



Making new energy flow

Cyprus Employers and Industrialists Federation, Strovolos, Cyprus, Nov 7th, 2018

Competitive Electricity Market

Lessons from Belgium for Aggregators





Overview:

- ❑ **About myself**
- ❑ **Timeline of the market opening in Belgium**
- ❑ **Market structure in Belgium, coupling to CWE**
- ❑ **Renewables and aggregation**
- ❑ **Opportunities for Cyprus**
- ❑ **Yuso over the years**



About Myself: Michel Verschuere, Ph. D.

- Ph. D. in Natural Sciences (Physics) University of Leuven, Belgium 2003
- Postdoctoral position, Vienna University of Technology, Department of Financial and Actuarial Mathematics, Austria (2003-2004)
- Risk Analyst at power and gas supply company Luminus (now EDF Luminus) in Hasselt Belgium 2004
- Pricing Manager at VERBUND – Austrian Power Trading in Vienna, Austria
- Head of Structuring, Electrabel Trading and Portfolio Management in Brussels, Belgium (2005-2009)
- Owner and MD Renewable Wholesale operation in Waregem, Belgium (2009-2012)
- Owner and MD Yuso, renewables and flexibility aggregator in Waregem, Belgium (2012-)



Timeline of the market opening in Belgium

- Late 1990'ies: Adoption of EU directives on deregulation of electricity markets
- 2001: Unbundling of generation and transport operations, creation of TSO Elia
- 2002: First (large industrial) consumers of electricity can choose their supplier
- 2003: Consumers of all sizes get a 'default supplier' for electricity allocated
- 2004: Commencement of operations at the Day Ahead power exchange BELPEX
- 2007-2012: Renewables share (wind and solar PV) grows to more than 5 GW



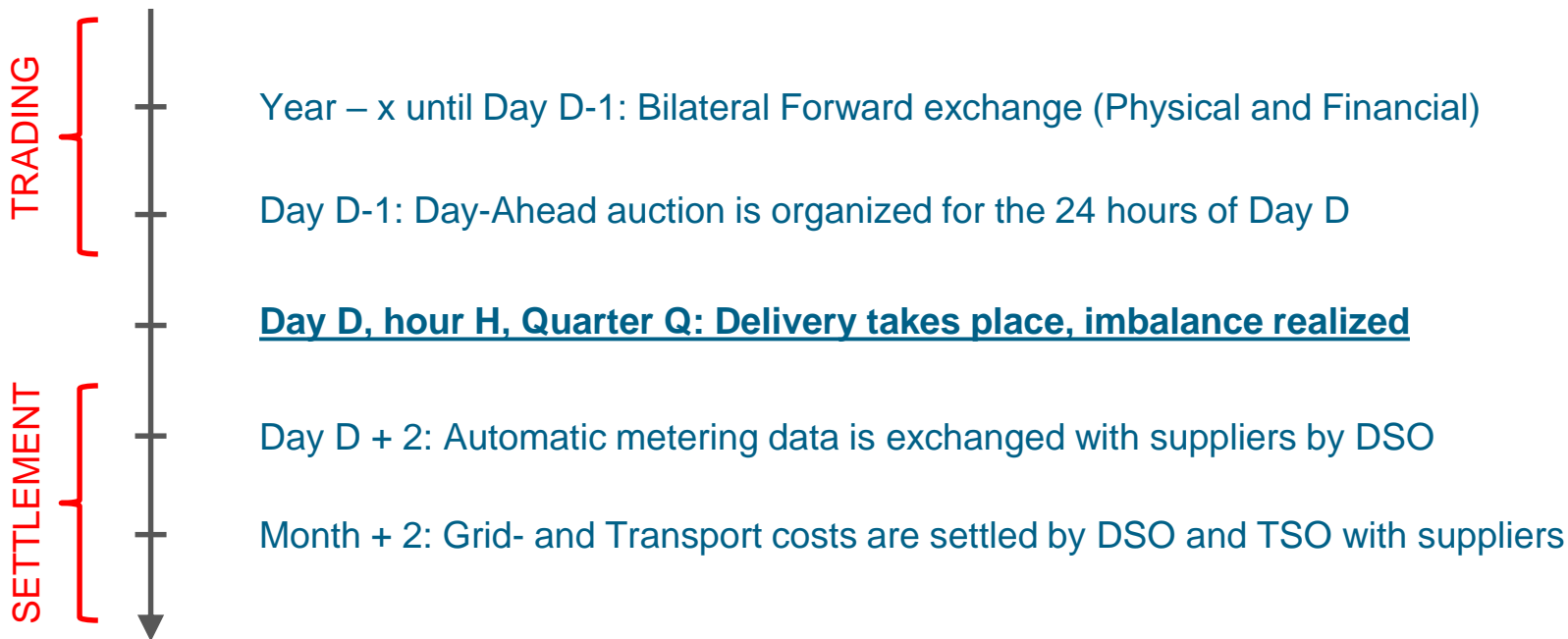
Timeline of the market opening in Belgium



Currently more than 40 certified power suppliers!



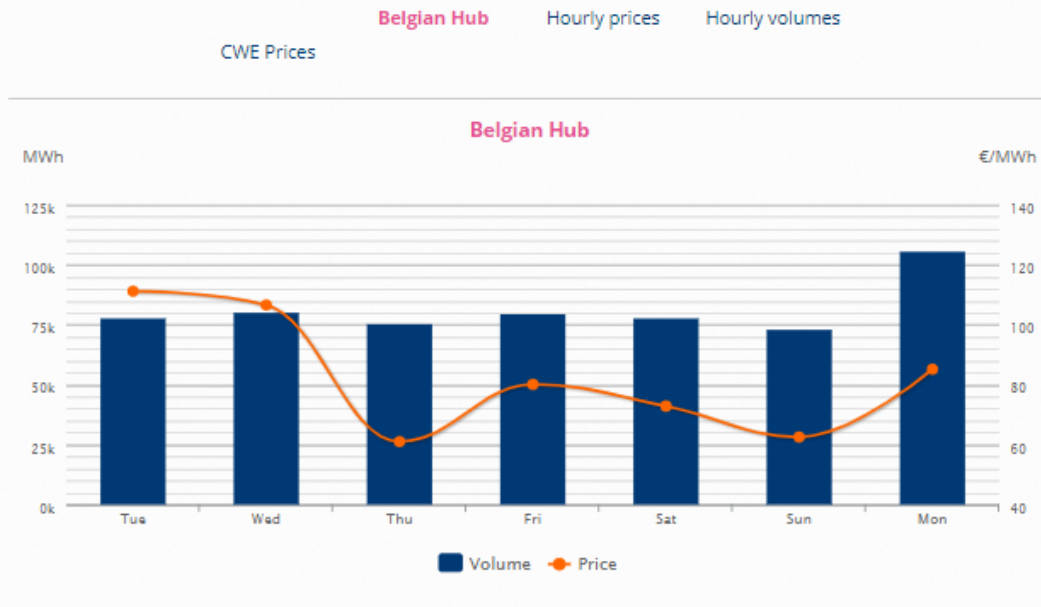
Market Structure in Belgium





Market Structure in Belgium: EPEXSPOT DA

Latest Market Results



Host: zeus.yuso.be Database: laravel Query*

```
1 select * from `belpex.prices` where dtlit >= '2018-11-05'
```

dtutc	dtlit	price	volume
2018-11-04 23:00:00	2018-11-05 00:00:00	55.70	3,234.50
2018-11-05 00:00:00	2018-11-05 01:00:00	51.10	3,888.50
2018-11-05 01:00:00	2018-11-05 02:00:00	46.32	4,203.40
2018-11-05 02:00:00	2018-11-05 03:00:00	42.09	4,626.30
2018-11-05 03:00:00	2018-11-05 04:00:00	41.47	4,775.10
2018-11-05 04:00:00	2018-11-05 05:00:00	50.30	4,328.50
2018-11-05 05:00:00	2018-11-05 06:00:00	54.22	4,424.80
2018-11-05 06:00:00	2018-11-05 07:00:00	67.64	4,695.10
2018-11-05 07:00:00	2018-11-05 08:00:00	69.91	4,775.90
2018-11-05 08:00:00	2018-11-05 09:00:00	75.50	4,652.50
2018-11-05 09:00:00	2018-11-05 10:00:00	69.17	4,414.00
2018-11-05 10:00:00	2018-11-05 11:00:00	68.31	4,394.40
2018-11-05 11:00:00	2018-11-05 12:00:00	66.37	4,216.70
2018-11-05 12:00:00	2018-11-05 13:00:00	67.24	4,449.90
2018-11-05 13:00:00	2018-11-05 14:00:00	68.21	4,615.80
2018-11-05 14:00:00	2018-11-05 15:00:00	70.94	4,759.00
2018-11-05 15:00:00	2018-11-05 16:00:00	80.70	5,029.60
2018-11-05 16:00:00	2018-11-05 17:00:00	100.07	5,273.70
2018-11-05 17:00:00	2018-11-05 18:00:00	350.00	5,010.10
2018-11-05 18:00:00	2018-11-05 19:00:00	200.00	4,544.20
2018-11-05 19:00:00	2018-11-05 20:00:00	106.39	4,112.50
2018-11-05 20:00:00	2018-11-05 21:00:00	92.98	3,771.00
2018-11-05 21:00:00	2018-11-05 22:00:00	80.96	3,764.50
2018-11-05 22:00:00	2018-11-05 23:00:00	68.46	3,574.30

Hourly Prices!



Market Structure in Belgium: EPEXSPOT ID

Area	Ctrct	Cur	Pha	Sta	BAcc	OIBid	B1Qty	B2Qty	B3Qty	BWVA	Bid	Ask	AVWA	AQty	OA
ELIA	11-12_XB	EUR	CO	ACTI	0.1				0.1	74.60	74.60	74.80	74.80	5.0	
ELIA	12-13_XB	EUR	CO	ACTI					28.0	73.00	73.00	83.90	83.90	5.0	
ELIA	13-14_XB	EUR	CO	ACTI	28.0				30.0	75.20	75.20	119.88	119.88	10.0	
ELIA	14-15_XB	EUR	CO	ACTI	30.0				30.0	75.90	75.90	84.00	84.00	5.0	
ELIA	15-16_XB	EUR	CO	ACTI	30.0				4.8	73.50	73.50	109.99	109.99	30.0	
ELIA	16-17_XB	EUR	CO	ACTI	4.8				5.0	94.10	94.10	150.00	150.00	30.0	
ELIA	17-18_XB	EUR	CO	ACTI	5.0				10.0	110.03	110.03	165.00	165.00	20.0	
ELIA	18-19_XB	EUR	CO	ACTI	10.0				20.0	90.00	90.00	155.00	155.00	4.0	
ELIA	19-20_XB	EUR	CO	ACTI	20.0				20.0	90.00	90.00	129.00	129.00	16.0	
ELIA	20-21_XB	EUR	CO	ACTI	20.0				20.0	75.00	75.00	129.00	129.00	16.0	
ELIA	21-22_XB	EUR	CO	ACTI	20.0				20.0	75.00	75.00	95.00	95.00	10.0	
ELIA	22-23_XB	EUR	CO	ACTI	20.0				5.0	61.20	61.20	95.00	95.00	10.0	
ELIA	23-100_XB	EUR	CO	ACTI	5.0										

- Individual Hourly Blocks traded in 0.1 MW size
- Gate closure (cessation of trading) 5 minutes before onset of delivery
- Through XBID initiative, linked with most of Western European countries, including Nordic region!



Market Structure in Belgium: Market Coupling

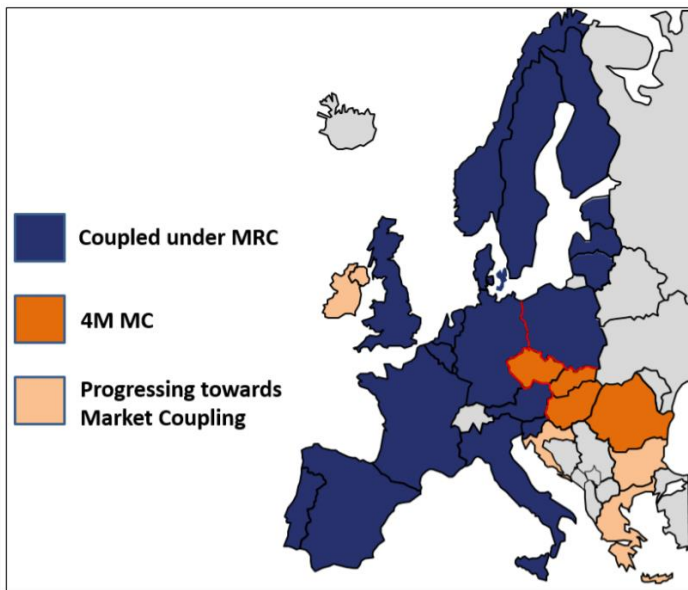


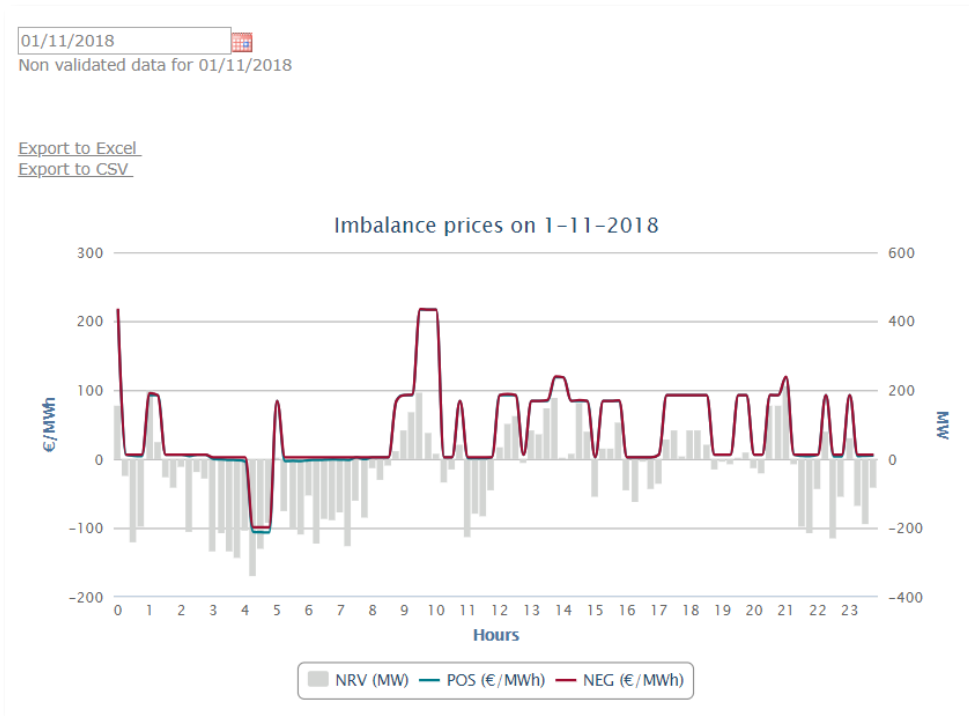
Figure 1: State-of-play in pan-European Single Day-Ahead Coupling as of February 2017⁷



Figure 2: State-of-play in pan-European Single Intraday Coupling as of February 2017



Market Structure in Belgium: BALANCING



- 'Live Market' organized by TSO Elia
- TSO's 'market' task relates to keeping demand and supply in balance
- Post unbundling, TSO's can not operate assets themselves (Transport vs. Generation)
- The 'imbalance price' reflects the active optimization of excess/shortage of power in the Elia zone versus offtake/supply bids obtained on 15-minute basis



The various **BALANCING** services (TSO Elia):



Renewables and Aggregation

How to integrate renewables and markets





Renewables and Aggregation: A practical guide

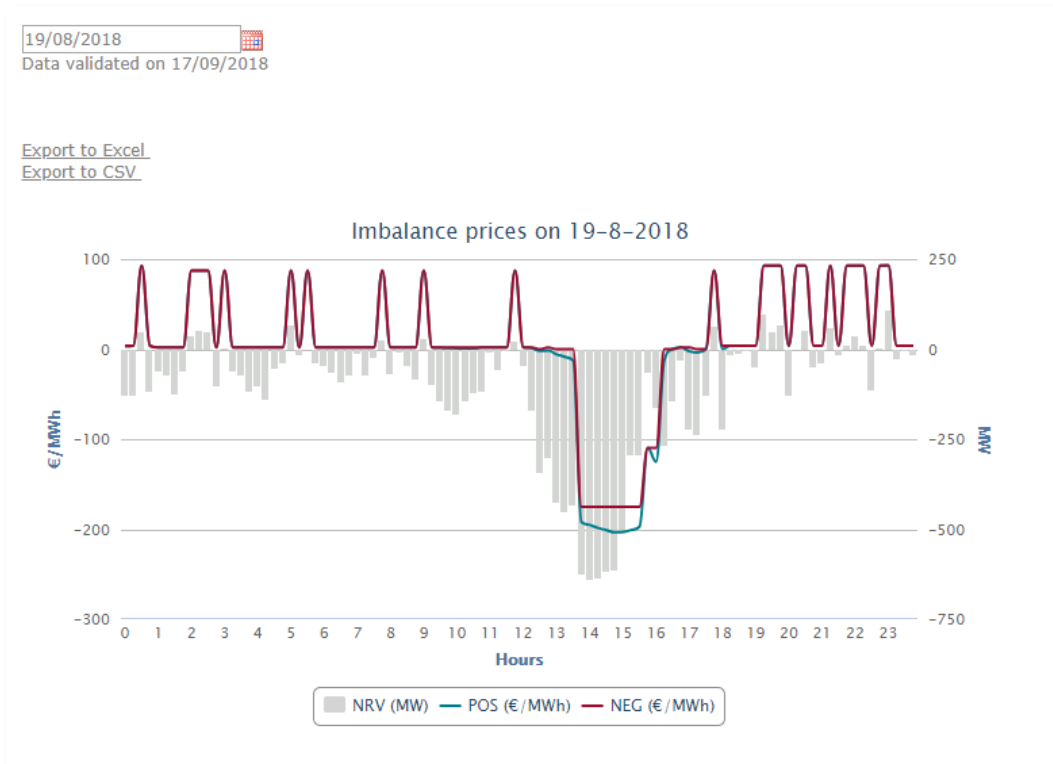
	Solar PV capacity in watts per inhabitant
Germany	512
Italy	338.4
Belgium	325
Greece	247.9
Luxembourg	242.2
Czechia	215
Malta	193.9
United Kingdom	192.9
Denmark	160.9
Bulgaria	158.3

- Belgium ranks 3rd on the list of Watts/Capita on EU solar
- Alas, this is not due to the weather, but rather because of favorable incentives for Solar PV from 2007 to 2012
- About 3300 MWp of Solar PV capacity is connected to the TSO grid, either directly or indirectly via various DSO's
- Next to solar, there is an additional 3100 MWp on Wind power capacity also ultimately linked to the TSO grid
- Compared to an average consumption between 7 GW and 12 GW, this came to represent a sizeable share!

Source: <https://www.statista.com/statistics/612412/installed-solar-photovoltaics-capacity-eu/>

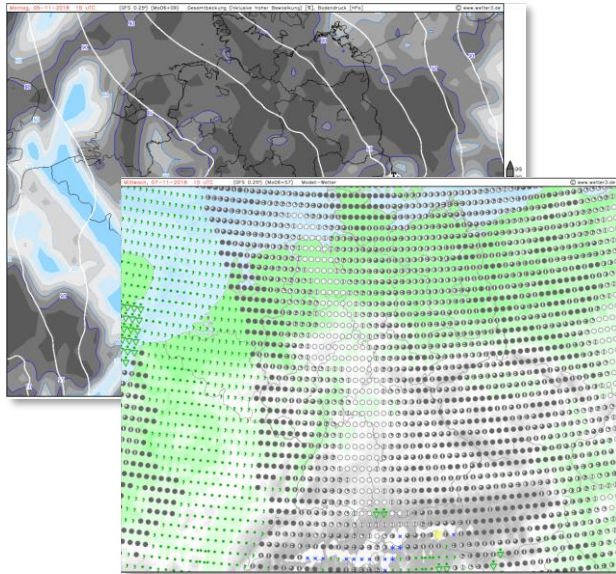


Renewables and Aggregation: A practical guide

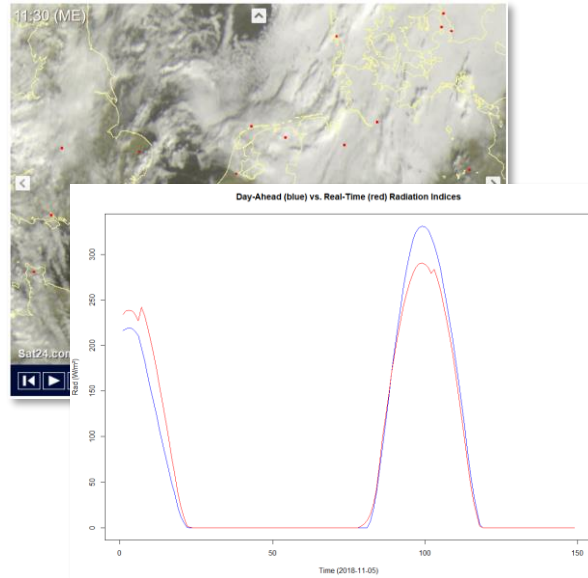


- Because of the intrinsic intermittency of RES, the system balance increasingly reflects RES availability every 15-minutes
- The imbalance market is therefore very punitive to badly managed RES portfolios
- The intrinsic relation between RES availability and grid imbalances is the key to succes!

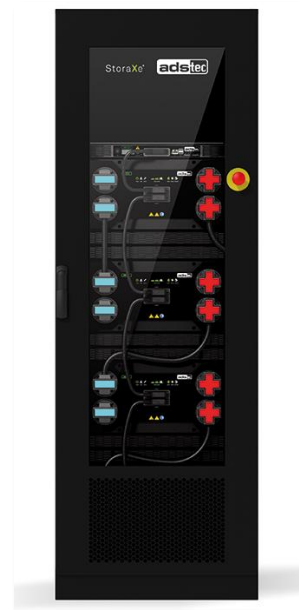
Renewables and Aggregation: A practical guide



Day-Ahead: Models, models

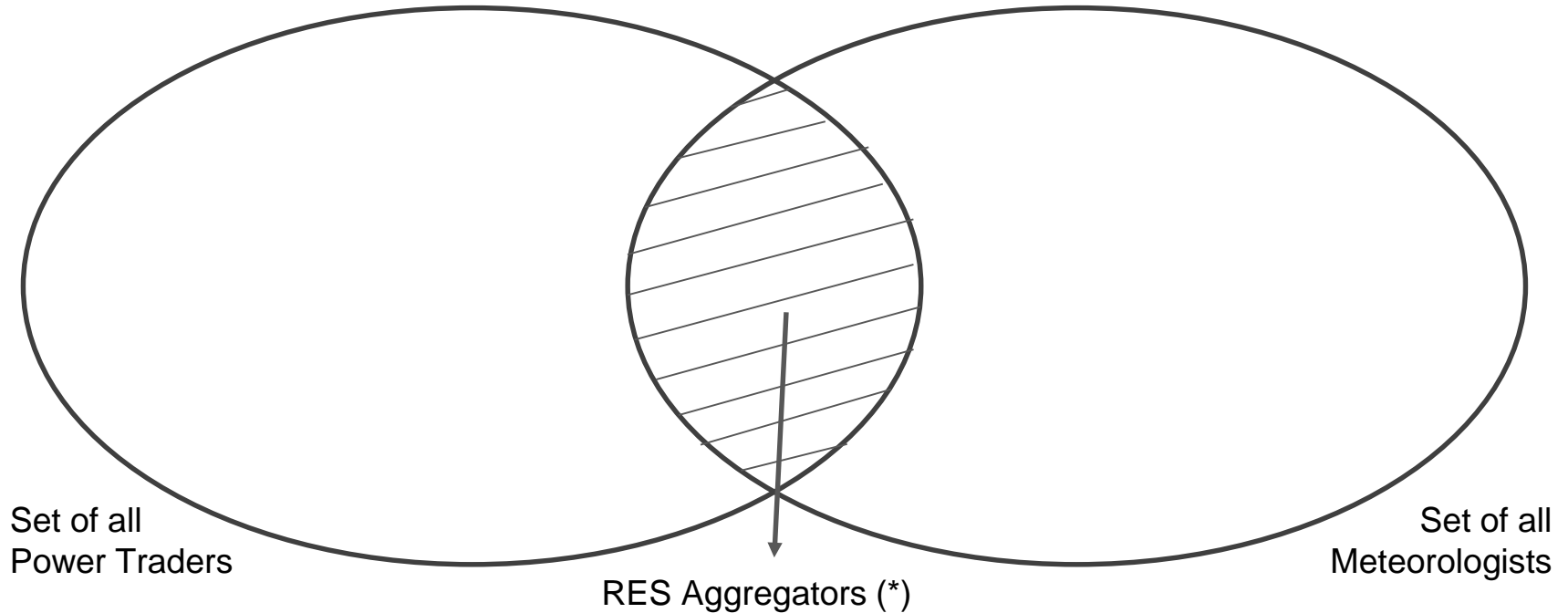


Intraday: Models, actuals and flexibility (batteries)





Renewables and Aggregation: A practical guide





Renewables and Aggregation: A practical guide

How portfolio management used to be:

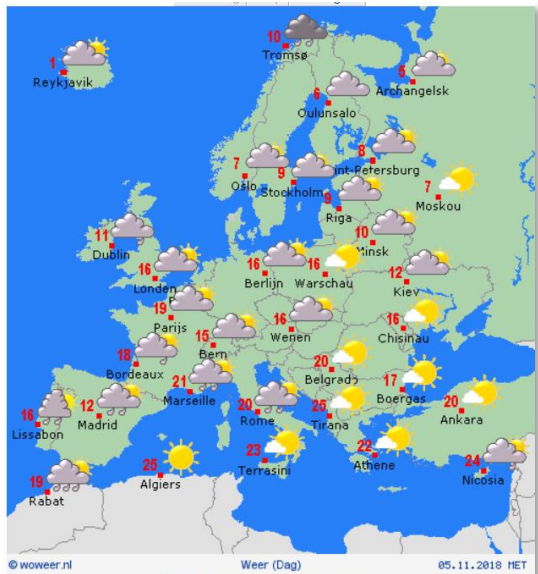
- Long term load forecasts depend merely on past experience and projected growth
- Firm risk policies stipulating hedging of power supply portfolios gradually and systematically using forward markets
- Volume and price risk is mitigated at the same time by 'locking in' adequate quantities for months, quarters and years to come

How RES portfolio management is like today:

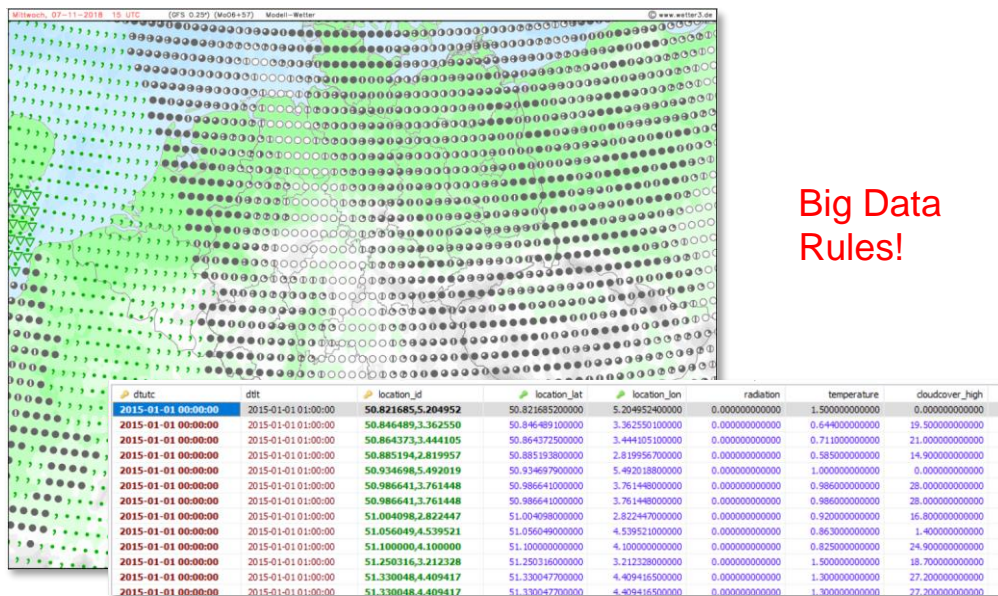
- Every day, changing weather implies different availabilities on RES also on a regional scale
- Where forward market dynamics tend to reflect wholesale price evolutions for fuel (Gas, oil, etc.), short term markets become closely tied to the RES availability
- Most volatility (day-to-day price changes) are now encountered in the short term markets (Day-Ahead, IntraDay and balancing)
- More risk may lead to higher returns! But...



Renewables and Aggregation: A practical guide



This is a good start...



Big Data Rules!

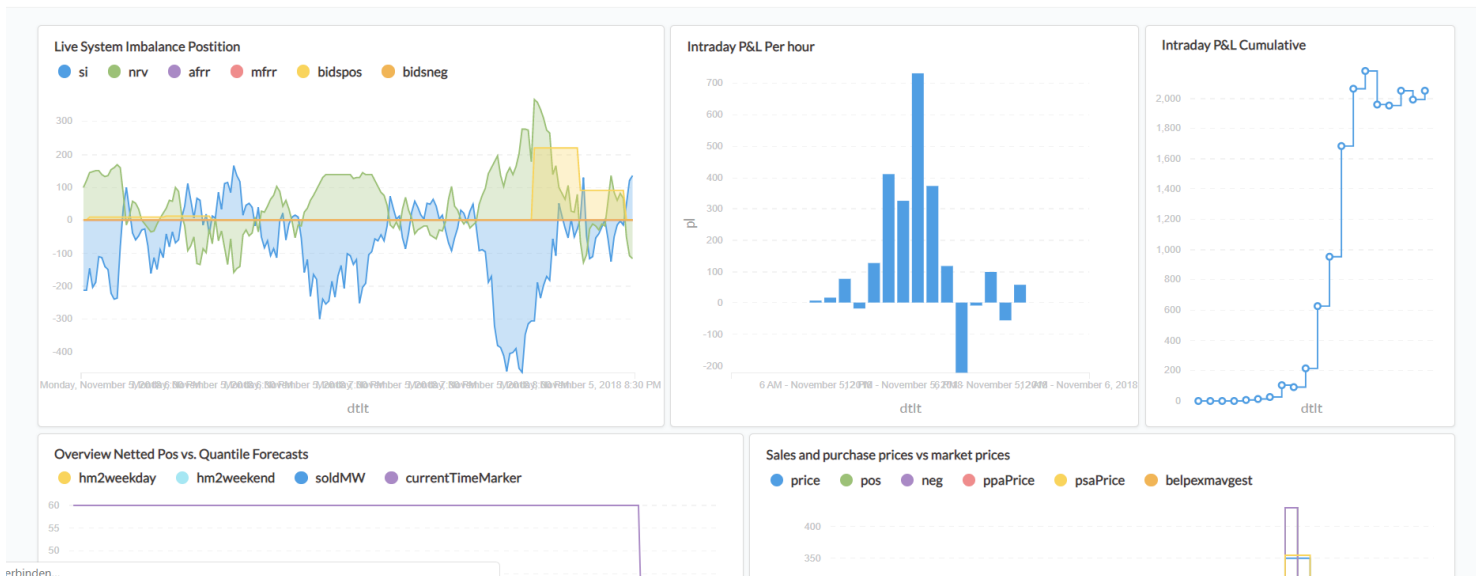
This is way better in terms of spatio-temporal resolution...



Renewables and Aggregation: A practical guide

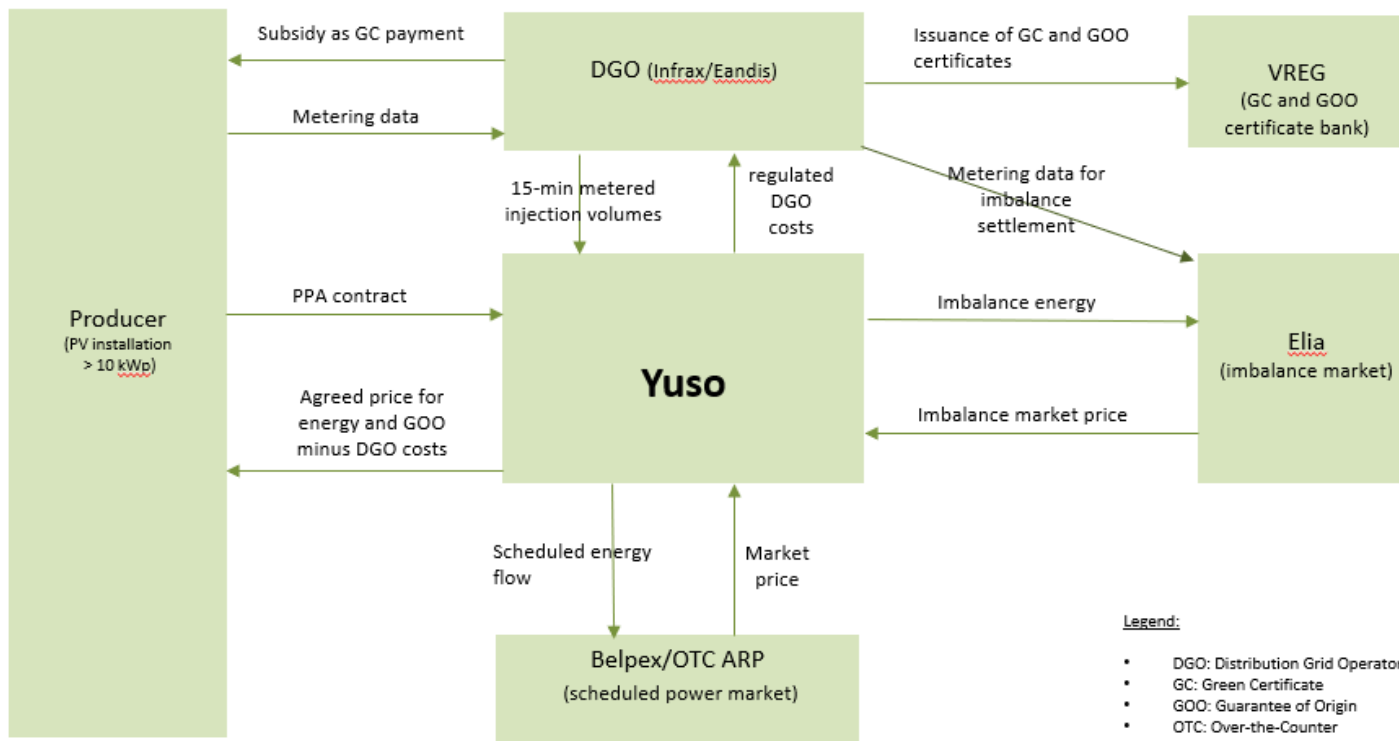
Navigation bar with links: Dashboards, Questions, Pulses, Data Reference, **New Question**, and a user profile icon (DW).

Intraday Dashboard Yuso



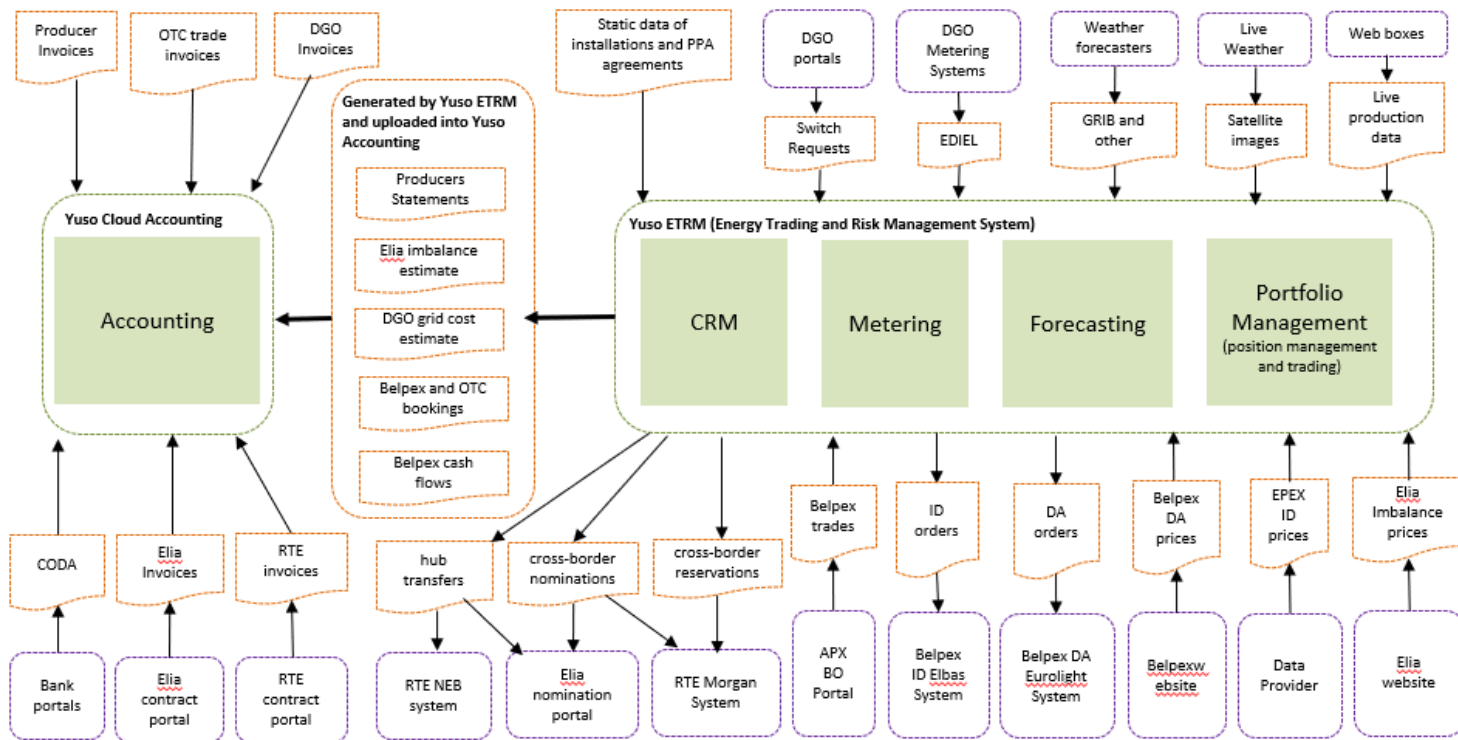


Renewables and Aggregation: A practical guide





Renewables and Aggregation: A practical guide



Opportunities for Cyprus

Markets are an opportunity, not a threat!





Opportunities for Cyprus



- Located in the Eastern Mediterranean, Cyprus has excellent potential for RES, mainly wind and Solar
- The meteorological cross-section is limited and there is only one balancing zone operated by DSM
- Market will open for Day-Ahead in 2020, Intraday market to follow soon thereafter
- One dominant generation technology (oil-fired) in combination with Wind (158 MW) and Solar PV (112 MW) as of 2017 with good yield for latter (ca 1600H)
- Share in RES as well as demand likely to rise!



Opportunities for Cyprus



- Aggregation of RES will become possible post market opening for portfolio sizes up to 20 MW
- One can opt either for wholesale markets or B2B / B2C supply as an offset for the RES generation
- In general, due to HVAC, there is a good match between offtake and RES supply, especially solar PV
- At present, more Wind and Solar PV is in the pipeline so wholesale prices will likely start to reflect the RES availability balance, just like elsewhere...



Opportunities for Cyprus



Wind Farm and Solar Generation (archive)

NOTES:

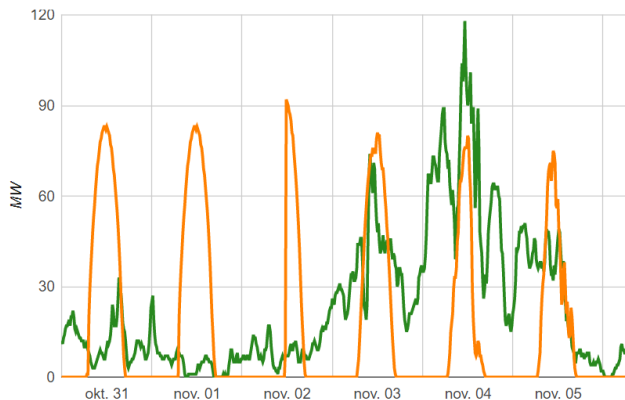
- 1) The Generation from Wind Farms is injected to the Transmission System and the generation from PV Parks to the Distribution System
- 2) The Generation from PV is estimated

Select Time Span for recent days

7 Days 3 Days Yesterday Today

or select dates in the past

Start Date 31/10/2018 No of days 7 Days Go



Yuso over the years

SUPPLY, INJECTION, BATTERIES





2012

YUSO IS CREATED...





2013

A GROWING PORTFOLIO
ON PHOTOVOLTAIC
ENERGY...

Energiemarketingbureau Yuso

“Wij verkopen uw zonne-energie”

De voorbije jaren investeerden ontelbare ondernemingen in zonne-energie op hun daken. Zeer interessant, zeker als je in een belangrijk deel van de energiebehoefte van je bedrijf kan voorzien en de resthoeveelheden optimaal verzilvert. Om die overschotten optimaal te vermarkten, richtte Michel Verschuere vorig jaar Yuso op. De expert in elektriciteitshandel focust zich op de zonne-energiemarkt: hij wil met een erg transparante aanpak en een duidelijke prijspolitiek zijn klanten optimaal ontzorgen.

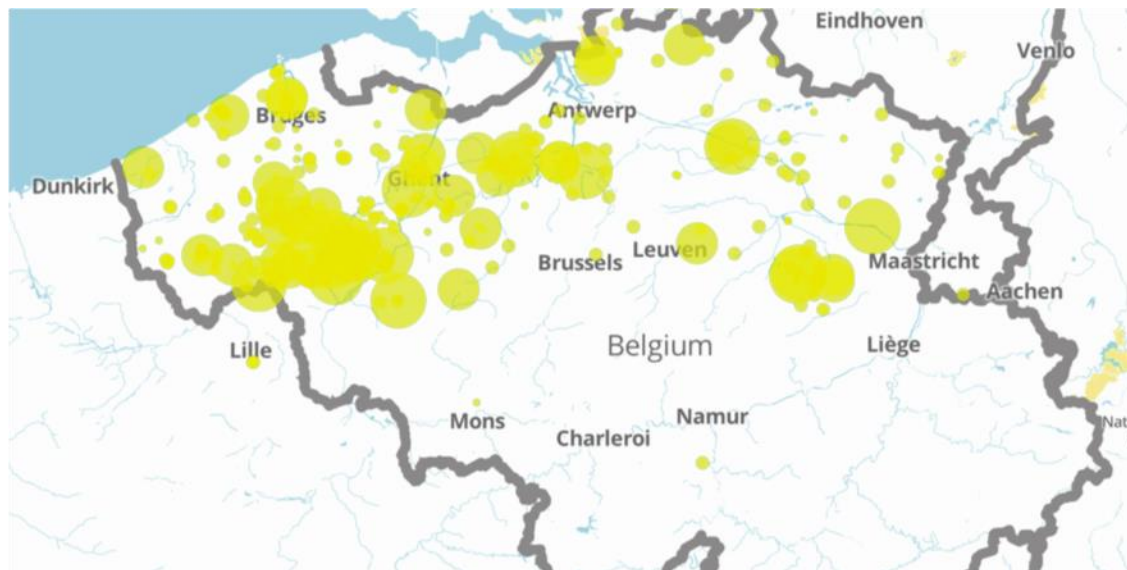


Michel Verschuere:
“België staat wereldwijd
op de derde plaats op
vlak van geproduceerde
zonne-energie per
inwoner.”



2014

YUSO CROSSES THE 100 MWp
MARK FOR THE FIRST TIME...





2015

THE FIRST YUSO PILOT PROJECTS ON ENERGY STORAGE...





2016

STORAGE, BATTERIES AND THE BLOCKCHAIN...



YUSO DOET EERSTE ENERGIEDEAL IN EUROPA VIA 'BLOCKCHAIN'

**Groene stroom aan elkaar
doorverkopen? Een Belgisch
bedrijf deed het al**





2016

SMART STEERING 10 MW / 10 MWh GRID STORAGE IN HOLLAND





2018

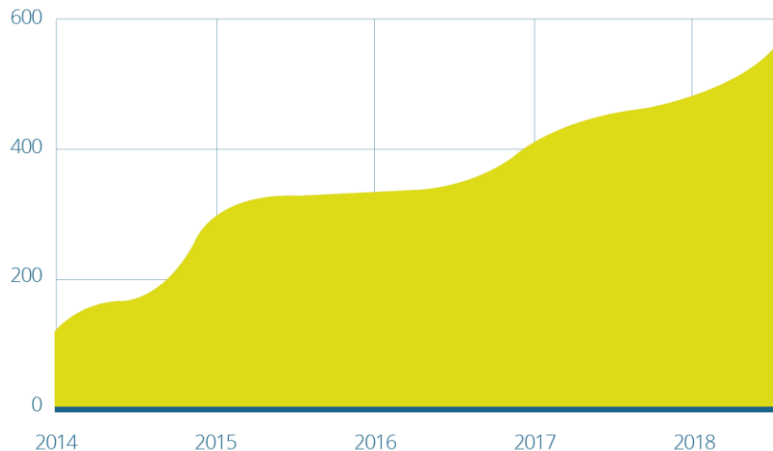
THE GROWTH STORY...

600+
connections

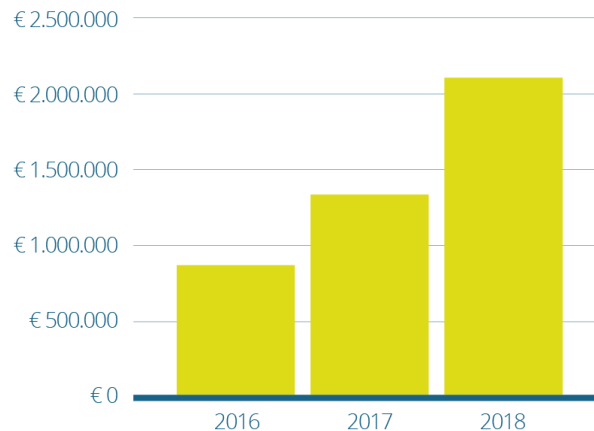
62+
GWh

172
MWp

■ Aantal PV aansluitingen in portfolio Yuso



■ Omzet op Belpex gedurende de eerste 7 maanden per jaar





2018

THE END OF AN ERA...



2018

THE END OF AN ERA...





2018

... AND A NEW CHAPTER FOR OUR COMPANY



Ruien Energy Storage

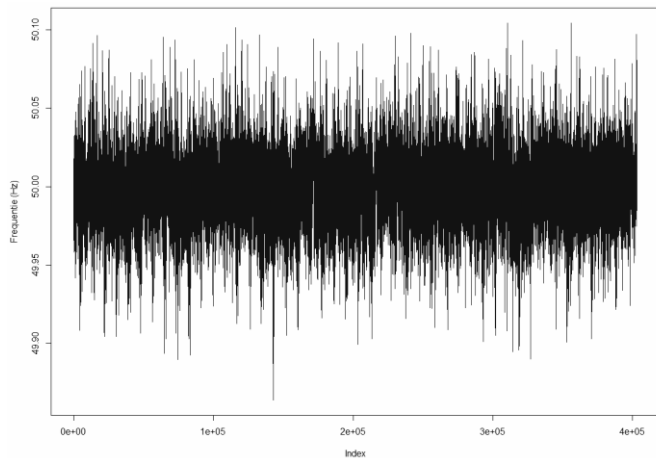




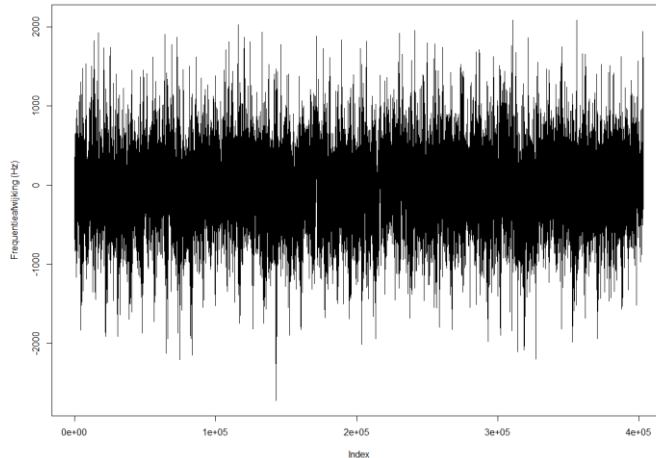
Grid Stability

WHY THE GRID IS UNSTABLE...

Grid frequency in Hz



Frequency deviation from 50 Hz





Grid Stability

...AND WHY IT CONCERNS ALL OF US...



- The electricity grid must be stabilized at a frequency of 50 Hz in order to prevent blackouts, but also to make sure your clock runs on time!
- Frequency regulation used to be the sole task of classical, mostly gas-fired power plants but battery storage overtook!
- Battery storages offer faster respons at a much lower cost

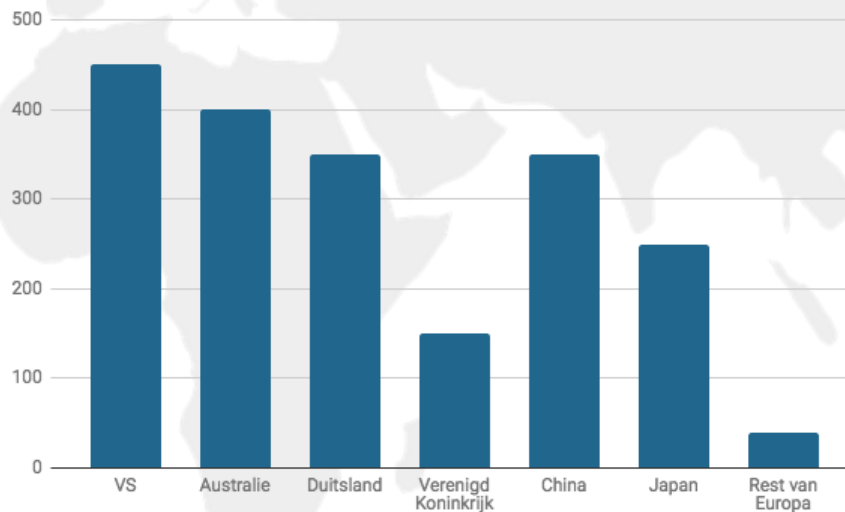


Energy Storage is booming worldwide...

**Global capacity of
Energy Storage:
2926 MWh**

**→ YES WE CAN!
(In Belgium)**

Worldwide distribution of Energy Storage in 2017
(MWh)





Energy Storage is booming worldwide...



A unique location for a project of this size...



- Direct coupling to the Belgian Transmission System (Elia)
- Newly created Industrial Zone [of the future]
- Closed distribution grid
- Potential for smart networks!



Nippon-Koei: A strategic cooperation!



YUSO 注入 供給 バッテリー

ネーデルランド フランス語

私たちに关しては MY YUSO PORTAL

最新に保つ
ニュースレターを購読する

Your email address

私を購読する

開始する
私の湯生に登録する

First name Last name

Email

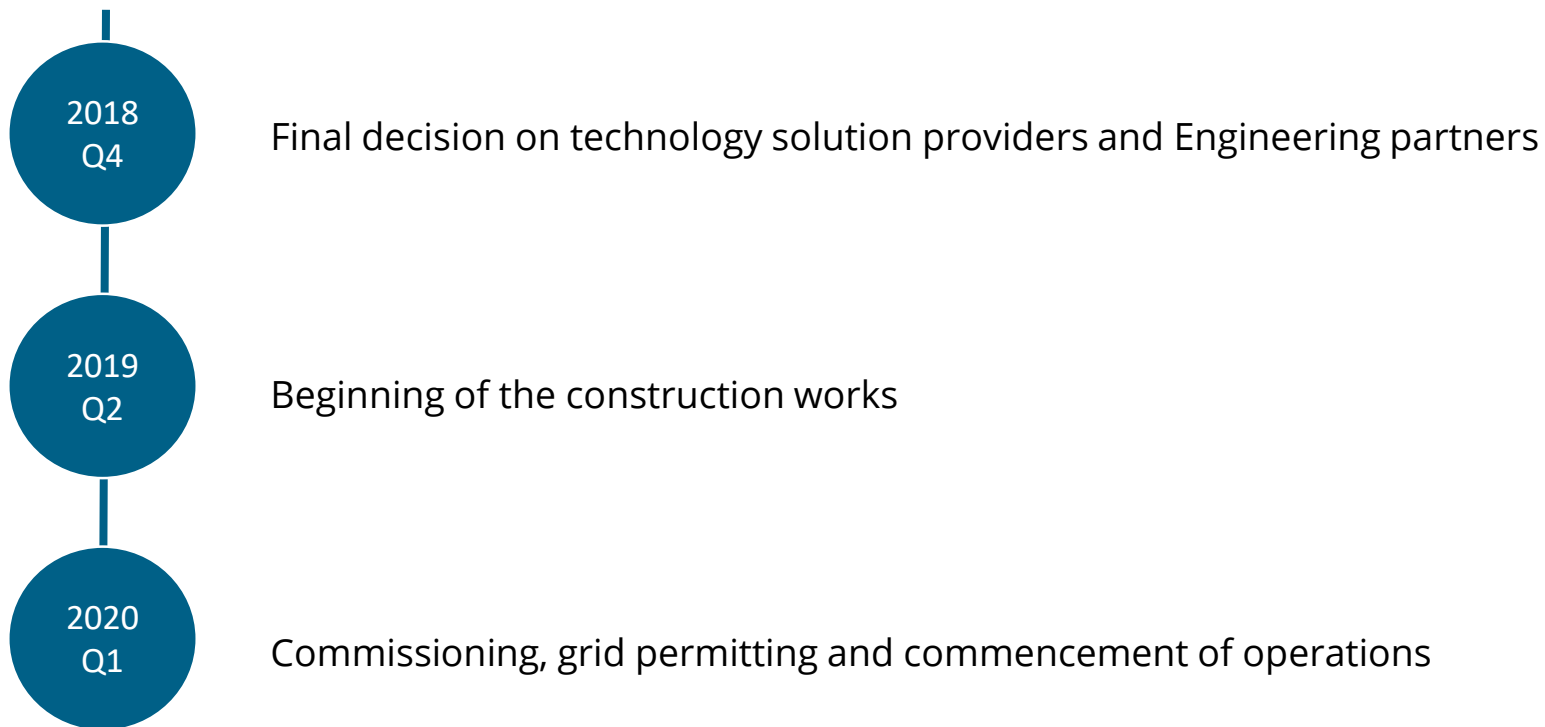
Phone (optional)

注入。SUPPLY。ストレージ。
新しいエネルギーの流れ
を作る
あなたのエネルギーのための1つのプラットフォーム

ユソを発見する



Status and planning



My Yuso Portal

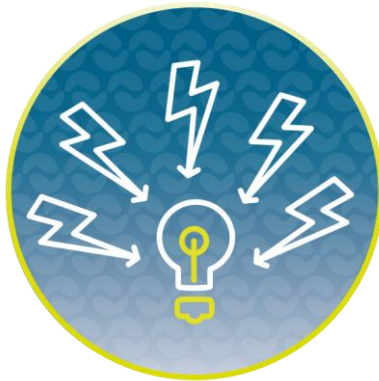
OPT FOR SUPPLY SERVICES OF THE
FUTURE, TODAY!



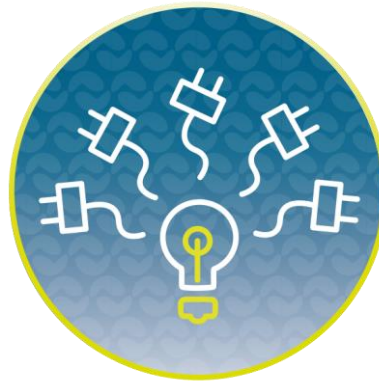


One Platform for all your Energy Needs

ENERGY OFFTAKE



ENERGY SUPPLY



ENERGY STORAGE





Where the Yuso Platform Price is made off...

**MARKET PRICES,
EVERY HOUR**



+

PLATFORM FEE



+

**GRID COSTS AND
TAXES**





One platform for all B2B 'prosumers'

DEMO



to the My Yuso Portal,
choose one of the sections below to continue.



Services !

An overview of all your service points with the accompanying technical data and contractual parameters.



Dashboards

Displays your energy consumption or injection for every hour, as well as the wholesale price. These amounts determine the energy component of your invoice or self-bill.



Documents

A list of all invoicing documents concerning your company, divided into overview documents, self-bill documents, invoice documents and a detail document.

We only need a few details from you !

To finalise your supply agreement, we only need a few details from you. This concerns the EAN code and the capacity of your installation, and also the expected use. Click further to complete this information.

[Activate your offtake today](#)

Do you want to use your green energy as optimally as possible?

Yuso provides the best battery solutions for your company. Discover the benefits of our approach.

[Request your battery analysis](#)



Contractual advantages of the Yuso offering

**FLEXIBLE
CONTRACT**



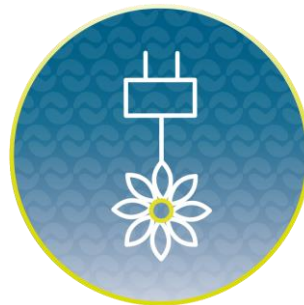
**ALWAYS THE
WHOLESALE PRICE**



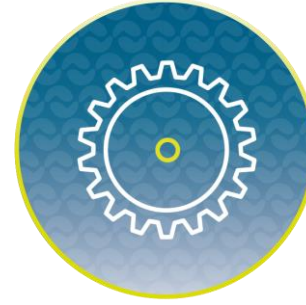
**TRANSPARENCY
&
DIGITAL REPORTING**



**100% GREEN
ENERGY**



**SMART ENERGY
MANAGEMENT**





Yuso

MAKING NEW ENERGY FLOW





What uniquely identifies Yuso...

- **OUR KNOW-HOW OF THE MARKET**
 - Transparency guaranteed...
- **ADVANCED INFORMATION SYSTEMS AND AUTOMATION**
 - Lowest transaction costs for its customers...
- **HANDS-ON EXPERIENCE IN STORAGE**
 - Use your Energy in the best way possible...



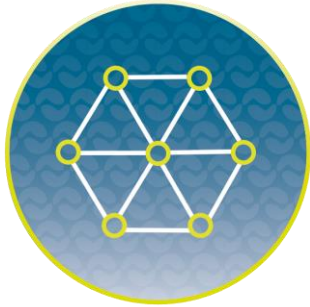
For enterprises...



BECOME A YUSO CUSTOMER TODAY



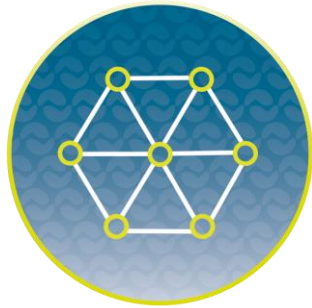
For investors...



INVEST IN STORAGE TOGETHER WITH US!



For Energy Professionals...



TEAM-UP WITH YUSO

The Yuso team



Bart Pycke

Managing Director

Finance

Business
development

IT management



Michel Verschuere

Managing Director

Trading

Business
development



Dries Wijns

Full Stack Engineer

IT development

Trading
automation



Sofie Schell

Financial Manager

Finance

Operations



Jonas Boury

Product Manager

Business
development

IT developments



Jasper Vermandere

Portfolio Manager

Trading

Origination

Business
development

**We are ready
for the future...**

How about you?





Making new energy flow

Cyprus Employers and Industrialists Federation, Strovolos, Cyprus, Nov 7th, 2018