

# Rapeseed oil in a Capstone C30

Dipl.-Ing. (FH) Yvonne Schmellekamp

Prof. Dr. Klaus-Peter Dielmann

Belgium, Brussels  
September 2004

1

# Contents

- Background and reasons
  - Why a microturbine?
  - Why rapeseed oil?
- Technical problems
- Possible solutions
- Testing rig
- First results

# Why a microturbine?

- Replacement of conventional systems
  - Lower exhaust gas emissions
  - Lower acoustic emissions
  - Longer operating hours through longer maintenance intervals
  - Easier integration of heating systems
    - one temperature level of the heat
- Power generation in water protection areas
  - Microturbine of Capstone uses foil bearings
    - No oil cooling
    - No lubricants



# Why rapeseed oil?

- Renewable resource
- Easy production  
→ no chemical processing necessary
- Water pollution class 0



- Easy transport and storage  
→ high flame point
- New income source for the agriculture

# Future prospect for rapeseed oil in Germany

- 1.000 to 2.000 Liter rapeseed oil and 10.000 m<sup>3</sup> oxygen per hectare
- Cultivation on areas not required for food production  
→ presently 335.000 hectares
- Considering the crop rotation and the location, the cultivation could be enlarged to 1-2 mil. hectares.  
→ **1-2 mil. liters rapeseed oil**  
→ **4-7% of the present demand of diesel**

# Technical problems

- Limits given by the rapeseed oil

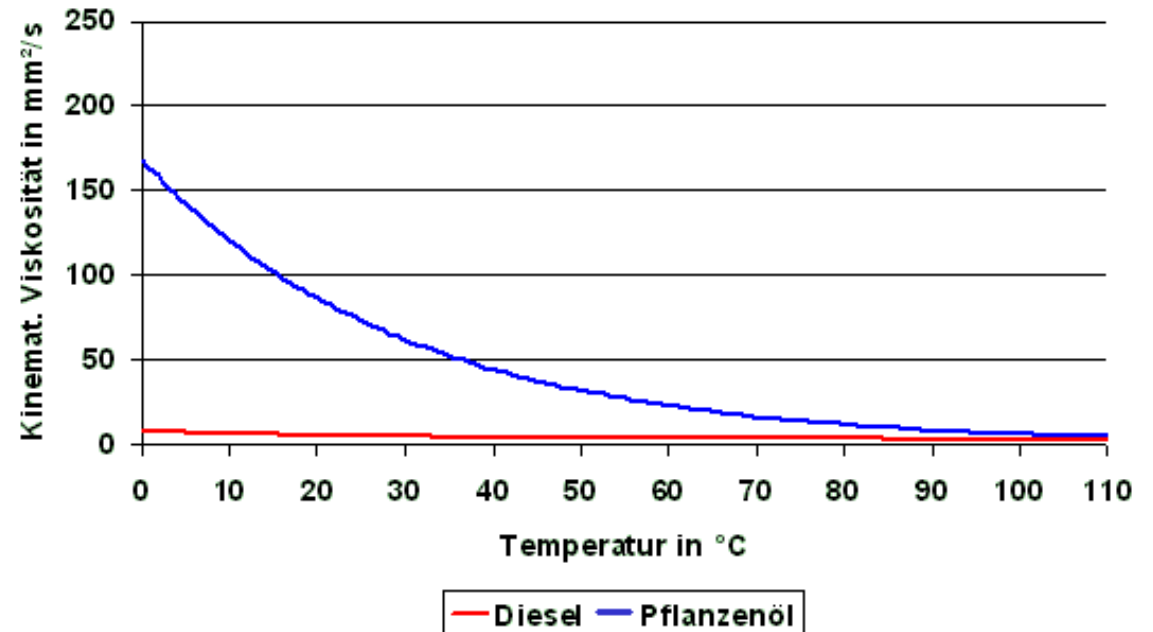
	Operating range of the turbine	Diesel	Biodiesel	Rapeseed oil
Viscosity [mm <sup>2</sup> /s]	1-5	3-4	6	80
Flame point [°C]	38-66	60	135	239

- Limits given by the microturbine
  - Inlet temperature of the fuel: 0-50 °C
  - Power of the fuel pump

# Possible solutions

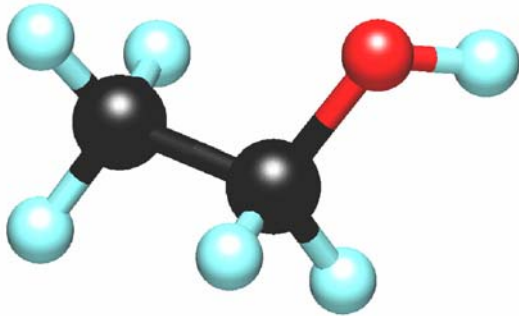
Preheating the fuel to decrease the viscosity

- Outside the Turbine
  - Heated tank
  - Flow heater
- Inside the Turbine
  - Heated pipes



# Possible solutions

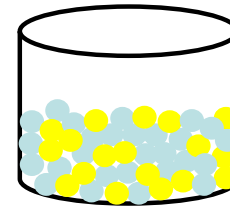
Adding ethanol to decrease  
the flame point and the viscosity



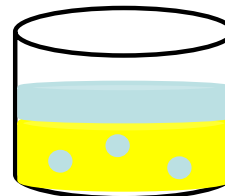
Ethanol:

- 85% alcohol
- Viscosity: 1,5 mm<sup>2</sup>/s
- Flame point: 12 °C

→ Inhomogeneous mixture  
Emulsion

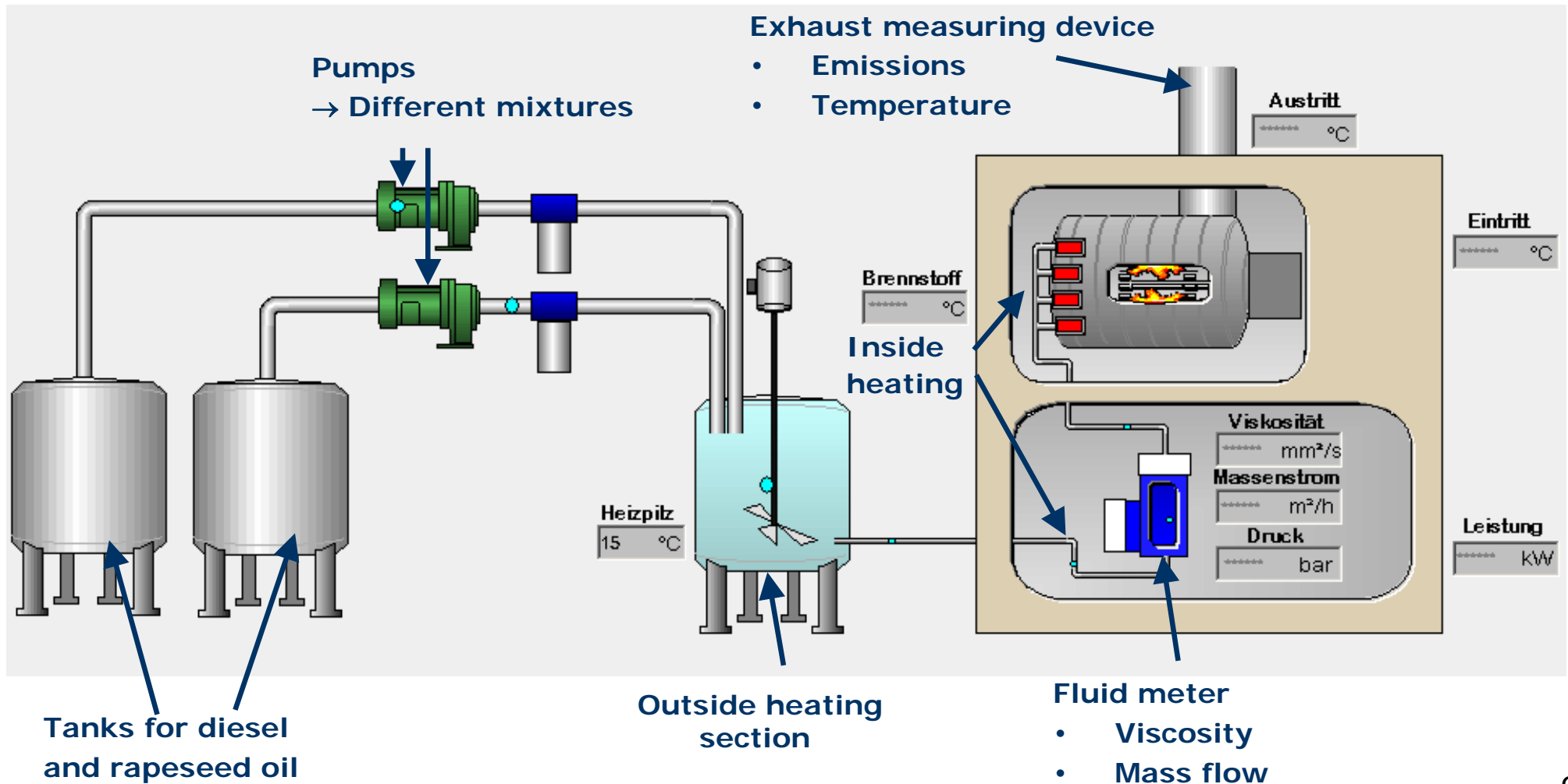


→ Separation



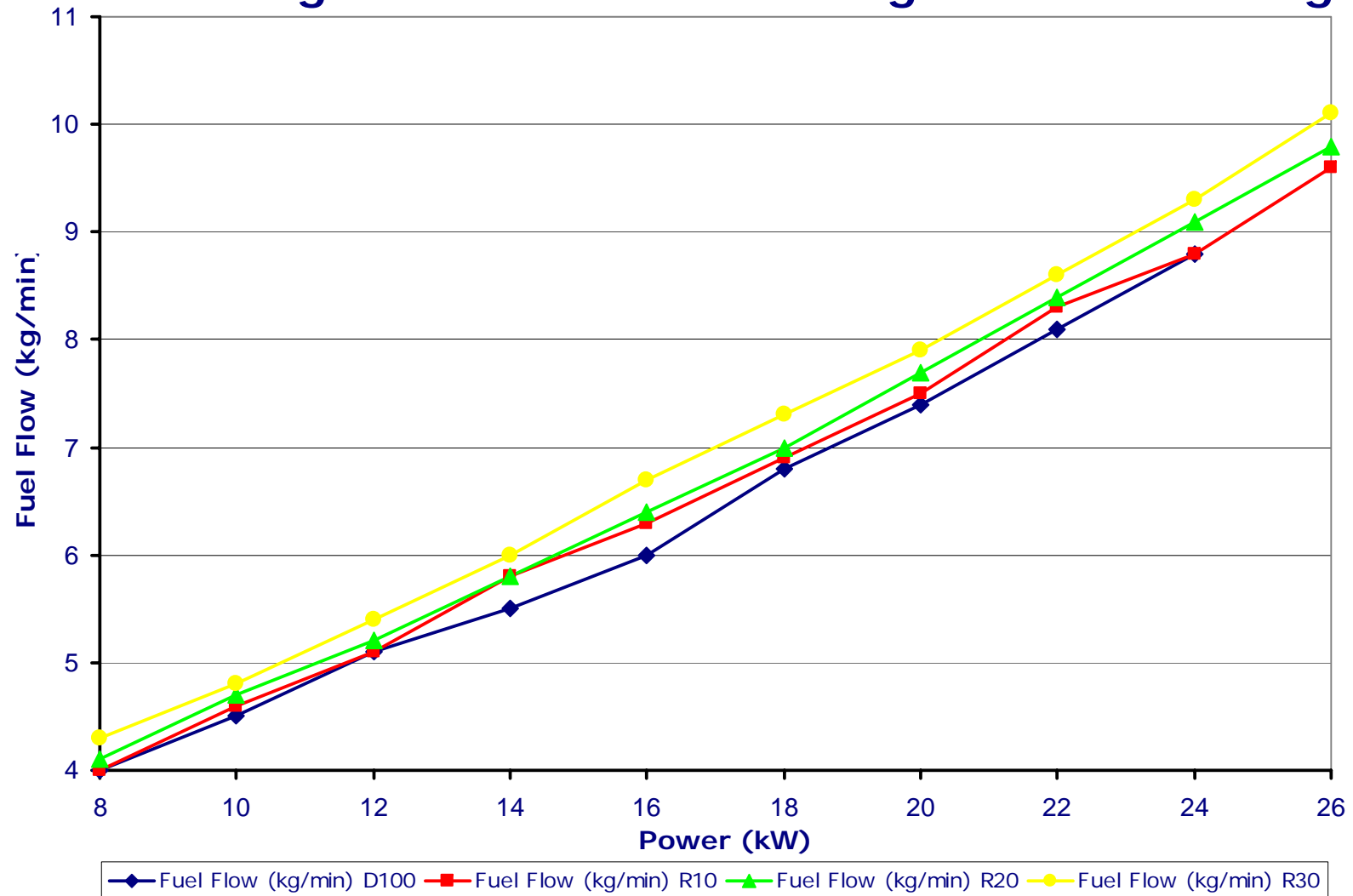


# Testing rig



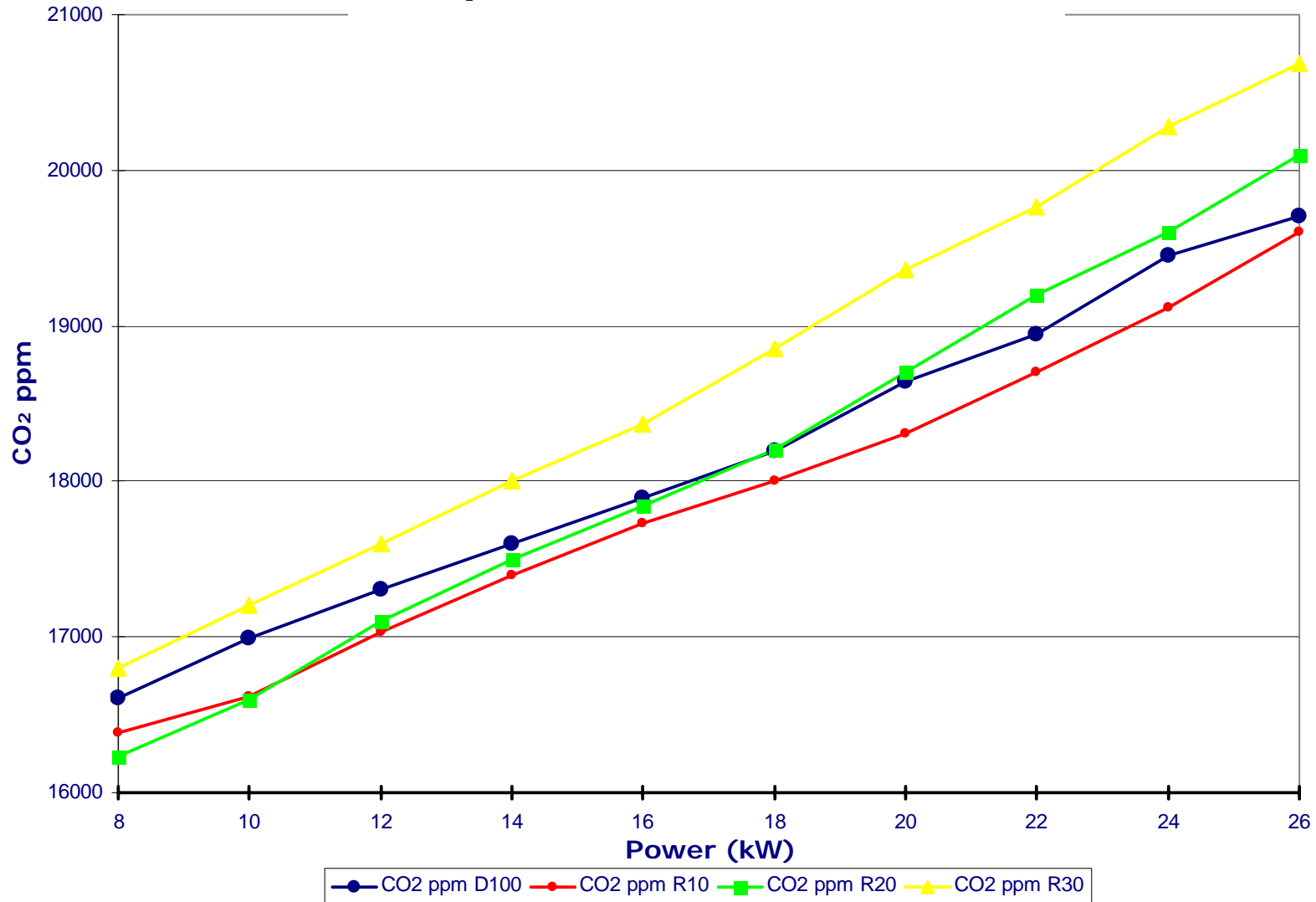
# First results

## Fuel Usage of Microturbine throughout Power Range



# First results

## Comparison of CO<sub>2</sub> Emissions



**Thank you for your attention**

NOWUM-Energy  
Ginsterweg 1  
52428 Jülich

Tel.: +49-2461-993020  
Fax.: +49-2461-993288  
Web.: [www.nowum-energy.com](http://www.nowum-energy.com)

