


**Efficient use of biogas with
SCHNELL
dual fuel technology**

47% electrical efficiency below 500 kWe

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Innovative – modern – ground-breaking



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- # **General information about SCHNELL**
- # Principles of dual fuel technology
- # Gas turbine in the exhaust gas system

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SCHNELL, the company

- # Founded in 1992 by Hans Jürgen Schnell
- # Planning and construction of some 60 complete biogas plants by 2000
- # Currently > 400 employees
- # 14,000 m² covered production facilities
- # At present, more than 3,000 machines operating in 20 countries on 4 continents
- # Production capacity of up to 1,000 modules per annum
- # Market leader in the production of dual fuel units

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SCHNELL, the company



**Amtzell:
Management and Production
facilities**

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SCHNELL, the company 

**Amtzell:
Management and
Production facilities**



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SCHNELL, the company 

**Amtzell-Korb:
R&D and Service**



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SCHNELL, the company 

**Company owned biogas plant in Schmitten
to operate 4 test benches with biogas**



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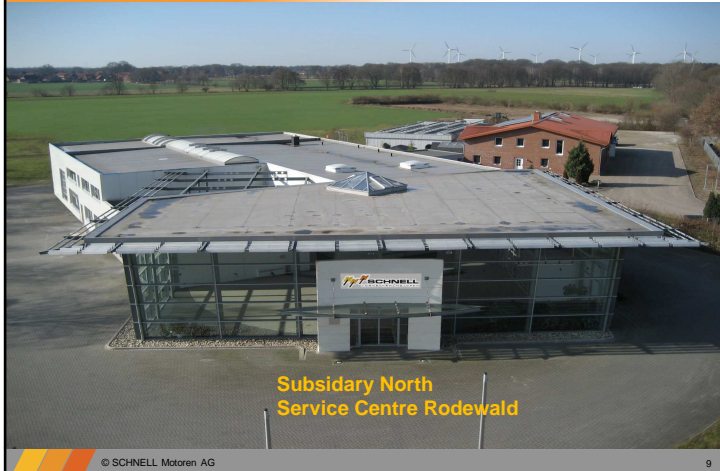
SCHNELL, the company 

**Northern branch office/
Service centre**



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SCHNELL, the company



Subsidiary North
Service Centre Rodewald

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SCHNELL, the company



Branch office
Czech Republic



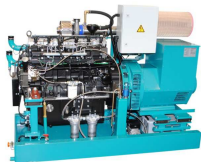
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Dual Fuel Units



SISU 4 + 6 cyl. 40 – 120 kW



SCANIA 6 cyl. 180 – 265 kW



SCANIA V8 290 – 340 kW



Mitsubishi 6 cyl. 460 – 530 kW



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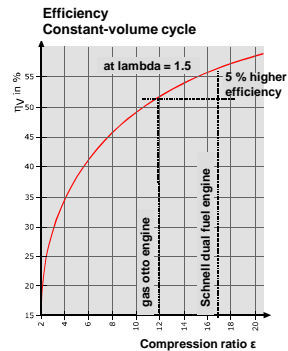
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Principles Biogas and dual fuel technology



Physical principles:
Efficiency benefits from higher compression



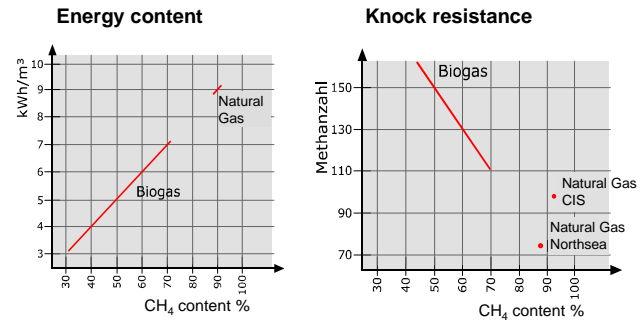
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Principles Biogas and dual fuel technology



Properties of biogas:
Relationship between energy content and knock resistance



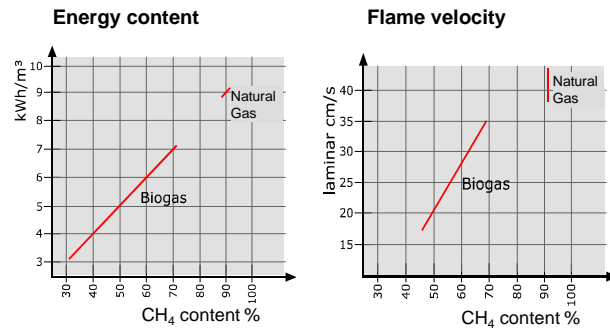
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Principles Biogas and dual fuel technology



Properties of biogas:
Relationship between energy content and flame velocity



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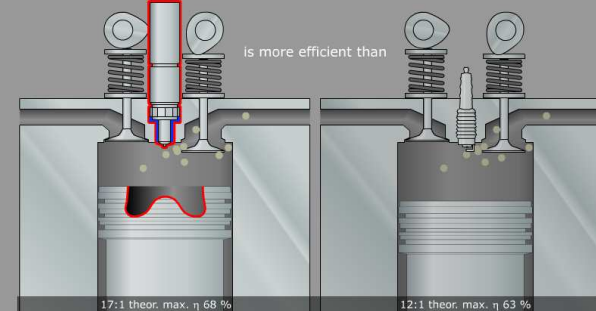
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Principles Biogas and dual fuel technology



Why dual fuel technics?


Dual fuel engine analogous diesel engine Gas Otto engine analogous gasoline engine



Because of its better antiknock properties biogas can be compressed higher than natural gas. That's why **dual fuel technics** can be applied. Higher compression brings out **higher efficiency**.
Weak gas with low methane content e.g. biogas has a small flame propagation. It needs shorter combustion distances as well as a higher ignition energy.

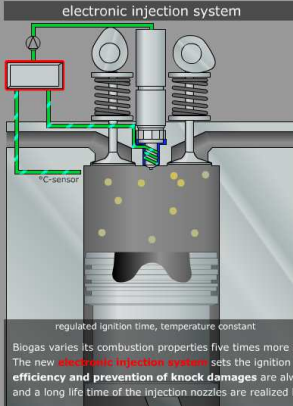
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SCHNELL dual fuel technology 

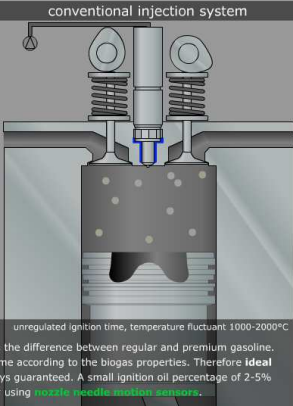
The new electronic injection system by Schnell

electronic injection system



regulated ignition time, temperature constant


conventional injection system






unregulated ignition time, temperature fluctuant 1000-2000°C


Biogas varies its combustion properties five times more as the difference between regular and premium gasoline. The new **adaptive injection system** sets the ignition time according to the biogas properties. Therefore **ideal efficiency and prevention of knock damages** are always guaranteed. A small ignition oil percentage of 2-5% and a long life time of the injection nozzles are realized by using **novate needle injection sensors**.





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Gas turbine in the exhaust gas system 

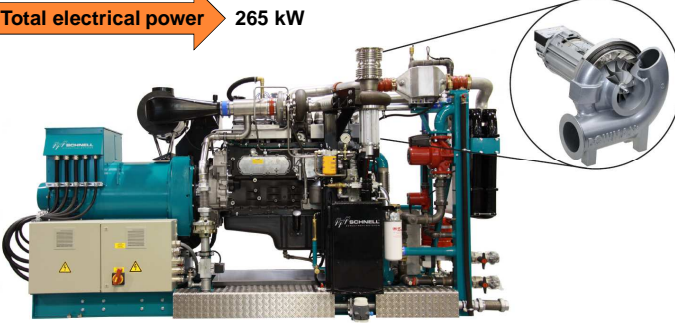
-  Currently in operation: appr. 120 gas turbines
 -  operating hours: ~ 20,000 oh
-  Current orders: 200 gas turbines
-  Engine power class > 460 kW: only with gas turbine technology

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Gas turbine in the exhaust gas system 


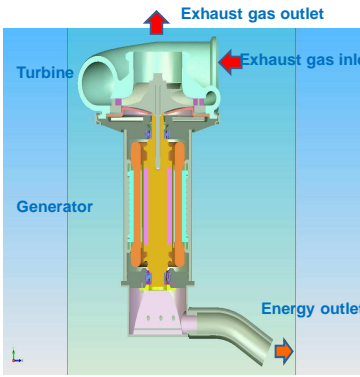
Exhaust gas turbine
 The 6-cylinder unit will be operated with **235 kW**.
 Additional **30 kW** electrical power is provided by the exhaust gas turbine.

Total electrical power  **265 kW**



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Gas turbine in the exhaust gas system

- ⚡ Direct drive (without gear box) using a turbine wheel
- ⚡ High-speed permanent magnet generator
- ⚡ 49.000 U/min, approx. 1.600Hz
- ⚡ Ceramic bearing
- ⚡ Overall result 47 % electrical efficiency (235 kW+30 kW) / approx. 104 m³/h
- ⚡ GT generates 30 KW

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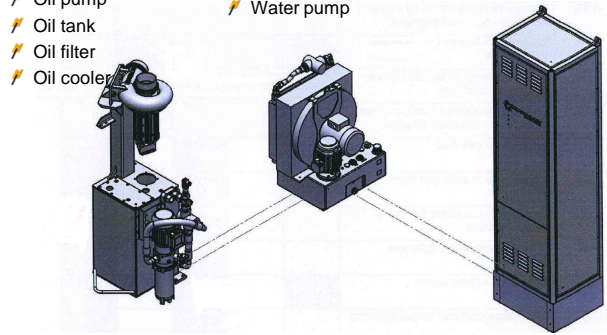
Gas turbine in the exhaust gas system



- ⚡ Installation
- ⚡ Holder
- ⚡ Gas turbine
- ⚡ Oil pump
- ⚡ Oil tank
- ⚡ Oil filter
- ⚡ Oil cooler


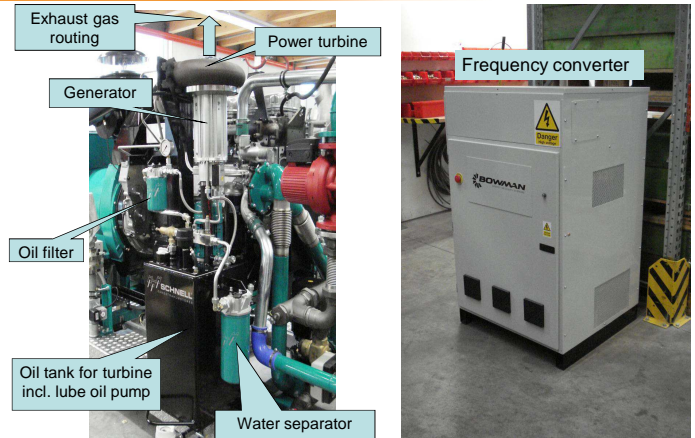
- ⚡ Air/water cooler
- ⚡ Water tank
- ⚡ Ventilator
- ⚡ Water pump

- ⚡ Inverter device
- ⚡ Control electronics




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Gas turbine in the exhaust gas system

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Data sheet 265 GT



Engine type	Scania - SCHNELL
Capacity	12.0 litre
Cylinder arrangement	6, inline
Speed	1.500 rpm
Generator	Stamford, 370 kVA
Total electrical power	265 kW
Electrical efficiency	47%, acc. to DIN 3046
Electrical power engine	235 kW
Electrical power exhaust gas turbine	30 kW
Thermal power	192 kW
Thermal efficiency	34%
Rated thermal input	563 kW

Biogas consumption	
at 60% CH ₄	90 m³/h (Biodiesel) / 87 m³/h (vegetable oil)
at 50% CH ₄	108 m³/h (Biodiesel) / 104 m³/h (vegetable oil)
<small>acc. to standard conditions: 0°C, 1013 mbar</small>	
Ignition oil consumption - Biodiesel*	2.2 kg/h (4% of rated thermal input)
Ignition oil consumption - vegetable oil*	4.0 kg/h (7% of rated thermal input)

* at full load

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Comparison 210 kW vs. 265 kW with GT



Advantage of the duel fuel engine:

The higher electrical efficiency of the chp-unit implies a higher generation of electricity with the same input of biogas.

Comparison:

With the same amount of biogas you can operate a gas otto engine with 210 kW (39% el. efficiency) or a dual fuel engine incl. exhaust gas turbine up to 265 kW

Gas turbine in the exhaust gas system



Additional use of the energy in the exhaust gas

Increase of the electrical efficiency up to 47%
acc. to DIN 3046

CHP coefficient: 1,38

Increase of the economical efficiency of the biogas plant

P.S. He who decides for an inefficient unit will later have to acquire more backing.



Many thanks for your attention.

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