

# *Fuel Technologies Ltd.*

## ***Water improves fuel burning!***

Water-in-oil emulsions produced by *Fuel Technologies Ltd.* provide for improved burning efficiency and significant ecological benefits

### **The Company**

Fuel Technologies Ltd. is a start-up company established in the framework of the technological incubator Orit in Ariel.

The Company is engaged in the development of advanced equipment for water-in-oil dispersing (hereinafter: "dispenser"), i.e. production of water-in-oil emulsions.

The company was founded by Prof. Damir Muchnik having more than 30 year experience in fuel preparation and processing.

### **The market**

The market on which the Company intends to operate is the market of petroleum products and more particularly the fuel oil market.

More and more fuel oil products come to burning in the emulsified form, i.e. as water-in-oil emulsions. Such kind of fuel provides for high efficiency of oil burning as well as for the significant reduction in emission of noxious combustion products (this acquires especially great importance in view of the upcoming strenghtening of the US and European regulations regarding the air pollution).

### **The product**

Fuel technologies Ltd. has developed and intends to market (in cooperation with a strategic partner) a mechanical disperser of a new type.

### **Technical background**

Water-in-oil emulsions have existed for more than 100 years. However, only recently it is became possible to control the stability and quality of the emulsion to make it advantageous for industrial and power-generating uses. Water-in-oil emulsion systems and products are now used in a variety of boilers and furnaces. The emulsions provide increased thermal efficiency, reduced carbon particulate, lower opacity, lower nitrogen oxide levels etc.

A typical burner atomizer produces a spray of fuel oil droplets around 100 microns. These fuel droplets do not completely burn, leaving unburned carbon to collect on heat transfer surfaces and escape as particulate matter in the exhaust gases. This reduces overall thermal efficiency and causes air pollution.

In the combustion of a water-in-oil emulsion, the primary spray fuel droplets are further divided as a result of the explosive vaporization ("micro-explosions") caused by rapid heating of the water dispersed within the individual fuel droplets. The internal water droplets undergo spontaneous nucleation of steam bubbles, causing a violent conversion of the water droplet to

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steam. The vaporization, in turn, produces a rapid expansion of the surrounding oil droplets, fragmenting the oil into a vast number of smaller fuel droplets (the name for this process is secondary atomization).

The benefits of emulsified fuel are:

- Reduction in NO<sub>x</sub> (up to 50%)
- Reduction in emission of SO<sub>3</sub>, CO, soot, benzopyren etc. (up to 60%)
- Elimination of need of frequent maintenance (cleaning of atomizers, heat transfer surfaces etc.)
- Increase in thermal efficiency and heat rate due to reduced fireside deposits and excess air
- Improved opacity
- Saving of fuel (up to 5%)

In summary, emulsified fuels can solve a major problem confronting utilities today - the need to produce more complete combustion minimizing fireside fouling and noxious emissions.

## **The technology and the advantages**

Although the advantages of emulsified fuels are obvious some significant problems still exist. These problems restrain the growth of this most promising market.

Among the foregoing problems are:

- Lack of technology providing for full control of water droplet size and emulsion quality and stability
- Expensive equipment
- High operation and maintenance costs
- Sensitivity of the equipment to the fuel quality and environmental conditions

Various methods are used today to prepare fuel oils for burning: colloid mills, mechanical mixers, pneumatic bubblers, ultra-sound equipment, cavitation dispersing tools and electro-hydraulic discharge units.

The proposed dispersing technology has a number of clear advantages. The technology is based on a new simple and engineer reliable tool (mechanical rotor disperser).

Following is the list of advantages:

- Optimal water droplet size (it is possible to obtain almost mono-dispersion - 90% of droplets in the range of 2 - 10  $\mu$ )
- Stable emulsion not dependant on changes in oil water-content and viscosity
- Low cost and high reliability
- Simplicity of installation and integration in existing systems
- Exploitation simplicity
- Inexpensive simple maintenance

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Additional scientific and technological information as well as market search results and Business Plan will be provided upon request.