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Energy Security Project

INSTRUCTIONS ON MONITORING THE ENERGY SECTOR

Monitoring indicators

November 3, 2021

AGENDA

- PRINCIPLES OF THE MONITORING ACTIVITY
- DATA AND INFORMATION
- THE MONITORING INDICATORS ON MARKET FUNCTIONING
- GENERATION INVESTMENT
- THE RESULTS OF MONITORING
- INFORMATION TRANSPARENCY

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PRINCIPLES OF THE MONITORING ACTIVITY (1)

RESPONSIBILITIES OF NEURC

- NEURC monitors legislation and market rules observance by participants, their behavior, market structure competitiveness and market efficiency, market transparency and integrity.

NEURC'S COOPERATION WITH OTHER ENTITIES

- NEURC collaborates *with AMCU and with NSSMC* to prevent, detect and discourage anti-competitive practices in the energy markets.
- NEURC operates in a close collaboration *with Market Operator (MO)* and *Transmission system Operator (TSO).*

PRINCIPLES OF THE MONITORING ACTIVITY (2)

MARKET PARTICIPANTS AND OPERATORS' RESPONSIBILITIES

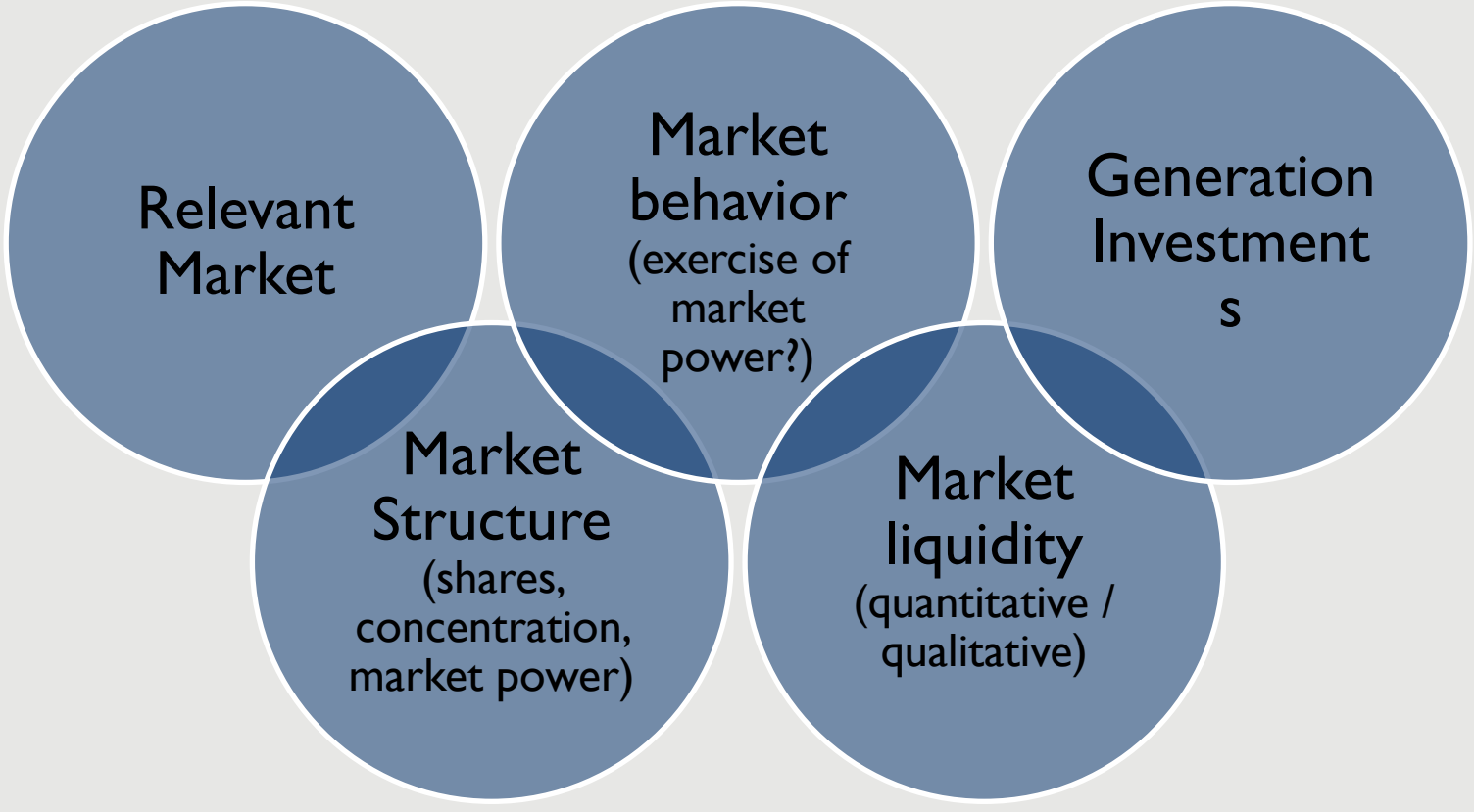
- Market participants transmit data based on monitoring forms, correctly, completely and on time.
- MO and TSO monitor administered markets according to their internal procedures to assess performance and to identify any abnormal market behavior of the participants.
- MP, MO and TSO notify NEURC about the inappropriate functioning of the energy markets, or the existence of a possible market abuse.
- Notifications of possible REMIT market abuse shall use ECRB template.

DATA AND INFORMATION

SOURCES OF DATA USED FOR MONITORING

- Reporting forms of licensees and information received by NEURC requests or during inquiries
- Transparency platforms & Inside Information Platforms (IIP)
- RRM reporting under REMIT on behalf of wholesale market participants
- Data and information from requests, complaints of consumers, business entities and state bodies
- Consumers' sociological surveys
- Other sources

CALCULATING MONITORING INDICATORS – **KEY PILLARS**

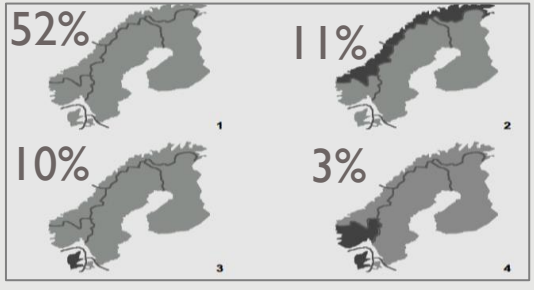


RELEVANT MARKET

- *Key concept in the competition law, describing a group of products linked by demand and supply patterns. Outlines the scope of calculation and assessment.*
- **RELEVANT MARKET** combines**:**
  - **RELEVANT PRODUCT MARKET** — comprises all products which are regarded as interchangeable or substitutable by the consumer.
  - **RELEVANT GEOGRAPHIC MARKET** — the area in which the supplied products and conditions of competition are sufficiently homogeneous.

➢ The wholesale market trade takes place in four separate submarkets (segments) belonging to the same relevant wholesale market in the **product dimension**
  - *the bilateral contracts market and the spot market,*
  - *the balancing market and the ancillary services market.*

➢ In the **geographic dimension**, the structure of relevant markets depends on the occurrence and location of congestions.



Nord Pool market. The four most frequent price area combinations, 2001

MONITORING INDICATORS ON MARKET FUNCTIONING

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GENERAL MARKET AND SYSTEM INDICATORS: NUMBERS / SHARES

To observe DYNAMICS OF A SERIES OF INDICATORS AS NUMBERS.

- *number of market participant by activities*
- *number of participants in day ahead and intraday markets*
- *number of balancing service providers and number of balance responsible parties*
- *number of ancillary services providers*

To calculate MARKET SHARES

- *the participants' market shares in different relevant markets*
- *the organized markets' shares in the total consumption*

MARKET SHARES are based on

- *installed capacity*
- *generation output and/or import (the injections)*
- *consumption and/or export (the withdrawals)*
- *wholesale/retail market turnover*
- *traded instruments turnover (in day-ahead, intraday, balancing)*
- *special market segments (PSO/US, as CRE in France accounts separately ARENH)*

MONITORING MARKET POWER

1. COMPETITIVE MARKET

- ***"Where numerous firms compete, and no one is large enough to influence the results"***
- Social welfare maximisation which is the reason to establish a deregulated market may be achieved by making the market as much as possible competitive.

2. MONITORING THE MARKET POWER

- ***"The ability of an individual or group to profitably maintain prices above competitive levels for a significant period of time"***
- Concentration indicators enable detecting the possibility of exercising market power.
- Concentration indicators and occurrence of abuse of dominant position shall be monitored. Ukraine Electricity Law addresses the abuse of dominant position.

CONCENTRATION

- Market concentration resides in number of participants and their market shares.
- The definition of relevant market is of the utmost importance.

CONCENTRATION INDICATORS (i)

- *MO and TSO shall calculate the concentration indicators for each of the administered markets*
- *NEURC shall calculate the concentration indicators for the retail and wholesale markets.*

MARKET SHARE

- *One firm installed electricity generation capacity (or amount generated/traded) divided by total generation capacity (or total amount generated/traded)*
- *If electricity nominations are available, the calculation of market shares may consider import at both numerator and denominator. If only the value of cross-border flows are available (ENTSO-E data) import may be considered only at denominator.*

THRESHOLDS

- ***TFEU:*** *30% is a reference for investigation of vertical agreements, while significant market power requires a market share greater than 40%. The European law states if no company has a share greater than 25%, there is a presumption of a lack of significant market power.*
- ***FERC:*** *< 20% - lack of market power.*

CONCENTRATION INDICATORS (ii)

a) N-Firm concentration ratio

- *Sum of market shares of a given number of firms with the largest share in a market.*
- **Most used:** market share of the largest market participant (C1), the sum of the market shares of the three (five) largest participants (C3, C5).
- **Thresholds:** A market where concentration ratios CR1; CR3; CR5 exceed 33.3%; 50% respectively 66.7% is considered concentrated.

b) Herfindahl-Hirschman Index – HHI

- *Sum of squares of the market participants' shares.* $HHI = S_1^2 + S_2^2 + \ldots + S_n^2$
- *For a product traded in a marketplace, calculation is done for both sales/purchases.*
- **Thresholds:** HHI<1000 (1500); unconcentrated;
  1000(1500)<HHI<1800(2500); moderately concentrated;
  HHI>1800 (2500), highly concentrated.

CONCENTRATION INDICATORS (iii)

London Economics report (2007) shows

- *BE and FR are highly concentrated*
- *DE, ES and NL range from moderately concentrated to highly concentrated*
- *GB ranges from borderline unconcentrated to moderately concentrated.*

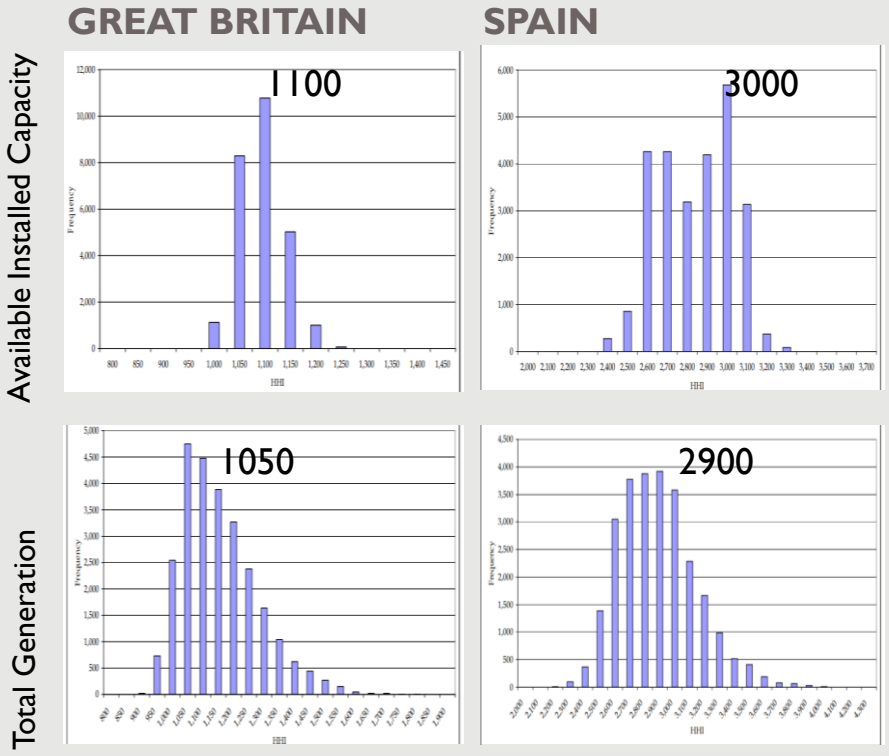
HHI based on Available Installed Capacity (2003-2005)

Country	CR(n)%	HHI
Belgium (n=1)	90.7	7694 (5332 to 8932)*
Germany (n=2)	54.1	1914 (1160 to 2603)*
Spain (n=2)	71.4	2 813 (1945 to 2293)*
France (n=1)	92.6	8 592
Netherlands (n=2)	57.7	2 332 (938 to 3835)*
Great Britain (n=2)	31.2	1 072 (1004 to 1189)*

(*) variation by considering interconnectors

Herfindahl-Hirschman Index – HHI (2003-2005)

Source: London Economic.



CONCENTRATION INDICATORS (iv)

*PSI & RSI want to reflect **Demand, Total available supply and Large suppliers' capacity**.*

c) PIVOTAL SUPPLIER INDEX

- ***(total power available in the system - available power of the producer) / total system load.***
- *THRESHOLDS: PSI=1 if ratio<1, PSI=0 if ratio=1 or higher; If PSI=1 the producer is necessary (pivotal) to cover the load.*

d) RESIDUAL SUPPLIER INDEX

$$RSI_i = \frac{total\ available\ capacity - capacity_i}{market\ demand}$$

• RSI = (Total Supply – Largest seller's Supply) / (Total Demand) • Total Supply = Total in-state supply capacity + Total net import • Largest Seller's Supply: The Seller's Capacity – its Contract Obligations to load • Total demand = Metered Load + Purchased Ancillary Service • *Ancillary services should be those contracted, not those activated.*	• *This is Sheffrin's definition during California deregulation (and crisis) (the year 2000)* • *But application today may be different.*

➢ *SENSITIVITIES:* The **seller's import** better to consider only if nominations available;
- *"import apportioning with firm's market share" (LE) may be a too high approximation.*

If **export of electricity is included** in the load, **import and not net import** shall be considered in total supply. **Outages** should be considered.

Must-run, PSO should not be included as well as **RES production** if it benefits from priority.

➢ RSI could be calculated for a **specific market (DAM/BE) and its time horizon**. "Total capacity" shall be "sum of sale offers", "generator capacity" shall be "participant sale offers" and "demand" shall be "total traded amount".

CONCENTRATION INDICATORS (v)

RESIDUAL SUPPLIER INDEX

FERC proposed Supply Margin Assessment (SMA) screen.

- If a Supply is pivotal during the annual peak hours, the supply does not pass SMA screen test

THRESHOLDS:

SHEFFRIN TEST (RSI SCREEN)

- *RSI indicator must not be less than 110% for more than 5% of the hourly intervals of a calendar year (438 hours), thereby RSI must be more than 110% for at least 95% of the hours in the year.*

Illustration of RSI Computation for Entire Market in the Peak Hour (2000-2002)

Demand		Total Supply			Total Supply	Largest Supplier Capacity	RSI Index
Year	(MW)	Must take (MW)	Thermal Capacity (MW)	Imported Energy (MW)	(MW)	(MW)	
2 000	50,421	23,995	17,798	2,386	47,443	4,002	0,86
2 001	45,197	21,674	19,186	2,309	47,155	3,683	0,96
2 002	48,070	21,019	20,036	7,353	49,474	4,424	0,94

An Illustration of a RSI Screen Test: % hours less than 110%

	Year 2000		With 5,050 MW additional capacity	
	% of Hours	RSI Screen	% of Hours	RSI Screen
Supplier 1	19.5%	Fail	4.3%	Pass
Supplier 2	20.8%	Fail	4.6%	Pass
Supplier 3	21.9%	Fail	5.2%	Fail
Supplier 4	22.6%	Fail	5.5%	Fail
Supplier 5	23.3%	Fail	5.9%	Fail

MONITORING MARKET PERFORMANCE (1)

a) LIQUIDITY

- *It is the measure of how efficiently a market enables participants to buy and sell assets at stable prices.*
- *A liquid market is one in which a trader can quickly buy or sell a particular product without causing a significant movement in the price.*
- *It will be characterized by high trading volumes and a close bid-ask spread.*
- *Key ideas: "QUICKLY" and "WITHOUT MOVING".*

IMMEDIATE INDICATORS

- Turnover (Volume turnover & Value turnover)
- Number of trades in a market (contracts)
- Number of participants in a market (in particular, the active participants)
- Number of suppliers (in particular, number of traders who do not have physical positions in the market reveals level of confidence in that market)
- Number of open buy and sell orders (the depth of the market)
- Number of the offered products

OTHER INDICATORS

- Bid-Ask spread
- Wholesale Churn-Rate

LIQUIDITY INDICATORS (i)

BID-ASK SPREAD.

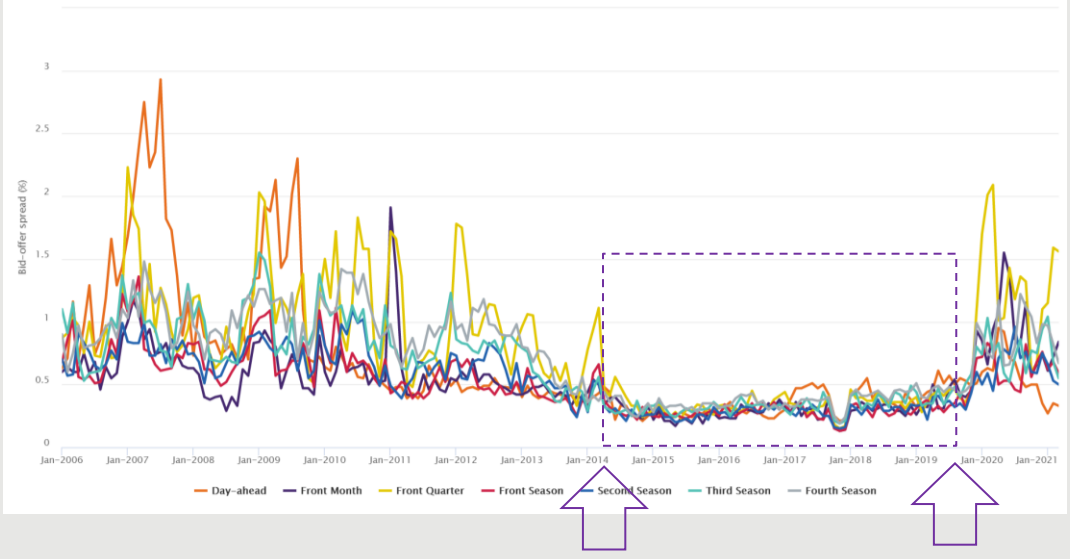
Difference between the highest price that a buyer is willing to pay and the lowest price that a seller is willing to accept

TIGHT SPREADS

- *Indicate high liquidity*
- *Likely to indicate many participants in the market and low cost of transactions*
- *Should encourage entry into the market; participants are confident of being able to buy and sell at a fair cost*

LARGE SPREADS

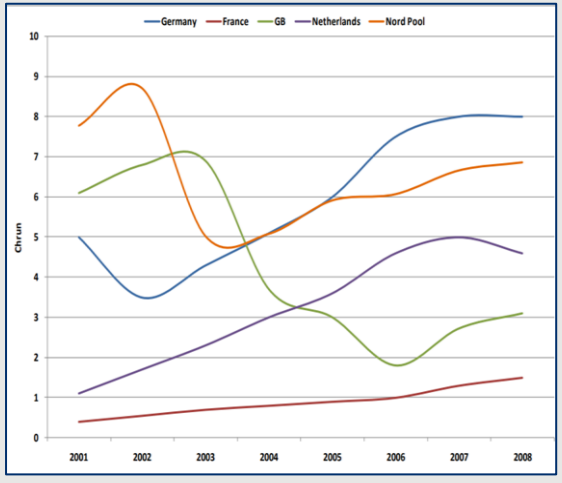
- *Quantify the cost of lack of liquidity.*



- ***Ofgem introduced the Secure and Promote (S&P) Market Making Obligation (MMO) from 31 March 2014 to 18 November 2019 to improve liquidity in the wholesale electricity market.***
- ***The MMO obliged six largest vertically-integrated companies to post bid-ask spreads on an accessible trading platform Peak-load and Base-load products.***
- ***The spread (between bid and offer prices) was limited for most Base-load products to 0.5 % and for most Peak-load to 0.7 %.***
- ***Ofgem argues that since the introduction of S&P, the volume of contracts traded has "slightly increased"***

LIQUIDITY INDICATORS (ii)

WHOLESALE CHURN RATE.



Definition

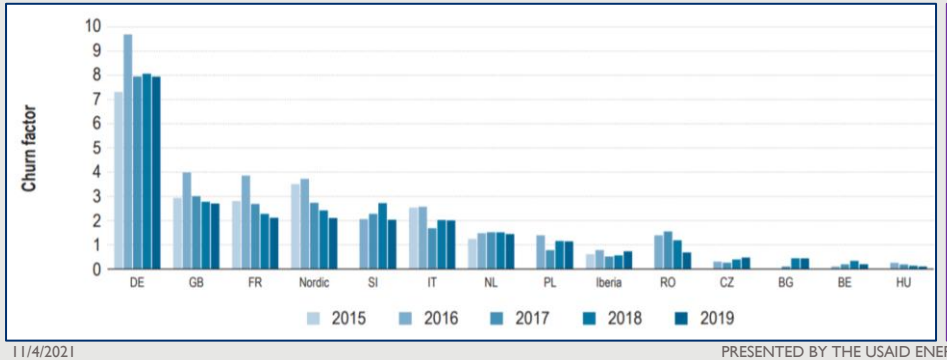
- *Ratio of the total trade and consumption (or demand). It reveals "number of times a unit of generation is traded before it is delivered to the customer."*
  - *net churn*
  - *gross-churn (denominator includes the export)*

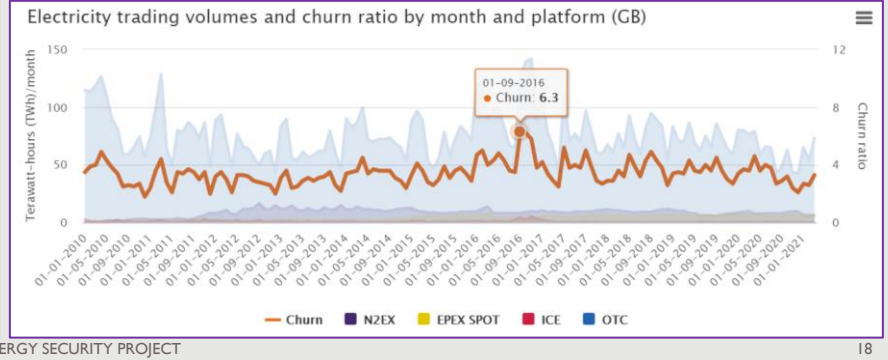
Threshold

- *A churn rate of 3 could be considered as the minimum threshold which represents the current realities of electricity wholesale markets in Europe. For liquid gas market minimum churn is 10.*

Evolution

- *In most EU markets, churn rates range now from 1 to a max. of 5-6, after better values last decade. Benchmarking values depend on sources and frequently differ.*





MONITORING MARKET PERFORMANCE (2)

b) PRICES LEVELS & TRENDS

Immediate indicators

- Weighted (or arithmetic) average prices in different segments
- Minimum price in different segments
- Maximum price in different segments
- Correlation between prices relevant for different segments.

Considerations

- *The level of resulting prices is an effect of market efficiency and performance due to design of products/instruments and an indicator of level of competition achieved.*
- *The convergence of prices in bilateral contracts, day-ahead, intraday, and balancing markets is a measure of performance while temporary non-convergence gives an information on scarcity conditions on different time intervals.*

MONITORING MARKET PERFORMANCE (3)

c) **NET REVENUE ANALYSIS** (important in the presence of price caps)

Compares estimated revenues with total costs, to assess:

- **Financial viability** (an indication of whether generators receive competitive returns on invested capital and of whether market prices are high enough to encourage new investment)
- **Barriers to entry** (persistent excess profit suggests market power and barriers to entry)

SPREADS

The analysis of electricity prices versus fuel costs gives an information on net revenues earned by generators.

- Clean dark spreads, Dark spreads
- Clean spark spreads, Spark spreads

MONITORING MARKET BEHAVIOUR (1)

A market may be concentrated as a general concentration indicator (HHI) reveals, and some participants may have market power as individual concentration indicators (C1, RSI, PSI) may indicate, but maybe they do not exercise their market power.

- *Differently, several behavioral indicators may identify if market power was exercised.*

I. LERNER INDEX [*LI= (P - MC) / P*]

- **Lerner Index** describes a generator market power by measuring the extent to which its prices exceed its marginal cost. A higher value of Lerner index indicates a higher markup in price over marginal cost and a higher market power.
- The load weighted average Lerner Index: wLI = (wP – wMC) / wP

II. PRICE-COST MARKUP [*PCMU = (P - MC) / MC*]

- The load weighted average Price-Cost Markup: wPCMU = (wP – wMC) / wMC

III. BID-COST MARGIN

- Bid-Cost Margin is price level difference of bids and marginal costs.

MONITORING MARKET BEHAVIOUR (2)

PRICE-COST MARKUP [*PCMU = (P - MC) / MC*]

Year	BELGIUM					GERMANY					SPAIN				
	Marginal Cost €	CO2 €	Mark-Up €	BE Index Price * €	PCMU %	Marginal Cost €	CO2 €	Mark-Up €	EEX Price €	PCMU %	Marginal Cost €	CO2 €	Mark-Up €	OMEL Price €	PCMU %
2003	29.75	0.00	11.31	41.06	*38.00*	19.46	0.00	11.42	30.88	59.00	23.95	0.00	6.29	30.24	26.00
2004	31.70	0.00	-0.70	31.00	*-1.00*	24.27	0.00	5.36	29.63	22.00	27.51	0.00	1.39	28.89	5.00
2005	50.40	10.11	-10.23	50.28	*-17.00*	28.17	13.86	6.39	48.42	15.00	33.65	10.12	12.20	55.97	28.00

(*) BE Index Price (BPI) – a Platts price index based rather Belgian OTC

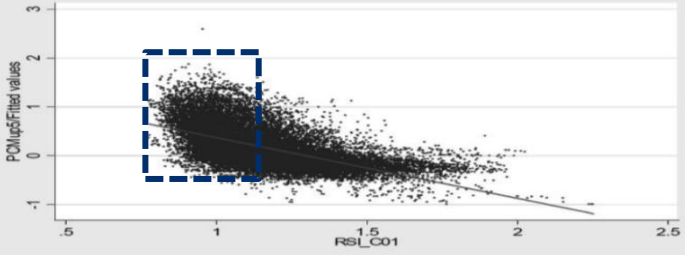
Year	FRANCE					NETHERLANDS					GREAT BRITAIN				
	Marginal Cost €	CO2 €	Mark-Up €	Powernext Price €	PCMU %	Marginal Cost €	CO2 €	Mark-Up €	APX Price €	PCMU %	Marginal Cost €	CO2 €	Mark-Up €	UKPX Price €	PCMU %
2003	11.09	0.00	18.96	30.05	*171.00*	36.26	0.00	11.99	48.24	33.00					
2004	12.92	0.00	15.98	28.90	*124.00*	34.64	0.00	-0.63	34.01	-2.00	33.33	0.00	1.25	34.58	4.00
2005	15.63	3.65	28.85	48.13	*150.00*	50.50	9.52	-3.09	56.93	-5.00	39.06	10.00	6.35	55.41	42.00

Source: London Economics, 2007

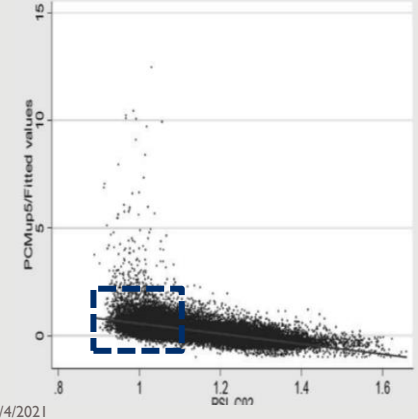
MONITORING INDICATORS ON MARKET FUNCTIONING

CORRELATION PCMU – RSI

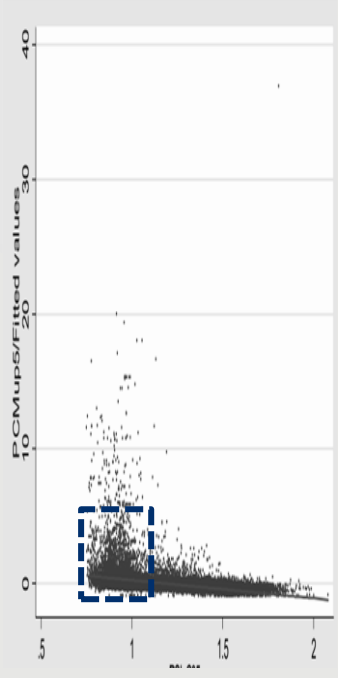
LE Survey: Spain (2004/2005)

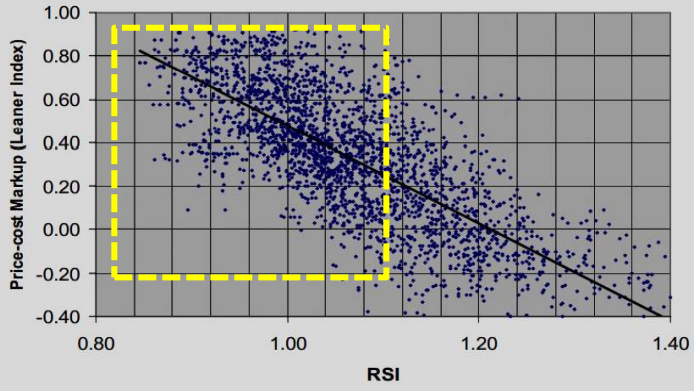


LE Survey: Germany (2004/2005)



LE Survey Netherlands





CALIFORNIA

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MONITORINGGENERATION INVESTMENT

MONITORING GENERATION INVESTMENT (1)

EU LEVEL (CLEAN ENERGY PACKAGE)

The European resource adequacy assessment describes expected level of security of supply for a 10-year horizon.

ENTSO-E

- Carry out the European resource adequacy assessment on an annual basis.
- Elaborates "Methodology for the European resource adequacy assessment" (the "Methodology") & "Methodology for calculating the value of lost load, the cost of new entry and the reliability standard".

ACER approves ENTSO-E methodologies in line with the EU Electricity Regulation.

MS LEVEL

- Each Member State determines the general structure of its energy supply and sets its own desired level of security of supply through a reliability standard.
- Regulatory authority, or another competent authority designated by the EU MS calculates the single Value Of Lost Load (VOLL) for Reliability Standard (RS).
- TSOs provide ENTSO-E with the data necessary to carry out the European resource adequacy assessment.
- National resource adequacy assessments have a regional scope and are based on the "Methodology "
- NRA to monitor investment in generation capacities in relation to security of supply (3rd Package, ED, 37, r).

UKRAINE

UKRENERGO delivers "Report on the assessment of the adequacy of generating capacity to cover the projected demand for electricity and provide the necessary reserve"

MONITORING GENERATION INVESTMENT (2)

VALUE OF LOST LOAD (VOLL) - ***"estimation of the maximum price that customers are willing to pay to avoid a supply interruption".***

- EU MS must estimate the VoLL for each bidding zone and update it at least every five years, or earlier.
- Sectoral VOLLs are estimated for different inadequacy situations and for different categories of consumers via dedicated surveys, then a single VOLL for RS shall be estimated.

COST OF NEW ENTRY (CONE) - ***"fixed and variable cost of new entry" by candidate technology.***

- **Fixed cost of new entry ($CONE_{fixed}$)**
- **Variable cost of new entry ($CONE_{var}$)**

RELIABILITY STANDARD (RS)

LOSS OF LOAD EXPECTATION (LOLE) – ***"number of hours per annum in which, over the long-term, it is statistically expected that supply will not meet demand."***

- Targets generally range from 3 to 8 hours. Ireland, France / GB and Netherlands target an LOLE of 8, 3, 4.

➢ **RELIABILITY STANDARD** express the level of security of supply which maximizes the socioeconomic surplus over a given timeframe. At this level of security of supply, incremental cost of additional capacity resource equals the incremental saving of load curtailments to customers.

➢ For a given MS or bidding-zone,

RS = LOLE $_{target\ for\ RS}$, the minimum of LOLE $_{RT}$

RT is 'reference technology'

$$LOLE_{RT} = \frac{CONE_{fixed}}{VOLL_{RS} - CONE_{var}}$$

$$LOLE_{target\ for\ RS} = \min(LOLE_{threshold})$$

MONITORING GENERATION INVESTMENT (3)

Generation capacity is not subject of price regulation except if tendering procedure applied or RES feed-in tariff used; therefore, NRAs rather intensively monitor TSOs and DSOs grid plans than generation investment. But monitoring goals are different thereby …

Generation investment should be
- in the RIGHT amount
- of the RIGHT type
- in the RIGHT location
- at the RIGHT time

SEVERAL ASPECTS TO BE CONSIDERED:

- **Regulatory incentives.**
- **Capacity market**
- **Moving from feed-in to market-based mechanism for RES**
- **Correct market price**
- **Net revenue analysis**
- **Good location**
- **Public/private interests and environmental issues**

THE RESULTS OF MONITORING

WHAT IS TO BE OBSERVED AT EACH INDICATOR (i)

THRESHOLDS

- For some indicators, their comparison with preestablished thresholds is important.
- The thresholds come from world-wide experience but there are not too many indicators for which a world-wide practice of thresholds exists.
- Moreover, thresholds for same indicators may differ.
- Such thresholds are established for market structure and concentration, for indicators of market liquidity as well as for quality standards of supply.

WHAT IS TO BE OBSERVED AT EACH INDICATOR (ii)

TRENDS, CONVERGENCE, CORRELATION

- For indicators which represent time series (prices, volumes, number of the offered tariffs and products offered for trading, number of trades), the dynamics should be assessed. Most important characteristics are:
  - *The trend of individual time series*
  - *The convergence of two ore more time series*
  - *The correlation of two time series*

➢ For some of indicators a desirable type of trend either ascendant or descendant could be established and compared with actual trends.

- In case of volumes traded and prices cleared, neither a higher nor a lower value as well as neither an ascendant nor a descendant trend could be stated as the good one.

MONITORING. WHAT NEXT?

- *The lists below are not intended to be a recommendation.*
- *The lists below are what others do or analyze to do or not to do.*
- *But first, monitoring should determine if there is anything which should change.*

CONCENTRATION AND MARKET POWER

1) Regulatory incentives for new generation investment.
2) Introducing market based supporting schemes for RES (CfD+tender).
3) Interconnectors' enhancement (+ *market structure changes in the perspective of Ukraine's integration into the power system of ENTSO-E*) and state of the art cross-border capacity allocation (explicit/*implicit*).
4) Virtual Power Plant (VPP) / Divesting assets / Assets' swap (! intrusive solutions if not voluntary)
5) Monitoring the bidding in day-ahead market to detect exercising of market power.

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LIQUIDITY

1) Interconnectors' enhancement and state of the art cross-border capacity allocation (explicit/*implicit*). It brings additional volumes and provides arbitrage opportunities.
2) Introducing well tailored (clauses and calendar of auctioning/delivery) standard bilateral contracts (prompt and forward) to be traded in centralized, transparent markets. Consider credit risk.
3) Introducing Market Making Obligation in such markets.
4) Introducing market based supporting schemes for RES (CfD+tender)
5) Assess and reduce credit risks if and where is the case.
6) Enhance transparency and take care on price formation. It brings trust and interest.

THANK YOU

Energy Security Project

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