



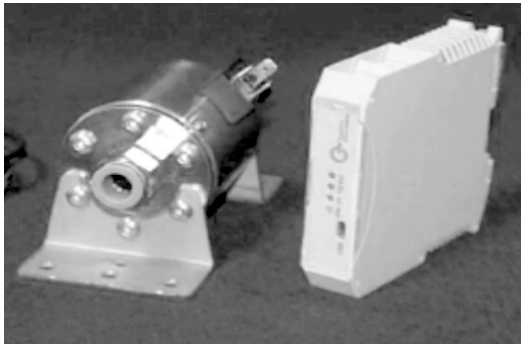
| SpaceTech 4 PlanetEarth



SpaceTech 4 PlanetEarth

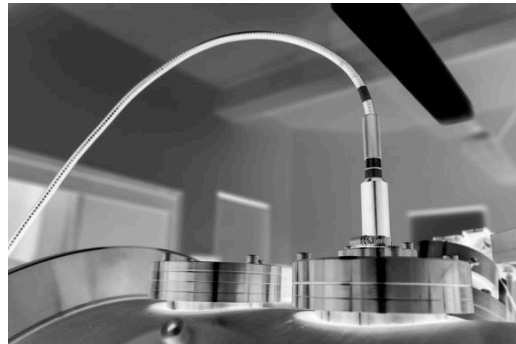
Technology to close the gap between sustainability and efficiency

SmartValve Tech



“The core of powerful solutions”

High Vacuum Laser Welding



“Future of high quality welding”

Titan Matrix Composites (TMC)



“Feather-weight champion for more stiffness and strength ”

- Proven Technologies out of space
- Innovative high-tech solutions with unique value propositions
- Huge market development potential in each area

PROJECT VIEW

SmartValve@AirFlowSaver

to reduce Compressed Air at Blow-Off Stations



Saving Potential up to
in Compressed Air,
CO₂ and Energy by
Real-time Pulsing



Customer Example:

Furniture Industry

Invest 25 T€ - Saving **100 T€** p.a.

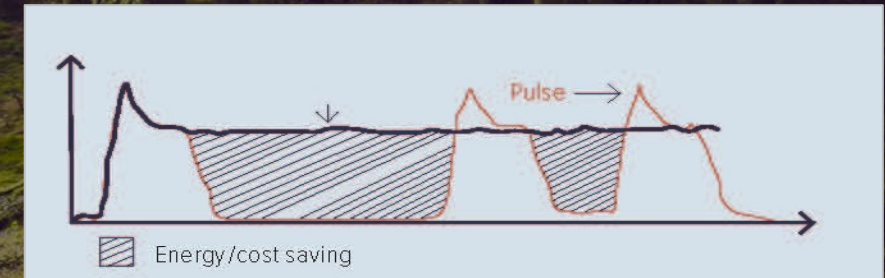
Food Industry

Invest 107 T€ - Saving **114 T€** p.a.

Increased Drying,
Cleaning, Blowing
effect by Real-time
Pulsing up to



ROI
3 to 18 month



SmartValve@AirFlowSaver

Compressed air:

- most expensive form of energy: of 100% produced electricity, is about 5% for CA
- mounts up to 30% energy cost in a manufacturing company
- approx. 70% of this CA is used for Blow Off Applications

7 AFFORDABLE AND
CLEAN ENERGY



8 DECENT WORK AND
ECONOMIC GROWTH



9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE



13 CLIMATE
ACTION



939bn kwh/p.a.
WW Energy
consumption to
produce CA



200bn kwh/p.a.
20bn \$/ p.a.
Saving Potential
by using
Airflow Saver



138m t/p.a.
Saving Potential
of CO2 by using
Airflow Saver



10bn \$
WW Sales
Potential
Airflow Saver

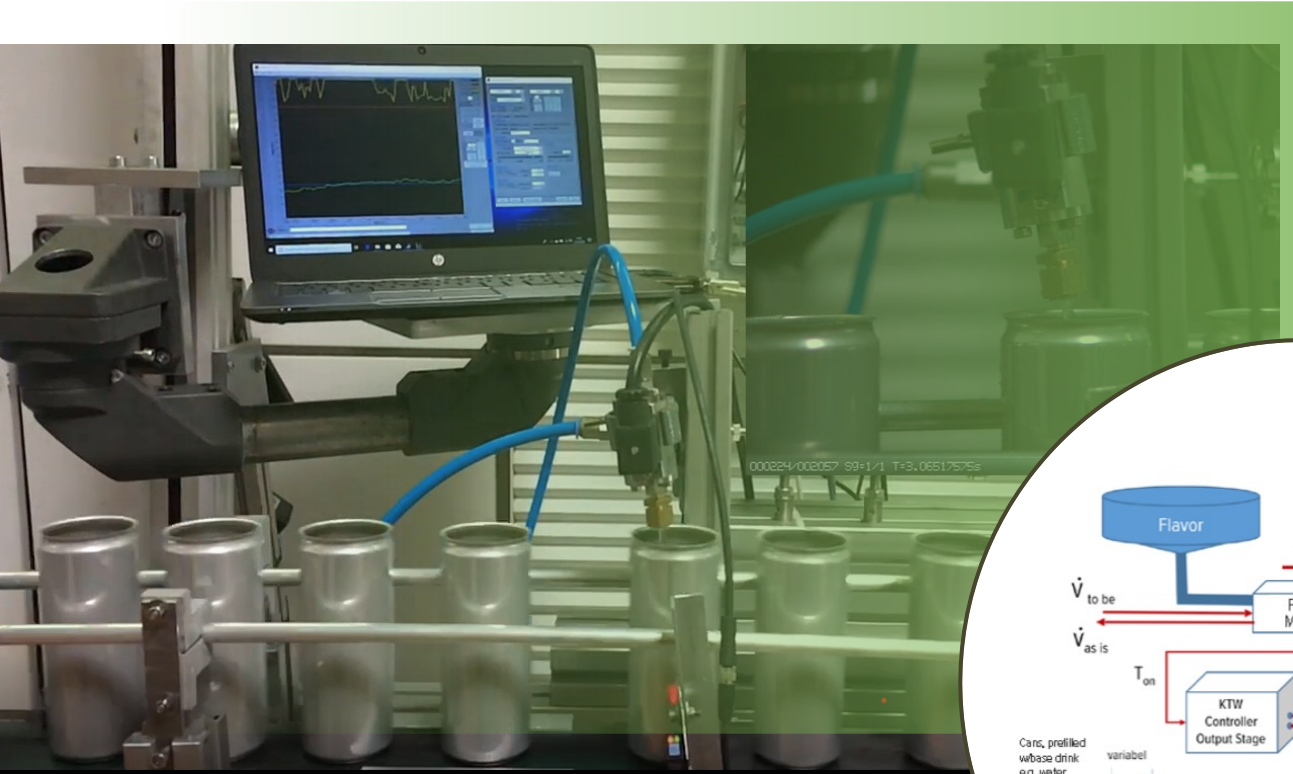


0,5 Years
Average ROI by
using Airflow Saver

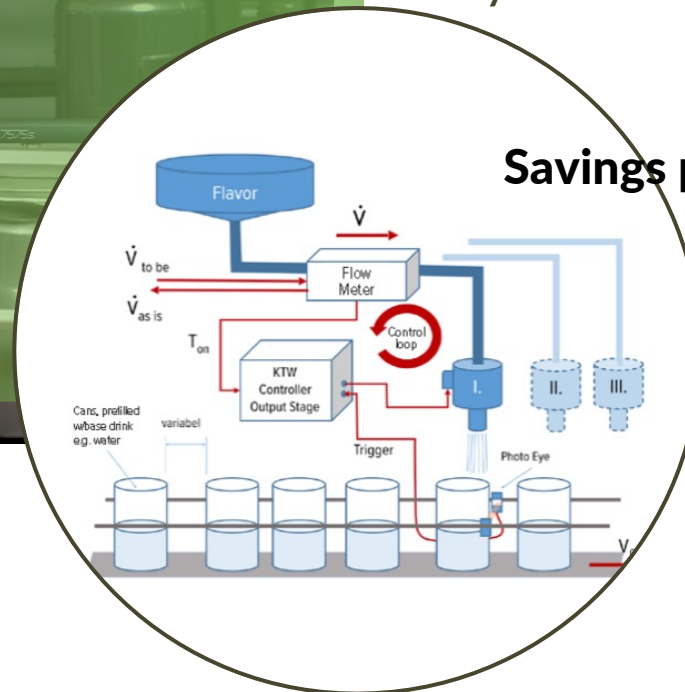
Source: Statista

SmartValve@High Speed Precision Dosing

Versatile stand-alone system of injecting flavour in base drink



- enabling technology to expand product portfolio
- avoid aroma + allergens carry-over, reduce waste
- saves energy and increases utilization
- reduces CapEx because of not necessary mixer/tanks
- key towards filling on demand and flavoured liquids



Savings p.a.: **6digit** amount in € per System



SmartValve@High Speed Precision Dosing

Rapid growth in consumption of functional beverages; Further manufacturing innovations to limit the loss of flavourings are required

Market Trends > 2026

Global beverage flavors: CAGR 5,9%



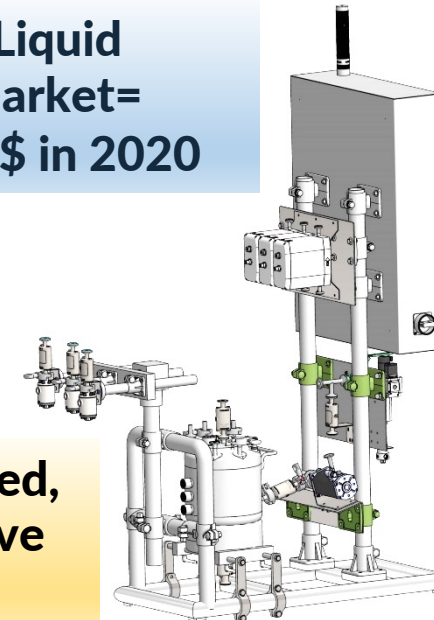
Global Automatic Liquid Filling: CAGR 7%

Autom. Liquid Filling market= 2415bn \$ in 2020

Growth Markets: APAC and USA

Major Players: Bosch Packaging Kronos E-Pack

Fragmented, competitive market



Source: Mordor Intelligence

SmartValve@Medical Device for ECMO*

Ground-breaking automatic oxygenation process

Problem: The existing procedures do not allow for the simultaneous and independent regulation of the oxygen and carbon dioxide concentration in the blood and therefore

Poor medical control

- ⇒ No independent control of blood oxygen and carbon dioxide
- ⇒ Alteration of gas flow changes $p\text{CO}_2$ and results in critical acid-base-imbalance
- ⇒ Alteration of blood flow could lead to fluctuation of cardiovascular circulation

Solution: Automatic Oxygenation Process by HyPower

Strong level of medical control

- ⇒ Closed Gas circuit
- ⇒ Optimal alteration of gas partial pressures of O_2 und CO_2 in blood
 - > easy control, no patient hazard, simultaneous + independent control of $p\text{O}_2$ und $p\text{CO}_2$ in blood, high control accuracy and control speed eliminates pressure fluctuation on gas side

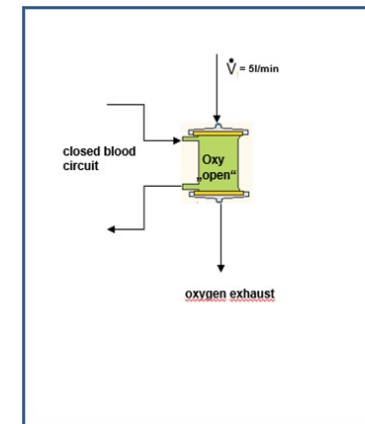


*ECMO (i.e. **Extracorporeale Membrane Oxygenation**) provides the respiration within the intensive care for adults, children and neonates with severes lung damages.

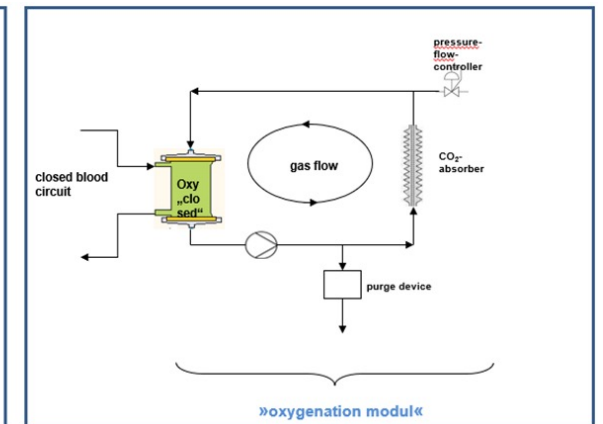
SmartValve@Medical Device for ECMO

Increasing WW Demand due to Covid

Comparison of features	MAQUET GETINGE GROUP	TERUMO	SORINGROUP AT THE HEART OF MEDICAL TECHNOLOGY	Medtronic	XENIOS	KTW Technology SpaceTech 4 PlanetEarth
ECMO	✓	✓	✓	✓	✓	✓
closed circuit	X	X	X	X	X	✓
electronic gas flow	X	X	X	X	X	✓
simultaneous + independent control of pO2 and pCO2	X	X	X	X	X	✓
quick emergency oxygenation	X	X	X	X	X	✓
Miniaturizable for portable application	X	X	X	X	X	✓



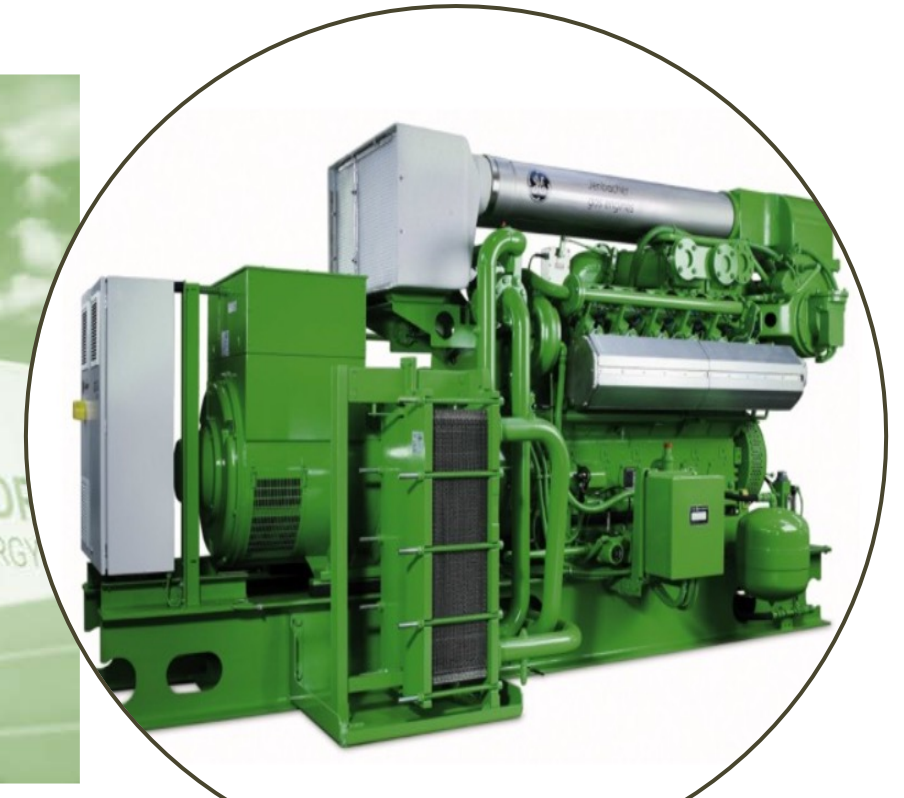
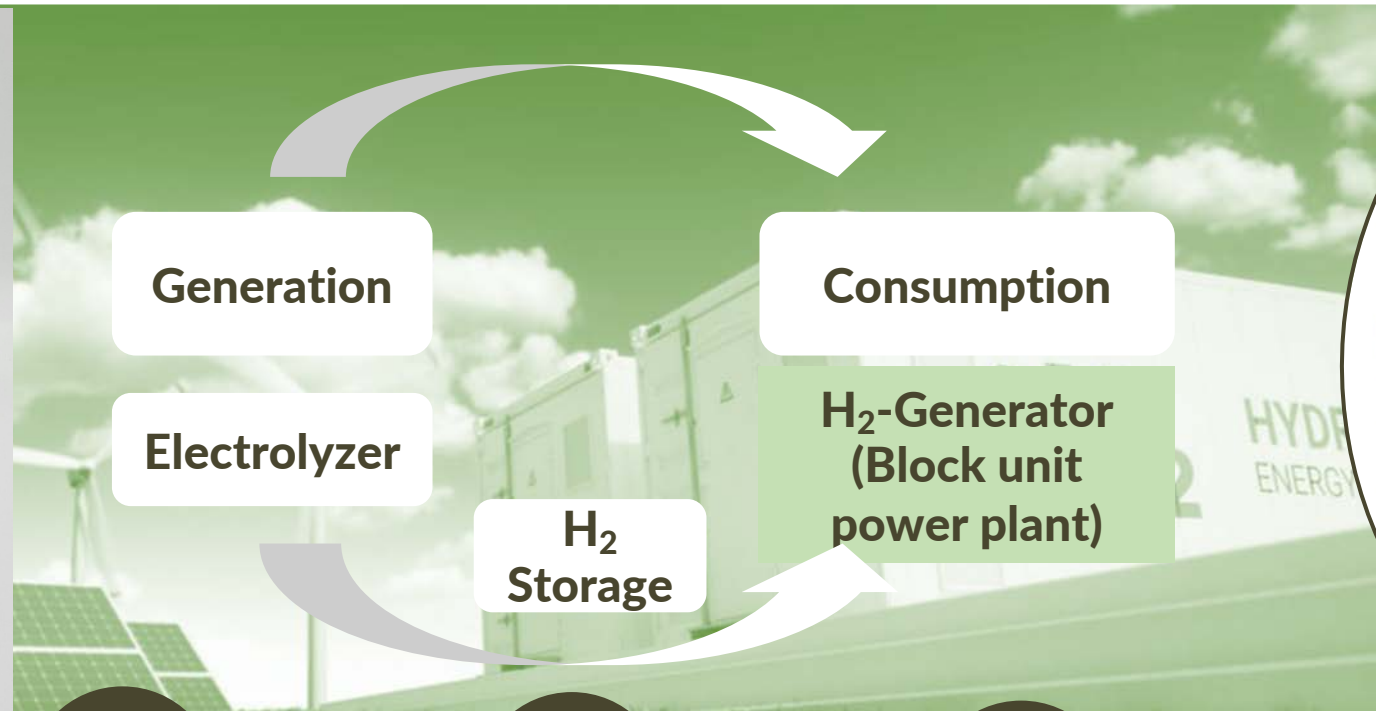
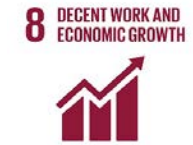
Conventional process (fig. 1)



HyPower process (fig.2)

SmartValve@H₂-Injection

Re-Electrolyzation with H₂ in Block Unit Power Plant



755
m t/a

CO₂ Emission
Germany 2018

Source: Roland Berger

257
bn €

Est. CapEx WW
in H₂ till 2030

130
bn €

Est. Turnover EU
H₂ in 2030

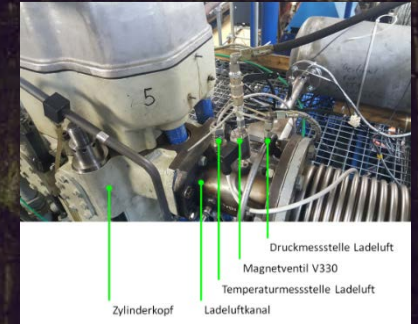
SmartValves increase durability, makes the application more flexible and safer

Development and 5Y Delivery Contract signed with 2G Energy AG

SmartValve@Water Injection System

Freely controllable injection of water in large engines

- into the intake tract of ICE
- or by direct injection in the combustion chamber



01

Diesel consumpt. Ships WW 44bn (l/a) + Vehicles Germany 14bn (l/a)

02

NOx emissions Ships WW 3-6m (t/a) + Vehicles Germany 20m (t/a)

03

Saving Potential Nox > 50% and Fuel > 5%

04

Water Injection Potential:
Trucks in Germany > 11.5m valves
Ships in Germany > 18.0k valves

The alternative: spending a low 5digit amount of \$ instead of investing millions of \$ in new engines!

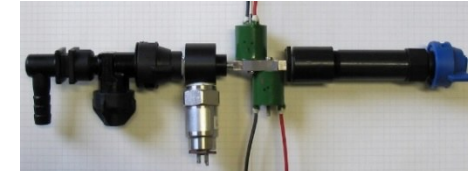
9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE

13 CLIMATE
ACTION



SmartValve@Smart Farming Spray System

Optimizing smart farm machines to manage crops at a plant-level



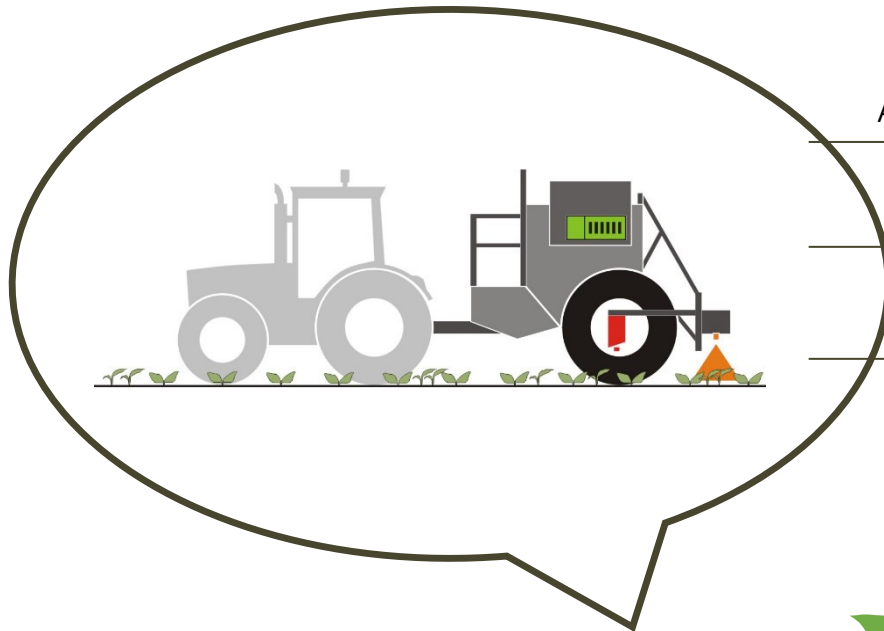
2 ZERO HUNGER



8 DECENT WORK AND ECONOMIC GROWTH



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Application of the crop protection agents on dosage units in a spray bar

processing the sensor data to a control unit

weeds detection by the camera and image processing



Farmers Profit

increase with the weed control challenge

Insect Protection

is an important side effect of weed control

Herbicide-resistant

weeds will be better controlled

90% Lower Cost

herbicides(\$25bn/a) by selectively applying herbicide to weeds only

2.5bn lbs

savings in global herbicides use with sustainable weed control

TMC@E-Drives for Regional Air Mobility

Expand use of E-Drives into Aerospace by increasing power density



- Worldwide more than 100 aerotaxi projects ongoing
- Piloted or autonomous
- Different principles: jet or helicopter
- Weight, payload, drive power are critical

Today's limitations due to power density of available E-Drives (<10 kw/kg), doubling required as target performance

Use of innovative techniques and materials

- 3D prints, carbon fiber to reduce weight of components
- Limited esp. regarding high temperature applications

Advantages of TMC-based components:

- Reduced weight of heavy iron parts, esp. rotor / stator
- Increased performance (increased RPM)
- Reduced weight of safety shields etc.



TMC@Orthopedic Implants

TMC based implants improve quality of life for patients



Materials used

- Titanium alloys (TiAl6V4, TiAl6Nb7 - forging alloy)
- CoCrMo forging alloys

Today's limitations

- risk of fatigue fractures (titanium implants)
- Pure biocompatibility of steel
- Limited number of implant operations per joint

Implants typically replaced after 15 years

Costs per surgery in Germany (EUR 10.000 excl. material)

Advantages of TMC-based implants:

- Lifecycle extension of implant
- Replacement of steel implants
- Reduction of medical surgeries
- Improved quality of life

TMC@Orthopedic Implants

The TMC advantages promises to be the perfect material for hip implants

Per anno 400.000 hip implant operations in Germany,
Worldwide Turnover of hip implants is approx. \$20bn



Problem: the dwell time is limited to ~15 years inside the body



Solution: hip implants of TMC shall have a significant longer lifetime (we are in the research phase)



Idea: prostheses made of TMC under use of Ti-Alloy with medical approval



Advantage: further operative procedures are extremely reduced and relief of the health system

High Vacuum Laser Welder



Wherever technology has reached a high level of development and high-quality – there is our market

Automotive

Aerospace

Machinery and plant construction

Electrical industry

Defense technology

Railway engineering

Petrochemistry

Medical Tech

Research and Development

Power engineering / power plant construction / wind energy

Mining

Nuclear applications



Vacuum Laser Welder fulfills the requirements of **high quality welding** results (E Beam Welders) at reasonable costs, without big efforts and very flexible in the dimension of the device.