
POWERING
EVERYONE
GE's Distributed Power Customer Event 2016
MADEITAAS

GE Jenbacher gas engines - proven solutions for today’s and future requirements

- Product portfolio & scope options & advantages of GE’s Gas Engines
- Trends & outlook, future developments

Imagination at work

Covering a broad output range
Distributed Power

0.1 – 1.5 MW | **1.5 – 5 MW** | **5 – 10 MW**

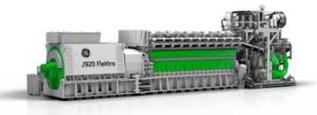
Power Generation

TYPE 2
250 kW – 335 kW

TYPE 3
500 kW – 1 MW

Type 4
800 kW – 1.5 MW

Type 6
1.6 MW – 4.4 MW



Type 9
10.4 MW

VGF*
120 kW – 880 kW

VHP*
270 kW – 1.5 MW

275GL+*
1.9 MW – 3.7 MW

Mechanical / O&G / Mining / Marine

VGF*
120 kW – 800 kW

VHP*
270 kW – 1.5 MW

275GL+*
1.9 MW – 3.7 MW

Mobile/ Emergency Power

J320* generator set
1 MW

moblieFlex* J320/VHP*
Gas Engines 860 kW – 1MW

616 Diesel
Genset 2.6 MW

*** Trademark of General Electric Company**


Manufacturing
facility Jenbach/ Austria

Recip Engines Jenbacher

14,500+ engines delivered • Operating in 100+ countries

Jenbacher Type 2

- Electrical output: 250 - 330 kW (50 Hz), 335 kW (60 Hz)
- In-line, 8 cylinder
- 1,500 rpm (50Hz) 1,800 rpm (60Hz)
- Delivered engines: ~ 1,000
- Since 1976 in the product program

Jenbacher Type 3

- Electrical output: 526 - 1,063 kW (50 Hz), 633 - 1,059 kW (60 Hz)
- V12, V16 and V20 cylinder
- 1,500 rpm (50 Hz) 1,800 rpm (60 Hz)
- Delivered engines: ~ 8,000
- Since 1988 in the product program

Jenbacher Type 4

- Electrical output: 844 - 1,562 kW (50 Hz), 852 - 1,421 kW (60 Hz)
- V12, V16 and V20 cylinder
- 1,500 rpm (50 Hz) 1,800 rpm (60 Hz)
- Delivered engines: ~2,500
- Since 2002 in the product program

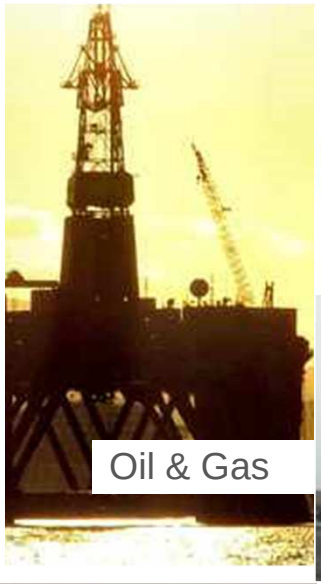
Jenbacher Type 6

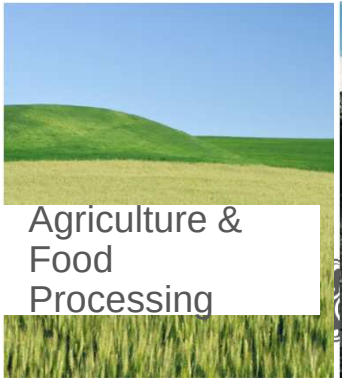
- Electrical output: 1,639 - 4,491 kW (50 Hz) 1,622 - 4,335 kW (60 Hz)
- V12, V16, V20 and V24 cylinder
- 1,500 rpm (50 Hz, 60 Hz with gear-box)
- Delivered engines: ~3,500
- Since 1989 in the product program

Jenbacher Type 9

- Electrical output: 9,500 kW (50 Hz), 8,550 kW (60 Hz)
- V20 cylinder
- Electrical efficiency: 48.7%
- Total efficiency: 90%
- 1,000 rpm (50 Hz), 900 rpm (60 Hz)

GE's Distributed Power provides customers of all types the ability to generate reliable, sustainable power whenever and wherever it is needed.





Jenbacher scope options

Transformer

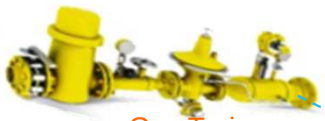
Activated carbon adsorber

Cooling system

Exhaust gas treatment

Exhaust gas heat exchanger

MV panel



Gas Train

LV panel

Dian.ne XT panel

minimum scope

Exhaust gas silencer

CL.AIR*

Master control

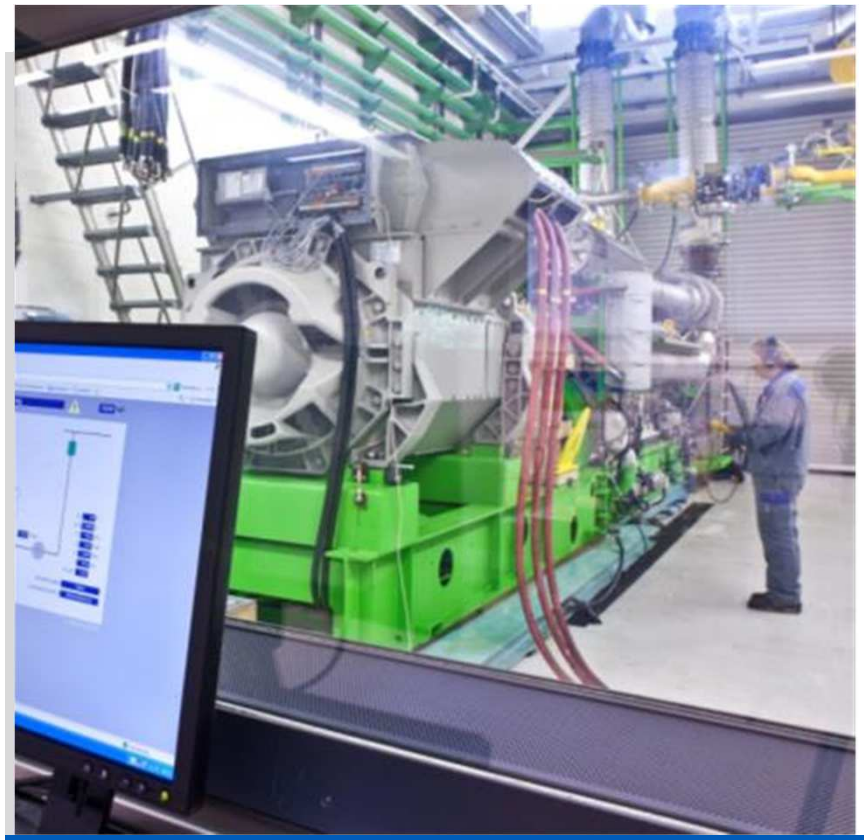
optional scope

* Trademark of General Electric Co.

Factory tested packages for genset & container

Proven genset ... reduced risk at commissioning

Every genset is delivered fully tested



Mechanical run test

Performance run

Full load / full speed

Complete genset test

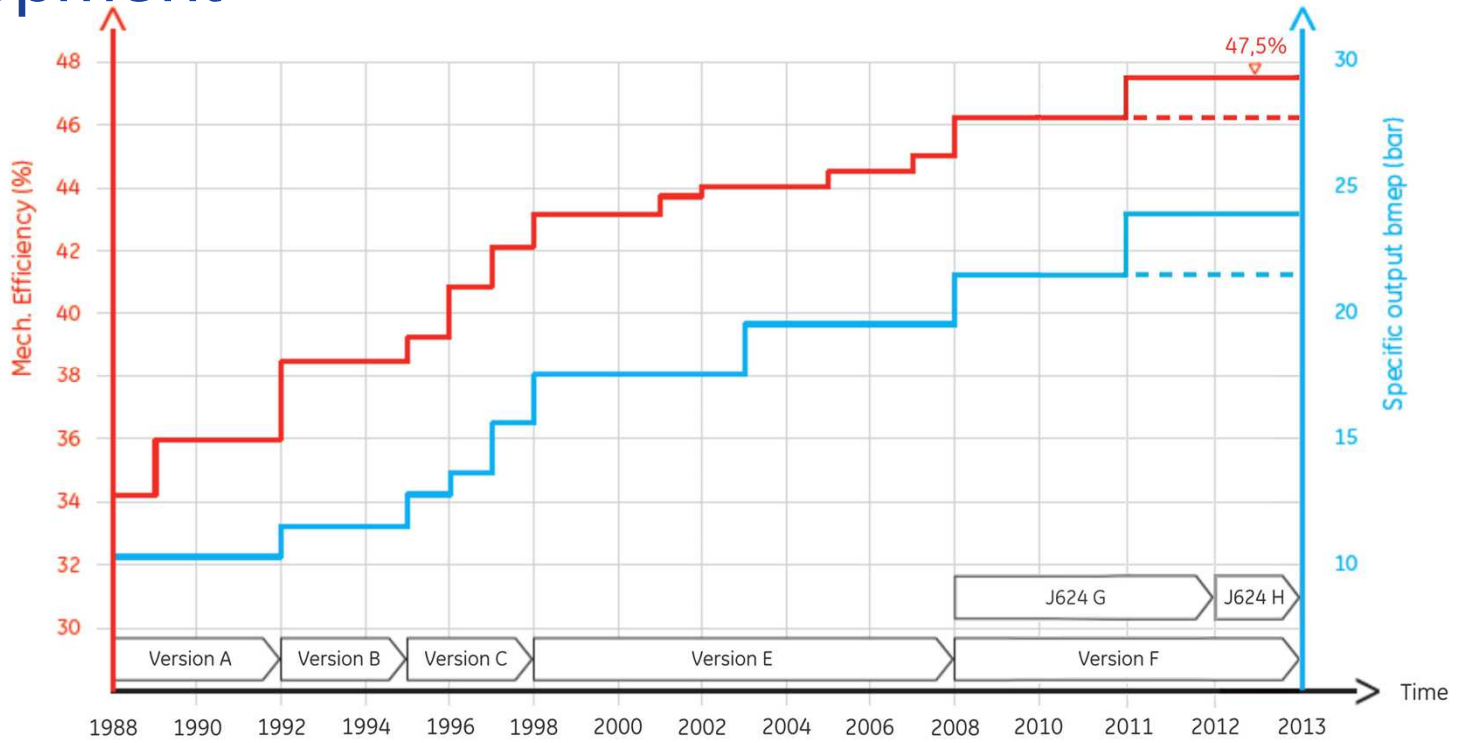
Control panel tested & parameters adjusted

Proven genset ... reduced risk at commissioning

Efficiency development gas engines

- Example Type 6

Example: Type 6 - efficiency & output development



- specific output increase >100% in 20+ years
- efficiency increase ~30%rel in 20+ years

Electricity landscape

- Grid codes
- UK Peaking
- Energy Balancing Germany

Changed electricity landscape

Coal/Fossil Fuels

Nuclear

Hydro power

previous

- **Central**
- **Static load**
- **Schedulable**

today

- **Decentralized**
- **Dynamic load**
- **Limited plannable**

Renewable energy

BIG INERTIA
Constant Frequency

SMALLER INERTIA
Changing Frequency

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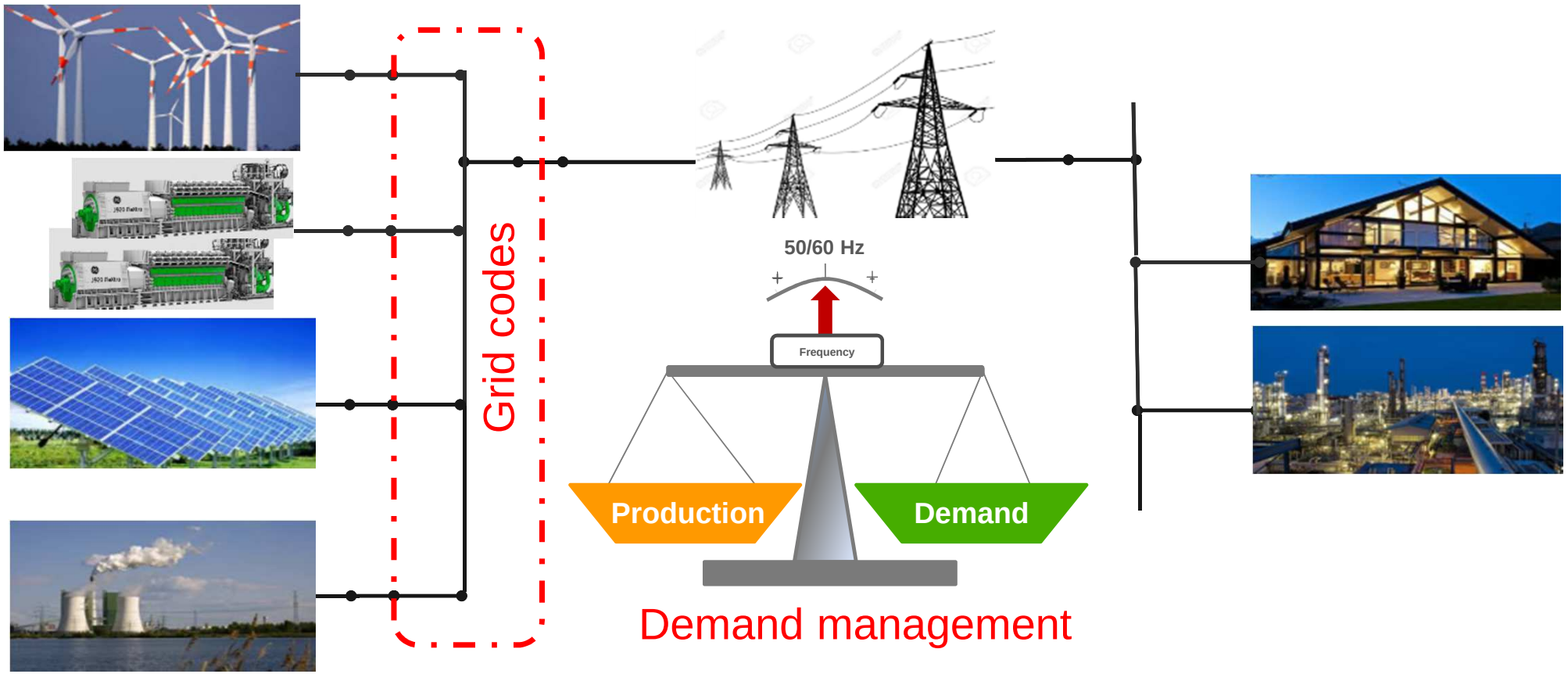
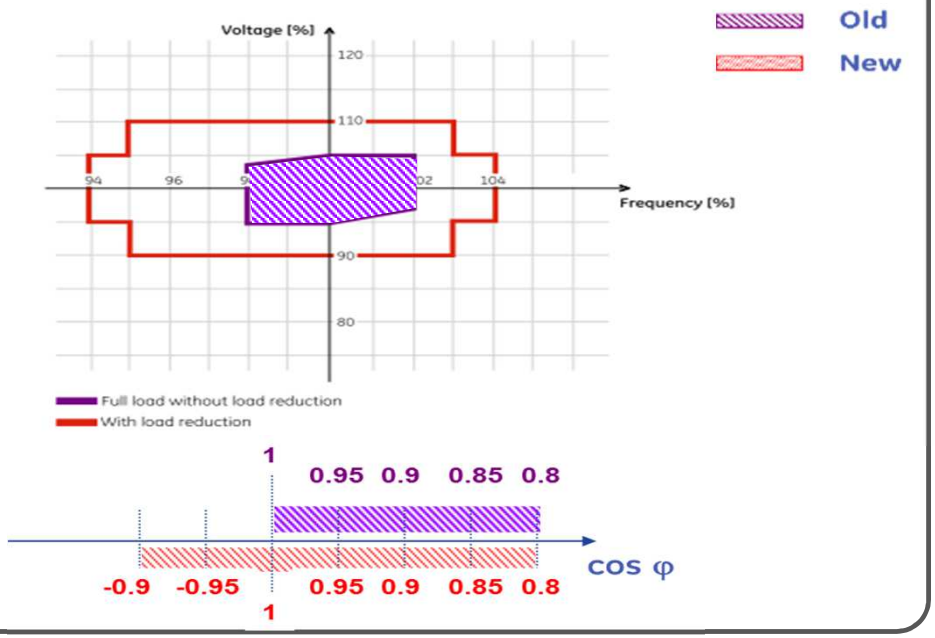
Liberalization of electricity landscape



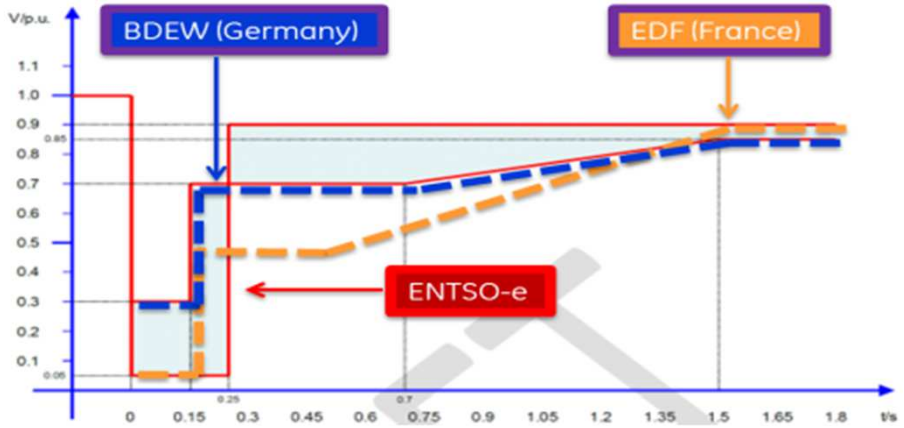
Stricter rules for grid connection & new opportunities for energy balancing

„Grid Codes“

Static Requirements



Dynamic Requirements

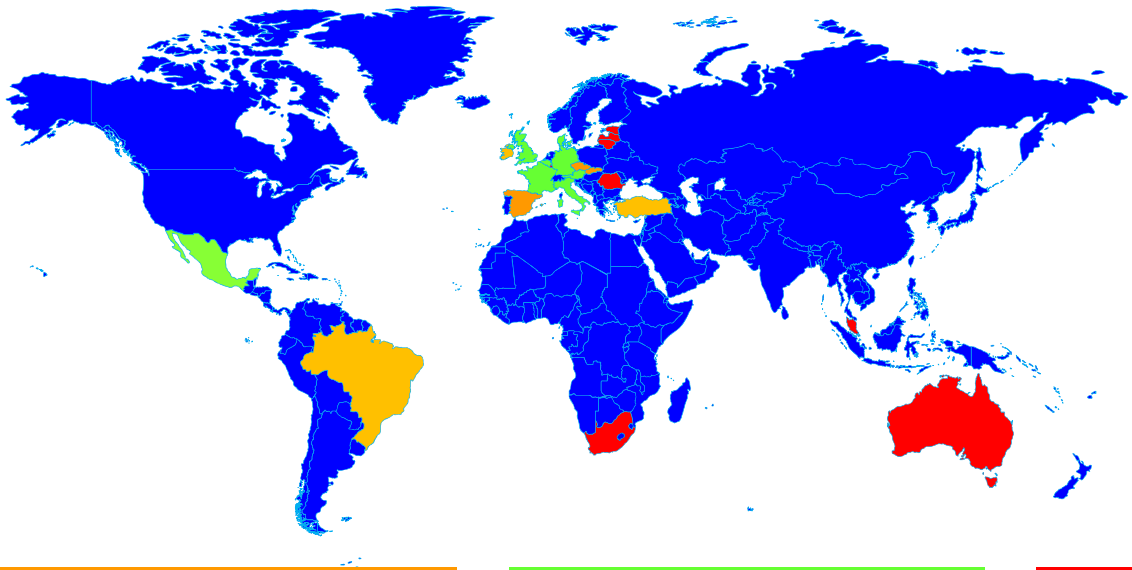


Communication

Interfaces to Transmission System Operators (TSO’s)

➔ IEC 60870-5-101/-103/-104

Grid Code standards



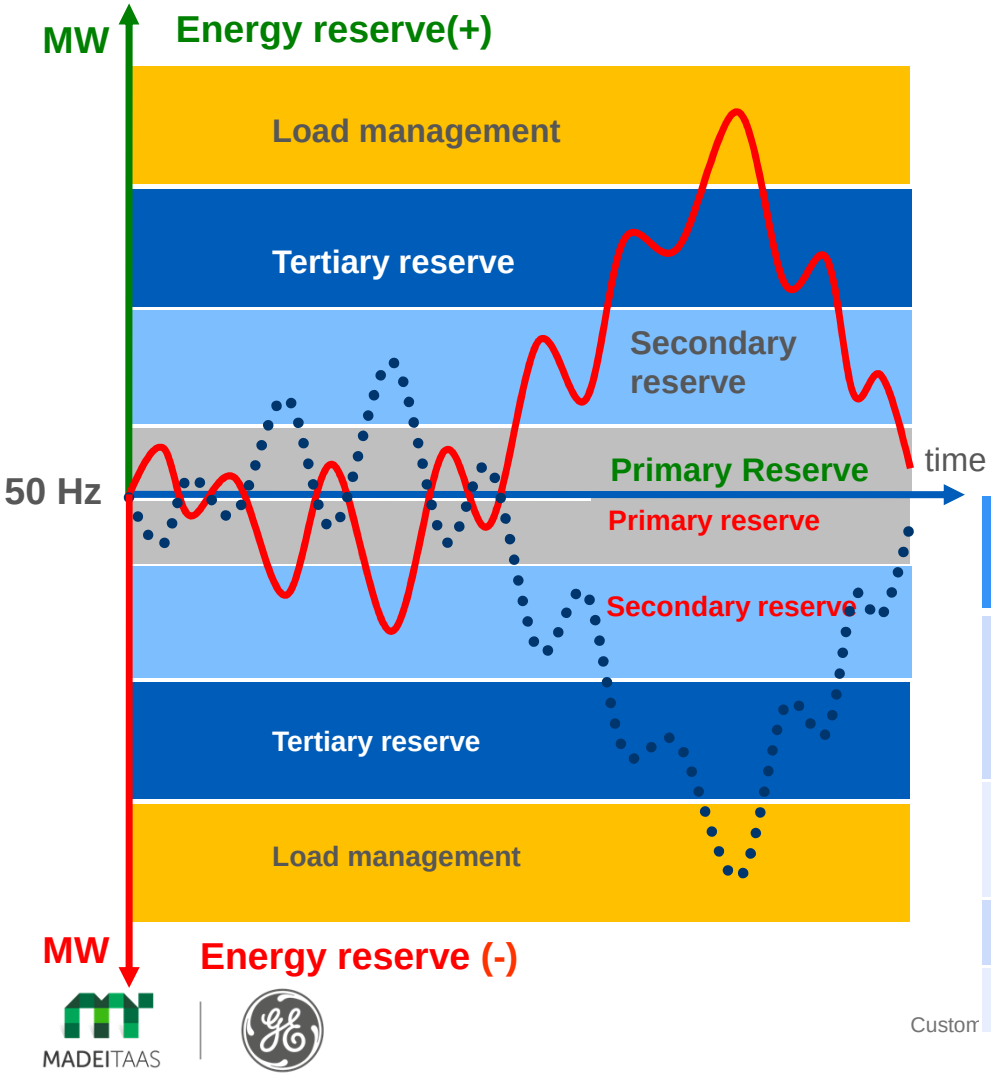
Grid code requirements

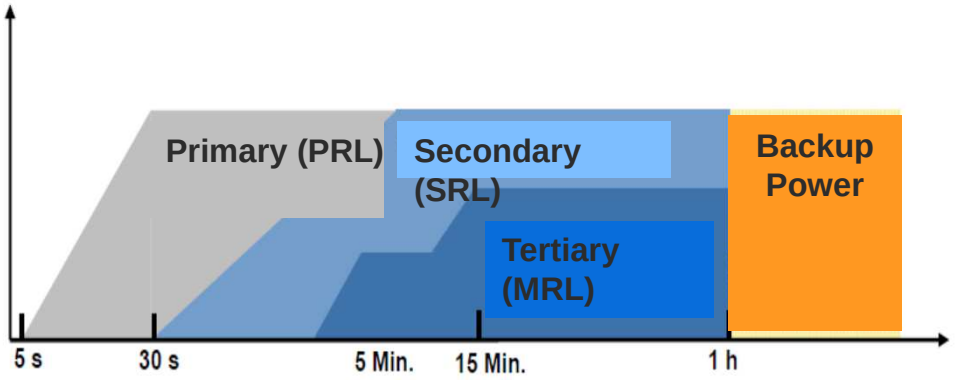
- Static /dynamic grid support
  - Voltage range/ frequency
  - Power factor
  - Reactive power control
- Simulation/models
- Protection and communication
- Certification

Static grid code | Dynamic grid code | Special release | NO special Grid Code requirements requested

Several GEJ standard packages available
Attention to Point of Connection (POC): LV / MV / HV

Energy balancing (Example Germany)





	Target segment: Primary (PRL)	Actual segment: Secondary SRL	Tertiary MRL
response/ min Power	30sec/1MW	5min/5MWe 1st MWe <30sec	15min/ 15MW
activation	automatic (Δf)	Electronic (bus)	phone
Pooling	yes	yes	yes
auction	Weekly	Weekly	Daily

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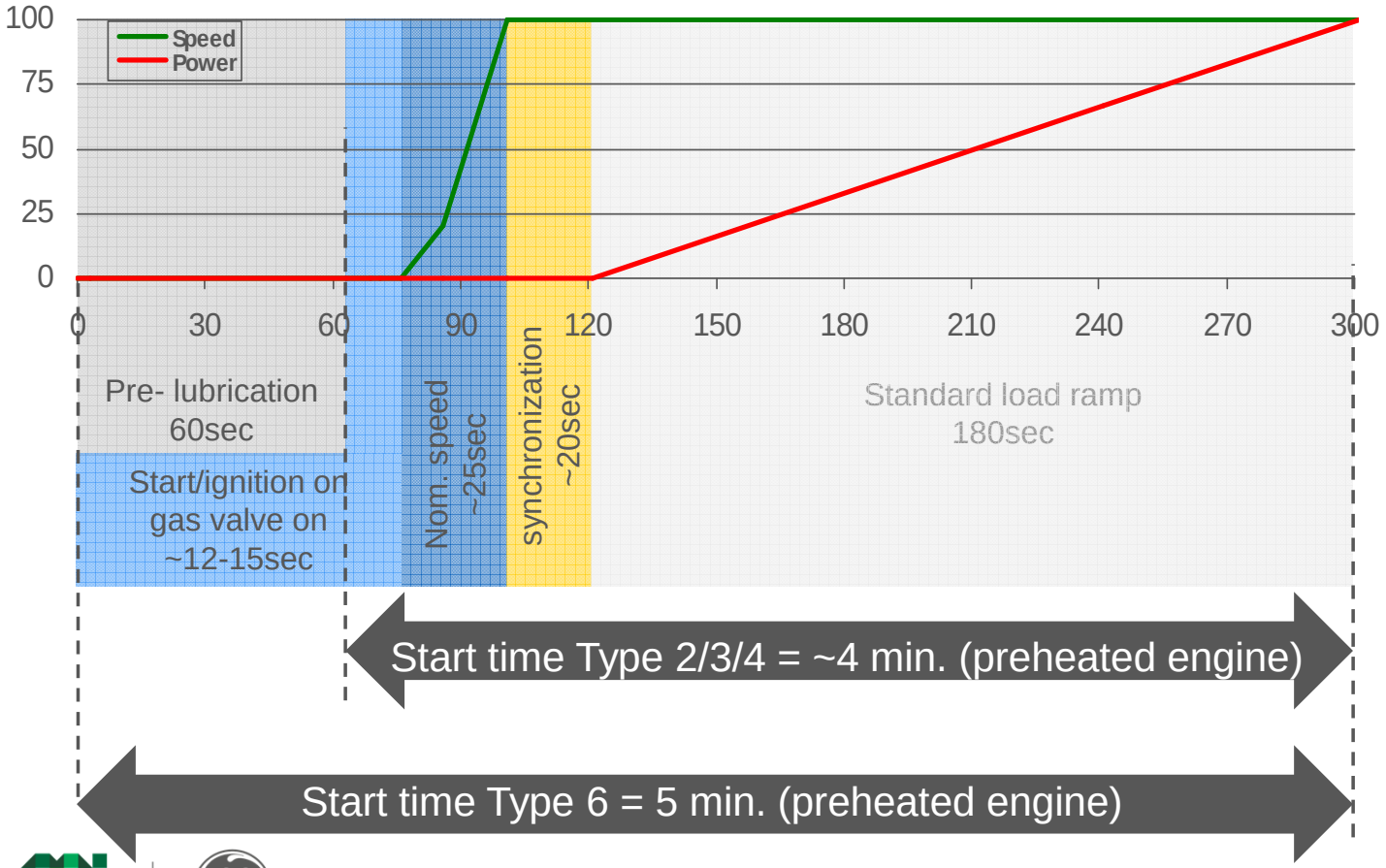
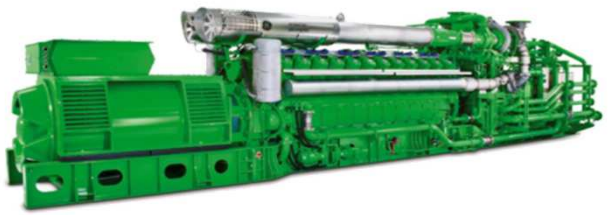
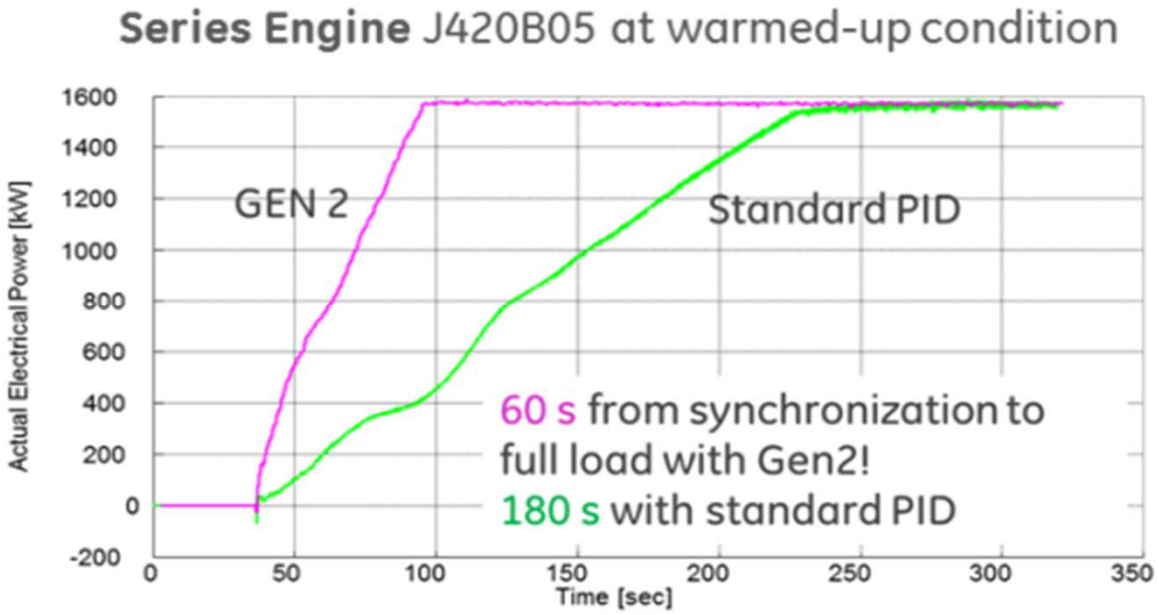
Typical start time for energy balancing





UK Capacity Segment



J420B fast start version for peaking

- < 120 sec from demand to full load (warm engine)
- < 90sec from demand to full load (hot engine)

From demand to full load in <120sec (on demand)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