



OPET AUSTRIA

# MICRO GAS TURBINES STATE-OF-THE-ART AND MARKET POTENTIAL

**Günter R. Simader**

**Petra Hasslacher**





# Contents of Study



## **„Analysis of the market potential for micro-gas turbines in Austria“**

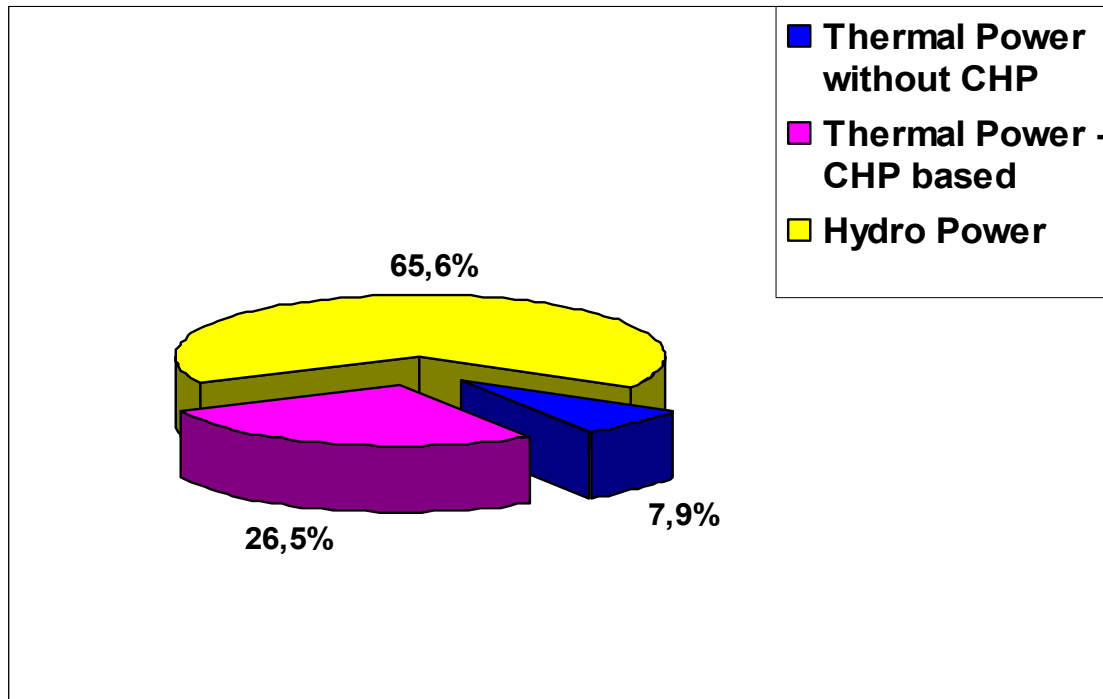
- legal and environmental requirements**
- market price situation of electricity and gas**
- economics of micro-gas turbines**
- potential for mass market**
- potential for niche market application**



# General CHP Situation



OPET AUSTRIA



**Annual production of electricity in 1997 was 56.851 GWh.**

**Share of thermal produced electricity by CHP:**

utilities: 64 %  
IPP: 97 %  
Total: 77 %

**27 % of Austria's electricity production is based on CHP power plants. If only thermal production is taken into account, 77 % come from CHP plants.**



# Small Scale CHP in Austria



OPET AUSTRIA

- **micro-, mini- and small engine based CHP plants are well known in Austria**
- **about 550 SSCHP have been installed since 1990**
- **mainly installed CHP- technologies in Austria:**
  - Senertec 5,5 kW<sub>el</sub>, 12,5 kW<sub>th</sub>**
  - Jenbacher plants**
- **electricity Act: CHP = plant which supplies public heat - net**
- **therefore, most SSCHP – plants are not considered as CHP**
  - no minimum feed-in tariffs, no purchase obligation**



# MGT: Technology Providers



OPET AUSTRIA

<b>Company</b>	<b>Power Output [kWel]</b>	<b>State-of the-Art (February 2001)</b>	<b>European Packager</b>
<b>Honeywell / EDF (formerly Allied Signal)</b>	75	Pre-commercial units	?? (EDF, ATEL) Not clear at this stage
<b>Gasturbo / Bowman</b>	35 (New), 45, 60, 80	First commercial units (5 delivered units)	Yes (Bowman, Gasturbo-Energieanlagen)
<b>GAS / Capstone</b>	30	First commercial units (8 delivered units)	Yes (Gas Energietechnik GmbH)
<b>Turbec</b>	100	First commercial units (4 units delivered)	50 % Joint Venture Volvo/ABB
<b>Ingersoll Rand (vormals NREC)</b>	75	Demonstration units	Yes, status: at work



# Legal and Environmental Requirements



- **no general and emission regulations (so far)**
- **industrial units - GewO (Austrian trade regulations)  
emissions - state-of-the-art technology**
- **legal & environmental requirements - no barriers**
- **emission levels of MGTs - no problems for  
licensing and authorisation procedures**



# Subsidy Scheme for CHP Units



OPET AUSTRIA

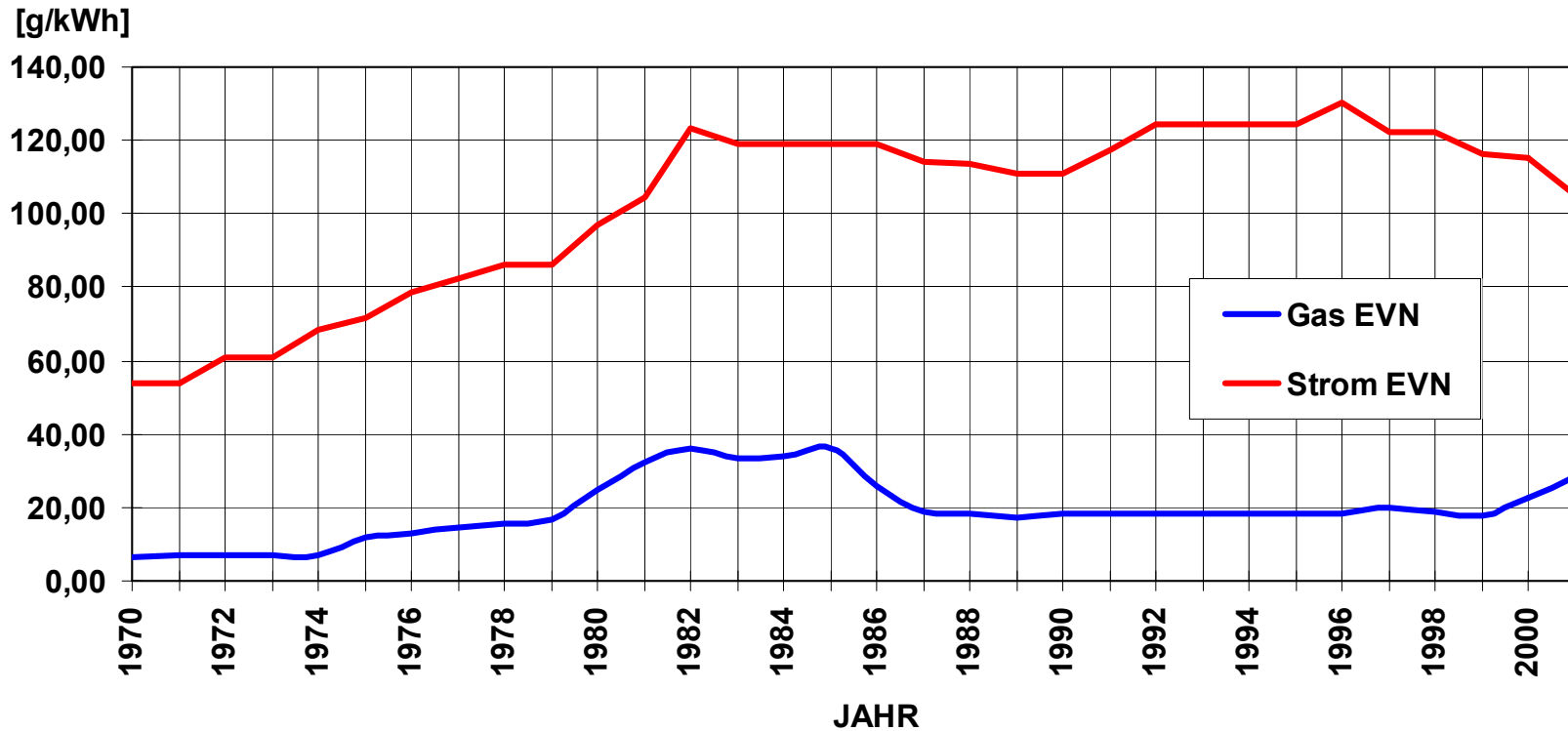
- **mainly for companies using CHP units for their own energy production substituting existing (inefficient) heating systems**
- **standard subsidy rate: 30 %**
- **minimum electric efficiency factor: 25 %**
- **minimum total energy efficiency factor: 70 %**
- **minimum/maximum investment: € 7.300/€ 2,900.000**
- **technical conditions: for gas turbines  $\leq 50$  MW,  
 $\leq \text{NO}_x$  100 mg/Nm<sup>3</sup> (based on 15 vol.-% O<sub>2</sub>)**



# Gas and Electricity Prices



OPET AUSTRIA





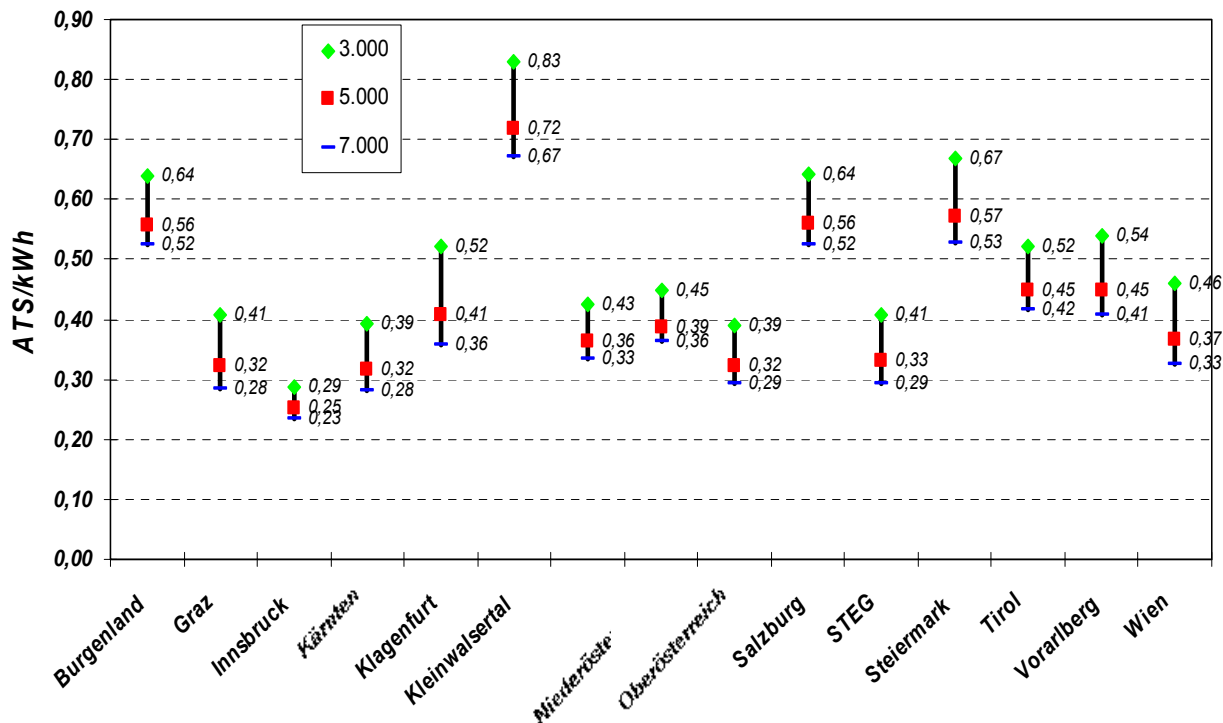
# Network Tariffs



OPET AUSTRIA

## NET - TARIFFS IN AUSTRIAN REGIONS LEVEL 6, annual consumption about 1 - 3 GWh

ÖEKV Graphik E299 - 11.09.2001

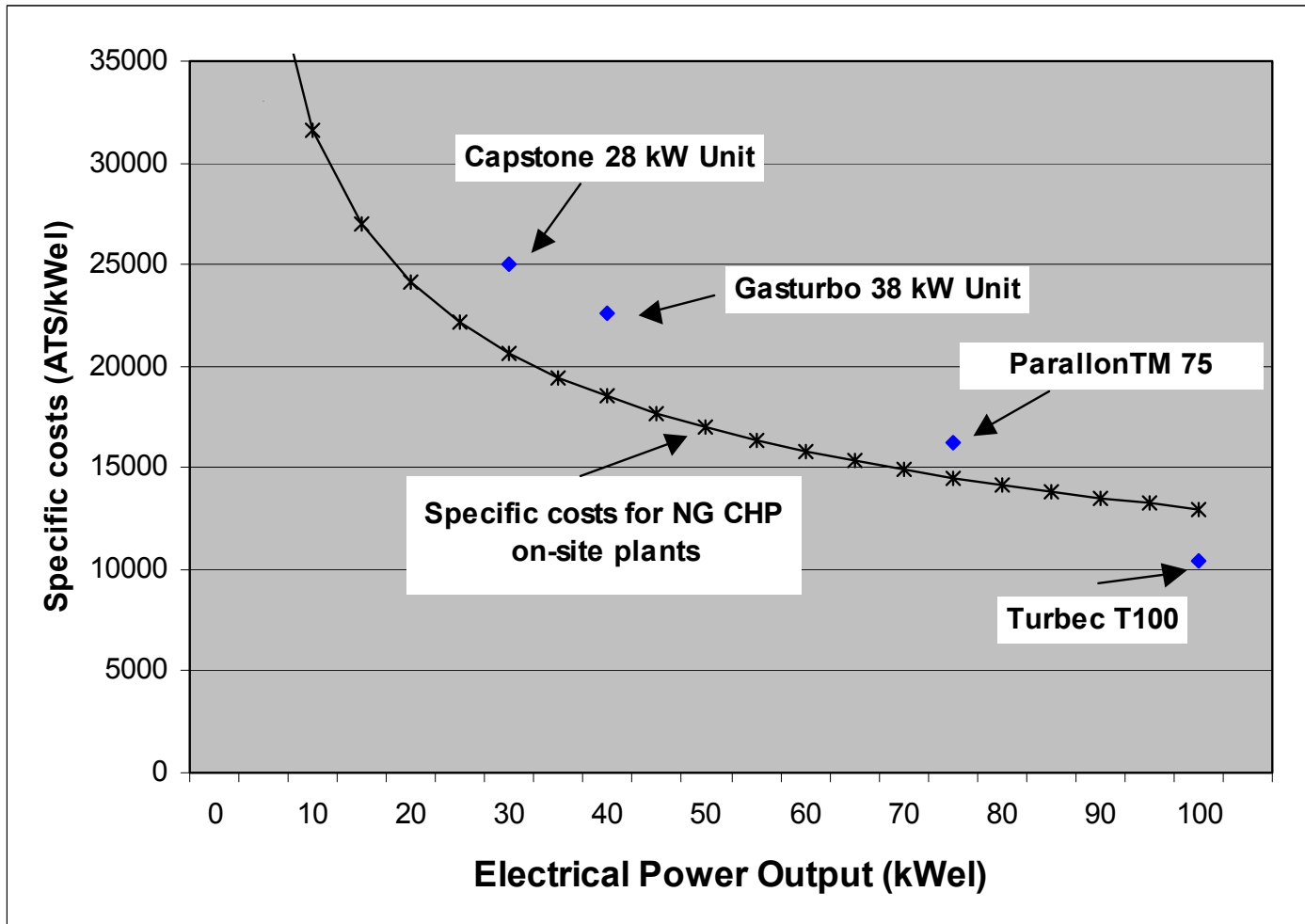


According to the region and the ratio of utilisation the net – tariffs for small scale enterprises are between 23 g/kWh (1.67 €-Cent) and 83 g/kWh (6.03 €-Cent)

In a case of selfconsumption these costs are avoidable!



# Investment Costs





# Costs for O&M



## ➤ costs for operation and maintenance services (O&M)

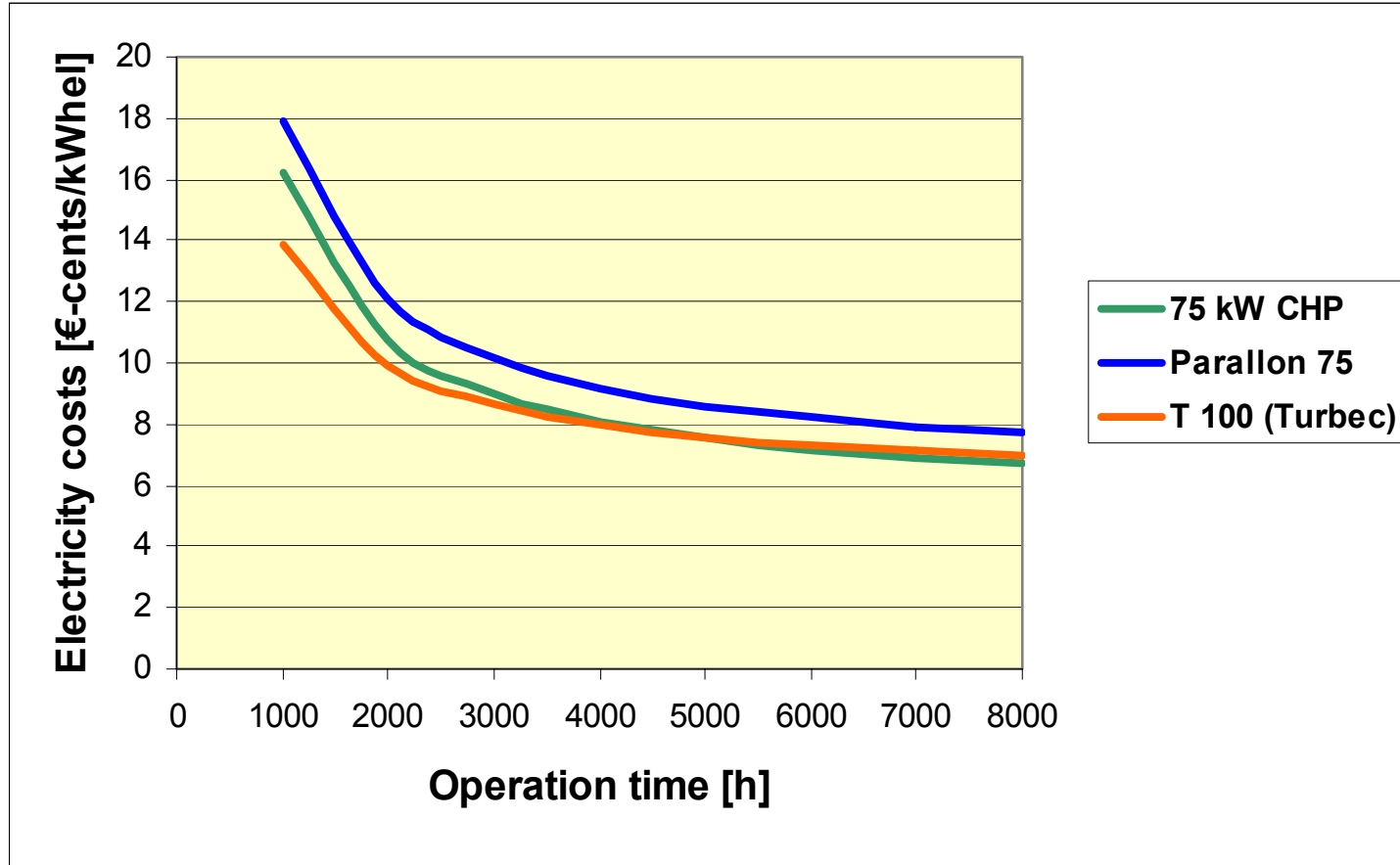
	<b>75 to 100 kW<sub>el</sub> engine</b>	<b>Parallon™ 75 Honeywell</b>	<b>T100 [Turbec]</b>
<b>O&amp;M cost €-cents/kWh</b>	<b>1,60 – 1,80</b>	<b>1,30</b>	<b>1,10</b>



# Economics: strong competition



OPET AUSTRIA



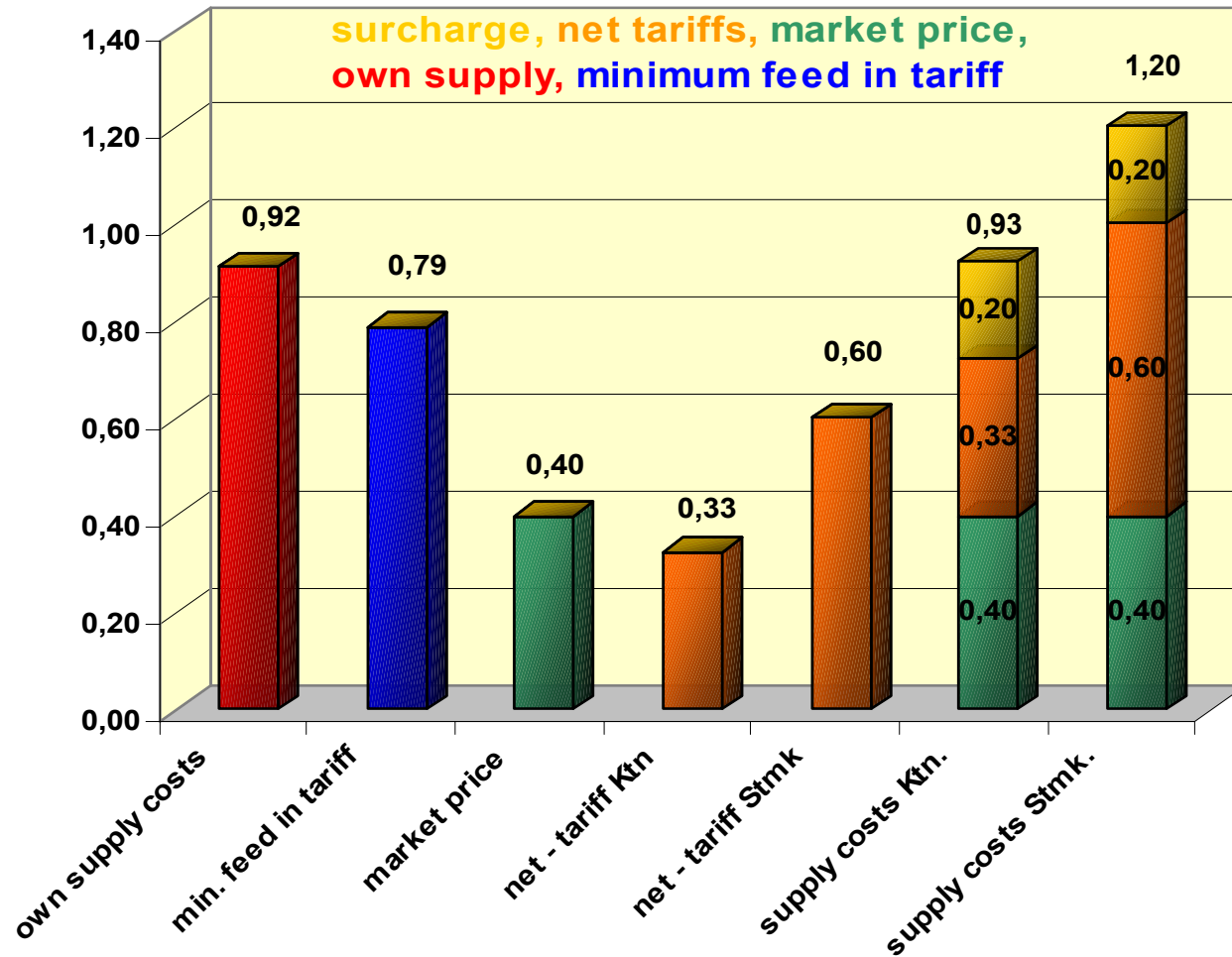


# 75 kW CHP engine 5000 operation hours



OPET AUSTRIA

Investment costs:  
1.08 Mio ATS  
Pay-back period for a CHP – plant in Stmk = 10 years





# Estimated Market Potential



OPET AUSTRIA

- **estimated market potentials based on the following scenario:**
  - **continuous operation  $> 75 \text{ kW}_{el}$ ,**
  - **electricity consumption 1 - 10 GWh/a**
  - **continuous heat demand  $\sim 150 \text{ kW}_{th}$**
- **theoretical technical potential: economical and site-specific requirements not considered**



# Market Potential for MGTs



➤ **mass market: hotels, small industries, hospitals, schools, swimming pools, residential house complexes**

➤ **350 – 750 units**

➤ **niche market: live stock farms, and other renewable fuels, emergency power supply**

➤ **up to 600 units**



# Market Introduction



- **competition between conventional systems**
- **competition between different micro-turbine technology providers**
- **first products and projects will set standards for the other ones**



# Summary



- **micro-/mini-CHP units are well known in Austria**
- **no problems for licensing and authorisation procedures**
- **subsidy 30 %**
- **high theoretical market potential for MGTs**
- **market entry barriers: strong competition due to four stroke engine systems and other competing MT providers. Investment costs, economics, availability and reference plants have major importance for investment decisions of potential clients.**