Reduction on soot and unburned asphaltene on oil fired boiler's heat exchangers.

Systems for lower operating costs, fuel savings and emissions reduction.

all photos and diagrams in this presentation
(except photo of Christ in Rio)
we get on our equipment and from our customers.
www.energy-saving-technology.com
Why am I reading this presentation?

1. At my fuel oil boilers, **nozzles and heat exchangers are constantly clogged**. By reducing the quality of fuel, they clogged even faster ...

2. Clogging exchangers cause of smoke, increasing fuel consumption and more harmful emissions.

3. Cleaning the boiler - a long and costly procedure and I want to increase the interval between cleanings.
4. Cleaning the boiler carries the risk of damaging the heat exchangers and I want to reduce it.

5. I do not want to use chemical additives in fuel or reduce the amount of expensive additives.

6. I'm looking for proven technical solutions, reliable, simple, low-cost in installation and operation, with a quick payback period.

7. I know a lot of boiler-houses that have **constant problems with the HFO burning**. Smoke, sludge, permanent sticking soot and unburned coke on heat exchangers, boilers stopping, cleaning and repair of equipment
We know how to solve these problems in full or in part, but the best in the former USSR.

Example - The Company RUSAL in Guinea. 2010 year.

**Boilers:**
- 1 boiler consumption of 15 m3 of HFO p/h (BKZ 160-9.8-490M)
- 3 boilers, consumption of 8 cubic meters p/h. (FOSTER WEELEER)

**Fuel Type** – heavy fuel oil slurry.
Before and after installation of our equipment.

The test time is 2 months.

Example – The Company RUSAL in Guinea. 2010 year.
Before and after installation of our equipment.
Side screens.
Test time 2 months.

Example –
The Company RUSAL in Guinea. 2010 year.
Before and after installation of our equipment.

Air heater.
Test time 2 months.

Example – The Company RUSAL in Guinea. 2010 year.
Fuel quality and the resulting economic benefits from our equipment – direct fuel economy 4.1%.

<table>
<thead>
<tr>
<th>Date / data</th>
<th>MAZOT / MAZAY (m³)</th>
<th>VAPEUR / NAP (t)</th>
<th>cons spécifique / удельный расход мазута (кг/т)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.08.2010</td>
<td>206</td>
<td>198.8</td>
<td>72.578</td>
</tr>
<tr>
<td>02.08.2010</td>
<td>205</td>
<td>197.8</td>
<td>72.384</td>
</tr>
<tr>
<td>03.08.2010</td>
<td>206</td>
<td>198.8</td>
<td>72.472</td>
</tr>
<tr>
<td>04.08.2010</td>
<td>205</td>
<td>198.8</td>
<td>72.340</td>
</tr>
<tr>
<td>05.08.2010</td>
<td>205</td>
<td>197.8</td>
<td>72.052</td>
</tr>
<tr>
<td>06.08.2010</td>
<td>205</td>
<td>197.8</td>
<td>72.971</td>
</tr>
<tr>
<td>07.08.2010</td>
<td>208</td>
<td>200.7</td>
<td>72.936</td>
</tr>
<tr>
<td>08.08.2010</td>
<td>212</td>
<td>204.6</td>
<td>74.828</td>
</tr>
<tr>
<td>09.08.2010</td>
<td>228</td>
<td>200.0</td>
<td>77.254</td>
</tr>
<tr>
<td>10.08.2010</td>
<td>214</td>
<td>206.5</td>
<td>74.284</td>
</tr>
<tr>
<td>11.08.2010</td>
<td>212</td>
<td>204.6</td>
<td>74.938</td>
</tr>
<tr>
<td>12.08.2010</td>
<td>203</td>
<td>195.9</td>
<td>74.684</td>
</tr>
<tr>
<td>13.08.2010</td>
<td>205</td>
<td>197.8</td>
<td>73.486</td>
</tr>
<tr>
<td>14.08.2010</td>
<td>211</td>
<td>203.6</td>
<td>73.243</td>
</tr>
<tr>
<td>15.08.2010</td>
<td>208</td>
<td>200.7</td>
<td>73.202</td>
</tr>
<tr>
<td>16.08.2010</td>
<td>197</td>
<td>190.1</td>
<td>75.625</td>
</tr>
<tr>
<td>17.08.2010</td>
<td>205</td>
<td>197.8</td>
<td>73.953</td>
</tr>
<tr>
<td>18.08.2010</td>
<td>214</td>
<td>206.5</td>
<td>74.231</td>
</tr>
<tr>
<td>19.08.2010</td>
<td>216</td>
<td>208.4</td>
<td>73.810</td>
</tr>
<tr>
<td>20.08.2010</td>
<td>216</td>
<td>208.4</td>
<td>72.678</td>
</tr>
<tr>
<td>21.08.2010</td>
<td>215</td>
<td>207.5</td>
<td>73.209</td>
</tr>
<tr>
<td>22.08.2010</td>
<td>216</td>
<td>206.5</td>
<td>73.205</td>
</tr>
<tr>
<td>23.08.2010</td>
<td>148</td>
<td>142.8</td>
<td>73.354</td>
</tr>
<tr>
<td>24.08.2010</td>
<td>265</td>
<td>201.5</td>
<td>73.205</td>
</tr>
<tr>
<td>25.08.2010</td>
<td>200</td>
<td>193.0</td>
<td>73.265</td>
</tr>
<tr>
<td>26.08.2010</td>
<td>199</td>
<td>192.0</td>
<td>73.773</td>
</tr>
<tr>
<td>27.08.2010</td>
<td>200</td>
<td>193.0</td>
<td>71.133</td>
</tr>
<tr>
<td>28.08.2010</td>
<td>201</td>
<td>194.0</td>
<td>70.558</td>
</tr>
<tr>
<td>29.08.2010</td>
<td>203</td>
<td>195.9</td>
<td>72.985</td>
</tr>
<tr>
<td>30.08.2010</td>
<td>200</td>
<td>193.0</td>
<td>71.402</td>
</tr>
</tbody>
</table>

Среднее снижение удельного расхода мазута на тонну произведенного пара на кotle 2.994 кг/т

Фактические показания параметров измерялись штатными приборами, входящими в нижний уровень АСУП котлов:
- расход пара (KRONHE 3800/20/М),
- расход мазута (KRONHE 3800/20/М),
Расчет поуточный величин производился верхним уровнем системы АСУП котла "Honeywell".
We know how to solve these problems in full or in part, but the best in the former USSR.

Example - cardboard factory Aleppo, Syria. 2012 year.

Boiler –
1 boiler with consumption of 1 m3 of HFO p/h (MINGAZZINI )

Fuel type –
high-viscosity heavy fuel oil.

Photo - firebox control for 30 days.
No smoke, minimal deposits on the nozzle for 30 days, which are easily removed with a brush for 15 minutes.

www.afuelsystems.com/ru/trga/s228.html
No smoke, all heat exchangers are clean, minimal consumption of fuel oil - all are satisfied.
We know how to solve these problems in full or in part, but the best in the former USSR.


Boilers –
4 boilers with consumption of 8 m3 of HFO p/h

Fuel - HFO №6

Photos - a deposit on boiler hatch and in pipes.
Before and after installation of our equipment.

The right screen. The test time is 10 months.

Example - Windalco, Jamaica. 2013-17 year.

Feature - simultaneous use TRGA homogenizer and additives in the fuel.
Before and after installation of our equipment.

The left screen and the bottom of the furnace. The test time is 10 months.

Example - Windalco, Jamaica. 2013-17 year.

Feature - simultaneous use TRGA homogenizer and additives in the fuel.
We know how to solve these problems in full or in part, but the best in the former USSR.

Example - Nickel Plant, Guatemala. 2016 year.

**Boiler**: 1 boiler consumption 25 m³ of HFO p/h

**Fuel type** - heavy tar oil.

**In the stage of waiting for our answer** to the sent proposal. 6 months ...

They can not find money .... for a project with a payback period of 2-2.5 months…
We know how to solve these problems in full or in part, but the best in the former USSR.


Boilers:
- 2 boilers with a consumption of 1 m.cub. HFO p/h (DE 25)
- 2 boilers with a consumption of 1 m.cub. HFO p/h (Holman Boiler)

The fuel type is M100 black oil + watered oil sludge from its own tanks. Works successfully from 2013.
Deposit on heat exchangers after 6 months of boiler operation. The deposit is brittle and can be easily removed by tapping.
Cleaning boiler "before" – long, hard and mechanical removal of the soot.

Boiler cleaning "after" - tapping and removing bt broom.
This fuel is combusted completely, leaving on the surface the minimum amount of dry ash which can be easily removed.

Top - economizer, after 11 months of continuous operation with our equipment (fuel – mixture HFO and sludge).
The minimum amount of dry ash, which can be easily and quickly removed ...
It successfully works for 4 years – Clean heat exchangers, no smoke, no corrosion when burning watered oil sludge (8%) in Russian (DE 25) and American (RILEY UNION Holman Boiler Works Inc.) boilers with light and heavy, high-quality and shocking fuel.
We know how to solve these problems in full or in part, but the best in the former USSR.


Boilers:
- 2 boilers DKVR 10/13
  (0.3-0.7 cub. m. HFO p/h)
- 2 boilers DKVR 20/13
  (0.7-1.3 cub. m. HFO p/h)
Fuel type - M100 (HFO#6)
with triple quantity of mechanical impurities. HFO combustion before and after.
Left screen after 3 months of work. Report.
Reminder:

all photos and scans in this presentation are received on our equipment and from our customers

Our sites
www.afuelsystems.com
www.energy-saving-technology.com
https://www.youtube.com/user/andrewrubanut/videos?shelf_id=0&sort=dd&view=0
Our technology provides:

Heavy fuel savings, suspension processes sulfuric acid corrosion, reducing smoke, odors, decreased CO, Sox. Possibility of burning watered and substandard HFO, waste of its transportation, washing of cisterns.

Reduction clogging in heat exchangers, its maintenance, minimization specific consumption for a long time, increases the inter-repair period of boilers, injectors, filters and pumps.

We solve these problems for a long time, successfully and on boilers of any design.

**Economic effect** $60,000 - $600,000 for one boiler* per year.

(* depending on the amount of fuel oil burned, from 1 up to 10 tons p/h)

The same boiler - but more calories and energy in fuel and less specific consumption and costs
Work time is 3-4 years. Some models work for 8 years. Warranty is 1-2 years. Payback time is much less than 1 year. We offer increase your income on the basis of our equipment and practical knowledge.

Burning of black oil in an industrial boiler – before, after and always. With our equipment.
**Objects** - industrial boilers and furnaces, cement plants, mines, dairy and sugar factories, power stations, refinery, heat power plant, energy ship...

**The main difference** - high reliability, long-term effective work with heavy fuels, high quality processing fuels with a viscosity up to 1200 cSt..

**Possibility** of installation and maintenance works by customer staff, real experience of successful operation for 8 years, tests, analyzes, **certificates for use in Ukraine, EU and Russia.**

**Works on the principle** – install and forget.
1. **Reliable and proven.** Works long and does not break. Tested in the work of 10 years and at more than 150 industrial facilities in the condition of different fuels and poor maintenance.
2. Works on principle - **set - forget.**
3. **Low weight** 10-90 kg, (unlike other 200 kg). It savings in transport and installation costs.
4. **Can use add equipment** - pipes, pumps, valves and other - **from the customer location.**
5. May be install and served by the customer's staff.
6. **Different models** work on **heavy and light fuel.**
7. Operating data: pressure **2 - 40 bar**, temperature range "**-20 +250**" degrees.
8. **High crushing effect.** **Working in aggressive fuels** - coke fuel, jet fuel, and various mixed fuels, may be used for blending biodiesel components comprising methanol and alkali and as a tool for intensifying mixing of liquids or blending.
Awards, certificates and diplomas

155 successful projects
2007 - 2017, in Ukraine, Kazakhstan, Belarus, Russia, Syria, Croatia, Serbia, Belgium, Guinea, Jamaica, the Philippines.
Fuel, processed on our systems – burns better, faster, completely.

Waste and smoke remain less, the cost of buying fuel and maintenance is reduced.

This is our main competitive advantage.

Examples of fuel processed on our systems - visual effects.
Fuel processed by our system – burning better, waste and smoke are less, price for purchase/exploitation is lower.

This is our significant competitive advantage.

Examples of the fuel processing by our system - visual effects
Our first test on diesel generators with standard, light automotive diesel fuel.

Compare please:
- amount of unburned particles
- completeness of combustion in engine.

A simple test - two sheets of paper near the exhaust pipe
Examples of heavy fuel processing by PSSF system - M100 black oil, coal tar
Examples of the fuel processing by our system - coal tar, hydrocarbon fuel
Effect of increased caloric content of fuel oil is confirmed by analysis of Russian Railways in 2013 - the original HFO - water - 2.8%, processed HFO - 6.9%, but the calorie content is almost equal. Fuel – HFO #6.
On this HFO quality, our systems work 12 months without clogging.
( Aluminum Plant in Guinea )
Different civilizations - the result of one - fuel, after our systems, burns better.

It was our first test in Croatia in November 2008 (fuel type - light heating oil, ideal of purity, 25 kilometers to the refinery)

**Table:**

<table>
<thead>
<tr>
<th>Datum</th>
<th>Cas</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.11.08</td>
<td>15:47:49</td>
</tr>
</tbody>
</table>

**Analiza Plina**

<table>
<thead>
<tr>
<th>Substance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurilno olje</td>
<td>22 °C</td>
</tr>
<tr>
<td>T-zraka</td>
<td>225 °C</td>
</tr>
<tr>
<td>O2</td>
<td>4.9 %</td>
</tr>
<tr>
<td>CO</td>
<td>113 mg/m³</td>
</tr>
<tr>
<td>NO</td>
<td>352 mg/m³</td>
</tr>
<tr>
<td>NOx</td>
<td>565 mg/m³</td>
</tr>
<tr>
<td>CO2</td>
<td>11.9 %</td>
</tr>
<tr>
<td>Eta</td>
<td>88.3 %</td>
</tr>
<tr>
<td>Izsube</td>
<td>11.7 %</td>
</tr>
<tr>
<td>Lambda</td>
<td>1.30</td>
</tr>
<tr>
<td>Toc. ros.</td>
<td>46 °C</td>
</tr>
</tbody>
</table>

**Before CO = 113**

**After CO = 76**

Contact Information:

- **TOPLANE d.o.o. RIJEKA**
  - Kozala 87
  - Tel.: 051 54 50 60
  - Fax.: 051 50 03 08
Different civilizations – the result of one - fuel, after our systems, burns better.

Less smoke, less carbon, less corrosion, less sludge, less slag, less harmful emissions (Benzopyrene, CO, SO$_2$, No$_x$) less costs to recycle fuel residues and oily water – it is our standard results for the past 10 years.
Examples of processing sludge from open storage by our system.
Test - oil sludge **visually** before and after treatment.
Examples of processing sludge from open storage by our system. Test - oil sludge burning before and after treatment.
Qualitative changes in the fuel before and after treatment - comparison table - increased caloric reduction in viscosity, partial binding of sulfur. Philippines 2017

And some results that require additional research to determine borders of effect of, but can be explained. This is the sulfur content.

The first results summary:

<table>
<thead>
<tr>
<th></th>
<th>sulfur content</th>
<th>viscosity (cSt)</th>
<th>Calorific (BTU/lb)</th>
<th>density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samp. No. 3 - original fuel</td>
<td>0.531</td>
<td>94.33</td>
<td>8,875</td>
<td>0.9822</td>
</tr>
<tr>
<td>Samp. No. 2 - original fuel processing by TRGA gomogenizatore 1 times.</td>
<td>0.458</td>
<td>77.84</td>
<td>10,786</td>
<td>0.9722</td>
</tr>
</tbody>
</table>

Percentage comparison: (-13.74%) (-17.48%) (+21.53%) (-1%)

Samp. No. 1 - the starting fuel (HFO) + Diesel 10% + processing by TRGA homogenizer

0.3 9 15.179 0.9103

Look analyzes below ...
Our industrial TEST RESULTS is 2.44 - 4.1% fuel economy for industrial boiler, oven and on some types of ship engines and industrial diesel generators.

Boilers and power plants not only on land - but also on the sea, on oil rigs on power ships, on ships with boiler power systems…

The same fuel, but more caloric and more energy.

The same objects, but lower specific fuel consumption and maintenance.

Works on the principle – install and forget.

But it works not only for open fire!
Problem with HFO quality for ships / platforms engines and diesel power plants more critical.

Problems with HFO the same - not complete burning, smoke, harmful emissions, equipment wear, slurry disposal, possibility of using cheaper fuel and reduction of fuel costs.
Test - our ship-board system for processing fuel on ships without additives. It worked continuously, without maintenance and safety for the engine - 1.5 years. Result: reduction viscosity and ash content, pour point, size dispersion of solid particles, carbon residue, reduction amount of sludge ( "-95%"), removing clots. Fuel economy 4%. Reduced smoke and harmful emissions. Conducted by a certified laboratory in Slovenia.

Analysis of the documents - modify the properties of heavy hydrocarbon fuels

<table>
<thead>
<tr>
<th>shipboard fuel IFO-180 (INA HR)</th>
<th>N</th>
<th>formal standart</th>
<th>original sample</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>density at 15 °C</td>
<td>1</td>
<td>kg/m3</td>
<td>&lt;= 991</td>
<td>947.6</td>
<td>945.7</td>
<td>945.7</td>
<td>948.1</td>
<td>949.6</td>
</tr>
<tr>
<td>kinematic viscosity at 50 °C</td>
<td>2</td>
<td>mm2/s</td>
<td>&lt;= 180</td>
<td>138.5</td>
<td>117.8</td>
<td>117.6</td>
<td>129.1</td>
<td>136</td>
</tr>
<tr>
<td>aromaticity index</td>
<td>3</td>
<td>(CCAI)</td>
<td>&lt;= 860</td>
<td>820</td>
<td>820</td>
<td>820</td>
<td>821</td>
<td>822</td>
</tr>
<tr>
<td>total sulfur content</td>
<td>4</td>
<td>% m/m</td>
<td>&lt;= 4.5</td>
<td>1.59</td>
<td>1.56</td>
<td>1.57</td>
<td>1.54</td>
<td>1.49</td>
</tr>
<tr>
<td>flash-point</td>
<td>5</td>
<td>°C</td>
<td>&gt;= 60</td>
<td>92.0</td>
<td>94</td>
<td>94</td>
<td>&gt; 100</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>amount of sediment</td>
<td>6</td>
<td>% m/m</td>
<td>&lt;= 0.10</td>
<td>0.02</td>
<td>0.05</td>
<td>0.04</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>amount of coke residue</td>
<td>7</td>
<td>% m/m</td>
<td>&lt;= 15.0</td>
<td>14.06</td>
<td>8.53</td>
<td>8.18</td>
<td>8.19</td>
<td>7.63</td>
</tr>
<tr>
<td>flow point</td>
<td>8</td>
<td>°C</td>
<td>&lt;= 30</td>
<td>+30</td>
<td>+24</td>
<td>+24</td>
<td>+21</td>
<td>+24</td>
</tr>
<tr>
<td>amount of water</td>
<td>9</td>
<td>% v/v</td>
<td>&lt;= 0.50</td>
<td>0.1</td>
<td>0.05</td>
<td>0.05</td>
<td>3</td>
<td>5.6</td>
</tr>
<tr>
<td>amount of ash</td>
<td>10</td>
<td>% m/m</td>
<td>&lt;= 0.07</td>
<td>0.04</td>
<td>0.04</td>
<td>0.03</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>amount of vanadium</td>
<td>11</td>
<td>mg/kg</td>
<td>&lt;= 200</td>
<td>125</td>
<td>122</td>
<td>120</td>
<td>115</td>
<td>112</td>
</tr>
<tr>
<td>amount of sodium</td>
<td>12</td>
<td>mg/kg</td>
<td>&lt;= 50</td>
<td>4.93</td>
<td>7.25</td>
<td>7.85</td>
<td>5.72</td>
<td>5.34</td>
</tr>
<tr>
<td>amount of Al + Si</td>
<td>13</td>
<td>mg/kg</td>
<td>&lt;= 50</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>energy value</td>
<td>14</td>
<td>MJ/kg</td>
<td>-</td>
<td>-</td>
<td>41.02</td>
<td>41.02</td>
<td>39.7</td>
<td>38.88</td>
</tr>
</tbody>
</table>

standart | no add | no add | no add | +3% w | +6% w |
1. Left - laboratory filter is completely clogged by fuel residues from original ship fuel RME IFO 180.
2. Right – the same filter, but fuel after treatment 3 times by our system. It is clean, you can see the filter’s structure only and single particles.
Photography

- changes before and after switching on our system.

(Oostende - Ramsgate Aug. 2012)

difference of emissions before and after
Photography

- visual changes in smoke before and after switching on our system on the ship

(Oostende - Ramsgate Aug. 2012)

Channel La Manche - full speed and full load
All traditional system of fuel preparation have common drawbacks:

- After filtration (separation) of fuel, part high molecular fuel moves to sludge tank;
- It does not provide complete removal of water;
- Separation systems are very expensive to purchase and maintain.

<table>
<thead>
<tr>
<th>type of equipment</th>
<th>dewatering</th>
<th>removal of solid particles in the fuel</th>
<th>loss of fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>filter</td>
<td>no (water from the fuel is not removed)</td>
<td>satisfactory</td>
<td>moderate</td>
</tr>
<tr>
<td>separator</td>
<td>good, but not excellent (the limit is caused by the fuel density)</td>
<td>good but not complete</td>
<td>large, up to 3%</td>
</tr>
<tr>
<td>PSSF system</td>
<td>no (water dispersity up to 3-5 microns)</td>
<td>good - dispersity up to 3-5 microns</td>
<td>absent</td>
</tr>
</tbody>
</table>

Our PSSF system - work continuously and without repair 1-2 years, converts 95% of sludge into fuel and totally not destroy the ship or diesel generator engine.

Our system - totally safe for diesel (HFO) engine (proved by supervision industrial diesel generator working during the 3 years) and all boilers.
Our systems work on old and new boilers, furnaces and engines, on the Russian, American, German and Italian power units, light and heavy, high-quality and shocking fuel.
Gogol Str. 405, Cherkassy, Ukraine, 18005.

Contact
5183898@ukr.net
andrruban@gmail.com

cell +(380)505183898
w.f. +(380)472313396
VIBER +380505183898
WhApp +380505183898