

# FUELSAVE GmbH

## COMPANY & SOLUTION INTRO

-  Save energy.
-  Save money.
-  Save the planet.

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**WE ARE HELPING CUSTOMERS TO BECOME MORE ENERGY EFFICIENT  
SAVE ENERGY - REDUCE OPEX - INCREASE PROFITABILITY  
ECONOMICAL VIABLE AND SUSTAINABLE**

## VISION

FUELSAVE GmbH wants to create measurable return for our customers with a contractually guaranteed ROI within the warranty period.

## MISSION

FUELSAVE GmbH wants to establish itself as the leading provider for efficiency enhancement solutions that pay themselves through their achieved savings

## PHILOSOPHY

- CUSTOMER SATISFACTION FIRST
- ROI WITHIN THE WARRANTY PERIOD
- „NO CURE NO PAY“ MENTALITY
- DETERMINED FOR CREATING SUCCESS STORIES

## APPROACH

FUELSAVE combines its own patented technologies with industry leading manufacturers to provide turnkey solutions to the most respected clients worldwide in direct sales (B2C) as well through partner & OEM (B2B) models.

## AREA FOCUS / R&D

Any application with high pressurized air consumption especially in lucrative and demanding segments:

- EFFICIENCY ENHANCEMENT OF COMBUSTION ENGINES
- NOVEL COMBUSTION ENGINES (MULTIFUEL)
- AIR MOTORS / PNEUMATIC ENGINES
- PRESSURE RECOVERY TO POWER
- WASTE HEAT RECOVERY – WHRS / ORC
- ENERGY STORAGE - AA-CAES
- GREEN TECHNOLOGY CONSULTING & SI



# FUELSAVE GmbH – BRIEF

## COMPANY BACKGROUND:

- FOUNDED 2012
- ACTIVE WITH STAKEHOLDERS SINCE 2015
- SME WITH STRONG R&D BACKGROUND
- EFFICIENCY ENHANCEMENT / CLEANTECH / GREEN TECHNOLOGIES & GREEN ENERGY

## HUMAN RESSOURCES / TEAM:

- 7 X FTE (END OF 2020) + 14 Externals
- ADDITIONAL OVER 20 PEOPLE DIRECT & INDIRECT
  - 6 X ADMINISTRATION / MANAGEMENT
  - 7 X OPERATIONS / TECHNICAL SALES / BIZDEV
  - 11 X R&D / ENGINEERING / MANUFACTURING
    - 3 X THERMODYNAMIC SIMULATIONS
    - 2 X TECHNICAL DESIGN & ENGINEERING
    - 1 X CNC & ASSEMBLY & TESTING
    - 2 X ENGINEERING ASSISTANCE
    - 3 X PLCS / CABINETS

## CURRENT LOCATIONS:

- HQ: WALLDORF → HAMBURG
- R&D: BUCHHOLZ (INNOV. CENTRE)



## FUTURE LOCATIONS:

- EU
  - NORWAY ( CLEANTECH & MARITIME)
  - ROTTERDAM (LARGEST EU PORT)
  - LUX → PATENT HOLDING & R&D ?
- ASIA
  - SINGAPORE (LARGEST PORT)



# PATENTS / AWARDS / ACHIEVEMENTS - EXTRACT

## PATENTS

- ✓ 11 PATENTS / PATENT FAMILIES .. ONLY THE BEGINNING.. ☺
- ✓ SOME REGISTERED IN 40 COUNTRIES

## ACHIEVEMENTS

- ✓ WORLDS 1st APPROVAL OF DNVGL OF SUCH TECHNOLOGY
- ✓ CHOSEN IN LEADING ACCELERATORS FOR SHIPPING & ENERGY
  - CMA CGM / E&Y / ACCENTURE / MCKINSEY
  - TOTAL / REGIONAL GOV FRANCE / INCO
  - TECHSTARS / EQUINOR / KONGSBERG / CAPGEMINI

## AWARDS

- ✓ TOP 10 FINALIST GREENTECH AWARDS 2016 / 2017
- ✓ 3 SEALS OF EXCELLENCE OF EU / EC
- ✓ TOP SME IN EUROPE – HIGHEST EVALUATION SCORE OF EC
- ✓ BEST CLEANTECH COMPANY IN MIT / MS NERD CENTER END OF 2018
- ✓ SOLUTION OF THE FUTURE BY THE INDUSTRY (NEPTUNE AWARDS)

## FUNDING


- ✓ BOOTSTRAPPED BY FOUNDERS + NOW FIRST INVESTORS
- ✓ FUNDED BY THE EU (H2020 – SME INSTRUMENT PHASE 2)





*This project has received 1.6 Mio funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 806083"*

# FUELSAVE PORTFOLIO

BRIEF OVERVIEW OF OUR CURRENT FOCUS

 Save energy.

 Save money.

 Save the planet.

# EFFICIENCY ENHANCEMENT FOR OPEX & EMISSION REDUCTION FOR MARITIME VESSELS.

INNOVATIVE CLEANTECH SOLUTION WITH HIGH IMPACT & ROI



Save energy.



Save money.



Save the planet.



**MARINE**

GREEN  
TECHNOLOGY

# EFFICIENCY ENHANCEMENT FOR OPEX & EMISSION REDUCTION FOR MARITIME ASSETS.

INNOVATIVE CLEANTECH SOLUTION WITH HIGH IMPACT & ROI



Save energy.



Save money.



Save the planet.



**MARINE**

GREEN  
TECHNOLOGY

# EFFICIENCY ENHANCEMENT FOR OPEX & EMISSION REDUCTION FOR STATIONARY POWER.

INNOVATIVE CLEANTECH SOLUTION WITH HIGH IMPACT & ROI



Save energy.



Save money.



Save the planet.



**POWERPLANT**

GREEN  
TECHNOLOGY

# EFFICIENCY ENHANCEMENT FOR OPEX & EMISSION REDUCTION FOR CRANES.

INNOVATIVE CLEANTECH SOLUTION WITH HIGH IMPACT & ROI



Save energy.



Save money.



Save the planet.



**PURIFIER**

GREEN  
TECHNOLOGY

# EFFICIENCY ENHANCEMENT FOR OPEX & EMISSION REDUCTION FOR TRUCKS & TRAINS.

INNOVATIVE CLEANTECH SOLUTION WITH HIGH IMPACT & ROI



Save energy.



Save money.



Save the planet.



**PURIFIER**

GREEN  
TECHNOLOGY

# EFFICIENCY ENHANCEMENT FOR OPEX & EMISSION REDUCTION FOR TRUCKS & TRAINS.

INNOVATIVE CLEANTECH SOLUTION WITH HIGH IMPACT & ROI



Save energy.



Save money.



Save the planet.



**PURIFIER**

GREEN  
TECHNOLOGY

# WORLD'S MOST EFFICIENT PNEUMATIC / AIR MOTOR.

MOST EFFICIENT WAY TO TURN PRESSURE  
INTO ROTATIONAL ENERGY

 Save energy.

 Save money.

 Save the planet.



**ENGINE**

GREEN  
TECHNOLOGY

# TURNING UNUSED PRESSURE INTO FREE ENERGY AT PRVs & EXPANDERS.

EFFICIENT CLEANTECH SOLUTION WITH HIGH ECONOMICAL IMPACT



Save energy.



Save money.



Save the planet.



**PRESSURE2POWER**

GREEN  
TECHNOLOGY

# LONG DURATION ENERGY STORAGE FOR A CLEAN ENERGY TRANSITION.

ADVANCED ADIABATIC COMPRESSED AIR ENERGY STORAGE SYSTEM  
FOR GRID BALANCING & SWITCHING TO RENEWABLES



Save energy.



Save money.



Save the planet.



**AA CAES**

GREEN  
TECHNOLOGY

# HIGHLY EFFICIENT WASTE HEAT RECOVERY ORC / SRC / TDC

TURN HEAT INTO POWER TO INCREASE EFFICIENCY & SAVE ENERGY

 Save energy.

 Save money.

 Save the planet.



**HEAT2POWER**

GREEN  
TECHNOLOGY

# FIRST DEDICATED MULTIFUEL **HYDROGEN / GAS / ALCOHOL** NOVEL COMBUSTION ENGINE

MULTI-FUEL & MULTI STAGE DUAL ROTARY PISTON ENGINE

HYDROGEN / ETHANOL / METHANOL / AMMONIA / BIOMETHANE

 Save energy.

 Save money.

 Save the planet.



**FS ENGINE ICE**

GREEN  
TECHNOLOGY

# WORLD'S MOST EFFICIENT PNEUMATIC / AIR MOTOR

MOST EFFICIENT WAY TO TURN PRESSURE INTO ROTATIONAL ENERGY

 Save energy.

 Save money.

 Save the planet.



**ENGINE**

GREEN  
TECHNOLOGY



## FS ENGINE+ BACKGROUND – INDUSTRY RELIES ON AIR MOTORS

ALMOST EVERYWHERE IN MODERN INDUSTRIES AIRMOTORS ARE USED TO **POWER TECHNOLOGIES AND INDUSTRIAL PROCESSES**

- ABOUT **8-10%** OF THE TOTAL INDUSTRIAL ELECTRICITY IS CONSUMED IN COMPRESSED AIR APPLICATIONS EVERY YEAR
- THE TOTAL POTENTIAL FOR OPTIMIZING A COMPRESSED AIR SYSTEM BEING **> 30%**
- FOR COMPANIES SAVINGS POTENTIAL OF **>60%** ARE FEASIBLE





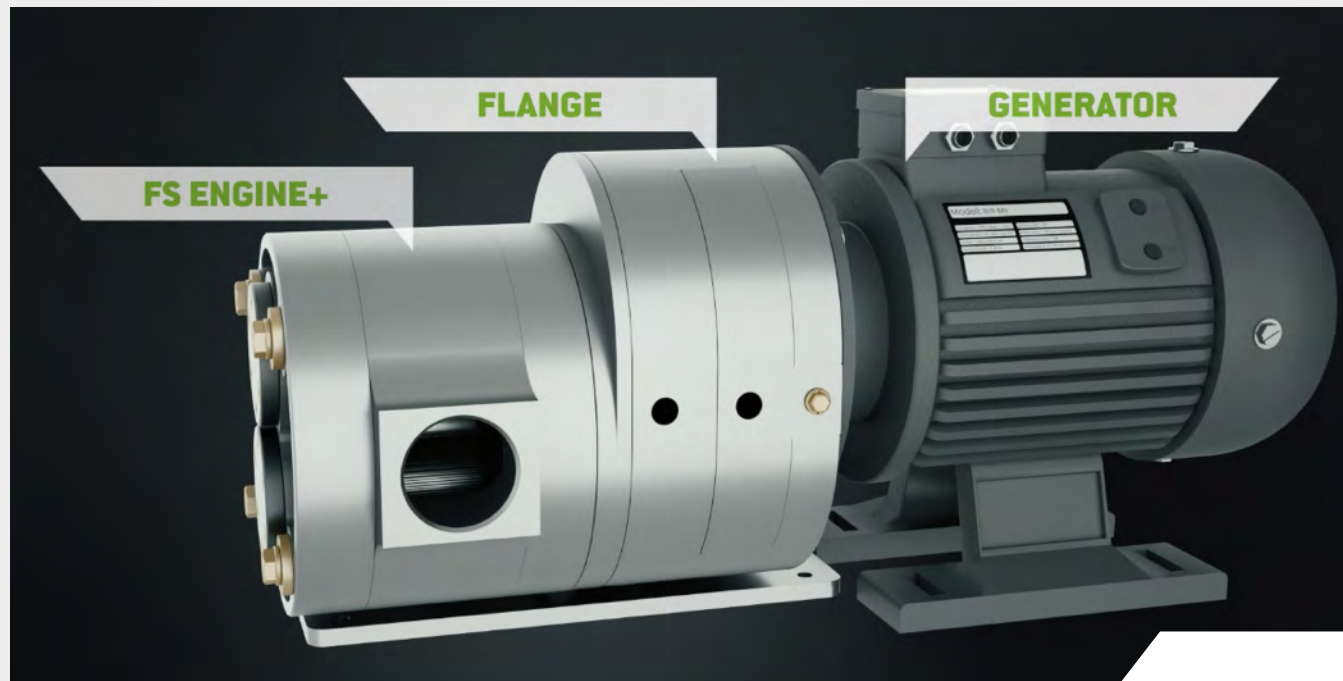
## FS ENGINE+ GAME CHANGER FOR THE AIR & GAS INDUSTRY

THE WORLDS MOST EFFICIENT PNEUMATIC AIR ENGINE CHANGING THE PARADIGM FOR ENERGY RECUPERATION IN VARIETY OF MARKETS THROUGH INGENUOUS DESIGN & MARKET LEADING SEALING.

- **NEXT GENERATION / DISRUPTIVE TECHNOLOGY**
  - **HIGHEST EFFICIENCY IN THE MARKET**
  - **CONSTANT EFFICIENCY ACCROSS ALMOST THE ENTIRE OPERATING RANGE**
  - **VALIDATED MEASUREMENT SERIES WITH TÜV & UNIVERSITY**
  - **OUTPERFORMING EVERY OTHER ENGINE / TURBINE / EXPANDER IN THIS SEGMENT BY 60-140%**
  - **FULLY SCALABLE (FROM X kW to XXX MW)**
- UNIQUE & PATENTED INNOVATION  
→ HIGHEST ROI

**GAME CHANGER  
IN VARIOUS  
INDUSTRIES**

**95,2 %**  
ETA





# FS ENGINE+ PROVEN EFFICIENCY BY TÜV & LEUPHANA UNI



**95,2 %**  
ETA



## Versuchsparameter:

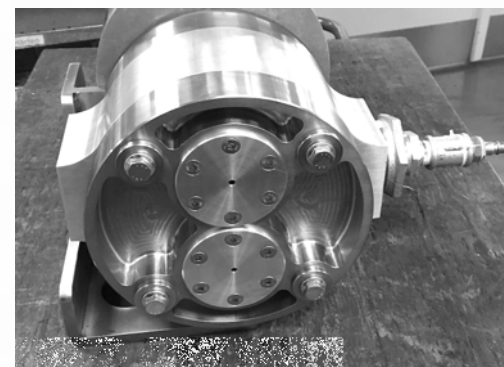
- Die Druckluft wurde auf einem Druckniveau von 4,2 bar bereitgestellt

## Messergebnisse:

- Die Leistungsmessung ergab einen stabilen und reproduzierbaren Messwert von ca. 2.400 Watt
- Die gemessene Drehzahl von 1500 - 1505 U/min entsprach ca. 95% der erwarteten Drehzahl des FS ENGINE+ mit dem eingangsseitig gemessenen Volumenstrom

## Bewertung:

- Die gemessene Leistung wurde bezogen auf den gemessenen Luftmassenstrom bewertet
- Die berechneten Werte dienen als Vergleich
- Der gemessene Wirkungsgrad beträgt gemäß der vorliegenden Ergebnisse ca. 95%**

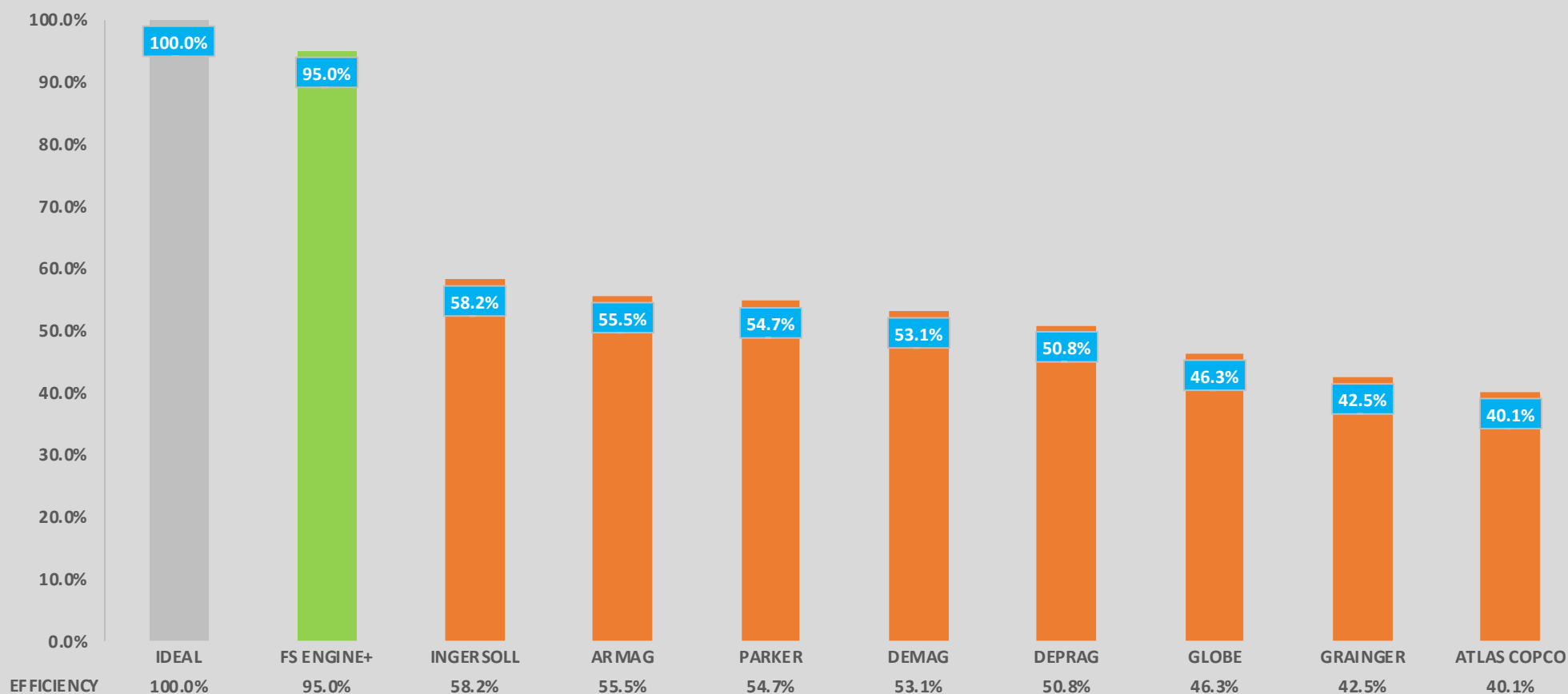




## FS ENGINE+ OUTPERFORMING COMPETITION SIGNIFICANTLY

WE ARE OFFERING THE **WORLDS LEADING HIGHEST EFFICIENCY** ON THE MARKET, **OUTPERFORMING OTHER ENGINES BETWEEN 63% - 137% IN EFFICIENCY AND AIR CONSUMPTION → HUGE COST SAVINGS FOR END-USER !!!**

### COMPETITION – EFFICIENCY (ETA) COMPARISON





## FS ENGINE+ KEY ENABLER FOR NOVEL APPLICATIONS



**WORLD'S MOST EFFICIENT GAS / AIR MOTOR**  
MOST EFFICIENT WAY TO TURN PRESSURE INTO POWER

**DUAL ROTARY PISTON ENGINE**  
HIGH EFFICIENCY OVER ENTIRE WORKING RANGE



## FS ENGINE+ KEY ENABLER FOR NOVEL APPLICATIONS

OUR **TECHNOLOGY** DISRUPTS **NEW AND EMERGING FIELDS OF DEPLOYMENTS** AS WORLD'S MOST EFFICIENT WAY TO TRANSFORM PRESSURE IN ROTATIONAL ENERGY WITH **CONSTANT EFFICIENCY ACROSS OPERATIONAL RANGE** IN CONTRAST TO TURBINES:

### COMPRESSED AIR ENERGY STORAGE (AA-CAES)

- AS TURBINE REPLACEMENT FOR SUSTAINABLE LONG DURATION, HIGH EFFICIENT LOW COST ENERGY STORAGE, OVERCOMING LIMITATIONS FROM TURBINES WITH **ROUND CYCLE EFFICIENCIES of 75 – 85 %**

### TURBINE REPLACEMENT

- AIR MOTORS UP TO XXX MW AS REPLACEMENT FOR TURBINES OUTPERFORMING IN **LOW PRESSURE & LOW TEMPERATURE** APPLICATIONS

### FREE POWER FROM UNUSED WASTE HEAT

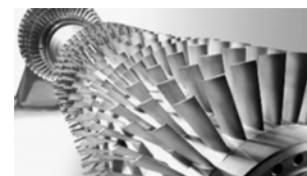
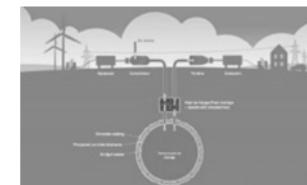
- WHRS (WASTE HEAT RECOVERY SYSTEMS) / ORC / SRC
- **EXCELLING AT LOW HEAT LOW PRESSURE** - UNTAPPED POTENTIAL THAT CANNOT BE ADDRESSED BY OTHER TECHNOLOGIES TODAY

### FREE POWER FROM UNUSED PRESSURE

- PRESSURE2POWER **ENERGY RECOVERY FROM GAS, AIR AND WATER-** NETWORKS AND COMBUSTION EXHAUST GASES ( FS REGAINER+)

### HYDRAULIC RANGE EXTENDER FOR EVS

- SPRING EFFECT FOR EVS WITH **HIGHER EFFICIENCY THAN CURRENT REGENERATIVE BREAKING** DUE TO BETTER MECHANICAL ENERGY TRANSITION → **MORE MILES PER CHARGE**



THANK YOU VERY MUCH FOR YOUR ATTENTION.

„It depends on you us alone  
whether you we want to use the new year  
as a brake or an engine.“


Henry Ford

FUELSAVE GmbH

THANK YOU FOR YOUR ATTENTION!!

**FOR INQUIRIES**  
PLEASE FEEL FREE TO CONTACT:

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[www.fuelsave.de](http://www.fuelsave.de)

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