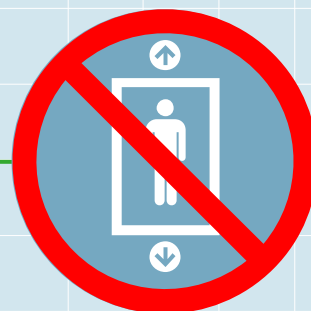# Let's talk about energy

Frank Nobel

A moment for safety

Samen zorgen we voor een veilige werkomgeving waarbij we leren van fouten en het delen van ideeën, zorgen en vragen vanzelfsprekend is.
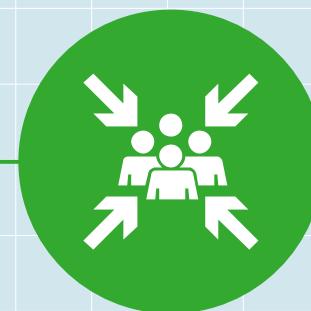
Daarnaast vragen we aandacht voor de volgende veiligheidsmaatregelen in geval van een ontruiming van het pand

Volg de aangegeven vluchtroute

Gebruik de trap in plaats van de lift

Ga naar het verzamelpunt

Volg aanwijzingen bedrijfshulpverlener
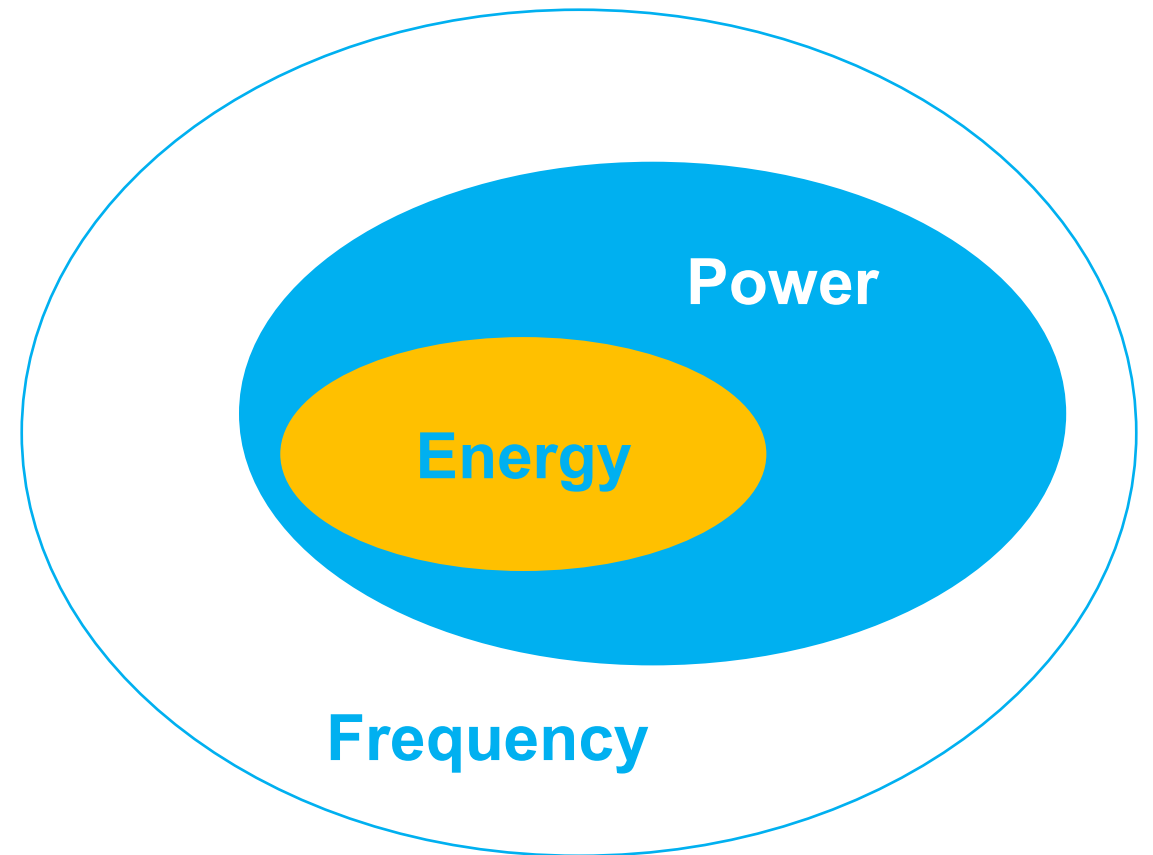
1

C1 - Publieke Informatie

'Unrestricted' access of Price-inelastic energy Demand

Prerequisites:

- Adequate Grid (TSO, DSO)
- Adequate Generation (Users)

- Adequate Ancillary Services (TSO)
  - Frequency Containment (TSOs)
  - Frequency Restoration (TSO)

- Adequate Energy supply (Users)

Power

Energy

Frequency

Srce: "On Balancing Market Design"

16 juni 2023 **C1 - Publieke Informatie**

Traditional approaches to Adequacy

- Grid dimensioned on peak demand rather than on capacity connected
- Generation capacity dimensioned (price inelastic) peak demand [PIP]

- Ancillary Services
  - Capacity dimensioned on Global (FCR) and Zonal (FRR) Power imbalances
  - Balancing energy provision secured:
    - Product requirement (FCR), e.g. LER discussion)
    - Balancing energy market (aFRR, mFRR) with GCT close to ISP of delivery

- 'Permanent' Energy resources (Coal, Nuclear, Gas, Hydro)

TenneT

Increasing access of 0 variable cost generation (vRES):

Installed Generation capacity (Fe) >>> PIP

Increasing dissociation of generation and demand in place/time:

- Grid capacity (Cu) dimensioned on Peak generation:
  - DSO investments facilitating new vRES
  - TSO investments Offshore, Interconnectors, Overlay Grid

More Fe, Cu = more fixed cost with less utilization hours, therefore:

- Complement PIP with Price-elastic demand:
  - Power to Battery (Fixed/EV)
  - Power to Heat
  - Power to Hydrogen

TenneT

Lack of 'firmly' stored energy (Coal, Gas, Sun, Wind)

What energy then to power BRPs' (& BSPs') energy demands?

- Reduce PIP voluntary by offering Price-elastic demand on:
  - Whole sale markets DA, ID (implicit demand flexibility)
  - Balancing markets (explicit demand flexibility)
- Reduce PIP involuntary (curtailment, rationing)
- Offer stored energy (e, H_2) on DA, ID Balancing markets

Are Mandatory energy reserves required?
  - *By whom?*
  - *How much?*
  - *When (not) to commit?*
  - *How remunerated?*

TenneT

2

Future of Balancing Strategies of TSOs

Current strategies

1. Incentivize BRPs to minimize a priori individual Imbalances (*feed forward*)
2. Proactive TSO determines RR/mFRR demand on expected *energy* imbalance
3. Reactive TSO enable *all* BRPs to reduce expected system-wide energy imbalance by continuously publishing volumes/prices sub 4, 5, 6, 7 (*feed back*)
4. Imbalance Netting (IGCC)
5. aFRR demand
6. mFRR demand (supplementary to aFRR activation)
7. Emergency measures
8. Inadvertent exchange

- Reactive TSO (pro-active Market): Balancing energy is *consequence*
- Proactive TSO (passive Market): Balancing energy is *objective*

Reactive or Proactive?

BZ ISP = 15 mins		Down	Up
AT	GWh/a	**7,0**	**11,2**
	% ISP	1,2	1,6
BE	GWh/a	**78,1**	**197,7**
	% ISP	5,2	14,2
DE-LU	GWh/a	**14,0**	**26,1**
	% ISP	1,1	1,4
HU	GWh/a	**1,8**	**32,9**
	% ISP	0,3	3,0
NL	GWh/a	**3,3**	**13,8**
	% ISP	0,2	1,0

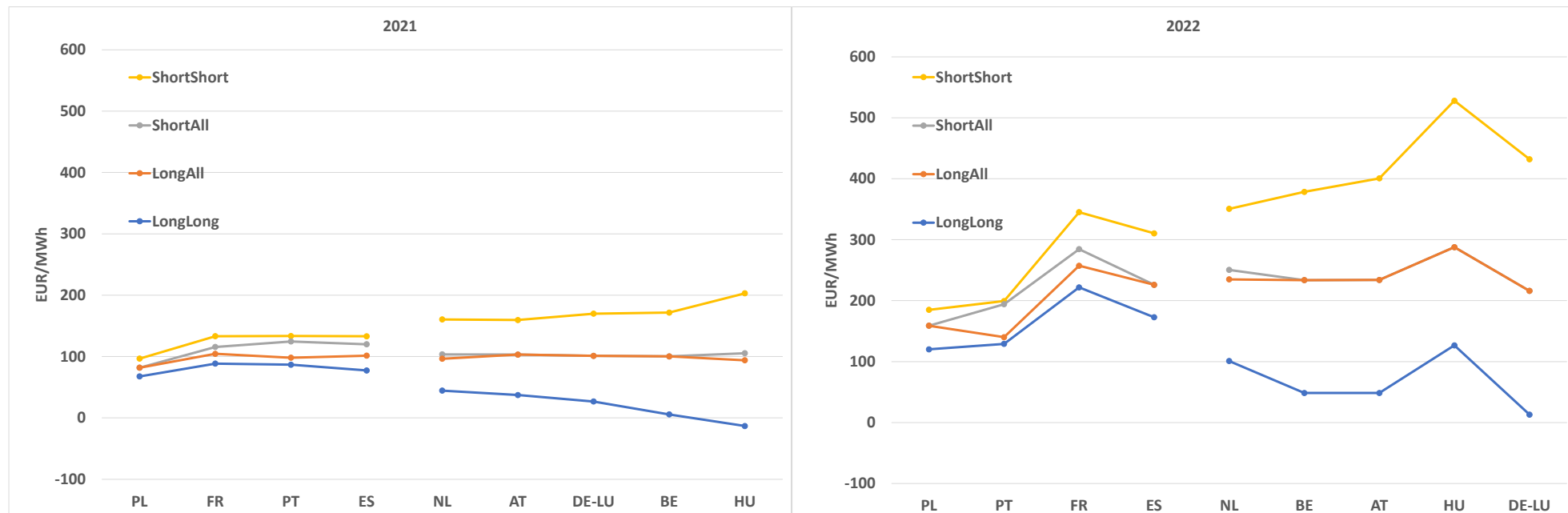| BZ ISP 1h	Down	Up
CZ	**2,6**	**51,5**
	0,6	7,6
DK1	**79,3**	**124,4**
	17,2	17,0
ES *	**1322,1**	**2157,5**
	34,4	49,3
FR 0.5h *	**1377,5**	**1988,6**
	44,8	48,4
PT *	**999,9**	**618,7**
	67,4	49,3

mFRR Balancing energy volumes 2021 from TP, [RR Systems marked *]

Proactive TSOs prefer longer ISP & early IDGCT (both to be ended), dual Imbalance prices
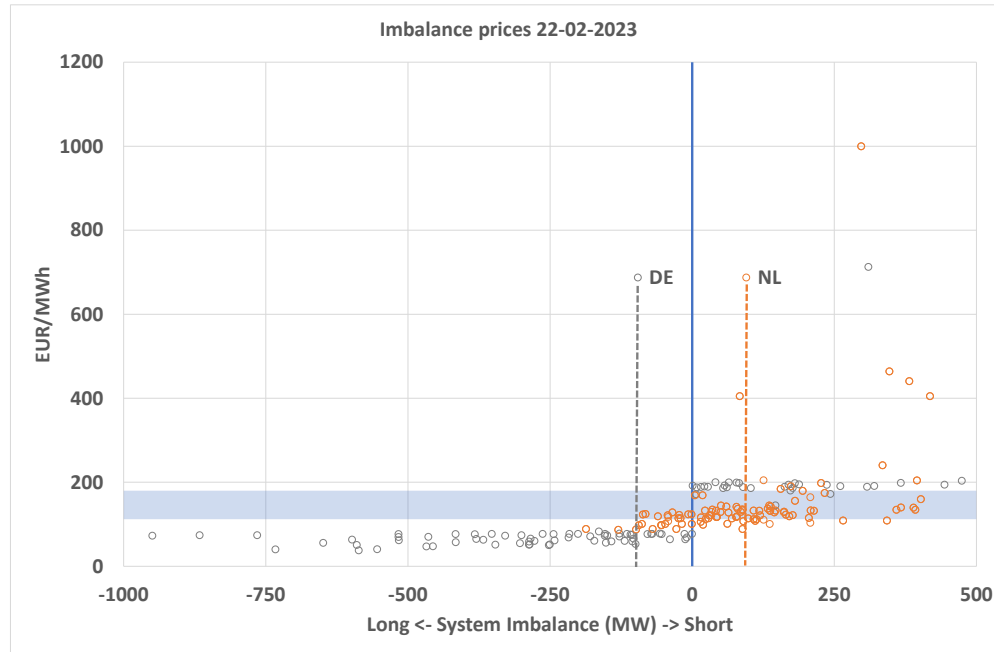
Reactive or Proactive?
Imbalance price PIs 2021, 2022 from TP

Reactive TSOs have larger spreads aggravating imbalance prices (stronger incentives)

Note relative small spread NL, compared to other Reactive TSOs

How to Incentivize BRP?
Imbalance prices 22-02-2023

Imbalance prices 22-02-2023

DE-LU ○:

Discontinuous flat-line function, depending only on *sign* system imbalance.

Imbalance prices outside DAM-range ■

NL ○ :

Continuous progressive function, correlates with *size* system imbalance:

Most imbalance prices close to DAM

Which Balancing Energy prices set Imbalance prices?
Certainly/Currently **NOT mFRR** for Reactive TSOs

BZ	2021	Down	Up
AT	GWh/a	7,0	11,2
	% ISP	1,2	1,6
BE	GWh/a	78,1	197,7
	% ISP	5,2	14,2
DE-LU	GWh/a	14,0	26,1
	% ISP	1,1	1,4
HU	GWh/a	1,8	32,9
	% ISP	0,3	3,0
NL	GWh/a	3,3	13,8
	% ISP	0,2	1,0

2022	Down	Up
	2,0	4,0
	0,4	0,6
	133,1	267,5
	8,8	17,9
	17,6	28,5
	2,0	2,2
	22,4	18,3
	2,1	1,8
	11,3	34,3
	0,5	1,6

mFRR data 2021, 2022 from TP

Yet their volumes and incidence of mFRR activation might not be stable….

TenneT

How (not) to activate FRR

TSOs forward standard balancing energy products from BSPs to Common Merit Order Lists
TSOs do not submit standard demands to Activation Optimization Functions
When to demand mFRR or RR? How much mFRR or RR to demand?

Pro- and Re-active TSOs differ in RR/mFRR demands compared to aFRR demands.

aFRR energy demands differ considerably too, even among Reactive TSOs

NL some 5-12% ISP bidirectional aFRR, and up to 10% without aFRR (Imbalance Netting)

DE-LU nearly 100% bidirectional (nearly always an aFRR volume activated)

BZ$_{15\,mins}$	2021	Down	Up
DE-LU *	GWh/a	836	852
	% ISP	100	99,8
NL *	GWh/a	329	269
	% ISP	55,3	50,1

BZ$_{15\,mins}$	2022	Down	Up
DE-LU *	GWh/a	942	787
	% ISP	100	99,9
NL *	GWh/a	360	408
	% ISP	52.9	59,6

3

16 juni 2023   **C1 - Publieke Informatie**   TenneT

*It begins with a blessing
and ends with a curse
Making 'like' easy
by making it worse*

C1 - Publieke Informatie

TenneT

Disclaimer

Deze powerpoint wordt u aangeboden door TenneT TSO B.V. ("TenneT"). De inhoud ervan - alle teksten, beelden en geluiden - is beschermd op grond van de auteurswet. Van de inhoud van deze powerpoint mag niets worden gekopieerd, tenzij daartoe expliciet door TenneT mogelijkheden worden geboden en aan de inhoud mag niets worden veranderd. TenneT zet zich in voor een juiste en actuele informatieverstrekking, maar geeft ter zake geen garanties voor juistheid, nauwkeurigheid en volledigheid.

TenneT aanvaardt geen aansprakelijkheid voor (vermeende) schade, voortvloeiend uit deze powerpoint, noch voor de gevolgen van activiteiten die worden ondernomen op basis van gegevens en informatie op deze powerpoint.