



# CARBON SLURRY FUEL

Equipment and Services

Effective Energy Technologies GmbH

- ▶ Production and supply of equipment
- ▶ Implementation and Engineering Services

☎ +43 664 890 4502,  
+43 660 353 4735  
@ info@cwstech.at  
🏠 www.cwstech.at

## Liquid Carbon Fuel



For public utility  
companies



Heat and steam  
for industrial  
enterprises



For asphalt  
plants



Recycling of  
pyrocarbon /  
carbon



For owners of  
coal mines in  
surface and  
underground  
mining



Recycling of  
petroleum coke



### For public utility companies

Reduced fuel costs by 30 ... 60% compared with masut and by 20 ... 40% compared with classical combustion of coal. Reduction of NOx emissions by 20 ... 30%. The minimum cost of CWS reconstruction on coal-fired boilers



### Heat and steam for industries

Reduced fuel costs by 20 ... 40% on steam production for technological needs chemical reductions of sugar refineries, textile and other industries. Steam boilers are the most adapted for the CWS reconstruction.



### Additional commercial product for owners of coal mines and quarries

The raw material for CWS are coal screenings (rubble, seed, and others), as well as sludge, which are usually utilised as waste. Application of CWS for own needs reduces the use of the trade coal shipped to consumers.



### For asphalt plants

CWS is used as a primary or additional fuel heating asphalt furnaces.



### Recycling of pyro carbon / carbon

CWS from carbon after pyrolysis of rubber tires and other raw materials, is an additional fuel for liquid fuel boilers.



### Recycling of petroleum coke

Petroleum coke, usually as a recyclable waste which can be used as raw material for CWS. Low ash of coke (less than 0.3%) lets to avoid installation of ash removal system.

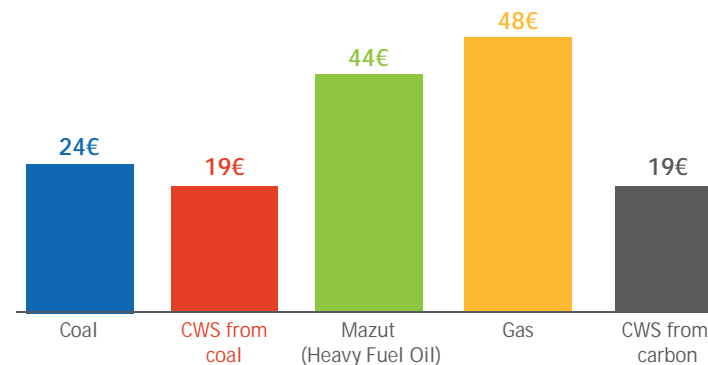


**Cost reduction for each ton of substituted oil:  
up to 45%**



**Average return on investment period:  
16 – 18 month**

**Cost of fuel components, 1 Gcal, eur**



## Comparative analysis of the cost of fuel components

Nº	Fuel type	Price of Fuel, eur/t	Calorific Value, kcal/kg	Combustion Efficiency	Cost of Fuel component, eur/Gcal
1	Coal	80	5 500	60%	24
2	CWS from coal	67	3 667	98%	19
3	Gas	400	8 400	99%	48
4	Mazut (Heavy Fuel Oil)	400	9 100	99%	44
5	CWS from carbon	70	3 800	98%	19



### Carbon Slurry Fuel (CWS)

CWS is a mixture of finely milled coal or other carbonaceous materials with water or an aqueous emulsion:

CWS = Coal (58% ... 70%) + water emulsion (29% ... 40%)

Internal moisture of most of coals is 15...30%, accordingly, the amount of added moisture does not exceed 25%. According to the feasibility study made by EET, the addition of 15 ... 20% water and its evaporation in the boiler furnace is more efficient than pre-drying of raw material and further milling.

Usage of oil-based and organic water emulsions improves CWS calorific value.

CWS has almost the same viscosity as masut (heavy fuel oil) what makes it suitable both for pumping on short and long distances and for spraying into a boiler via specially designed nozzles. Gas, oil/diesel, coal still could be used as a redundant fuel for boilers.



### Raw materials for CWS:

- ▶ Coal of most types: brown, gas, long-flaming, skinny, anthracite
- ▶ Carbonaceous Raw Materials: pyrocarbon (carbon after pyrolysis of tires, rubber), petroleum coke, etc.
- ▶ desired raw material ash content - up to 15 ... 16%



### Main Advantages of CWS Technology:

- ▶ Reducing fuel costs for coal-fired, oil-fired boiler of small and medium power for 30 ... 50%
- ▶ Complete combustion of coal (carbon) in the form of CWS, according to compared with layer combustion on coal boilers
- ▶ Significant Reduction of NOx emissions, possibility of compensation of SOx emissions
- ▶ Explosion proof
- ▶ The possibility of recycling sludge, waste



## WMM – Wet Milling Machine

Hydroshock complex of wet milling machine



## Combustion complexes

Nozzles with anchoring systems, furnace extension



## Engineering

Pre-operation works, supervision, project support, personnel training



### CWS Production equipment:

Wet Milling Machine (WMM) is a complex of hydroshock wet milling. Low costs of CWS Production, compact, simplicity of operation.

#### Technical specifications of WMM:

Performance	Up to 5 t / h
Mass share of coal in the VUT	57 ... 64%
Partical size (depend on coal)	30 ... 150 mm

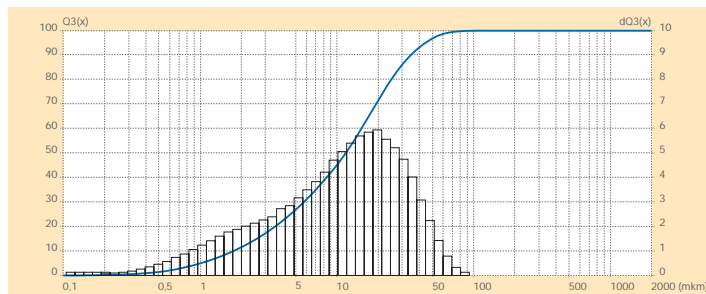
#### Energy consumption:

Installed capacity	44 kW,
Consumption during production	Less than 10 kWh / t

#### Dimensions:

Dimensions of WMM without conveyor, (L × B × H), mm	2280 × 1900 × 1750
Weight	1600 kg

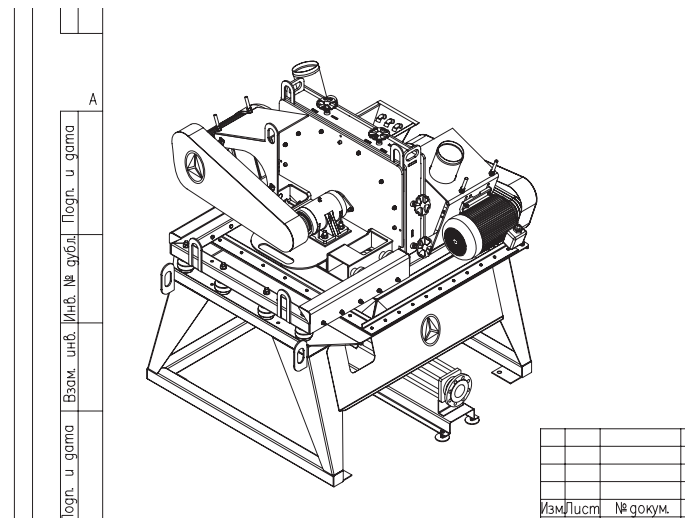
### CWS Particle Size Distribution



### WMM consist of:

- ▶ Bunker for crushed coal (0.2 m<sup>3</sup>)
- ▶ Coal dispenser
- ▶ Milling Chamber
- ▶ Metal separator
- ▶ Pumps for CWS
- ▶ RIA for water activation (vacuum cavitator)

Most of the equipment is mounted on a single frame of WMM. Hardware control is carried out from a single control shelf



## CWS production consists of three main parts:

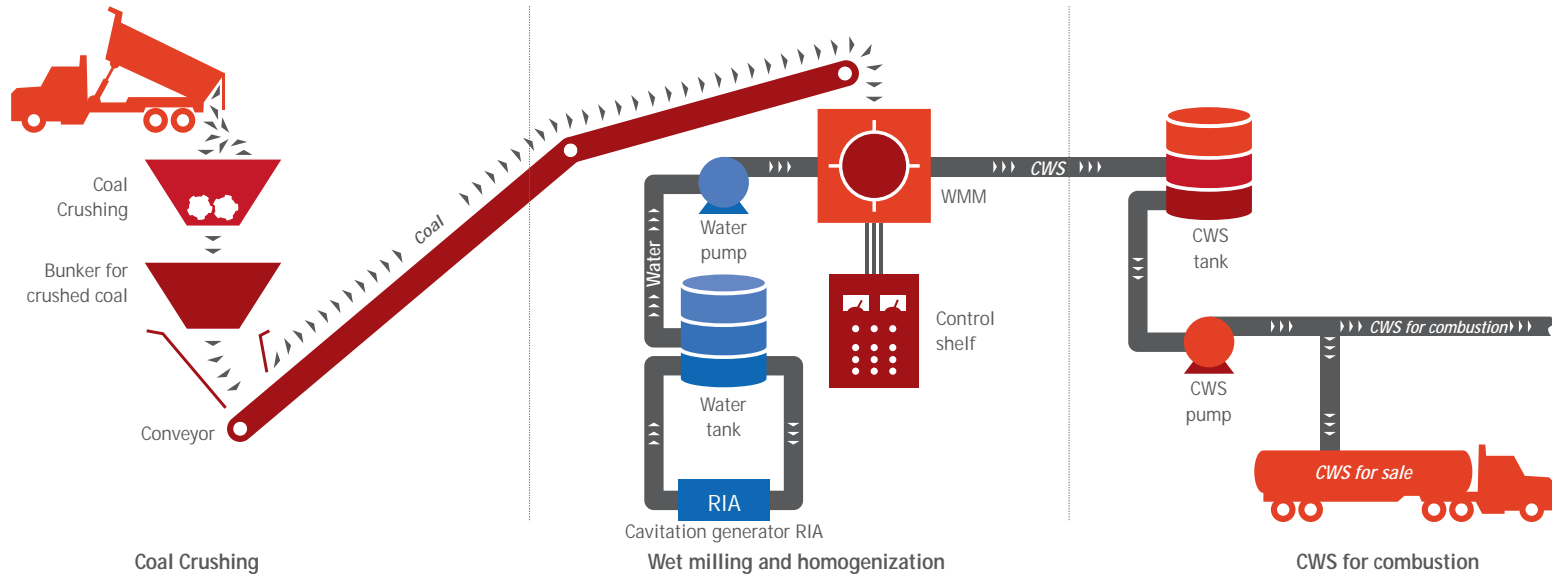
- ▶ Coal crushing if the original coal size exceeds 12 mm
- ▶ Wet milling and homogenization (WMM)
- ▶ Storage of CWS (use and/or sale of CWS)

Most of the additional equipment that connected to WMM can be produced locally:

- ▶ Intermediate water tanks and CWS
- ▶ Pumps for water
- ▶ Pipelines

Pumps for CWS EET are selects for each object individually.

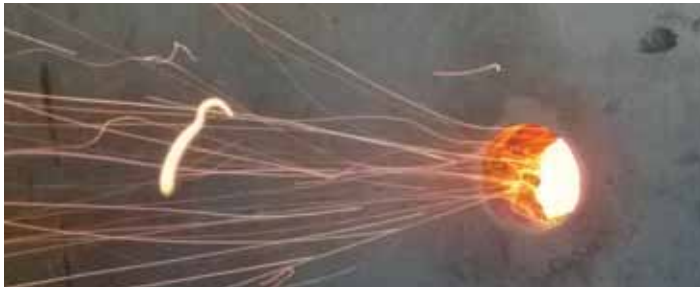
## CWS Production process





### CWS Combustion

- ▶ CWS can be burned in most of steam and hot water boilers
- ▶ Existing boilers in most cases are upgradable by replacing burners
- ▶ Existing masut-gas boilers may require installation ash collection system
- ▶ In boilers with layer coal combustion burning CWS / coal (80% / 20%) is possible
- ▶ For new construction a specially designed boilers can be used
- ▶ EET's pneumo-nozzle is designed to spray different types of fuel: CWS, masut, diesel, boiler and furnace fuel and other
- ▶ Special design of EET's nozzle and lance makes CWS spraying almost insensitive to abrasive impact of CWS



### Advantages of EET's nozzle:

- ▶ High wear resistance for abrasive water-coal fuel -1500 ... 2000 hours
- ▶ Low fuel pressure before nozzle
- ▶ Wide throughput range
- ▶ Spraying with steam or air



### Specs of the air nozzle

Nº	Specs of the air nozzle	Measure units	Range
1	CWS Flow range	kg/h	200-1700
2	CWS pressure	MPa	0,05-0,15
3	Operating pressure atomizing agent	Mpa	0,5-0,8
4	Spray cone angle	degrees	80-120
5	Fuel atomizing agent	%	10-15
6	Spraying agent	steam/air	





## Results of measuring emissions from oil-gas boilers in comparison with coal boiler:

	Burning of diesel	CWS with preheat of 20%	Coal
NOx (35 O <sub>2</sub> )	145 mg/m <sup>3</sup>	93 mg/m <sup>3</sup>	176 mg/m <sup>3</sup>
O <sub>2</sub> measured	3,7 %	3,6 %	4,8 %
Basis O <sub>2</sub>	3,0 %	3,0 %	3,0 %
Air excess	1,22 %	1,22 %	1,28 %

- ▶ Burning coal in the form of CWS reduces emissions of nitrogen oxides (NOx) in comparison with the burning coal 35 ... 40%
- ▶ Co-firing of diesel and CWS reduces the NOx emissions by 30% compared with the simple diesel combustion on the same boiler
- ▶ Mechanical underburning (q4) of coal as part of CWS does not exceed 1%, which eliminates slag emissions into the atmosphere
- ▶ Temperature combustion mode of CWS reduces slagging boiler 30 ... 50%, typical for pulverized coal combustion
- ▶ Environmentally friendly fuel at all stages of production and use, accidental spills do not harm the environment
- ▶ Ashes from the combustion of CWS contains not more than 3% of under burned carbon and it can be used in concrete fillers





*Dr. Andrey Morozov,  
CEO*

Effective Energy Technologies (EET) is an engineering company specialising in the application of coal-water fuel since 2004. Our company gathered the best international experience in production and use of CWS. A number of technological solutions have passed from the stage of research and development with the means of EET to the stage of commercial product. Our equipment is highly modular, what significantly reduces the cost of implementing the technology on new and existing facilities, as well, possibly using the local resources as well.

The equipment of EET is produced under the CE Certification.

### **Production and supply of equipment**

- ▶ WMM (Wet Milling Machine) - highly efficient wet milling complex for CWS Production
- ▶ Burners for CWS of high lifespan
- ▶ Full range of equipment for CWS production and its combustion

### **Implementation Services**

- ▶ Pre-project preparation, engineering
- ▶ Preparation of feasibility studies, fund raising
- ▶ Supervision, project support
- ▶ Maintenance, supply of spare parts, personnel training

- 2015: installation and start of CWS production and combustion system of the CWS from coal in Katowice, Poland
- 2014: installation and start of CWS combustion system of the CWS from pyro-carbon (carbon obtained after pyrolysis of tires)
- 2014: pre-project preparation for the replacement of oil for water-coke suspension of pet coke at the refinery in India. Conducted combustion tests.
- 2013: Effective Energy Technologies and Korea Trading Business Company launched the installed and started CWS fuel complex in the suburbs of the city of Suwon, Republic of Korea.
- 2013: installation of CWS production complex for Effective Energy Technologies GmbH, Vienna, Austria.
- 2011: supply of equipment for the homogenization for the Polytechnic University in Poland
- 2011: installation of CWS production complex, WMM, with productivity of 5 ton per hour for construction plant in Irkutsk region.
- 2010: installation and start of CWS production complex with productivity of 15 ton per hour based on 3 WMMs on chemical plant (Republic of Armenia).
- 2010: installation and start of CWS production complex WMM for CWS gasification installation in Biysk.

- 2009: pre-project work for assessment of the possibility of using CWS on the 3rd Unit of the Krasnoyarsk GRES-2 (WGC-6, now - WGC-2). Results of the work outlined in report of Gazpromenergoholding.
- 2009: complete of final testing of hydraulic wet grinding complex (WMM). Installed a demo stand.
- 2009: pre-design works on replacement of oil fuel on the CWS in Murmansk HPP (TGC-1). The results of the two sessions showcased at NTS TGC-1 in St. Petersburg.
- 2008: pre-work on possibility of combustion of sludge in the form of CWS on the 9th Unit Novocherkassk GRES (OGK-6, now - WGC-2).
- 2008: upgrade of 6.5-DKVR boilers and DE-25 on the use of CWS in Ensky. Combustion made on the boiler burning CWS DKVR-6,5-13.
- 2007: design of the detailed specification for boilers for burning CWS low power (up to 1 MW).
- 2007: installation and start of CWS combustion system in Ensky.
- 2007: sign of the strategic cooperation agreement with the Federal State Unitary Enterprise "Gidrotuboprovod"
- 2006: according to the agreement with the Government of the Murmansk region, EET raised funding for the implementation of CWS boiler room at the village Ensky Murmansk region





# CARBON SLURRY FUEL

Equipment and Services



*Using CWS saves your money and the environment!*

## It is worth to work with us!

- ▶ **We offer solutions which lower your costs**
- ▶ **Maximally standardized equipment, use of local resources**
- ▶ **Individual approach to each client**
- ▶ **Equipment supply on a full construction basis as well as individual elements**

Effective Energy Technologies, GmbH  
Vienna, Austria

Tel.: + 43 664 890 4502,  
+43 660 353 4735  
e-mail: [info@cwstech.at](mailto:info@cwstech.at)  
web: <http://cwstech.at>

### Interested in the implementation?

Contact us:

[info@cwstech.at](mailto:info@cwstech.at)

or contact our office:

Donau-City-Straße 1, Ebene 1, Büro 1  
1220 Wien  
Austria / Österreich

To go to the site,  
Scan the QR-code

