



Energy AG



station for Africa

German Energy Conference in Lagos on 25. June 2019

**Outstanding 2G Technology for
Hybrid Solutions with 2G Gas Generator Technology**

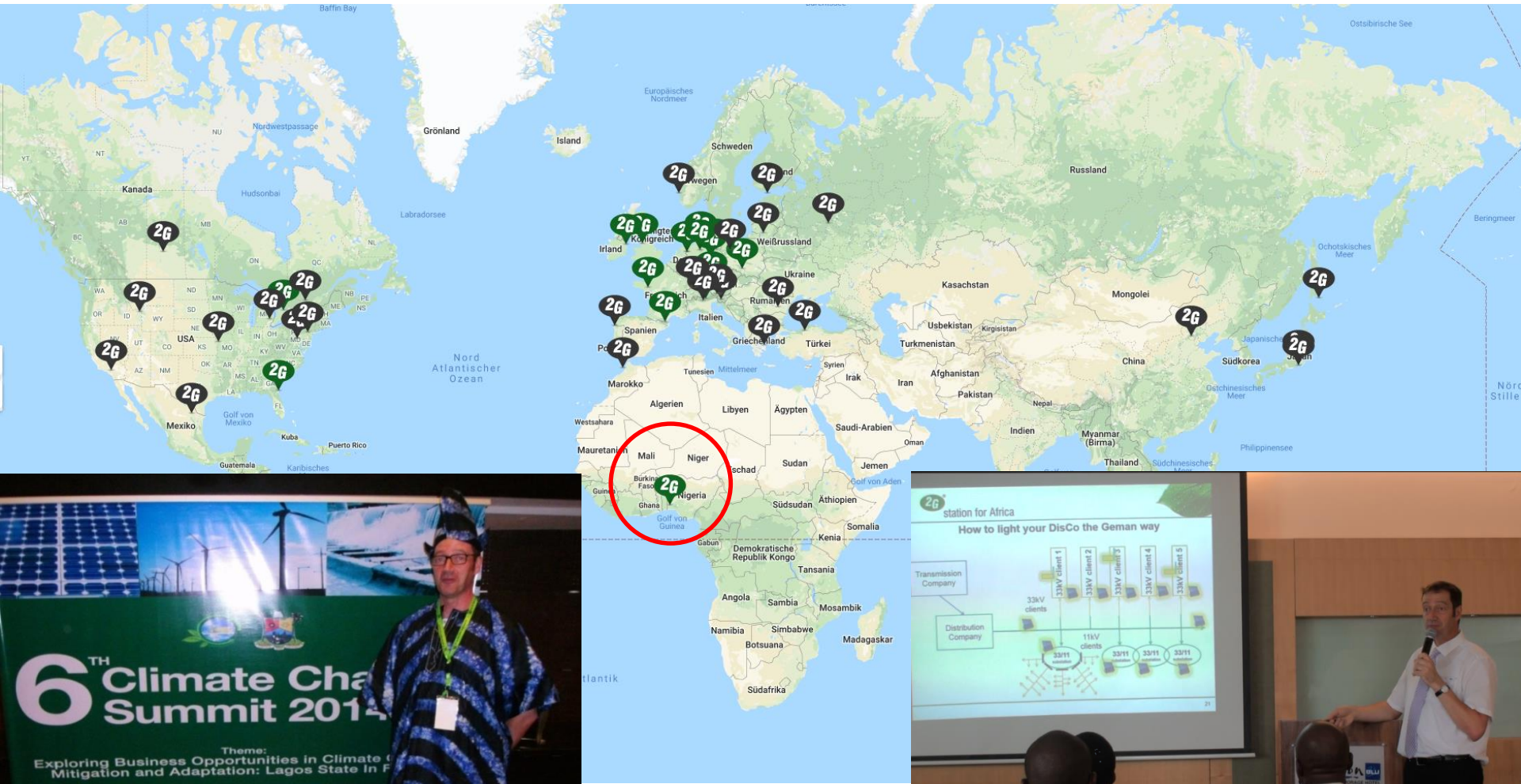


The 2G Group

- Founded 1995 as factory for biogas gensets
- Headquarters in Heek / North West of Germany
- Manufacturing and distribution of gas generators for **biogas, natural gas and landfill gas** applications between 20kW – 4,500 kW electrical capacity each
- Biggest independent gas generator manufacturer in Europe
- Solution provider: development, project engineering, production, service and after sales support
- Since 2007 listed at the German stock market
- **Over 5,500 power plants in more than 45 countries worldwide** (about two per day since 2016)
- **More than 1,000 of them are operated as hybrid with wind or solar already today**



The 2G Group



Sales and Service Network: >5,500 gas generator plants in more than 45 countries



The 2G Group

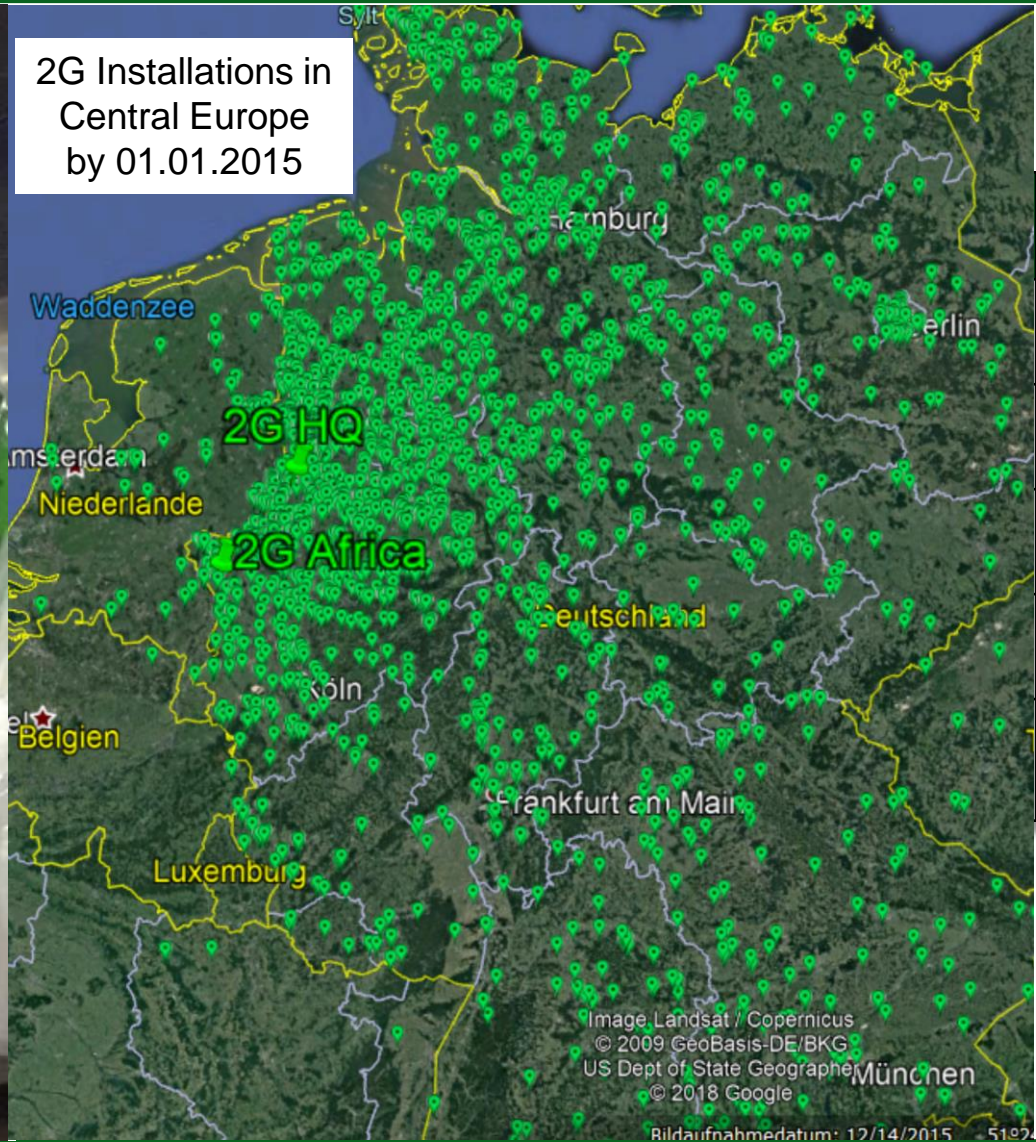
Gas Generator Portfolio

Product Group	Power Range	Type of fuel	Basic Engine
G-Box	20 to 50 kW	Natural Gas	MAN / Toyota
filiUS[®]	50 to 150 kW	Biogas	MAN / 2G
2G-KWK-Series	100 to 400 kW	Natural Gas / Biogas	MAN
agenitor[®]	200 to 450 kW	Natural Gas / Biogas	MAN / 2G
avus[®]	500 to 4,500 kW	Natural Gas / Biogas	Jenbacher / MWM / MTU / 2G





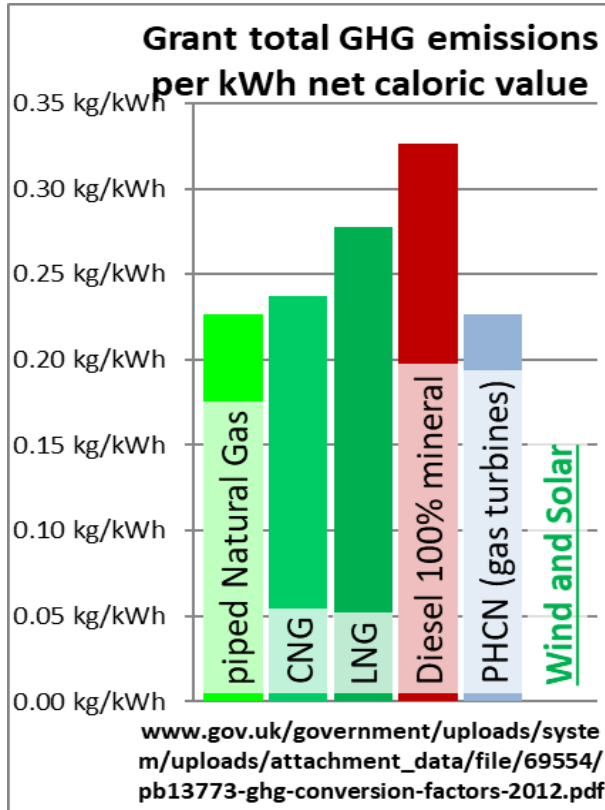
3.3 MW Jenbacher
containerized





Why changing to hybrid solutions

environmentally?



Hybrid solutions enable

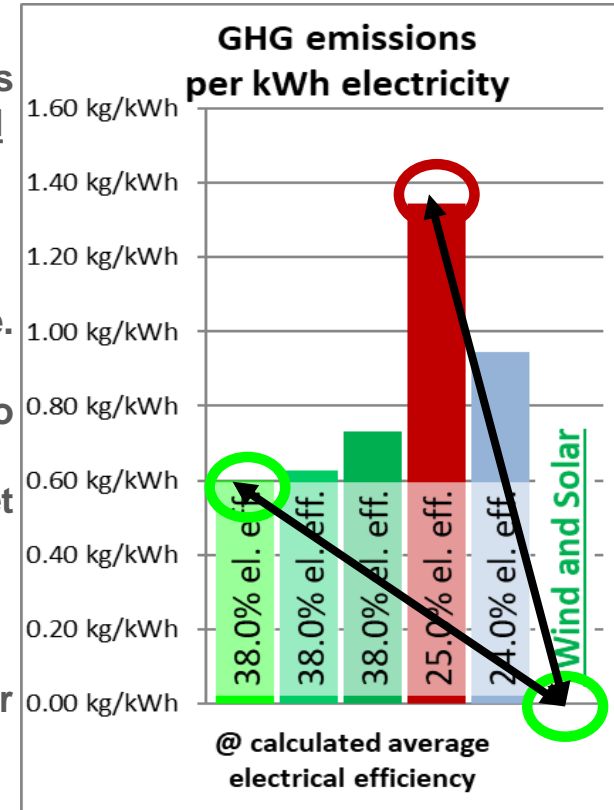
- Benefitting from renewables without battery storage demand
- substituting fossil fuels,
- Reducing fuel dependency

Hybrid solutions demand

- a stable and reliable local, i.e. captive grid
- large load spike capability to cope with cloud covering
- Full Redundancy with genset capacity

Hybrid solutions depend on

- Client load profile
- Available and suitable space for installation



Overall Hybrid solutions provide CO2 savings as combination

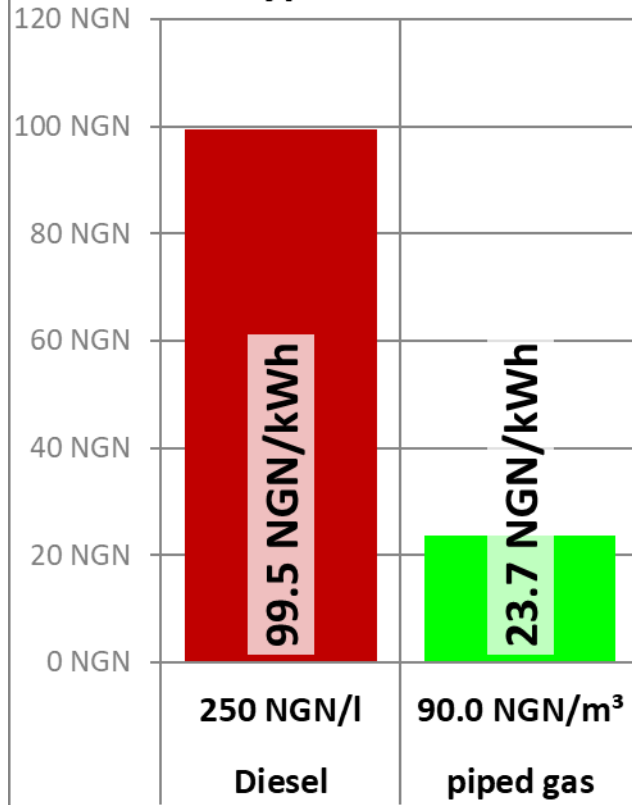
- of the achievable value of CO2 neutral renewables and
- the GHG emissions of underlying power generation technology

Hybrid with 2G Gas Generator technology provide larger CO2 savings.



Why changing to hybrid solutions commercially?

**fuel cost in NGN/kWh
@ typical efficiencies**



In Nigeria, just fuel expenses per kWh with

- commonly used diesel gens are about 100 NGN,
- 2G gas generator technology just below 24 NGN.

Solar hybrid installations

- are CAPEX intensive in relation to generation,
- are offered as IPP @ rates between 75 – 90 NGN,
- cannot substitute generator capacity;
- Most hybrids still run > 75% on fossil fuel.

Solar hybrid with diesel gensets

- generate power today at a very high price mix;
- don't provide any remarkable commercial savings.

Solar hybrid with 2G gas generator technology

- Save about 75% fuel cost (piped gas vs. Diesel)
- Waste heat recovery provides additional savings
- Gas generator CAPEX is recouped after 1 year
- Solar CAPEX can be covered with cash flow gains

Hybrids with 2G technology provide valid business cases.



Core Competences

Engine Periphery

Control and regulation of

- Cooling / combustion air flow at chosen design temperature to
- avoid any deratings

24/7 telemonitoring
from Germany

Fully automatic
operations



The chosen periphery defines the overall technical reliability



Core Competences

High-end engines

Standardized design to optimize / maximize

- Manufacturing
- Reliability
- Longterm quality
- Service and maintenance
- Compatibility
- Spare parts logistic



However, any chain is only as strong as it's weakest part.



Core Competences

Installation:

- Adjusted to space availabilities
- on top of a hospital
- Noise proven down to 45 dB(A) only
- Vibration free
- Assembly and commissioning in less than 10 hours
- Flexible and removable



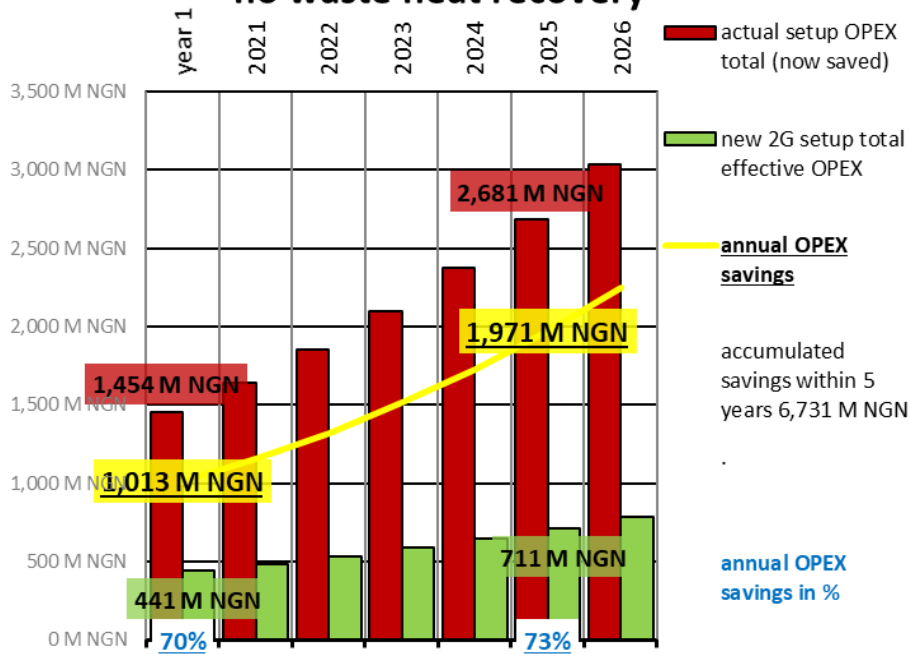
Very often, commercial savings generate space availability.



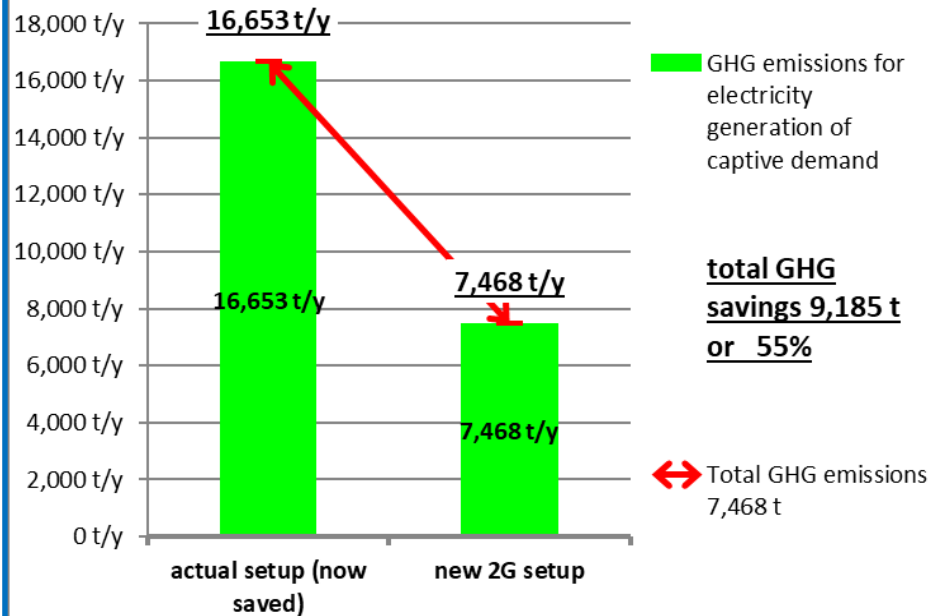
How to change from diesel to gas power generation?

Based on a case study for a 3MW gas generator installation

**diesel to gas power generation only
no waste heat recovery**



**diesel to gas power generation only
no waste heat recovery**



This technology can only be utilized,

- If the gas generator technology is tailormade for your individual local application and
- If you benefit from a proper after sales service including a prolonged equipment warranty;

Investment is „recouped“ after 1 year; annual savings will „last for ever“.



Core Competences

Waste Heat Recovery: „steam for free“ to substitute fuel expenses

Due to the combustion process in all combustion engines like cars, diesel or gas engines etc., plenty of energy dissipates as heat, mainly in form of

- hot exhaust gas (up to about 500°C), normally lost through the chimney and
- hot jacket water (about 90 – 93°C), normally dumped within heat dumpers.

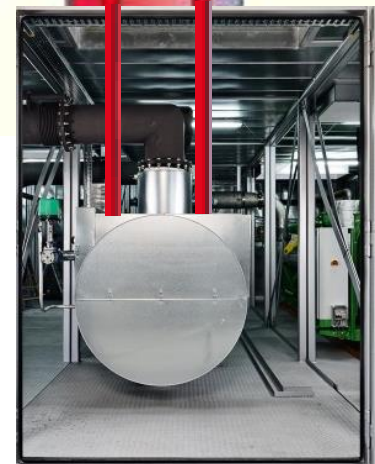
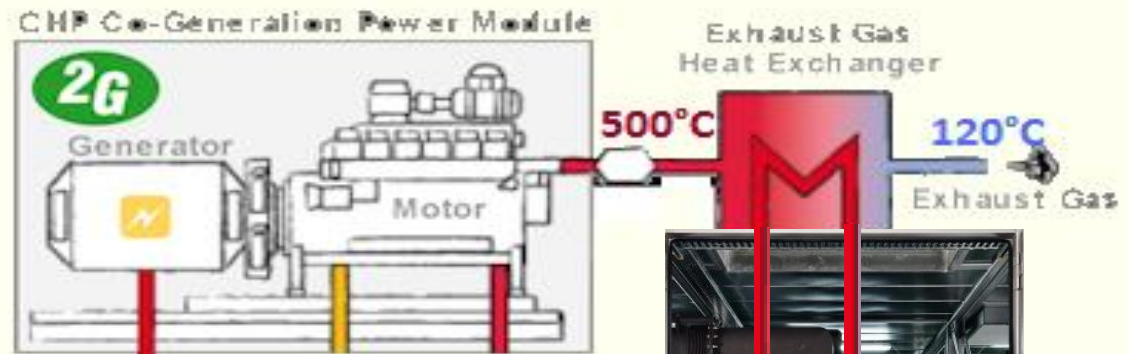
This „co-generated heat“ 2G can utilize to boost the overall efficiency.

The exhaust gas energy, i.e.

- exhaust mass and
- exhaust gas temperature, is utilized to generate steam.

A 2G gas generator of 1 MW can generate

- about 600 kg steam @ 10 bar per hour, thus
- substituting about 1,500 l diesel each day you need today to operate the same steam within your fossil fueled boiler.



This can save (1,500*365 =) 550,000 l/y diesel



Core Competences



3.3 MW gas generator
during commissioning

The steam generator substitutes about 2 mio l diesel p.a.

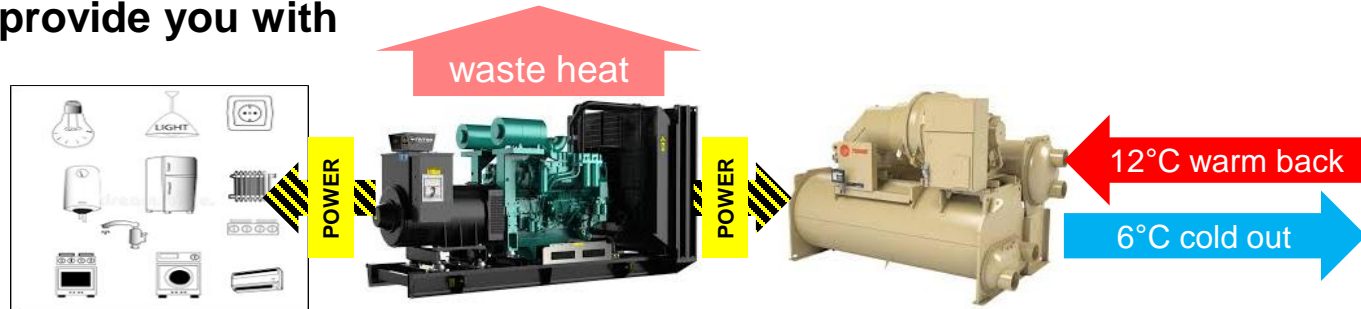


Core Competences

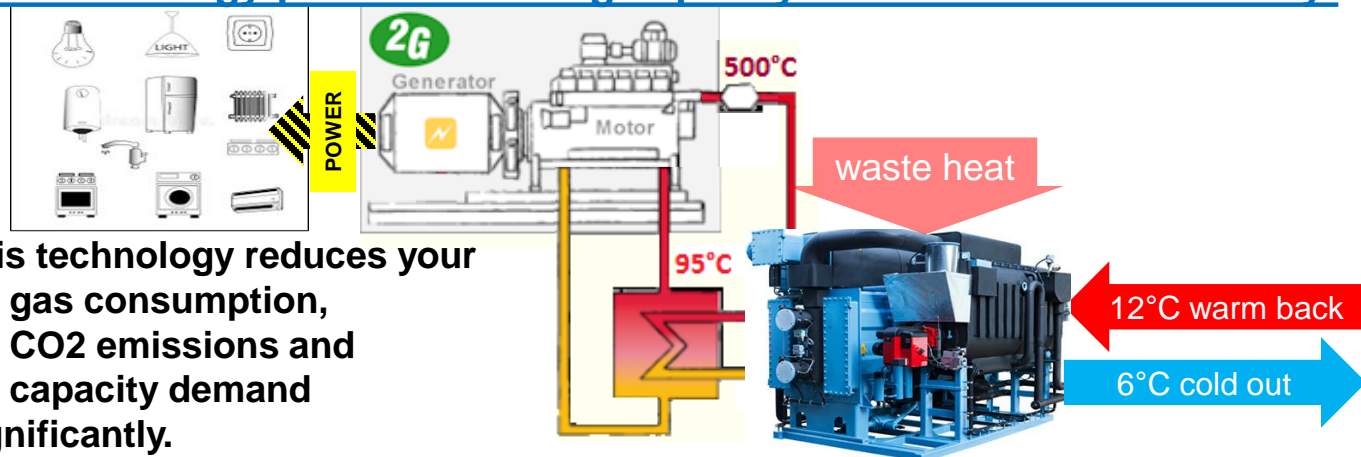
Waste Heat Recovery: Chilling water to substitute electrical chiller demand

Today, your generators provide you with power for

- normal consumers and
- large electrical chillers.



Our technology provides chilling capacity from waste heat recovery:



This technology reduces your

- gas consumption,
- CO2 emissions and
- capacity demand significantly.

Our technology can reduce energy and installation demand by 30%.



Core Competences

Project Engineering – customized installations @ optimized conditions:



Chilled Water



Hot Water



Steam



Power



manufactured and tested



trucked to site



assembly on site

Our „plug & play“ technology can be tested before shipment.



station Nigeria Services



2G Carefree Maintenance

2G station Nigeria Services Ltd. with its operational base in Ikeja structures and conducts our carefree maintenance services in cooperation with

- 2G certified local „2G Partners“ and
- 2G technicians from Germany



CARE BEFORE REPAIR

Instant Trouble Shooting

24/7 telemonitoring

Operational supplies

Preventive Maintenance

Based on daily operation by your operator on-site

Results in prolongation and upgrade of initial warranty and Technical availability of more than 95%

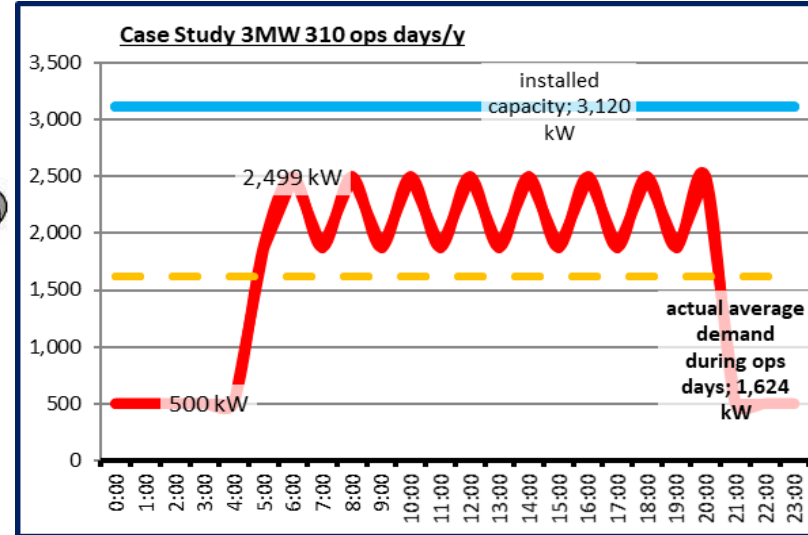
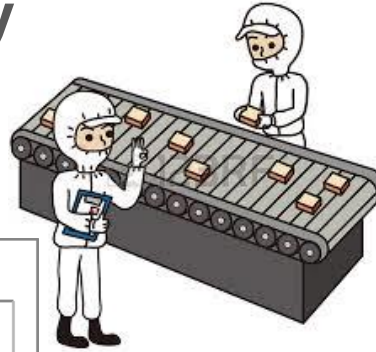


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Load Spike Capability

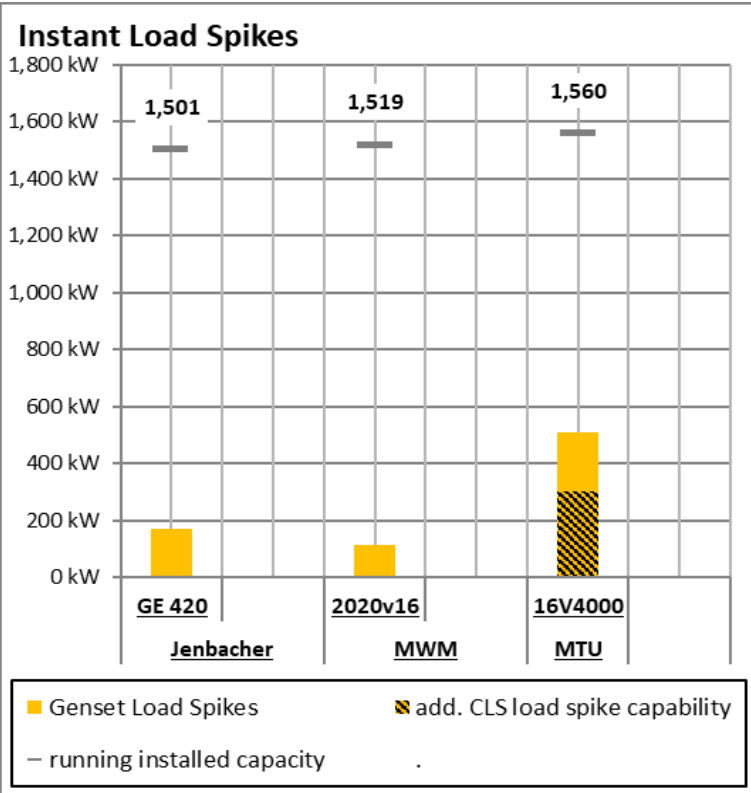
High quality gas engines can cope with load spikes of about 10 – 15% only



Hybrid Capability

- Whenever clouds cover a solar installation,
- the pv power disappears immediately,
 - causing a significant load spike,
 - your generators have to cover instantly

The load spike capability of the grid stabilizing equipment defines the usable hybrid capacity.



Our Central Load Stabilizer can provide much more.

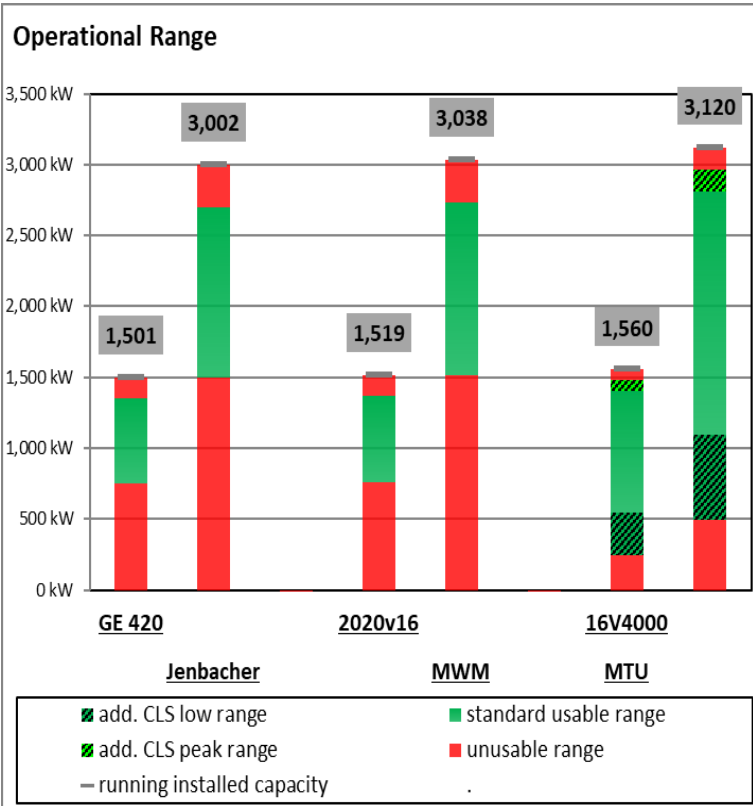
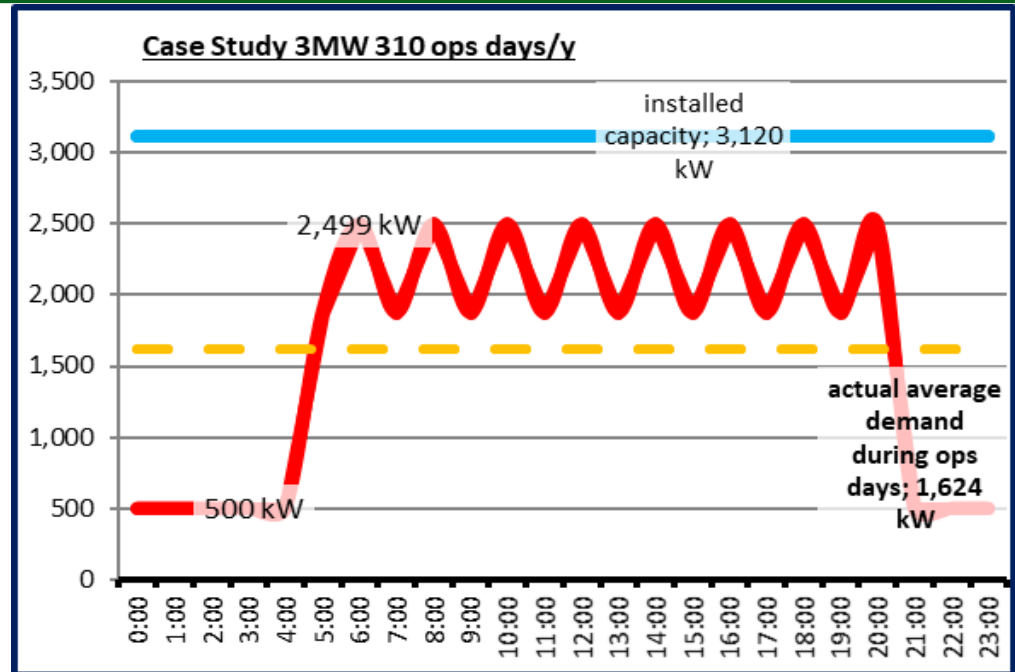


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Operational Range

High quality gas engines cannot be operated continuously below about 40 – 50%.



Expenses to run 15% diesel „just overnight“:

coverage:

15% diesel
85% Gas

Fuel expenses:

@ 100 NGN/kWh = 15 NGN
@ 24 NGN/kWh = 20 NGN
mixed fuel cost of 35 NGN

35 NGN instead of 24 NGN = 145% fuel cost

2G technology boosts the operational range.

A Flexible Operational Range supports Hybrid applications.

Thank you for
your attention!

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