



**SUNMACHINE®**

# SUNMACHINE GmbH



founded in 2002

(former developments by : E. WEBER Solartechnik )

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**HIGHLY EFFICIENT, RELIABLE  
AND ECONOMIC STIRLING ENGINES**

**Power range : 1 – 4 kW electric output**

**2.5 – 10 kW ( - 20 kW ) thermal**

**CORE BUSINESS**

**FINAL PRODUCTS :**

**MICRO – COGENERATION UNITS**

**CRYO REFRIGERATION UNITS (20 – 150 °K)**





## **MAJOR ENGINE CHARACTERISTICS**

**KINEMATIC STIRLING  
ENGINE**

**2 SINGLE-ACTING PISTONS IN  
V-TYPE ARRANGEMENT  
GENERATOR and FLYWHEEL  
mounted on CRANKSHAFT**

**PERMANENTLY  
LUBRICATED**

**(no oil)**

**LOW POWER DENSITY**

**DURABILITY**

**low demand in maintenance**

**High engine efficiency**

**ECONOMIC ENGINE**

**Few components (integrated)**

**low manufacturing cost**

**(suited for series production)**

**low operating cost**





## **MARKET I: MICRO POWER UNITS**

**1 – 4 kW<sub>EL</sub>**

**Residential homes**

**monovalent**

**Multi – Family homes**

**(small) trade and industry**

**bivalent**

**MARKET SIZE :** Germany : ~ 1 mio heating units / year  
European Union : 5 – 6 mio. units / year

**MOTIVATIONS :** better use of the fuel  
lowering of the CO<sub>2</sub> – footprint  
liberalisation of electricity market

**COMPETITORS :** internal combustion engine  
fuel cells  
other Stirlings

## **MARKET II : CRYO – REFRIGERATION UNITS**



### **DEVELOPMENT OF NEW MARKETS :**

**high temperature superconductors (HTSC) :**

- **cables**
- **transformers**
- **engine and current limiters**
- **mass telecommunication systems**

**cryo – pumping for vacuum systems  
(semi - conductor industry)**

**liquefiers for : nitrogen (labs., biomedical)  
oxygen  
natural gas (car refuelling)**

**closed cycle refrigerators**



<b>MOTIVATIONS :</b>	<b>smaller series, higher margins</b> <b>(particular advantages for series - built engines)</b>
<b>COMPETITORS :</b>	<b>piston- (or turbo-) expanders</b> (maintenance) <b>pulse tubes</b> } (rel. low <b>Gifford-McMahon refrigerators</b> } efficiency) <b>mixed gas cascades</b> (in developm't) <b>Stirling engines</b> (Stirling Cryogenic & Refrigeration BV)





## **MARKET III : RENEWABLE ENERGIES**

**SOLAR**

**BIOMASS** (wood pellet burner)

**MOTIVATION :**

**Penetrate renewables market with  
an existing, series - produced engine  
benefitting from a large diffusion**



## **COMPANY SITUATION AND DEVELOPMENT**

- EXISTING :**
- **Prototype Stirling Engines :**
    - **2 gas-fuelled micro-power units**
    - **2 hybrid solar – dish system**
    - **1 wood pellet burner**
    - **conceptual layout of cryogenerator**
  - **TECHNOLOGY**
  - **Patent application on Stirling engine concept**

## **EXPECTED INVESTMENT AND FINANCIAL REQUIREMENTS**

**12 mio. EURO investment and operating resources for 2 years, essentially for the further development and testing of basic components + field testing**



## EXPECTED COMPANY DEVELOPMENT

<b>YEAR</b>	<b>EBIT / TURNOVER mio. EURO</b>	<b>TOTAL STAFF</b>	<b>Total financial requirements mio. EURO</b>
<b>2002</b>	<b>-</b>	<b>4</b>	<b>( ~ 9 )</b>
<b>2005</b>	<b>1 / 30</b>	<b>50*</b>	<b>~ 16</b>
<b>2007</b>	<b>20 / 150</b>	<b>80*</b>	<b>-</b>
<b>2010</b>	<b>40 / 300</b>	<b>110*</b>	

**BASIC AIMS  
of the  
COMPANY**

**PRODUCTS OF OUTSTANDING QUALITY**  
in terms of economy, reliability, efficiency  
in considering ecologic market development drives

**STAY AT THE FOREFRONT OF INNOVATION**

- **continued product development**
- **development of derived products**

