Innovative Technological Systems S.r.l.

Staranzano 03 ottobre – La Ferula

ITS energy

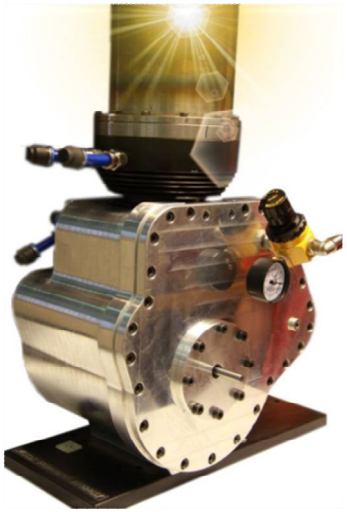
DECISIVE

A DECENTRALISED MANAGEMENT SCHEME FOR INNOVATIVE VALORISATION OF URBAN BIOWASTE

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 689229.

Description of the company's activity

ITS was born as **"Innovative start-up company"** established in the Technological Pole TechnoAREA of Gorizia, part of AREA Science Park in Trieste in 2012.



Mission:

Innovative development and production of high performance Stirling engines

Description of the company's activity

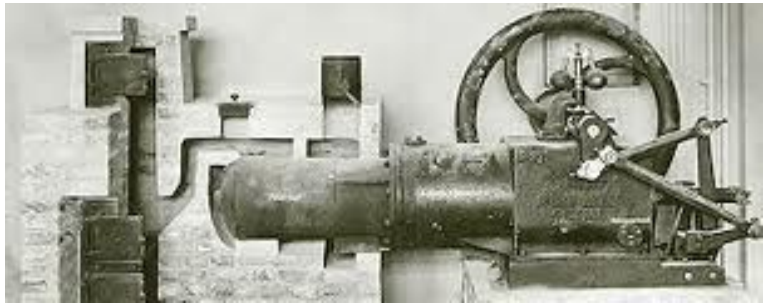
Recently we move in a new building in Fogliano Redipuglia for improve the activities of R&D, laboratory and test on the new ITS engines

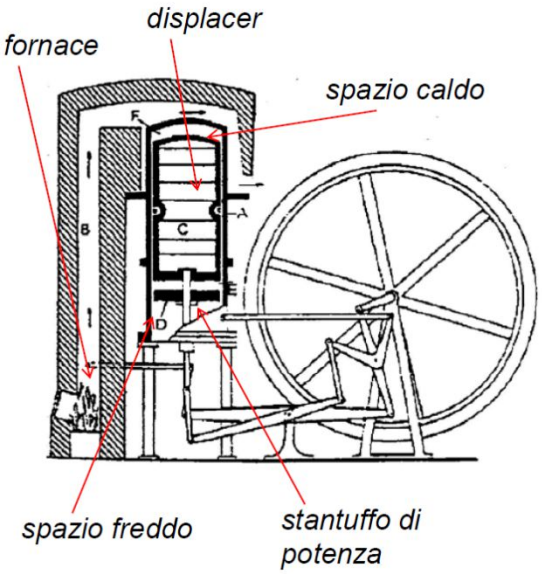
Old Technology… High Innovations

Stirling is an external combustion engine, invented by Robert Stirling in **1816**.

Disadvantages of the standard technology:

- Heavy and big machines
- High temperature requested
- Long warm-up period.
- No instantaneous modulation (no automotive)

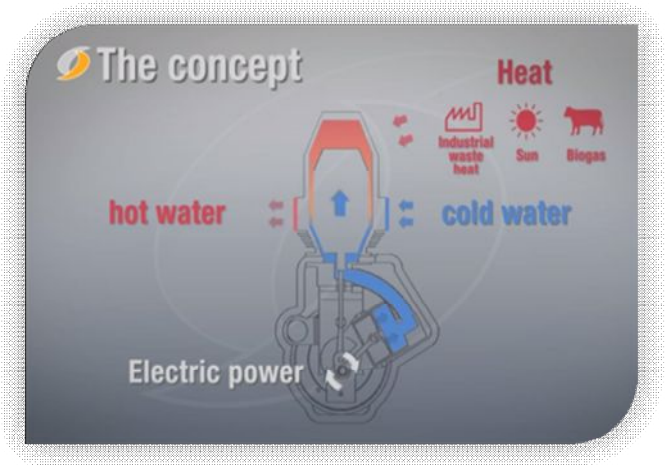


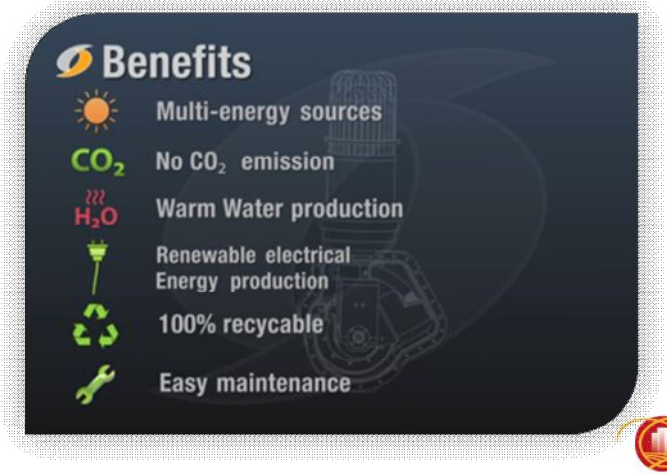


Old Technology… High Innovations

It works in closed cycle using a gas as the termodynamic fluid (usually air, nitrogen or helium or hydrogen in high-performance versions) and starts working when it will be reached an appropriate temperature difference between its hot spot and cold spot.

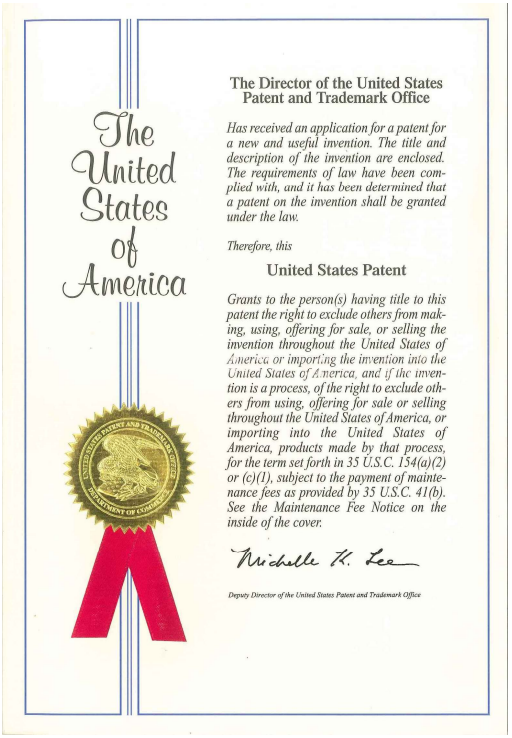
To produce the needed temperature difference it is possible to use several type of energy sources: solar concentrators, waste heat from industrial processing, biogas, etc.





Old Technology… High Innovations

Patented configuration in several countries: Europe, U.S, Japan and patend pending in Brasile and India



The United States of America

The Director of the United States Patent and Trademark Office

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, or importing into the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

Michelle K. Lee

Deputy Director of the United States Patent and Trademark Office

特許証
(CERTIFICATE OF PATENT)

特許第5484485号
(PATENT NUMBER)

発明の名称 (TITLE OF THE INVENTION) 外燃機関

特許権者 (PATENTEE) イタリア Ｉ－３４０７４ モンファルコネ，ヴィア ２５ アブリーレ １３
国籍 イタリア共和国
イノベーティブ テクノロジカル システムズ ディ フォンターナ クラウディオ

発明者 (INVENTOR) ジェンティーレ，ダヴィデ

出願番号 (APPLICATION NUMBER) 特願２０１１－５４１６３３

出願日 (FILING DATE) 平成２１年１２月１６日(December 16, 2009)

登録日 (REGISTRATION DATE) 平成２６年 ２月２８日(February 28, 2014)

この発明は、特許するものと確定し、特許原簿に登録されたことを証する。
(THIS IS TO CERTIFY THAT THE PATENT IS REGISTERED ON THE REGISTER OF THE JAPAN PATENT OFFICE.)

平成２６年 ２月２８日(February 28, 2014)

特許庁長官
(COMMISSIONER, JAPAN PATENT OFFICE)

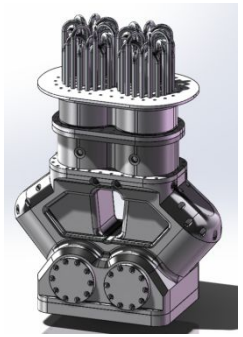
羽藤秀雄

Analysis of the competitors

MICROGEN STIRLING ENGINE

Product:	1 kW
Fuel:	Natural Gas
Working Temperature:	> 800 °C
Pressure:	36 bar
Size:	NA
Weight:	50 Kg
Modulating power on the shaft	NO

✓	**CIVIL APPLICATION**	✓
✗	**HEAT RECOVERY**	✓
✗	**LOW WORKING TEMPERATURE**	✓
✗	**SIZE SMALLER**	✓
✗	**AUTOMOTIVE - MARINE APPLICATIONS (PATENTED)**	✓



ITS ENERGY STIRLING ENGINE

Product	1 to 36 Kw
Fuel:	Biomass,biogas,syngas,ehaust gas,industrial **waste heat recovery**, **solar** and fossil fuels
Working Temperature:	> 400 °C
Pressure	< 5 bar
Size:	50x45x20 cm
Weight:	16 Kg
Modulating power on the shaft:	YES

Analysis of the competitors

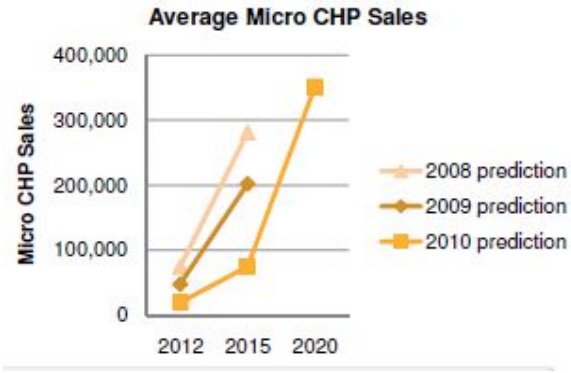
Company	ITS ENERGY	GENOA STIRLING	STIRLING TECH	STIRLING POWER	COOL ENERGY	MICROGEN	QNERGY (INFINIA)	SUNPOWER	KOCKUMS
Country	Italy	Italy	USA	USA	USA	Netherlands, UK, China, Asia	Israel and USA	USA	Sweden
power	1 to 36 kW	1 to 10 kW	3.7 kW	38 and 43 kW	1 to 50 kW	1 kW	3.5 - 7 KW	1 Kw	25 and 75 kW
Size	550x450x300 mm (for 2.5 kW)	716x770x240 mm (for 3 kW)	1245x1625x1625 mm	NA	914 mm diameter x 1100 mm lenght	NA	425 mm diameter x 829 mm lenght	270x435 mm	NA
Weight	16 Kg (for 1 kW), 35Kg (for 2,5 kW)	150 Kg for 3 kW	200 Kg	NA	900 Kg	150 Kg	67 Kg - 103 Kg	35 kW	NA
Working gas	Helium	Air (nitrogen)	Air	Hydrogen	Nitrogen	Helium	Helium	NA	Helium - Hydrogen
Pressure	5 bar	30 bar	5 bar	NA	NA	38 bar	40	NA	
Working temperature	350 - 400 °C	750 °C	650 °C	NA	300 °C	800 °C	40	NA	750 °C
Applications	Micro and mini CHP, heat recovery from exhaust gas, industriaol waste heat recovery, solar concentrators	Research Insititution	Biomass, remote locations	Waste water treatment and animal waste digestor	Heat recover from exhast gas, solar thermal inputs, biomass burners	Micro CHP, solar concentrators	Micro CHP, biomass, marine and solar concentrators	NA	NA
Price	20.000 € (for 2.5 kW)	14.000 € (for 3 kW)	NA	NA	11.000 € (for 1 kW)	9.000 €	16.000 €	NA	NA
Website	www.its-energy.net	www.genoastirling.com	www.stirling-tech.com	www.sp-usa.com	www.coolenergy.com	www.microgen-engine.com	www.qnergy.com	www.sunpowerinc.com	www.kockums.se

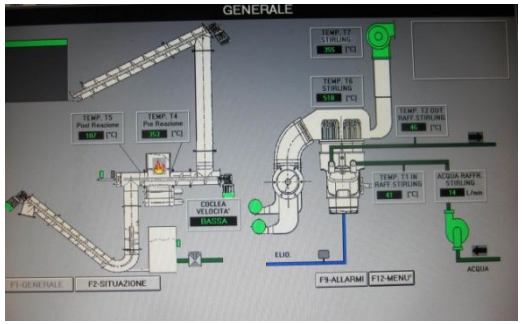
Analysis of the potential market addressed

Micro cogeneration for domestic production of electricity and hot water with **renewable energy**

Micro-cogeneration with 24 kW pellet boiler and integrated Stirling engine. Electricity + Hot water production

•Pyrolysis gasifier with a Stirling engine Electricity + Hot water + biochar as sub product

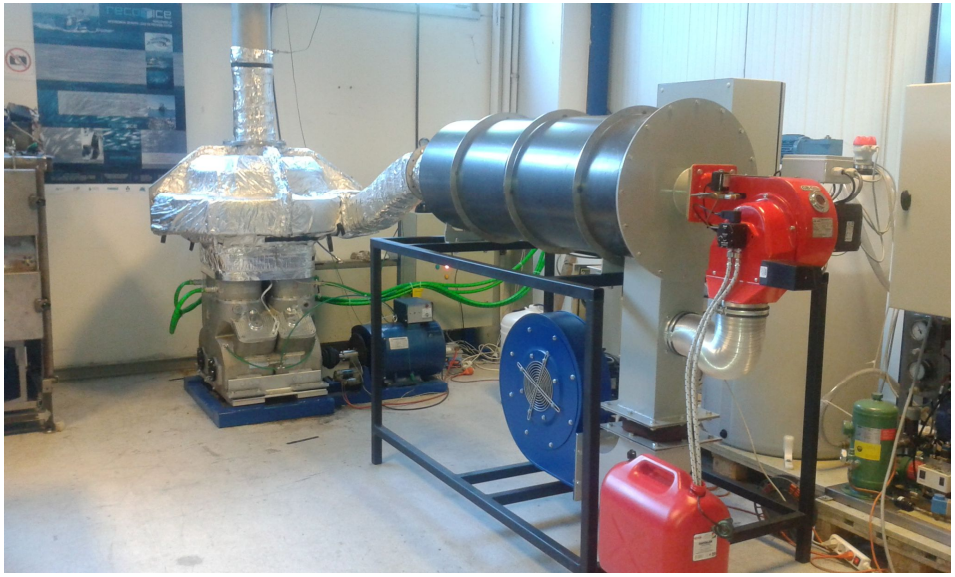




Analysis of the potential market addressed

Recovering of heat in internal combustion engines

European project FP7 RECOICE Recovery of exhaust gas of diesel engines with Stirling engine for production of ice on vessels board

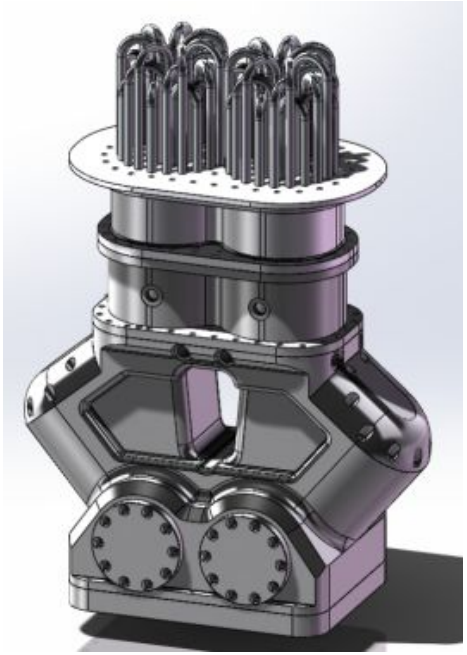


ITS inside DECISIVE Project

ITS is SME and the main activity inside DECISIVE Project is to valorize with ITS Stirling, the biogas produced with A.D. and produce:

Hot water

Electricity



Advantage to use an external combustion engine **Stirling**:

Low maintenance

Low noise

Low emissions

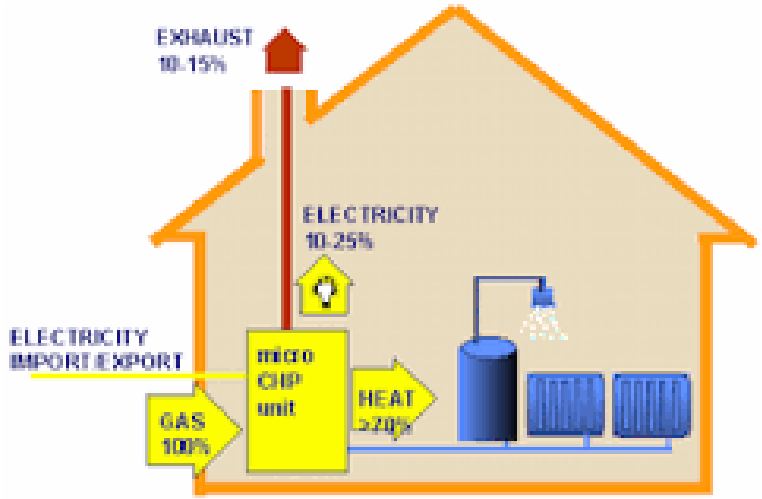
More reliable

ITS inside DECISIVE Project opportunities

2 demostrantion plants will be installed inside DECISIVE Project:

Lyon

Barcellona



Opportunities:

Test continuously in a real field the reliability of the full system

ITS inside DECISIVE Project opportunities

Furthermore **great opportunities** to be inside DECISIVE Project for a SME as ITS:

- To work with an **European top level team** as Universities, Reserch Institutes and a big company world leaders in waste and water treatment as Suez.

- To Have a knowledge of the European market potential

- To have, at the end of the project, a salable product.

-To have a clear idea of European regulations that will incentive or stop this kind of products.

-Final market price of the product to be competitive

Description of the Team

Eng. Davide Gentile (R&D)

Co-founder of Innovative Technological Systems Srl,

Mechanical engineer,

Race engineer in **World Superbike Championship** since **2006**

Stirling engines experience for more than ten years.

Inventor of ITS Stirling Configuration and Instantaneous power modulation

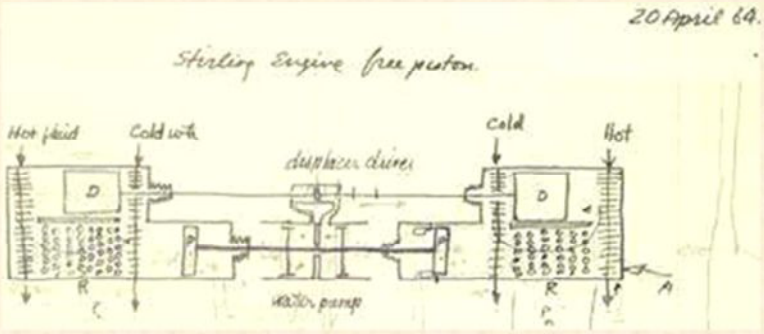
Claudio Fontana (CEO)

Co-founder of Innovative Technological Systems Srl,

Project manager in industrial engineering field since 1988;

Dealing in Energy and Renewable Sources since 2005

Conclusion



"... These imperfections have been in a great measure removed by time and especially by the genius of the distinguished Bessemer. If Bessemer Iron or steel had been known thirty five or forty years ago there is a scarce doubt that the air engine would have been a great success ...

It remains for some skilled and ambitious mechanist in a future age to repeat it under more favourable circumstances and with complete success... "

(Written in the year 1876 by Dr. Robert Stirling [1790-1878])

"... Queste imperfezioni sono state in gran parte rimosse dal tempo e specialmente dal genio del distinto Bessemer.
Se gli acciai di Bessemer fossero stati conosciuti trentacinque o quaranta anni fa non c'è dubbio che il motore ad aria sarebbe stato un grande successo ...

Resta a qualche ambizioso e qualificato tecnico in un'epoca futura di ripeterlo sotto circostanze più favorevoli e con pieno successo... "

(Scritto nell'anno 1876 dal Dr. Robert Stirling [1790-1878])

Thanks for your attention