



Biogas Across Borders

# Living up to its strengths: Biogas across borders in practice

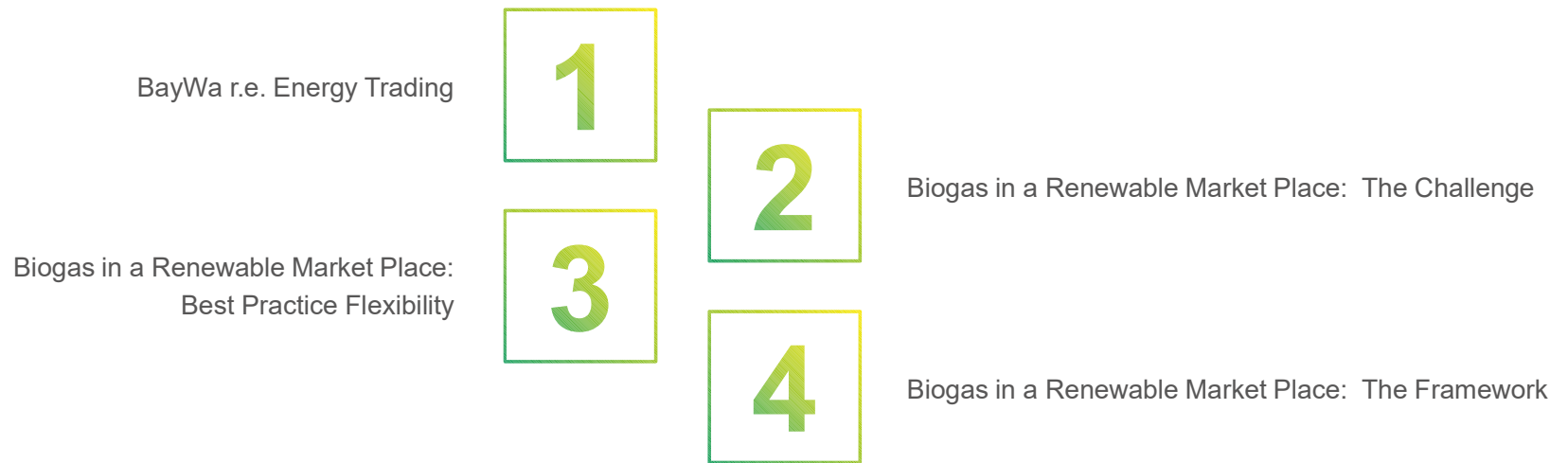
Kevin Hayward

BayWa r.e., Brussels 8<sup>th</sup> November 2018



**r.e.think energy**

# Living up to its strengths: Biogas across borders in practice





# BayWa r.e. Energy Trading

The Business Entity Energy Trading

# Business Segments

## Bio-methane Trading



- Purchase, trading and sale of physical bio-methane as well as Biomethane-certificates
  - Mainly long-term contracts
  - For all market segments: CHP, heating and fuel
- Nomination and energy data management
- Portfolio and balancing group management
- Management of guarantees of origin (via dena Biogas register)

## Direct marketing



- Direct marketing of power from distributed power plants: wind onshore, wind offshore, PV bioenergy, geothermal energy, and CHP
- Full service including forecast, balancing group management, and remote control (via VPP)
- Mainly according to EEG's market premium model
- Long-term PPAs for new power plants and mid-term PPAs for post-EEG plants under development

## Flexibility Management



- Flexible management and cross market optimisation of decentral generation at all power and ancillary service markets
- Virtual power plant based on own system EC24 as well as own developed optimization software 5/1
- Management of consumption of industrial power clients according to intraday price changes and demand of ancillary services (Demand Side Management)

## Business Entity Energy Trading Key Facts and Figures



**1 600 GWh**

Bio-methane and green gas traded



**1 500**

Wind, PV, bioenergy, geothermal power plants and CHP plants with

**2 200 MW**

Of capacity under management



**950 GWh**

Power supply to industrial, commercial and private customers

**20 000**

Customers are supplied with clean and sustainable green power



**Awarded**

Certificates and awards testify our high standard and excellent service (e.g. TÜV Süd, Ökotest)



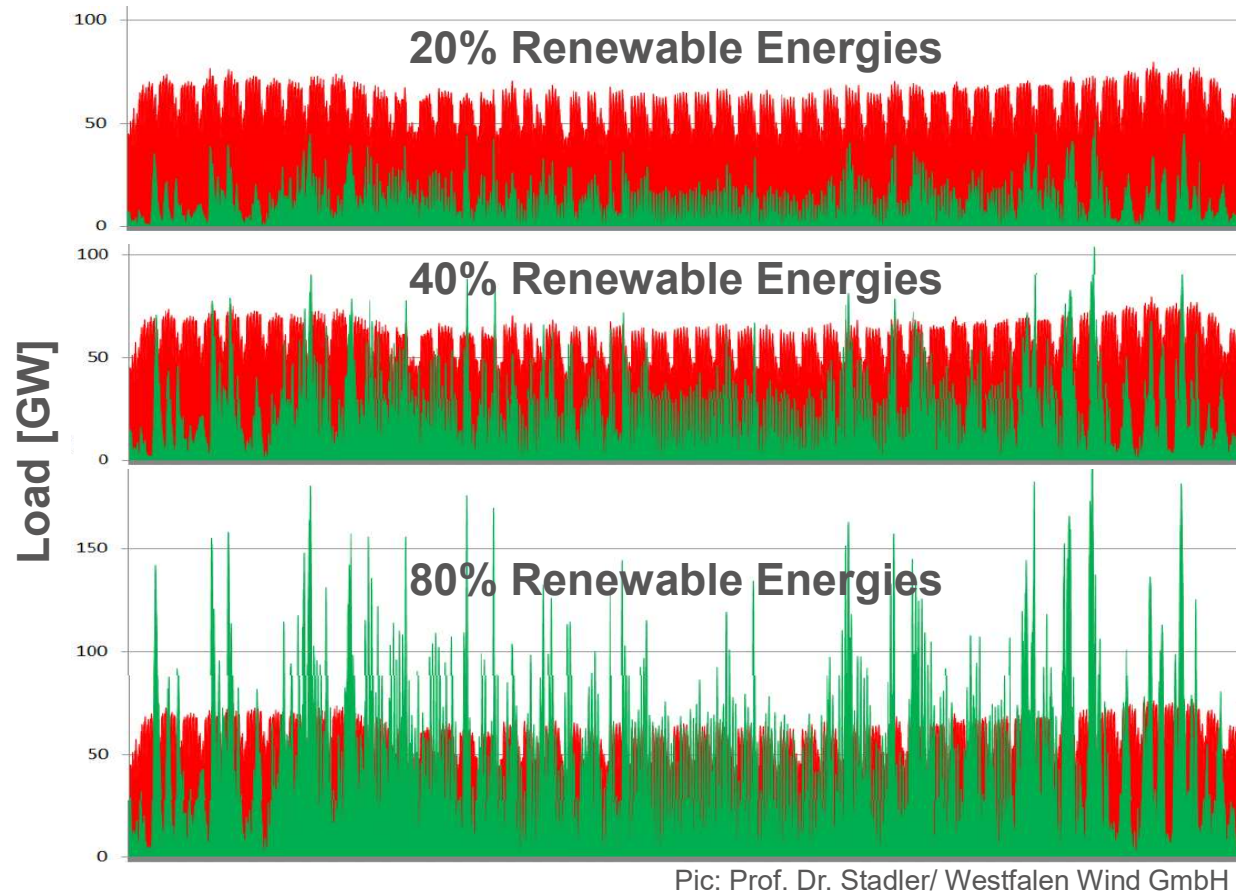
**90**

Highly qualified and experienced employees work with us in our offices in Munich, Leipzig and Frankfurt



# **Biogas in a Renewable Market Place: The Challenge**

# Renewable Energies are Changing the Basis of our Energy System



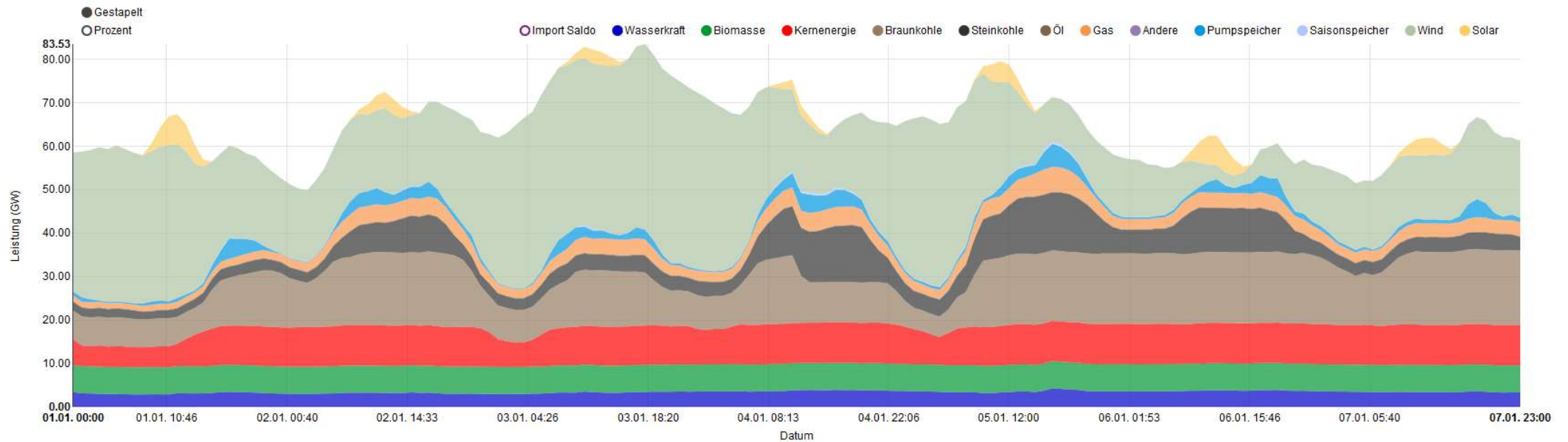
- **Distributed and fluctuating generation** from wind and solar
- **Baseload** has **no value** anymore
- **Increasing demand for flexibility**
- **Digitalisation** enables the paradigm change

red Power demand Germany (2010)  
green Generation wind & solar @ different shares



The Challenge

## The market is becoming more and more flexible



Nettoerzeugung von Kraftwerken zur öffentlichen Stromversorgung.  
Datenquelle: 50 Hertz, Amprion, Tennet, TransnetBW, EEX  
letztes Update: 24 Jan 2018 09:29

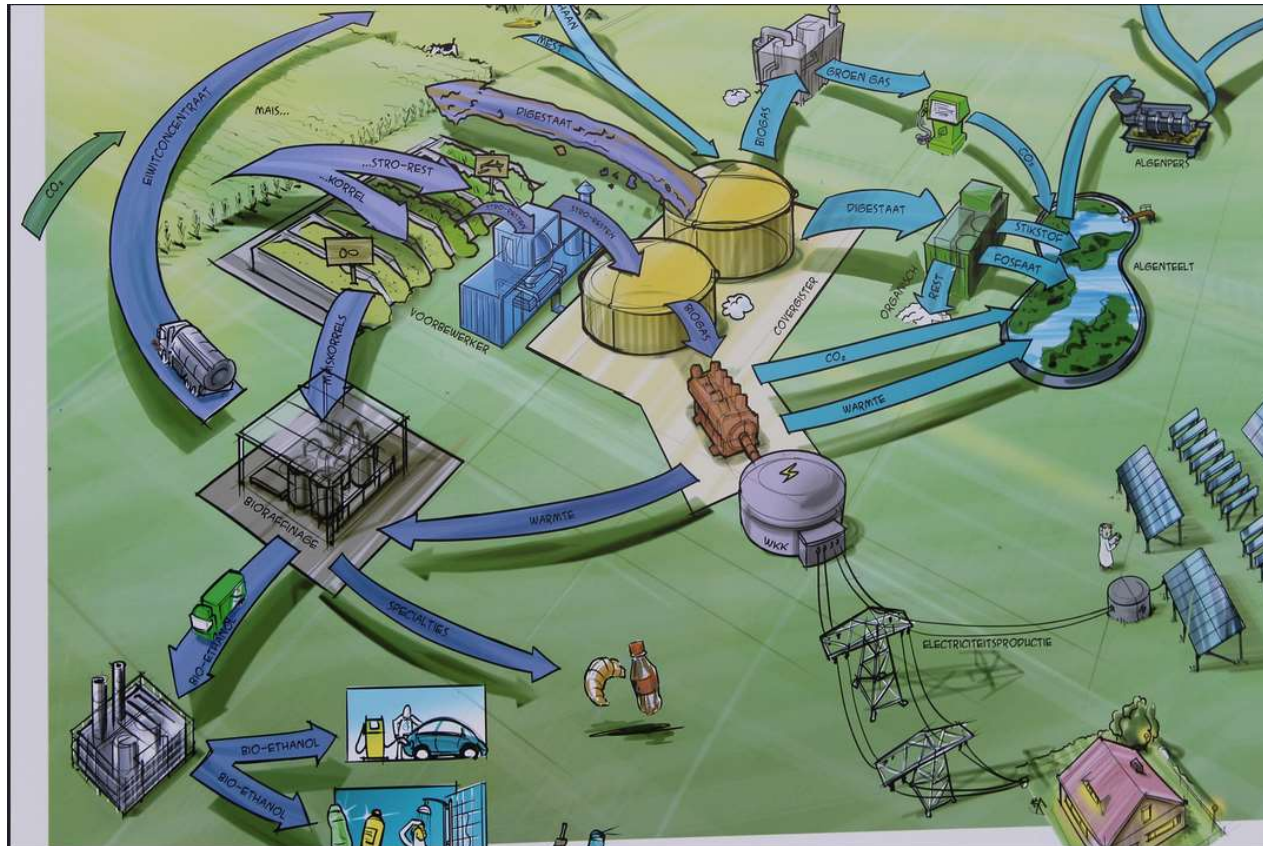
A growth in volatility requires an increased flexibility





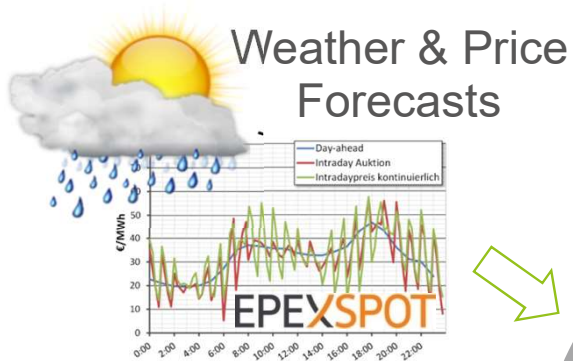
# **Biogas in a Renewable Market Place: Best Practice Flexibility**

## Biogas Plants in Dynamic Dispatching



Biogas Plants are complex systems, without the demands of dynamic dispatching

# 1<sup>st</sup> Step: Creation and Execution of the Optimised Schedules



5/1 Dynamic  
Optimisation



24/7 Trading Team

EC24 Virtual  
Power Plant

Technical Units



Restrictions

Technical Restrictions



Heat Demand



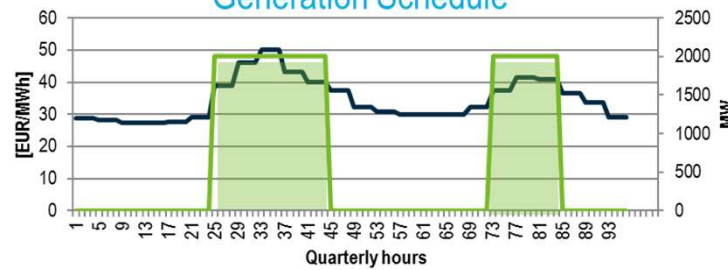
Biogas Availability



Contractual Restrictions

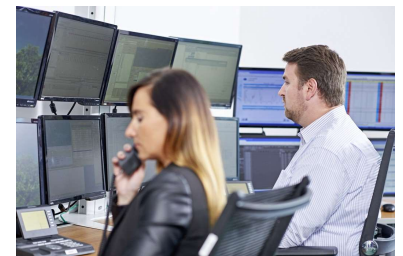
5/ONE

Generation Schedule



ec<sup>/24</sup>

Trading Floor /  
Markets



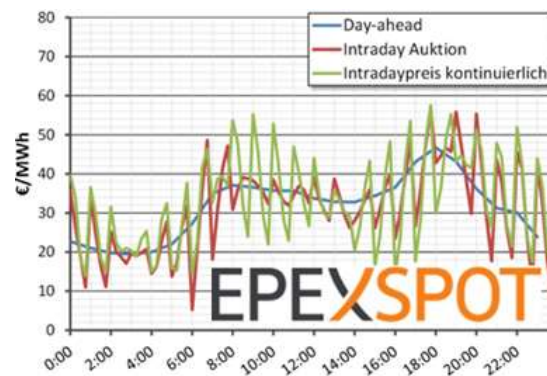
# But Things Always go Different than Expected...

## Deviations from Forecasts

Weather Forecast



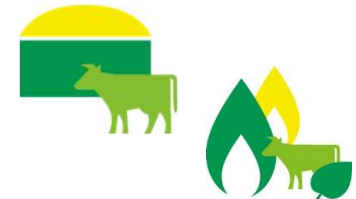
Market price Forecast



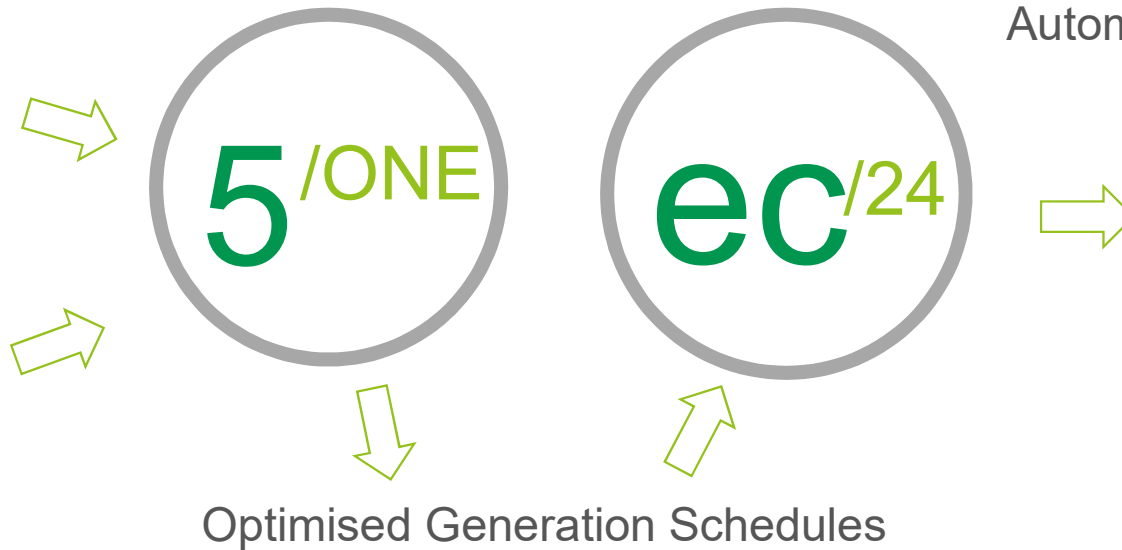
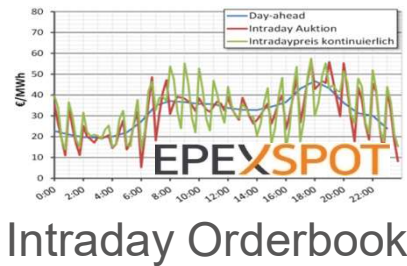
Heat demand



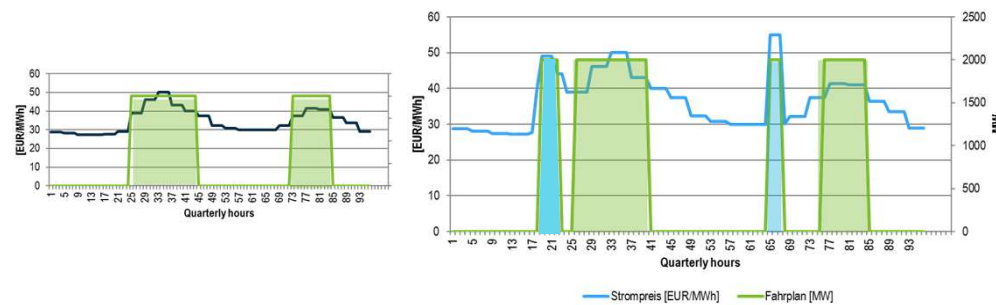
Plant Availability



## 2<sup>nd</sup> Step: Continuous Intraday Optimisation... Every 15 Minutes

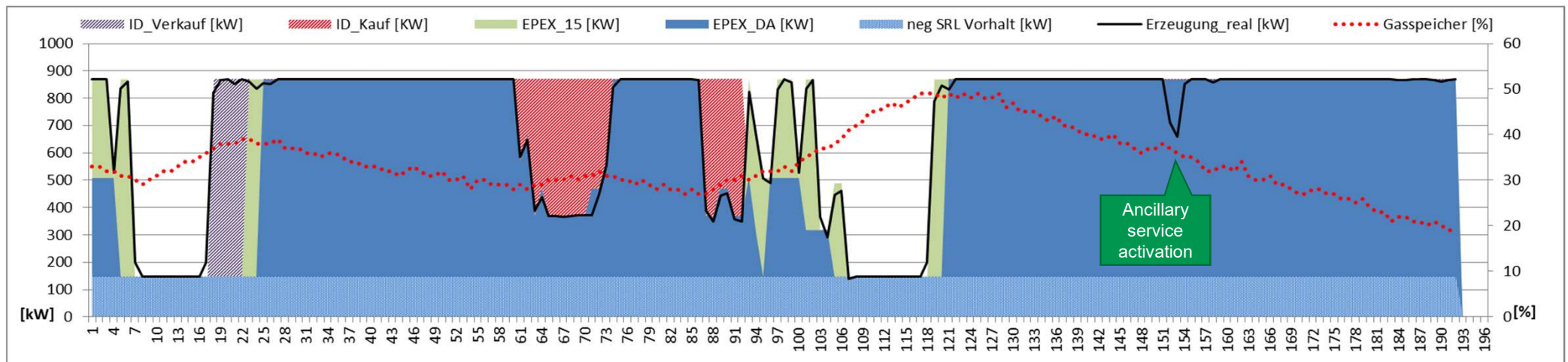


Automated Intraday Trading





# Result: Economically Optimised Operation of a Biogas Plant





# Biogas in a Renewable Market Place: The Framework



# Biogas is effective under the right conditions

## Competitive Framework

- **Technical**
  - Gas Storage
  - Heat Storage
  - Additional Electrical Production Capacity
- **Contractual**
  - OEM Maintenance & Guaranty
  - Direct Marketing Contract
- **Cost of Upgrades and Operations**
  - Investment Costs (~130€/kW for upgrading plants)
  - Motor Efficiency
  - Maintenance Costs
- **Operational Best Practices**
  - A new paradigm – Agricultural Expert to Power Producer!

## Regulatory Framework

- **Power Market Design**
  - Liberalized Ancillary Services Market
  - Liberalized Power Supply Market to allow for the direct marketing of REN by 3rd party market representation .
  - Efficient Imbalance Market, w/o Caps & Floors
  - Efficient Day-Ahead and Intraday Markets, w/o Caps or Floors
  - Liquid Intraday Market for each balancing unit (ex. ¼ hr)
- **Market Support**
  - Today Flexibility is subsidized at a level to enable the investment upgrades

**What will the value of flexibility be in the future?**

r.e.levant    r.e.sponsible  
r.e.duce    **r.e.think**    r.e.cycle  
r.e.spect    r.e.flect    r.e.lation  
r.e.newable

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[www.baywa-re.de](http://www.baywa-re.de)

[www.clens.eu](http://www.clens.eu)



# Backup

**With an increase in decentralization and free markets, the short term market volume increases.**

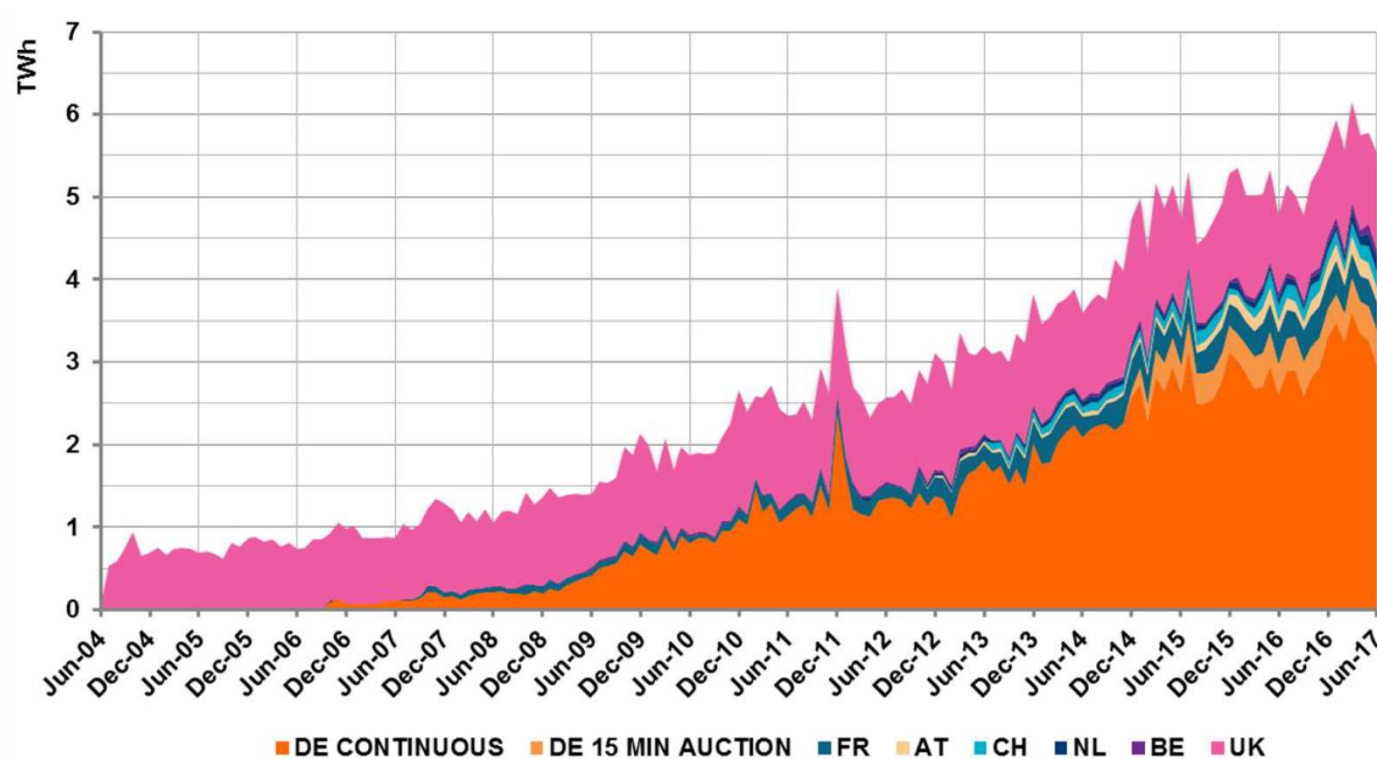
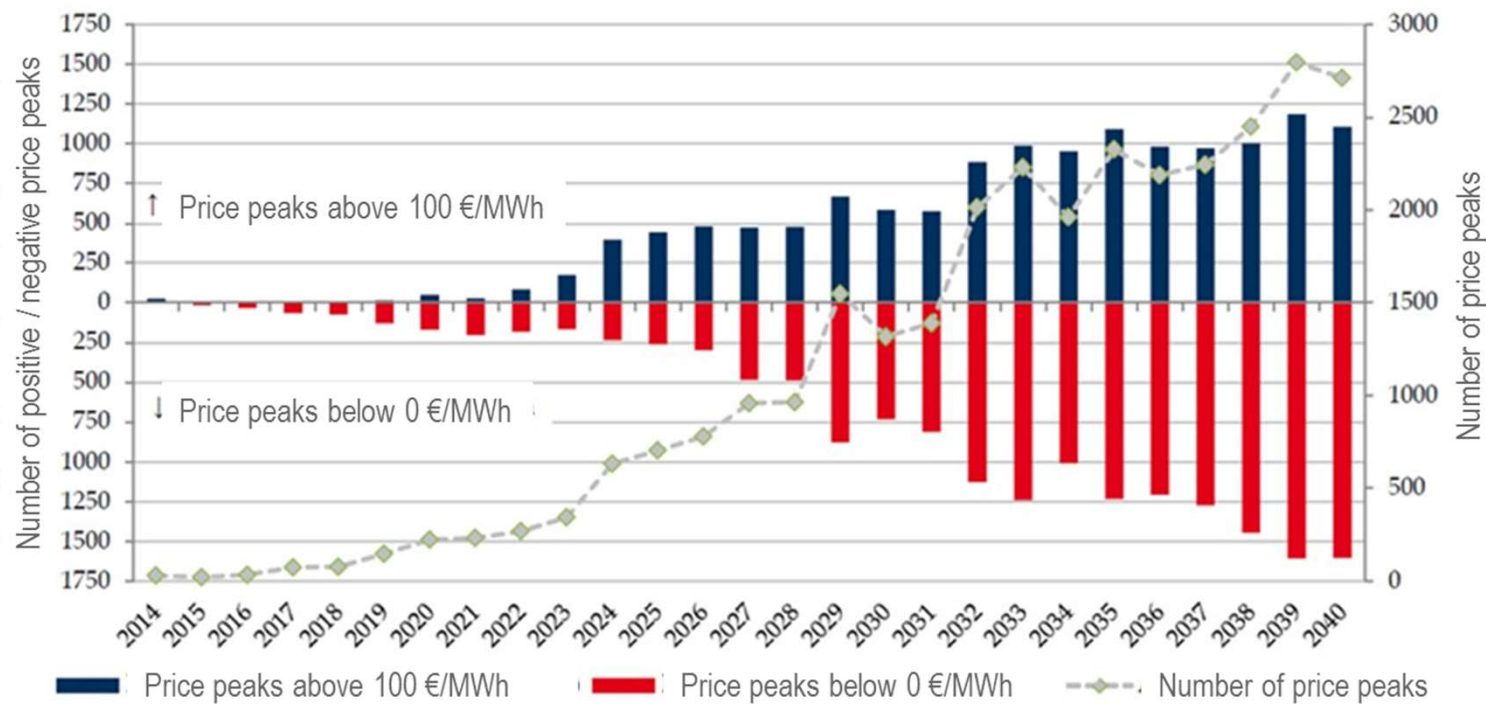


Abbildung 13 - Entwicklung der Volumen an den Intraday-Märkten der EPEX SPOT 2004-2016, Quelle: EPEX SPOT

Ref.: Report Direktvermarktung von erneuerbaren Energien an der Strombörse, EPEX Spot for DFBEW

## Highly volatile power production means growing spreads in the short term power prices



## Main Markets for Flexibility are Ancillary Services and Short-term Power Markets (Spot Markets)

### Ancillary services

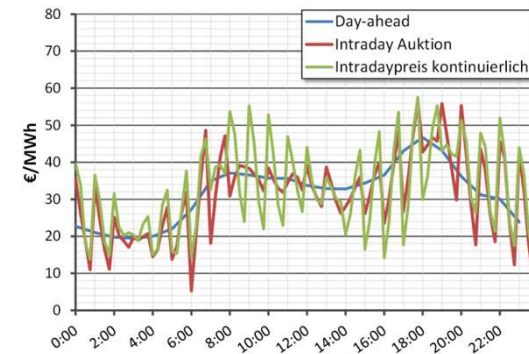
Provision and activation of reserves



- Increase of generation or reduction of consumption if grid frequency drops below 50 Hz or vice-versa if frequency rises above 50 Hz
- Remuneration of provision by capacity payment (€/MW) and of activation by energy payment (€/MWh)

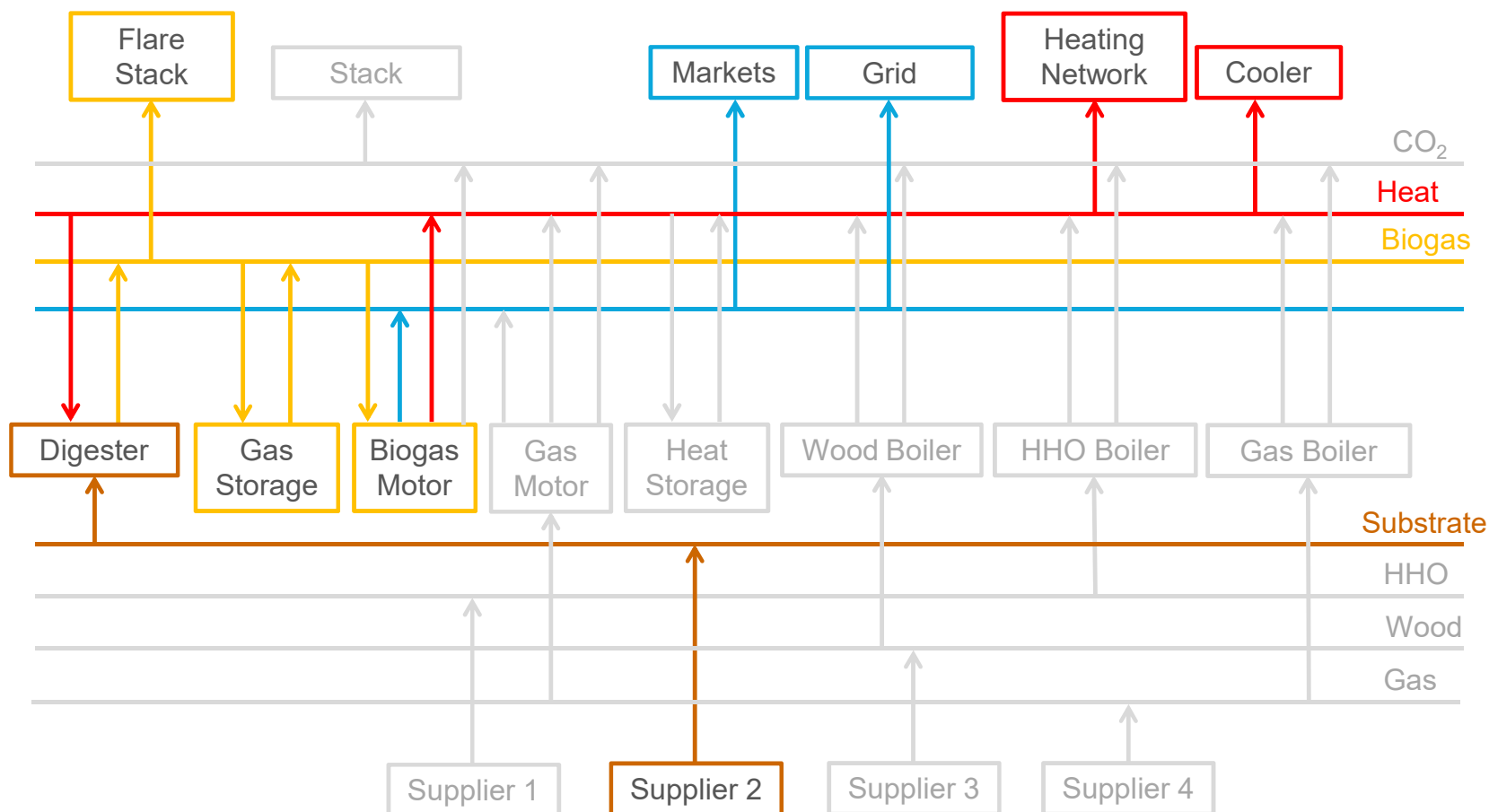
### Short-term power markets

Balancing of demand and generation of power based on price signals on spot markets



- Scheduled operation of power plants, consumers, or storages: Increase of generation or decrease of consumption if prices are high and vice-versa if prices are low
- Markets: Day-ahead & intraday auction and continuous intraday trading

## The variety of variable requires a complex sytem





# Foward looking analysis with respect to all relevant data and restrictions

The screenshot displays a software interface for managing virtual power plants (VPPs). On the left, a tree view under 'Übersicht' shows a hierarchy of VPPs, including 'Virtuelle Kraftwerke' and 'Kraftwerke'. A specific VPP, 'KW\_0800 (BG\_BHKW)', is selected. On the right, a table titled 'Parameter' provides technical specifications for this VPP across four time periods (TJ086\_1 to TJ086\_4).

Parameter	Kürzel	Einheit	TJ086_1	TJ086_2	TJ086_3	TJ086_4
Faktor	fakt	-	1,0000	0,7000	0,9500	0,9500
Summand	sum	kW	0,0000	0,0000	0,0000	0,0000
Installierte Leistung elektrisch	P_inst_el	kW	160,0000	210,0000	360,0000	400,0000
Maximale kurzfristig ansteuerbare Leistung elektrisch	P_max_kurz	kW	0,0000	210,0000	360,0000	400,0000
Maximale Leistung elektrisch	P_max_el	kW	0,0000	210,0000	360,0000	400,0000
Minimale Leistung elektrisch	P_min_el	kW	0,0000	210,0000	180,0000	200,0000
Bandleistung elektrisch	P_0_el	kW	0,0000	210,0000	0,0000	0,0000
Minimale kurzfristig ansteuerbare Leistung elektrisch	P_min_kurz	kW	0,0000	0,0000	0,0000	0,0000
Installierte Leistung thermisch	P_inst_th	kW	160,0000	220,0000	400,0000	467,0000
Maximale Leistung thermisch	P_max_th	kW	0,0000	0,0000	0,0000	0,0000
Minimale Leistung thermisch	P_min_th	kW	0,0000	0,0000	0,0000	0,0000
Wirkungsgrad elektrisch	eta_el	%	36,0000	38,0000	38,0000	39,4000
Wirkungsgrad thermisch	eta_th	%	0,0000	41,0000	42,0000	46,0000
Biogasanschluss	Biogas	-	0,0000	0,0000	0,0000	0,0000
Erdgasanschluss	Erdgas	-	0,0000	0,0000	0,0000	0,0000
Maximale Vollbenutzungstunden	vBh_max	h/a	0,0000	8.784,0000	8.784,0000	8.784,0000
Minimale Vollbenutzungstunden	vBh_min	h/a	0,0000	0,0000	0,0000	0,0000
Verhältnis Starts/Laufstunden	VSL	-	1,0000	1,0000	1,0000	1,0000
Mindestlaufzeit	T_min	1/4 h	4,0000	4,0000	4,0000	4,0000
Mindeststillstandszeit	A_min	1/4 h	4,0000	4,0000	4,0000	4,0000
Laufstundenrestriktion	T_l_max	-	0,0000	0,0000	0,0000	0,0000
Startrestriktion	ST_max	-	0,0000	0,0000	1,0000	1,0000
Tagesarbeit	T_W	-	0,0000	0,0000	0,0000	0,0000
Sperzeiten	SP	-	0,0000	0,0000	0,0000	0,0000
Pflichtzeiten	PF	-	0,0000	0,0000	0,0000	0,0000
Startkosten	K_an	EURO	0,0000	0,0000	0,0000	0,0000

For a Biogas Plant, 5/1 considers over 30 plant relevant restrictions in the model to deliver the optimal dispatching plan for the plant.

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