

Differences in balancing markets between France and Germany

Market design et transition énergétique – vers la multiplication des marchés?
June 19th 2019



Agenda

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Who we are: PwC

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Balancing at a glance

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Innovation and Balancing

1

Who

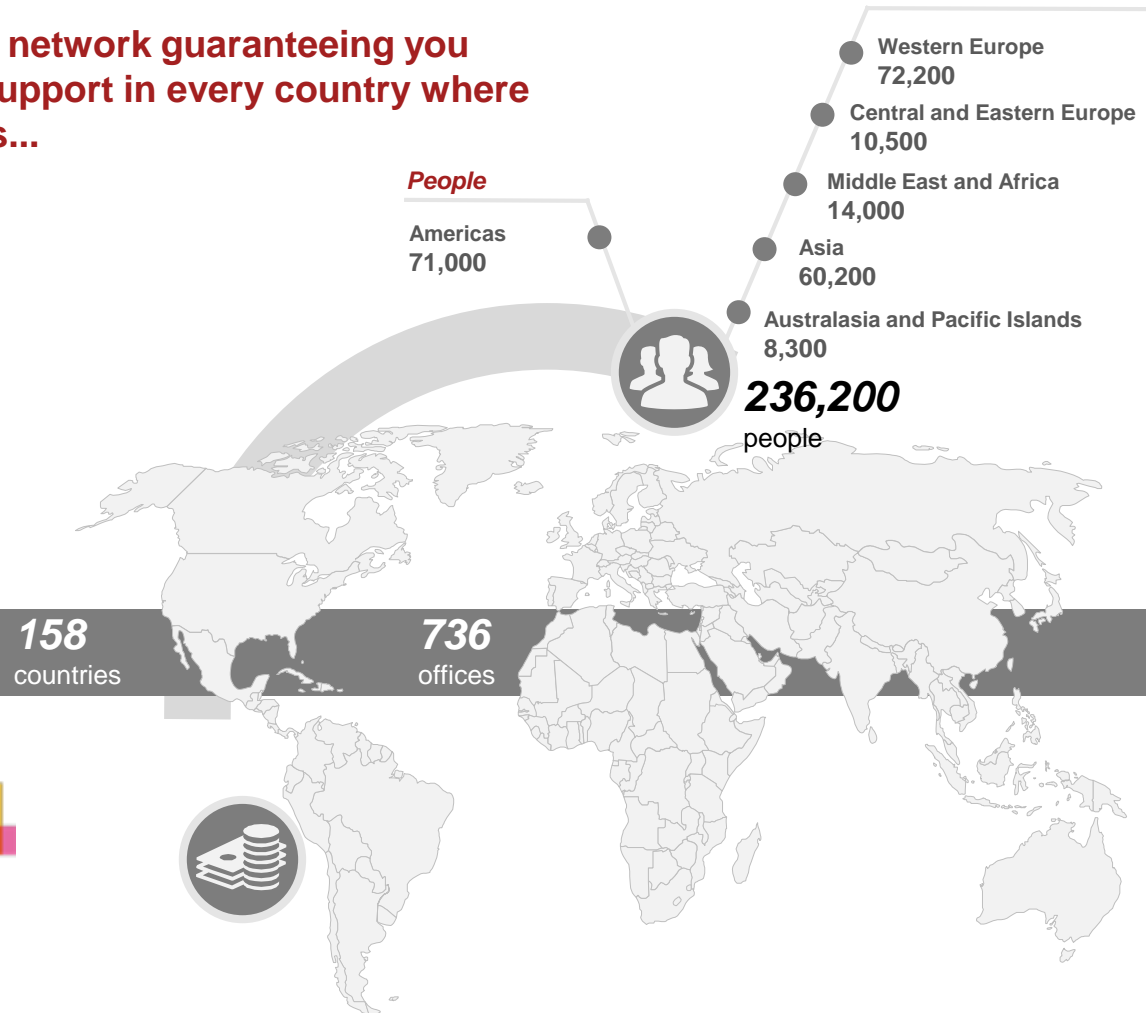
we

are

PwC

PwC's international network & expertise

An international network guaranteeing you will have local support in every country where you do business...



Build trust in society and solve important problems are the primary reason for a committed firm such as PwC.



...and across all of our lines of service

- Audit and certification of financial statements
- Strategy and consulting advisory services
- Transaction advisory services
- Tax and legal advisory services
- Chartered accountancy

Our Global Energy, Utilities & Resources industry network



What makes us different ...

- Our dedicated energy team is working from strategy to execution, living and breathing the sector, understanding your issues and responding to your priorities.
- Global business serving marquee clients and generating \$3,5bn in revenue in FY18
- Very close relationship with our industry networks (World Energy Council, World Economic Forum)
- 19,220 PwC Professionals are working across our four EU&R sectors
- Centers of competencies for each sector covering interdisciplinary expertise: public accountants, tax accountants, lawyers, engineers
- Extensive thought leadership and client roundtables program
- Invest and lead in technology-enabled innovation in serving our clients with the help of our global alliances with *SAP, Workday, Salesforce, Microsoft, Oracle, Guidewire, HPE, Google and GE Digital*
- Unique learning & education program for our network through annual Global EU&R Conference 2019

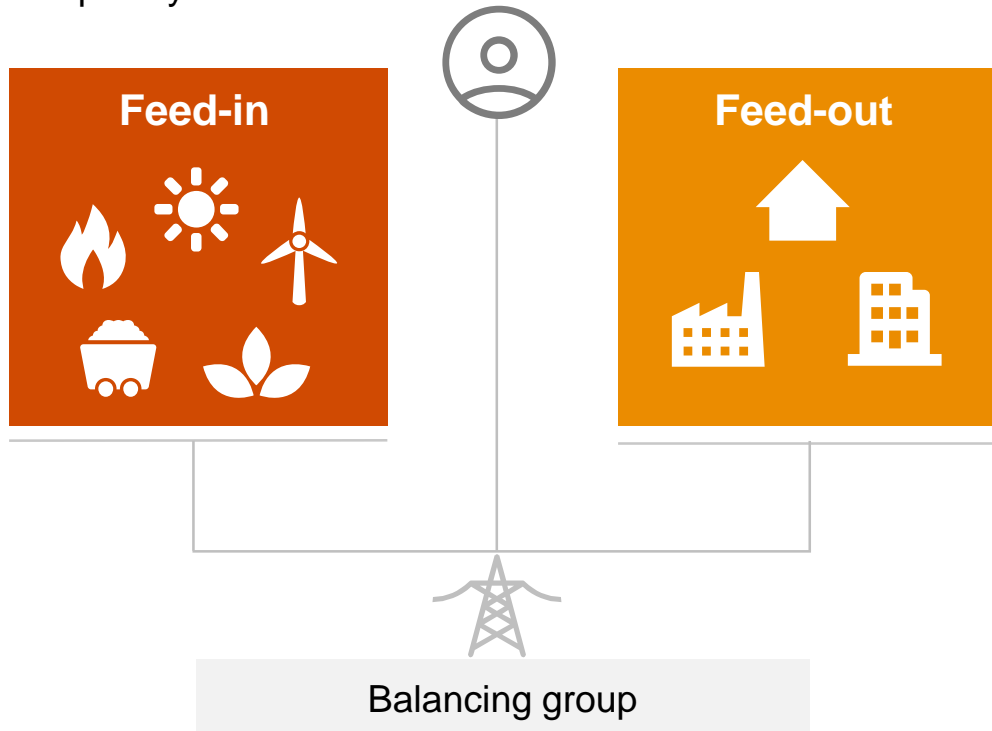


2

Balancing
at a glance

Introduction to balancing

Since electricity is not storable in a large-scale today, the electricity grid, i.e. feed-in and feed-out, must be balanced at all times. TSOs manage the Balancing process to ensure that generation equals consumption considering the European Grid Frequency at 50Hz.



In case of an **imbalance**, **flexibility** in production and consumption is required to manage imbalances.

Flexibility providers



Generation side: Power plants considering their technical capabilities

Demand side: E.g. industries, end-users through aggregators (responsible of balancing)

Valuable products of flexibility



Capacity: Remuneration (€/MW) for an activable power capacity during a period

Energy: Remuneration (€/MWh) after an effective power capacity during a period

The ongoing transformation of the European energy system calls for the integration of the balancing markets

The **transformation** of the European energy market asks for **harmonised real time market** for balancing products!






- Integration of more renewables
- Development of flexibility
- Management of system security

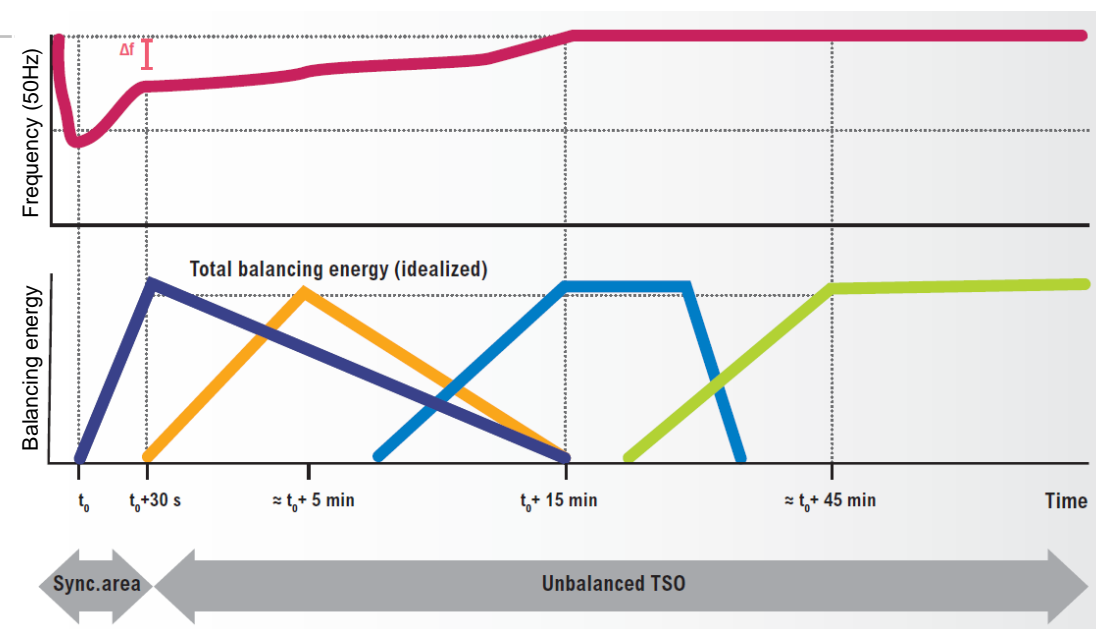


Integration of balancing energy markets in Europe until 2025 at least:

- Effective competition
- Non-discrimination
- Transparency
- European Integration
- Security of supply

Overview of European harmonised or being harmonised balancing mechanisms

Mechanism	Call	EU platform Project	Deadline	Countries
Frequency Containment Reserve (FCR)	< 30s	Regelleistung.net	Operational	
Automatic Frequency Restoration Reserves (aFRR)	30s to 15min	PICASSO	2021	
Manual Frequency Restoration Reserves (mFRR)	Max. 15min	MARI	2021	
Replacement Reserves (RR)	Min. 15min	TERRE	2019	
Inbalance Netting (IN)		IGCC	2019	



Other National mechanisms contributing to flexibility:

- Interruptibility (Consumers)
- NEBEF – Demand Response (Consumers)
- Capacity Mechanisms (Producers)
- Capacity Reserve (Producers)
- Quick and additional reserves

Source: ENTSO-E



















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French and German balancing products differ at some points due to ENTSO-E study

FCR (Primary Reserve) aFRR (Secondary Reserve) mFRR (Tertiary Reserve)

							
 Procurement scheme	Capacity	Market only	Mandatory only	Market only	Hybrid	Market only	Market only
	Energy	-	-	Market only	Mandatory only	Market only	Market only
 Activation rule for energy		-	-	Merit Order	Pro Rata (Parallel Activation)	Merit Order	Merit Order
 Activation time		$x < 30s$	$x < 30s$	$90s < x \leq 5min$	$5min < x \leq 15min$	$5min < x \leq 15min$	$5min < x \leq 15min$
 Product Resolution in MW	Capacity	$x \geq 1 MW$	$x \leq 1 MW$	$1 MW < x \leq 5 MW$	$x \leq 1 MW$	$1 MW < x \leq 5 MW$	$5 MW < x \leq 10 MW$
	Energy	No minimum bid size	No minimum bid size	$1 MW < x \leq 5 MW$	No minimum bid size	$1 MW < x \leq 5 MW$	$x \leq 1 MW$
 Product resolution in time	Capacity	Week(s)	Week(s)	Hour(s)	Hour(s)	Hour(s)	Week(s)
	Energy	Week(s)	30 minutes	Hour or blocks	30 minutes	Hour or blocks	30 minutes
 Distance to real time of reserve products auctions	Capacity	Day(s)	Week(s)	Day(s)	Day(s)	Day(s)	Year or more
	Energy	-	$x \leq h-1$	$x \leq 1 minute$	$15 minutes < x \leq h-1$	$5 minutes < x \leq 15 minutes$	$15 minutes < x \leq h-1$
 Providers		Generators, Load, Pump, Storages*, Batteries	Generators, Load, Pump, Storages*, Batteries	Generators, Load, Pump, Storage*	Generators, Pump, Storage*	Generators, Load, Pump, Storage*	Generators, Load, Pump, Storage*
 Need for symmetrical product	Capacity	Yes	No	No	No	No	No
 Settlement rule	Capacity	Pay as bid	Pay as bid	Pay as bid	Regulated price	Pay as bid	Marginal price
	Energy	Pay as bid	Regulated price	Pay as bid	N/A	Pay as bid	Pay as bid
 Cost recovery scheme	Capacity	100% Grid Users (tariffs)	100% Grid Users (tariffs)	100% Grid Users (tariffs)	100% Grid Users (tariffs)	100% Grid Users (tariffs)	100% Grid Users (tariffs)
	Energy	N/A	100 % BRP	100 % BRP	100 % BRP	100 % BRP	100 % BRP
 Free bids allowed		No	Yes	No	Yes	No	Yes
 Activations possible for other purposes than balancing?	Energy	-	-	No	No	No	Yes

3

Innovation
and
Balancing

Increasing decentralized generation by RES and conventional phase out lead to need for new flexible and other new technologies for providing balancing power

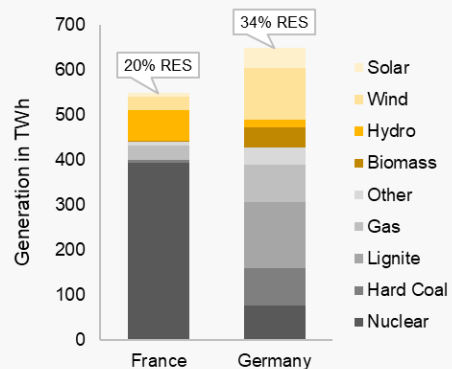


Trends in energy markets

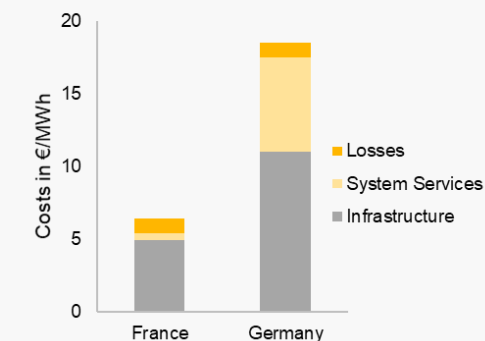
„Old world“ – until approx. 2025

- Mainly centralised conventional power plants, growing RES
- Mainly centralised conventional power plants

Energy Production 2017



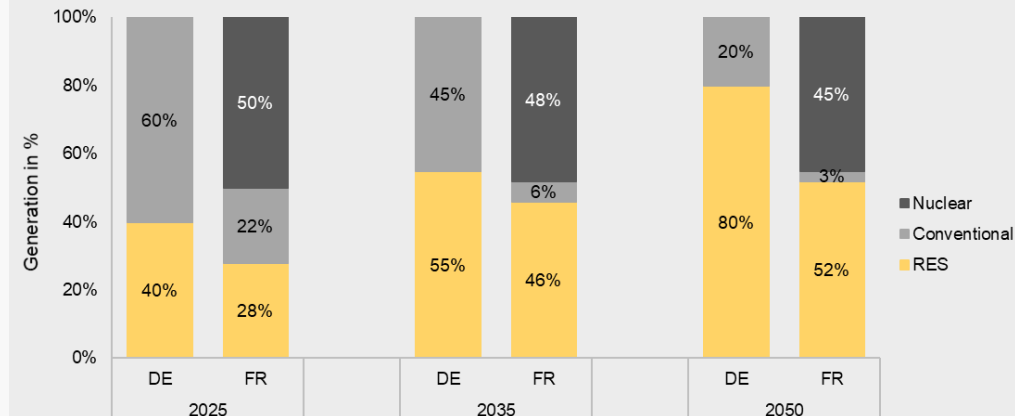
Components of TSO costs of the Unit Transmission Tariffs 2017



„New world“ – starting in approx. 2025

- Mainly decentralised electricity generation by RES
- Mainly centralised in France

RES generation targets



Balancing power provided by

- Mainly centralised base load power plants e.g. coal and nuclear power plants and a few biomass power plants
- Mainly centralised base load power plants

- Mainly flexible and small, pooled, decentralised power plants e.g. few coal, mainly gas and biomass power plants and new technologies like storages, batteries, electric vehicles
- Basically centralised base load power plants



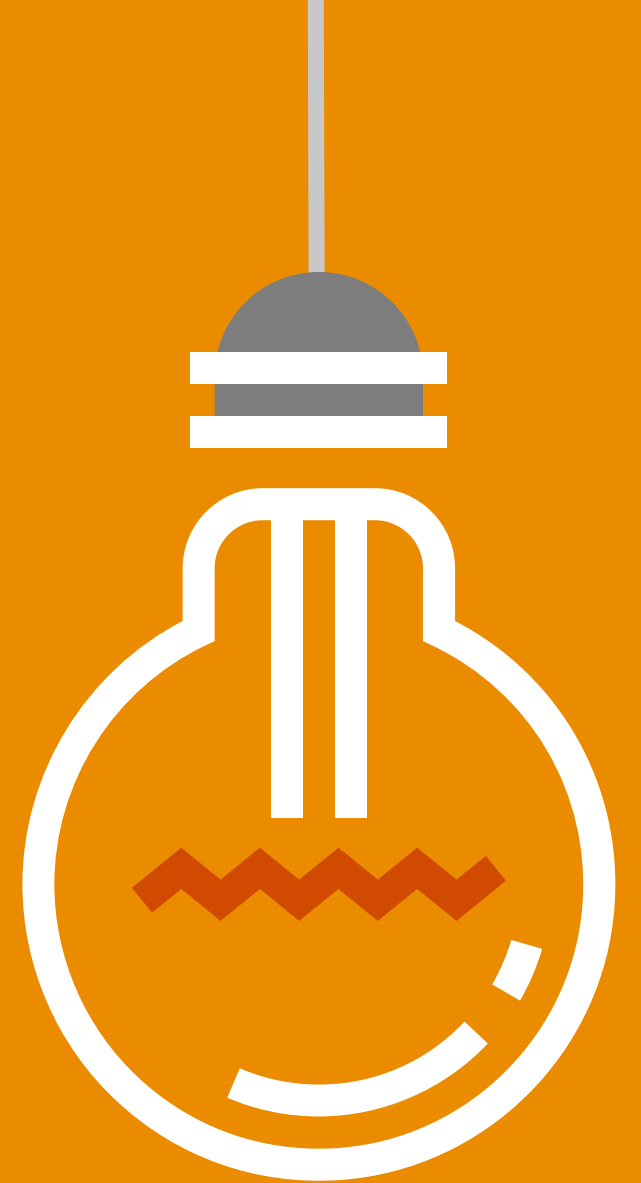
Balancing markets

Mainly national, in part European

European and on local scale (DSOs)

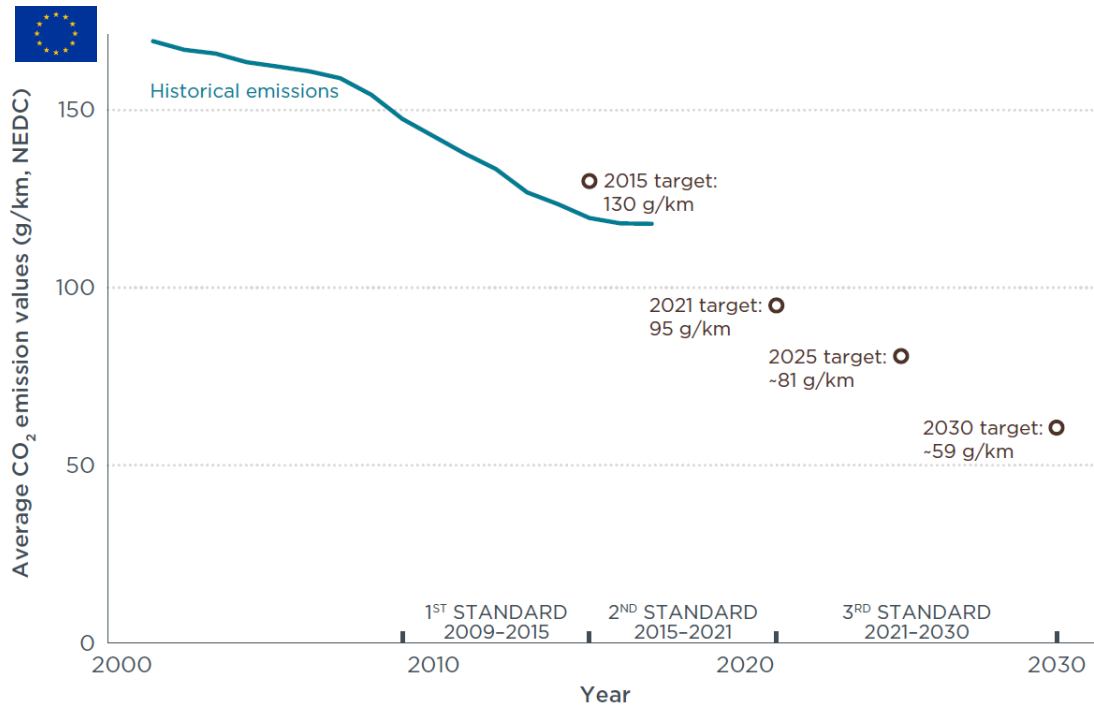
The energy system on both sides – producer and consumer – will change

	Past	Present and future
Power generation landscape	Few centralized power plants	High and further increasing number of decentralized power plants
Consumer behaviour	Passive consumption	Active prosumer
Power flow	Top-down One-directional	Top-down and bottom-up Bi-directional
Network landscape	Few network points	High number of localized network stations
Network system Operation	Predictable, demand based	Volatile (weather dependent)

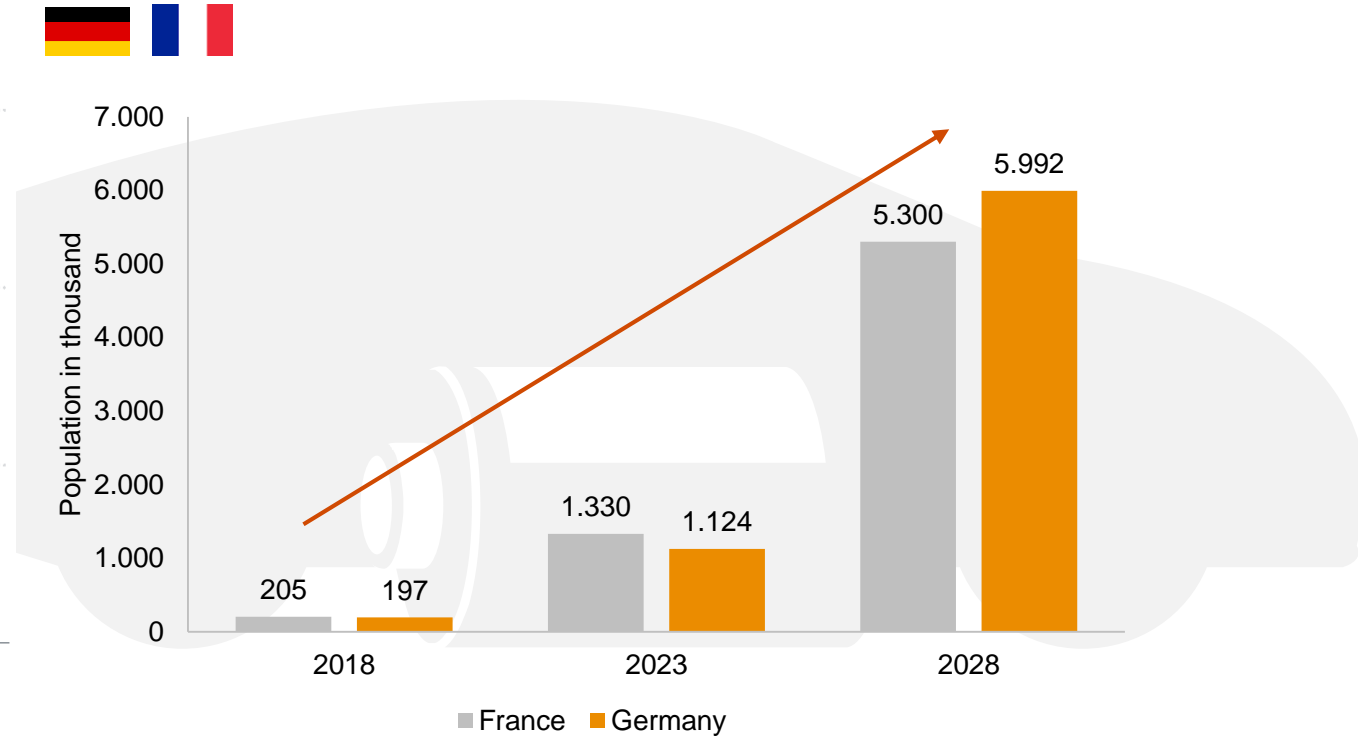


Regulations drive the electrification of drivetrains – globally. Admissions of electric vehicles will ramp up in all sectors in the coming years

Historic CO₂ emissions and future limits* for car admissions in the EU



Population of BEV & PHEV in thsd. per year



BEV – Battery electric vehicle; PHEV – plug-in-hybrid electric vehicle
 Source: ICCT 2019 PwC (Germany), target of the French multiannual energy program (France)
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The growing number of BEVs show a high potential for providing flexibility. First pilot projects have been launched

Current pilot project idea

Who?

- The Mobility House
- ENERVIE
- Amprion
- Nissan

Where?

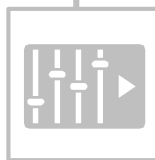
- Hagen, Germany

When?

- Since October 2018

What?

- FCR supply



Assumptions by PwC

CAPEX			OPEX			Revenue FCR		
ICE (Nissan QASHQAI)	Euro	30.170	Maintenance ICE/BEV	Euro/a	500/350	Average price FCR (June 2019)	Euro/MW/week	1.300
BEV (Nissan LEAF)	Euro	36.800	Insurance ICE/BEV	Euro/a	400/350	FCR capacity of BEV	kW	10
Charge point without/with FCR	Euro	1.000/3.000	Distance per year (60km/d, 260 d/a)	km	15.600	FCR remuneration BEV	Euro/a	676
Charge point installation	Euro	450	Consumption ICE	l/100km	5,7	Availability for supplying FCR	%	75
Duration of life	a	6	Consumption BEV	kWh/100km	19,55			
Interest rate	%	6	Gasoil price	€/l	1,46			
			Electricity price	€/kWh	0,28			

Annualised costs (yearly) without consideration of any subsidies

		ICE	BEV without FCR	BEV with FCR
Annual Revenue	Euro	0	0	507
Annual Costs	Euro	8.434	9.333	9.739
Vehicle (incl. Battery for BEV)*	Euro	6.135	7.484	7.484
Charging Point*	Euro	0	203	610
Charging Point Installation*	Euro	0	92	92
Consumption	Euro	1.298	854	854
Maintenance	Euro	500	350	350
Insurance	Euro	400	350	350
Tax	Euro	100	0	0
Annual costs, yearly	Euro	8.434	9.333	9.232
Additional yearly costs in comparison to ICE	Euro		899	799

* Annualised investment costs (interest rate: 6%; duration 6 years)

- Today's high price difference between BEVs and ICEs consume the potential FCR revenues.
- Yet, decreasing purchase costs for BEVs in the future will improve the FCR business case.

Enera demonstrates the change of a static, centralised energy system to a dynamic, decentralised one by combining digitalization and flexibility options on a local scale (1/2)

Current pilot project idea

Who?

- EWE AG
- 32 consortium partners
- > 75 Partners

Where?

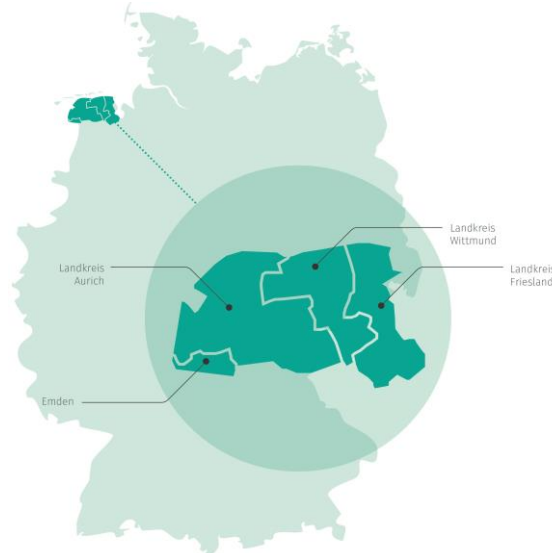
- Lower Saxony: Emden, Aurich, Friesland, Wittmund
- 20 kV, medium-voltage
- 2.655 km²
- Population of ± 390.000
- ± 200.000 households
- 2 GW of RES generation capacity
- 1,5 GW Wind capacity
- Production/consumption coefficient: 230%

When?

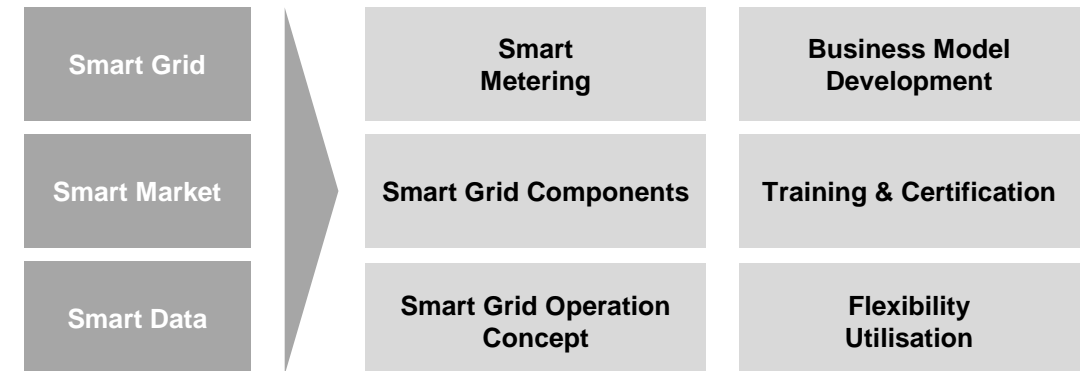
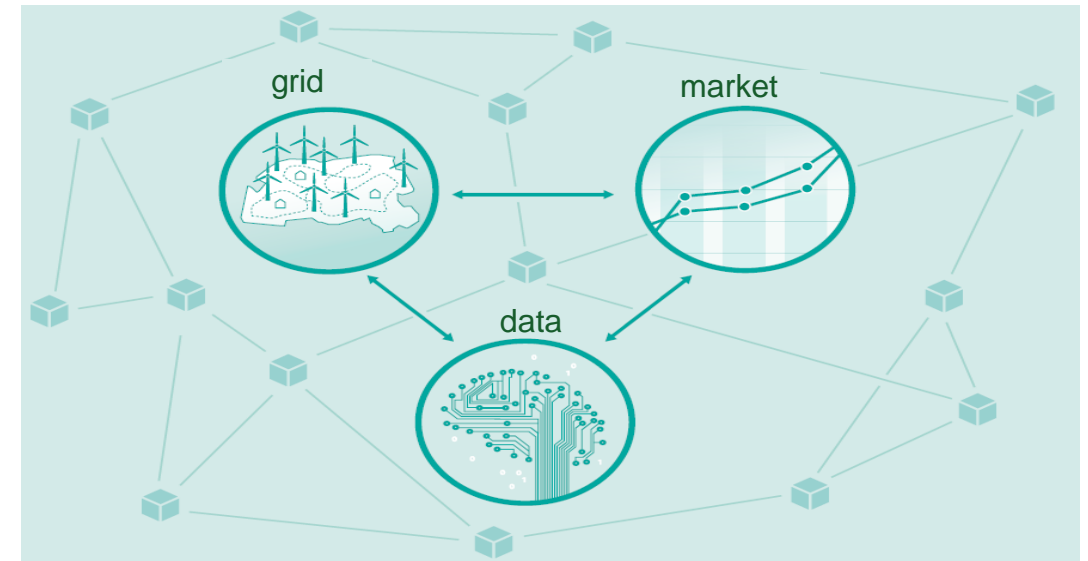
- 01.01.2017 to 31.12.2020

What?

- Local smart energy system
- Project value: 155 mio. €
- SINTEG funding: 51 mio. €



The aim of Enera is to optimize the interaction of grid, market and data

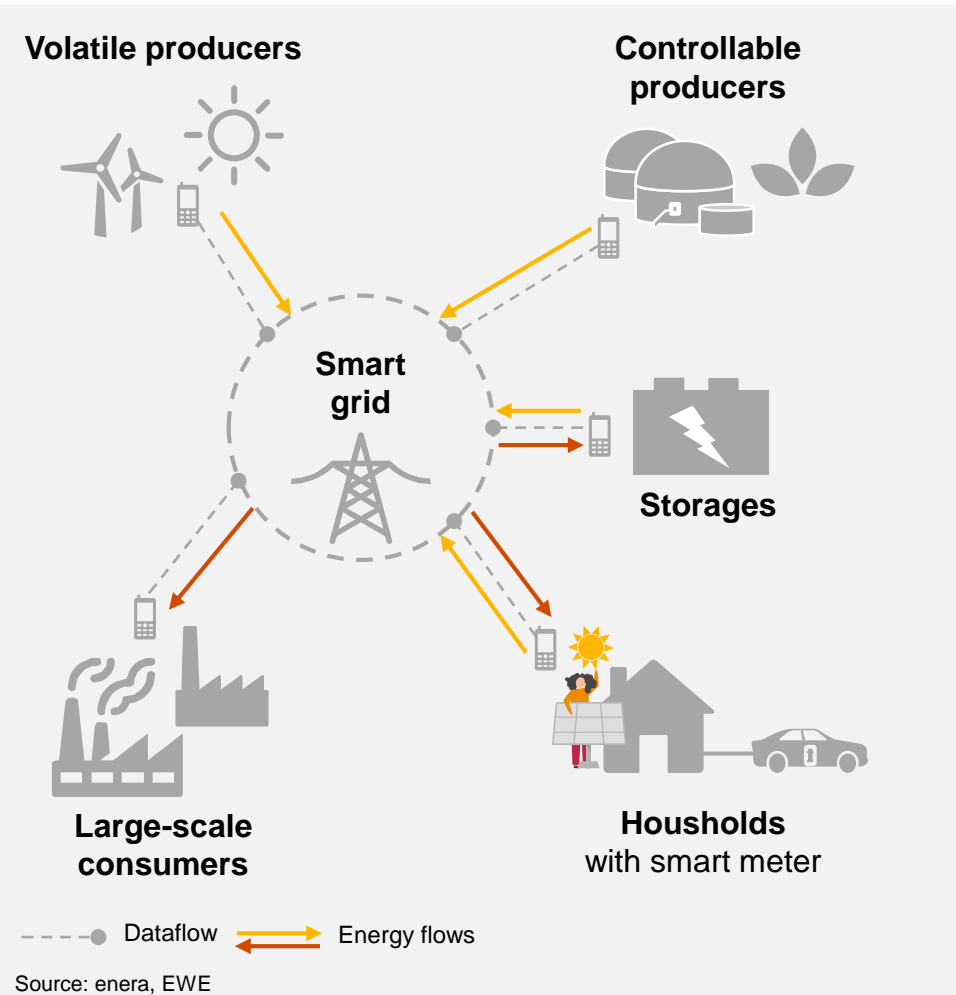


Source: enera

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Enera demonstrates the change of a static, centralised energy system to a dynamic, decentralised one by combining digitalization and flexibility options on a local scale (2/2)



ENERA - An innovative solution of market-based congestion management by striving to enable:

Decentralisation



- Shifting the network focus from transmission to distribution level.

Demand side management / flexibility market



- Creating an ecosystem of active participation of consumers in balancing the network based on "smart grid" infrastructure.

Transparency and data security



- Smart meter and mobile app enable users to monitor and optimized their consumption behaviour through secure data acquisition, processing and visualization.

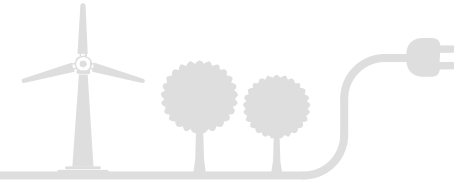


Any
questions?

Thank you
for your
attention.



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