



ProEcoPolyNet

Best practice Sheet

“SenerTec Dachs RS”

RTD Project Identification

Description of technology

The Dachs RS is the first small rapeseed oil-driven CHP which is available from serial production in the German (and later on in the European) market.

It is based on the Dachs HR, a CHP of similar size developed for the use of mineral heating oil 28 years ago. Until now, 6500 of these units have been sold and installed. Both CHPs use a single-cylinder diesel engine, which was specially developed for stationary use by the German Fichtel & Sachs AG.

Besides these two types, there are also the Dachs G and the Dachs F, running on CNG and LPG. 10500 of these units have been sold and installed until now.

The diesel engine is fitted with a closed diesel particulate filter which separates over 99% of the particles.

A maintenance free asynchronous generator is directly linked to the combustion engine. Heat is captured from the engine cooling system and from an additional exhaust gas heat exchanger.

Compared to a normal boiler with 85% efficiency, the standard heating oil powered Dachs HR reduces CO₂-emissions by approx. 3 kg CO₂/operating hour.

Regarding the rapeseed oil fuel itself being CO₂-neutral, the Dachs RS reduces CO₂-emissions even further, it can be considered as a “CO₂-valley”.

Operating principle

The operating principle of the Dachs RS is based on the standard diesel combustion process. Due to the differences in chemical and physical properties between rapeseed oil and mineral heating oil, the CHP's fuel system and injection system was adapted for the use of pure rapeseed oil.

Furthermore, an advanced controller software was developed, including a safety-function to prevent engine-breakdowns due to overload/deposit-formation, a data recording function and automatic reporting via modem.

Technical characteristics of installation

- ▶ *Type: CHP*
- ▶ *Electrical output capacity (kW): 5,0*
- ▶ *Thermal output capacity (kW): 10,3*
- ▶ *Electrical efficiency (%): 29*
- ▶ *Thermal efficiency (%): 60*
- ▶ *Total efficiency (%): 89*
- ▶ *Power to heat ratio: 0,49*
- ▶ *Noise emissions (dB) 54 ... 58 dB(A)*
- ▶ *Weight (kg): 530*

Location and use

- ▶ *Private Buildings: yes*
- ▶ *Residential Buildings: yes*
- ▶ *Commercial Buildings: yes*
- ▶ *Public Buildings: yes*
- ▶ *Others: yes*

Capital investment and maintenance costs

- ▶ *Capital investment*
- Cost of unit (€): 18.260,-
- Specific cost of unit (€/kWe): 3.652,-
- Installation cost (€): ca. 4.000,-
- Total Cost (€): 22.260,-
- ▶ *Total capital investment*
- Total capital investment (€): 22.260,-
- Total capital investment (€/kWe): 4.452,-
- ▶ *Maintenance*
- Specific maintenance costs (€/kWh) 5,1 ... 6,6

State of Development/Market implementation

- ▶ *Serial production*

Operational data

- ▶ *Average hours of operation (h/a): depending on location and use, up to ca. 8.000 operational hours/year*

CO2 and primary energy savings

See "Description of technology"

Benefits and obstacles

Despite numerous investigations in operating combustion engines with plant oils, major problems using this kind of fuel are still related to "the quality" of the fuel.

As far as rapeseed oil is concerned, a pre-norm exists in Germany today (V DIN 51605), which gives at least a rough indication, which oil quality/properties can be expected in "real life". However, the final specification of this norm is still under discussion, mainly due to the following two reasons:

- lack of sufficient knowledge of "true limits" for a number of fuel properties
- different interests of oil millers and engine manufacturers

On the other hand, this lack of a defined standard is also a chance to influence the ongoing work with the norm to make sure that a "sensible" specification is created.

For this reason, parallel to the development of the "Dachs RS" a scientific research programme was started together with the Technische Universität München, TFZ Straubing and University of Applied Sciences Konstanz. The major aim of this project was to investigate single effects of specific fuel-properties on the operating performance of the Dachs-CHP. Based on previous research done in this area, the investigations were focussed on different contents of Phosphorous, Calcium and Magnesium in the fuel.

Besides this fuel-focussing-aim, the second aim was to investigate the effects of different operating profiles and variations in design.

Results from the laboratory test were set on a wider basis by carrying out a field test with 35 CHP units of the same type, which operated under close observation:

The CHPs were equipped with remote monitoring software and visited regularly to carry out extensive measurements.

The major challenge when operating the CHPs with rapeseed oil was to reduce the amount of deposits on injection nozzle, piston and exhaust valve.

This was achieved by altering the design of the injection system and running a sufficient fuel quality (low on Phosphorous, Calcium and Magnesium), which enables an economical operation of the Dachs RS (sensible service intervals).

As the units are fitted with a diesel particulate filter, a fuel which is low on ash-forming components is also vital for the reliability of the filter system.

Besides these product-specific results, the generally valid results as far as the effect of fuel qualities is concerned are now part of the ongoing work of the DIN UA 632.2 to enhance the V DIN 51605.

Based on the results, SenerTec has now temporarily established an own specification rapeseed oil as fuel for the Dachs RS and carried out a survey amongst ca. 250 dealers and producers of rapeseed oil in Germany to secure the supply of the units with certified fuel.



Contact and further information

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