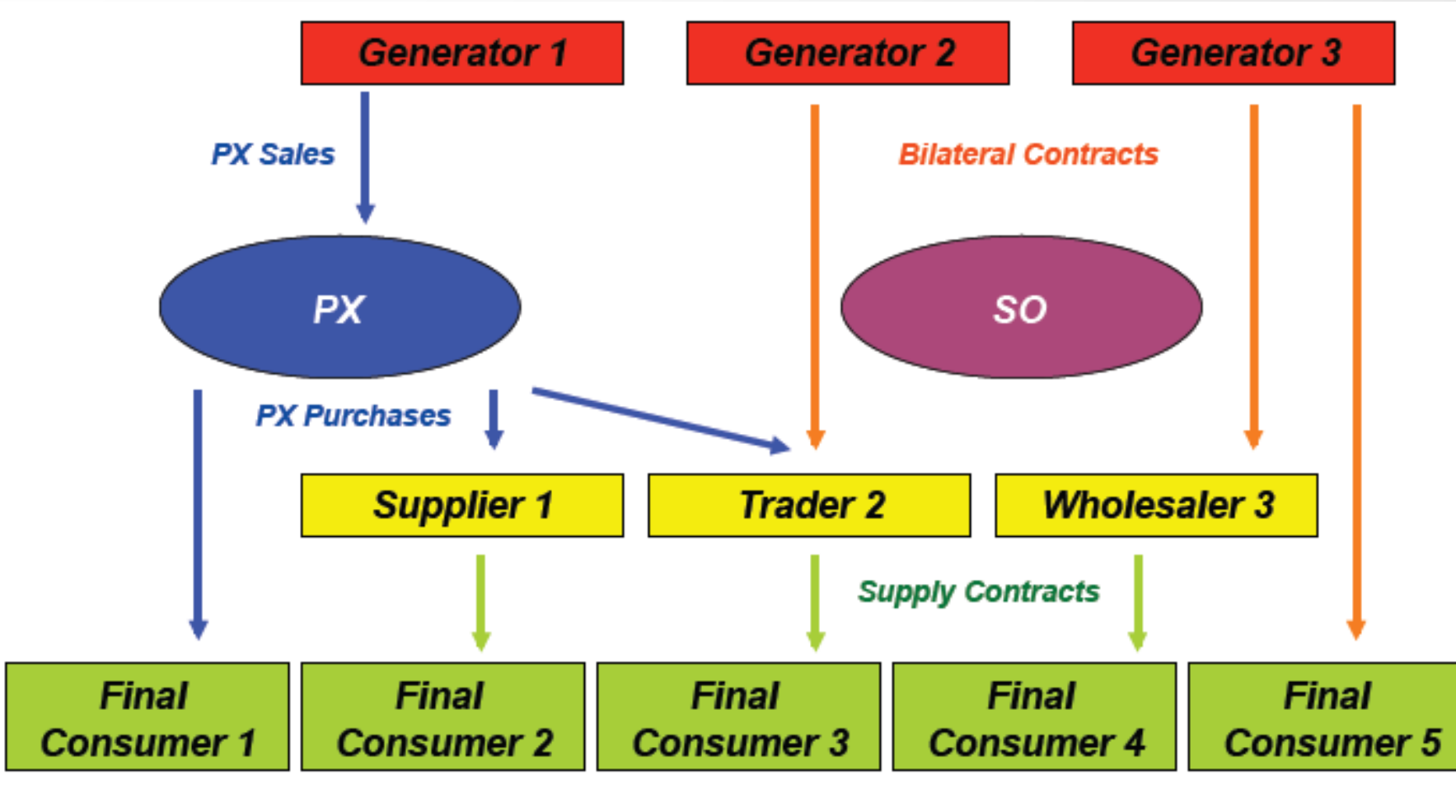
Trading Markets



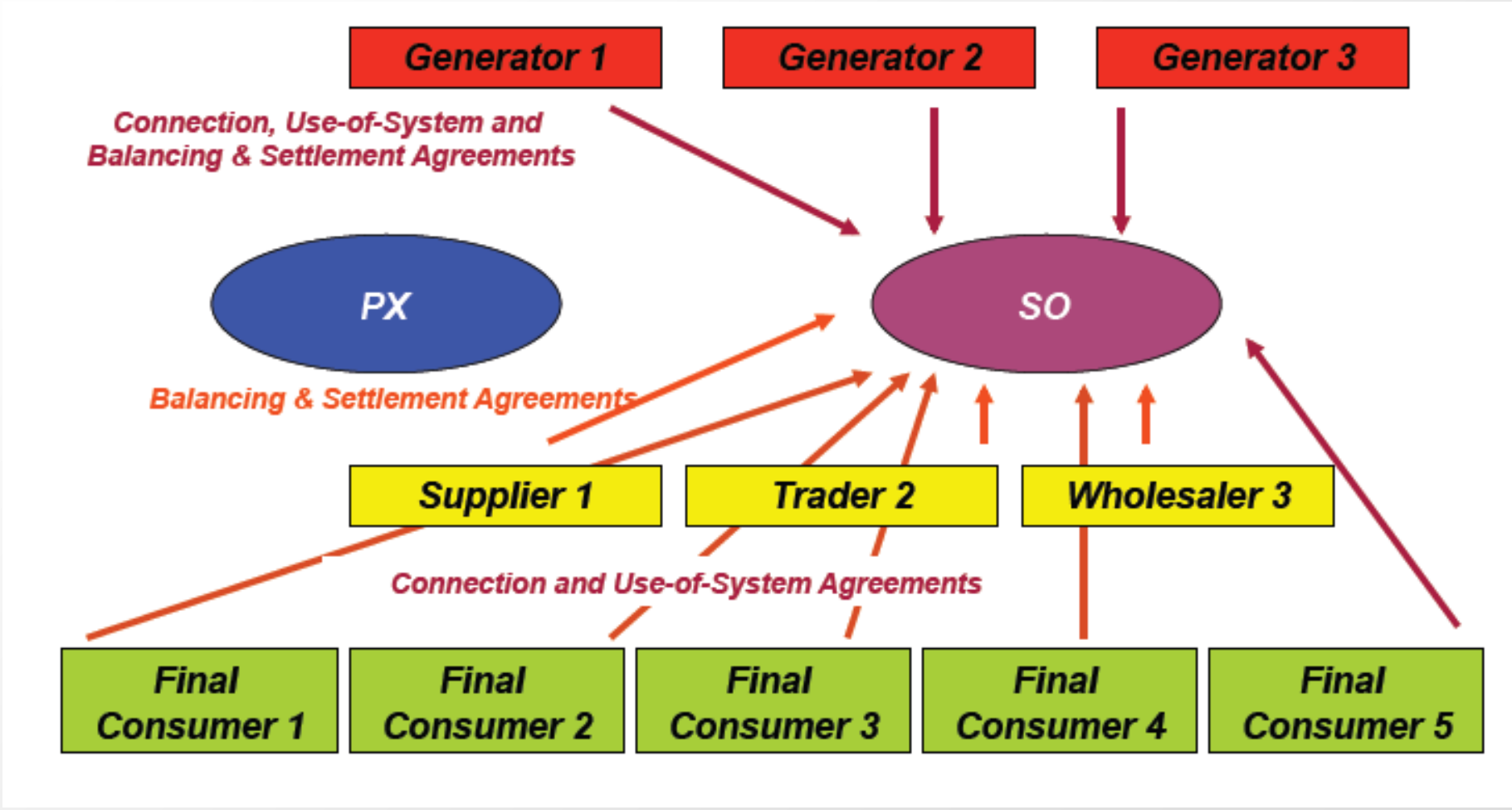
Energy Trading Opportunities

- Bilateral Over-the-Counter (OTC) contracts with free formats
- Contracts in organized markets (Power Exchanges, PXs)
  - Long-term contracts: physical or financial, with different standardized formats
  - Day-Ahead organized markets (spot markets)
  - Intraday markets
- SO-run markets for operating reserves & network constraints
- SO-run balancing markets

Commercial Relationships



Physical Relationships



Format Contracts

Properties	Trading Method	
	Over-the-Counter	**Power Exchange**
Anonymity of Trading	No	Yes
Counterparty	Bilateral	Central counterparty
Counterparty Risk	Yes, unless cleared	No
Trading Method	Continuous Trading	Either Continuous or Central Auction

Format Contracts

- Contracts may be:
  - Customised (bilateral)
    - Respond to the requirements of counterparties
  - Standardised (anonymous)
    - Standard features and clauses
    - Easier to negotiate
    - Easier to trade in a secondary market
- Brokers may facilitate the conclusion of bilateral contracts by matching counterparties with compatible requirements

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

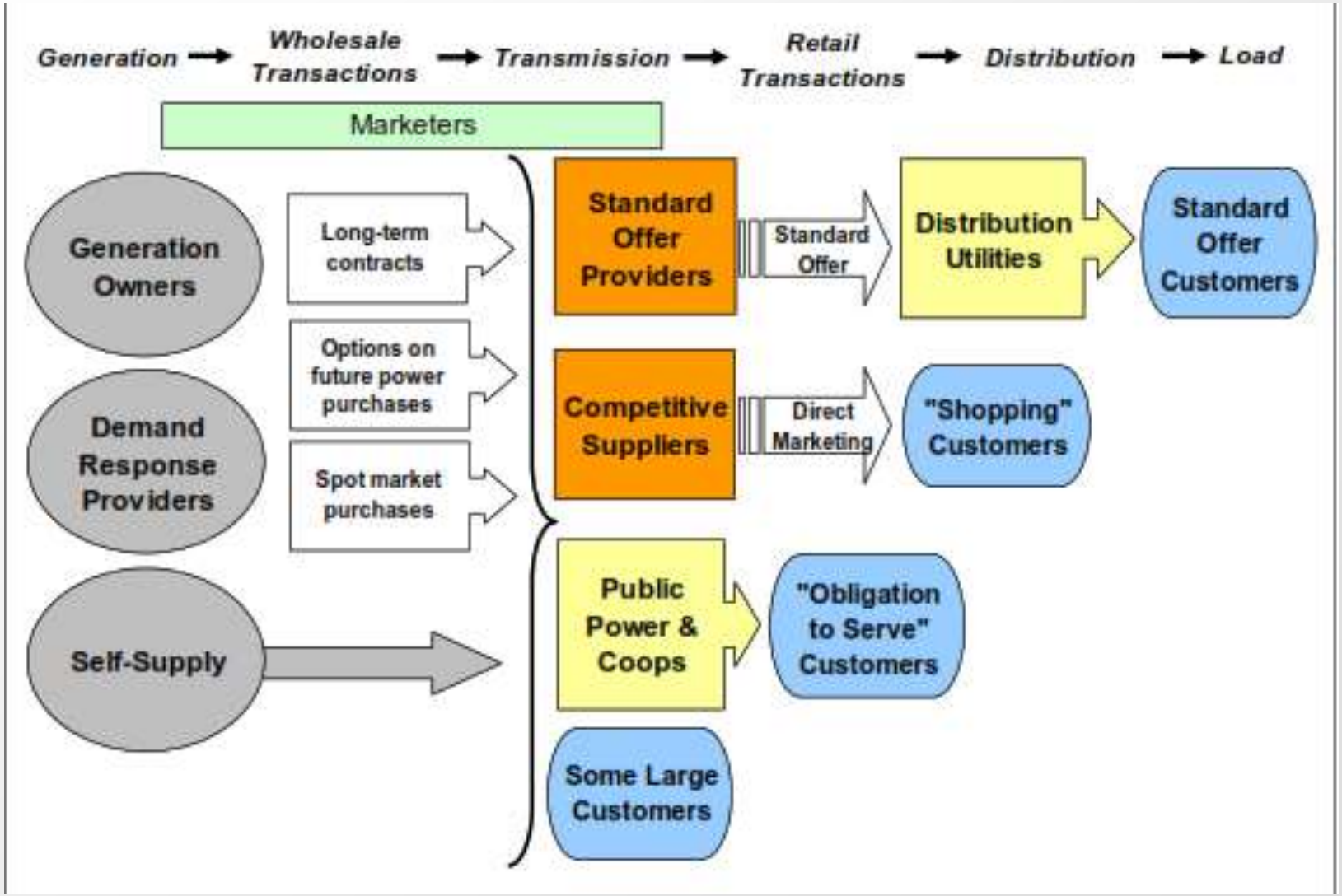
Activity	Estimated Timeframe
Drafting The RFP/RFQ	Week 1-12
Identifying Qualified Vendors and Publicizing the Solicitation	Week 13-14
Release the RFP/RFQ	Week 15
Obtaining Notice of Intent to Respond	Week 17
Holding a Pre-Proposal Conference	Week 18
Proposer Responses Due	Week 20
Evaluating Responses	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)