

# COAL DEGASATION AND CBM PRODUCTION

# ABOUT NOVAS GROUP

- Novas Group was established in 2007
- Enhanced recovery technology successfully applied in hundreds of wells in North America, Russia, Middle East and East Asia
- Offices and service centers in Houston, Calgary, Beijing and Moscow



# ABOUT TECHNOLOGY



**Depth** — up to 13,000 ft  
**Temperature** — up to 212 F  
**Energy density** — 1,5 kJ  
**Diameter** — 2.5 inch, 4 inhc

**Voltage** — 110/220 V  
**Input power** — 500 W  
**Output** — 102 MW  
**Impulse** — 55 ms

PROPRIETARY PATENT PENDING TECHNOLOGY - US20160319644A1



# TECHNOLOGY IN DETAIL

- PPT tool cleans production intervals to change the wells inflow conditions by clearing near wellbore damage while increasing the relative mobility of coal bed gas
- The tool generates high power shock waves having non-linear, broad band, repetitive pulsing and directed energy characteristics. The shock waves clean completed intervals then propagate and translate into elastic waves in the coal seam to compress and stretch the surrounding area
- Introduction of elastic vibrations into natural coal seam initiates resonant frequencies of “Plasma Waves” that increase the secondary permeability of coal seam that stimulate the transfer of gas into free state
- It is relatively inexpensive to treat a well because it is deployed on standard wire line cables and the service tools and crews are mobile

# ADVANTAGES



## Low Cost:

Significantly lower than hydraulic, CO<sub>2</sub> or nitrogen treatments



## Repeatability:

can be applied several times



## Selective Impact:

specific interval with precision of up to 4 inch



## Environmentally friendly:

no chemicals used, lower impact on adjacent land due to small crew and equipment efficiency



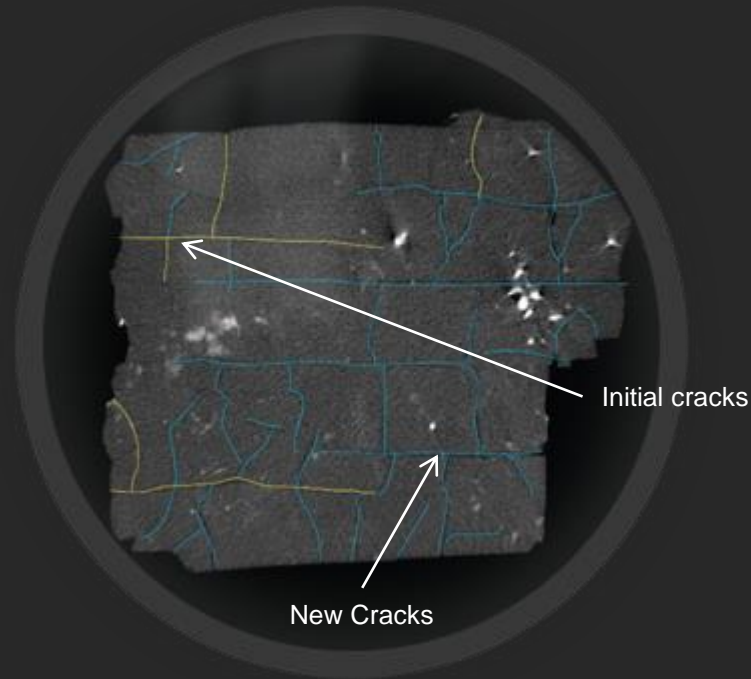
## Higher Recovery:

elegantly precise and accurate impact on coal matrix (butt/face cleats) to improve recovery factor



# ADVANTAGES FOR COAL MINING COMPANIES

- **Lower price:** one third of the price of traditional degasification technology (5x – 20x cheaper than fracking)
- **Faster process:** it takes 2 to 4 times less time to de-gas the coal seam and get it ready for start of mining process

# TOMOGRAPHY

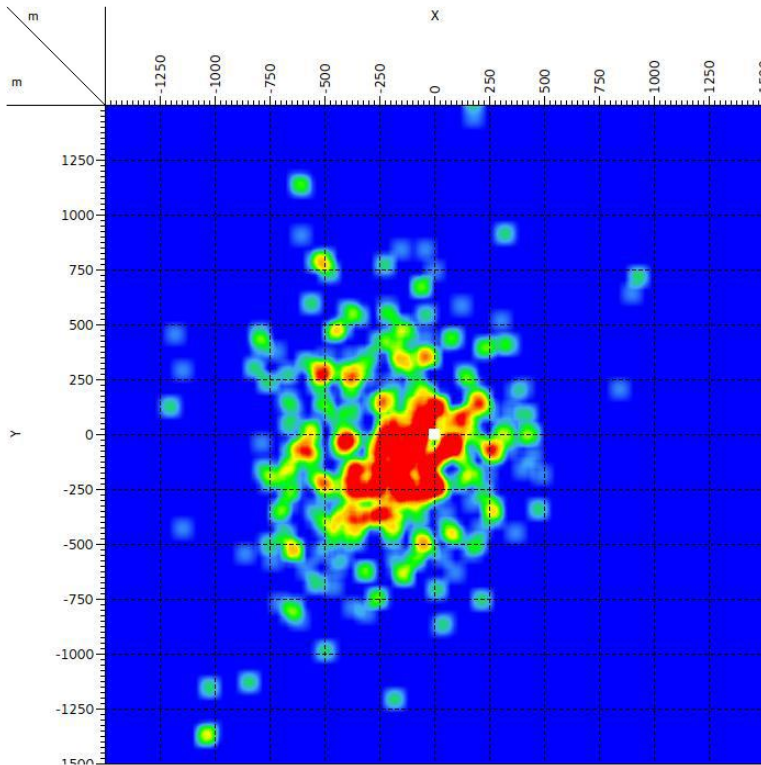


**Sample size** – approx. 1.5 inch  
**Resolution** – 30 microns

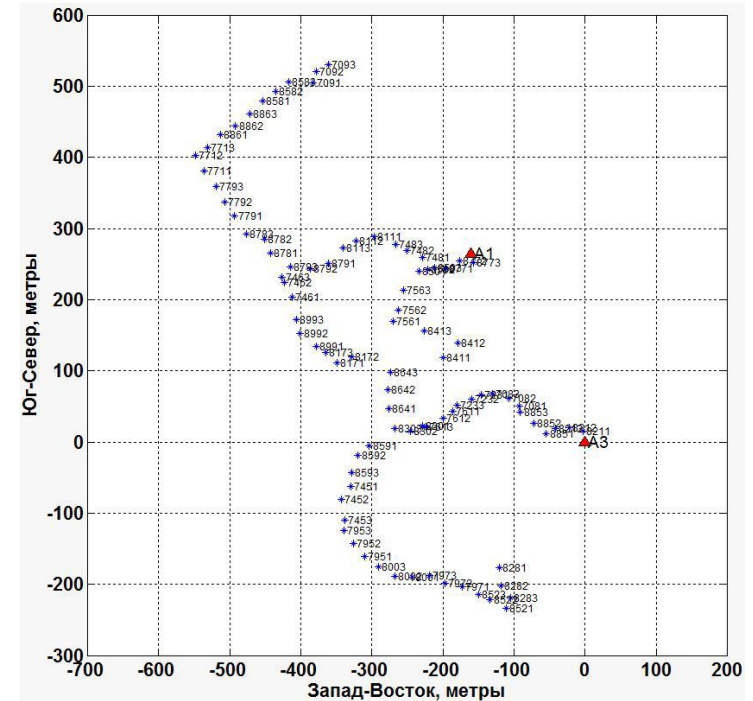
 Initial cracks before PPT  
 New Cracks after PPT



# MICROSEISMIC MONITORING RESEARCH



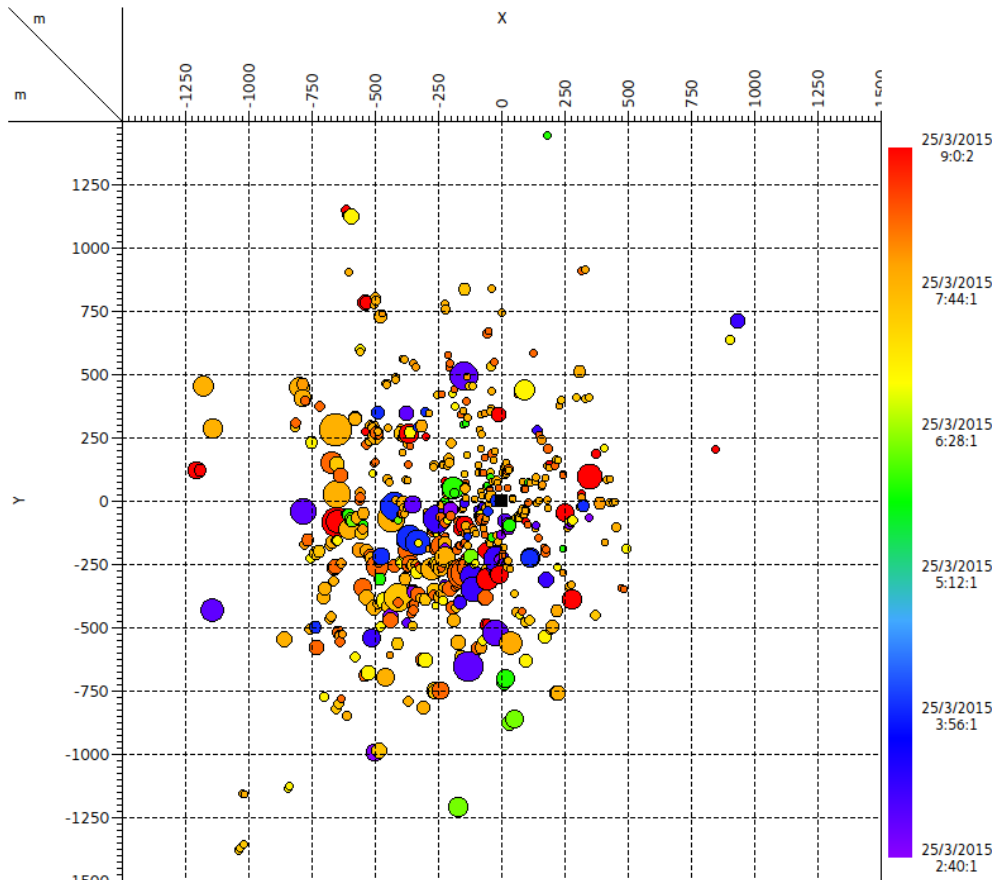
Location of microseismic antenna  
in regards to wells A1 and A3



Density map of **microseismic** emission  
energy in the projection to the surface



# MICROSEISMIC MONITORING RESEARCH



Map of microseismic events recorded during the monitoring process.

Event size proportional to their energy;

The total number of events is equal to 703, energy emission

- **3004 kJ**,

the energy of the maximum shear stress - **1950 kJ**

# WELLS ARE PUT INTO PRODUCTION

**Start:** July 2016

## Description:

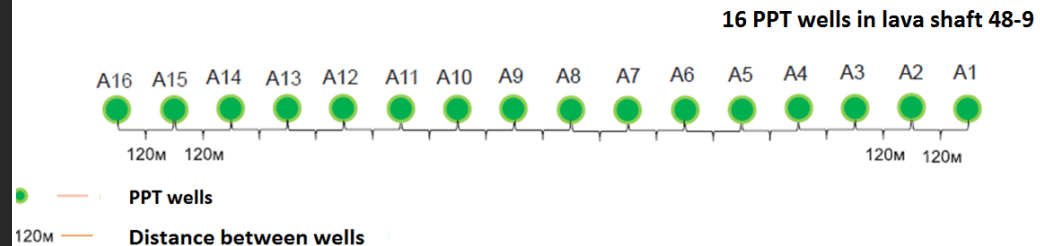
**Step 1:** Drilling of 8 wells 740 m in depth within limits of lava shaft 48-9. Distance between wells is 120 meters.

**Step 2:** Drilling of another 8 wells within limits of lava shaft 48-9

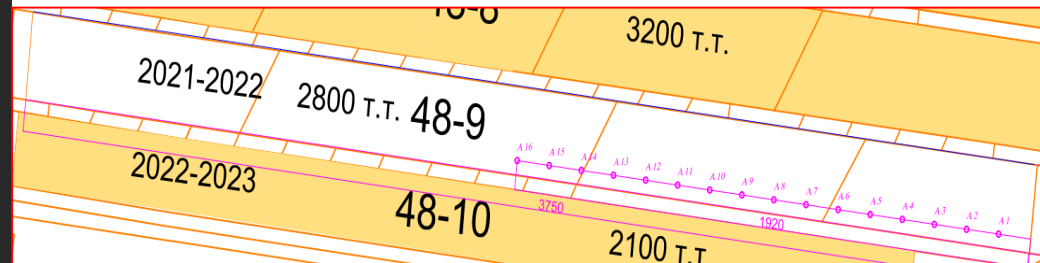
**Goal:** to reduce natural gas content of coal in wells from 25 M<sup>3</sup>/T to 13 M<sup>3</sup>/T

**It is necessary to extract methane:**  
14,500,000 m<sup>3</sup>

**Completion:** 2021-2022



Start drilling - November	2016
Wells are put into production	
A1-A4	01.03.2017
A5-A8	01.04.2017
A9-A12	01.04.2017
A13-A16	01.06.2017



- **The current date:** 02.04.2019
- **Currently producing wells:** 8
- **Wells drilling:** 11 (3 wells on PPT treatment)
- **Methane Extracted:** 6,076,092 m<sup>3</sup>
- **Expected deadlines:** January, 2021

# WELLS ARE PUT INTO PRODUCTION

Well #	Current* daily production rate of CBM from wells (m <sup>3</sup> per day)	Cumulative CBM production per well (m <sup>3</sup> )	Term well operation (days)	Maximum CBM flow rate (m <sup>3</sup> per day)	Average water flow rate (m <sup>3</sup> per day)
A5	1 418	398 004	497	1722	57
A6	1 005	174 175	353	1081	60
A7	2 667	487 966	284	3377	51
A8	976	357 752	436	1610	37
A9	3 030	1 304 212	618	4515	35
A10	2 297	1 512 199	652	4407	26
A11	2 021	1 290 678	630	4248	22
A12	1 048	551 106	534	2127	25

**Accumulated CBM production is 6,076,092 m<sup>3</sup>, methane purity is 97.41%**

**\* April 2, 2019**

# CONTROL EQUIPMENT, REMOTE MONITORING AND AUTOMATION SYSTEM INSTALLATION





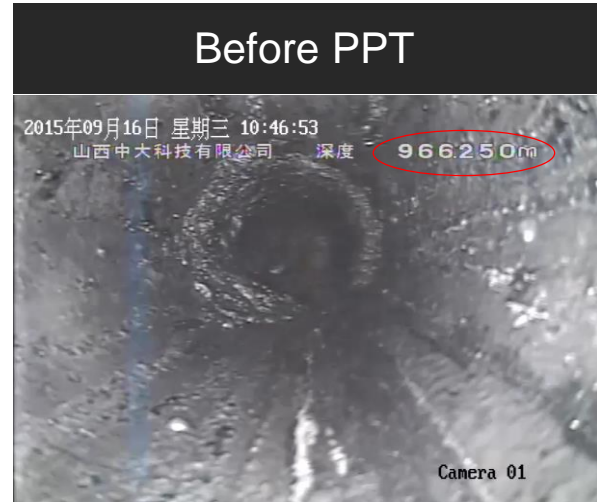
# WELLS ARE PUT INTO PRODUCTION



# TECHNOLOGY IN ACTION (1/2)

4-year old well was treated in Qinshiu basin in China (coal type – anthracite):

- Production increased from 15 MCF/D to 97 MCF/D



Please click on pictures to watch video

# TECHNOLOGY IN ACTION (2/2)

7-year old well was treated in Qinshiu  
basin in China

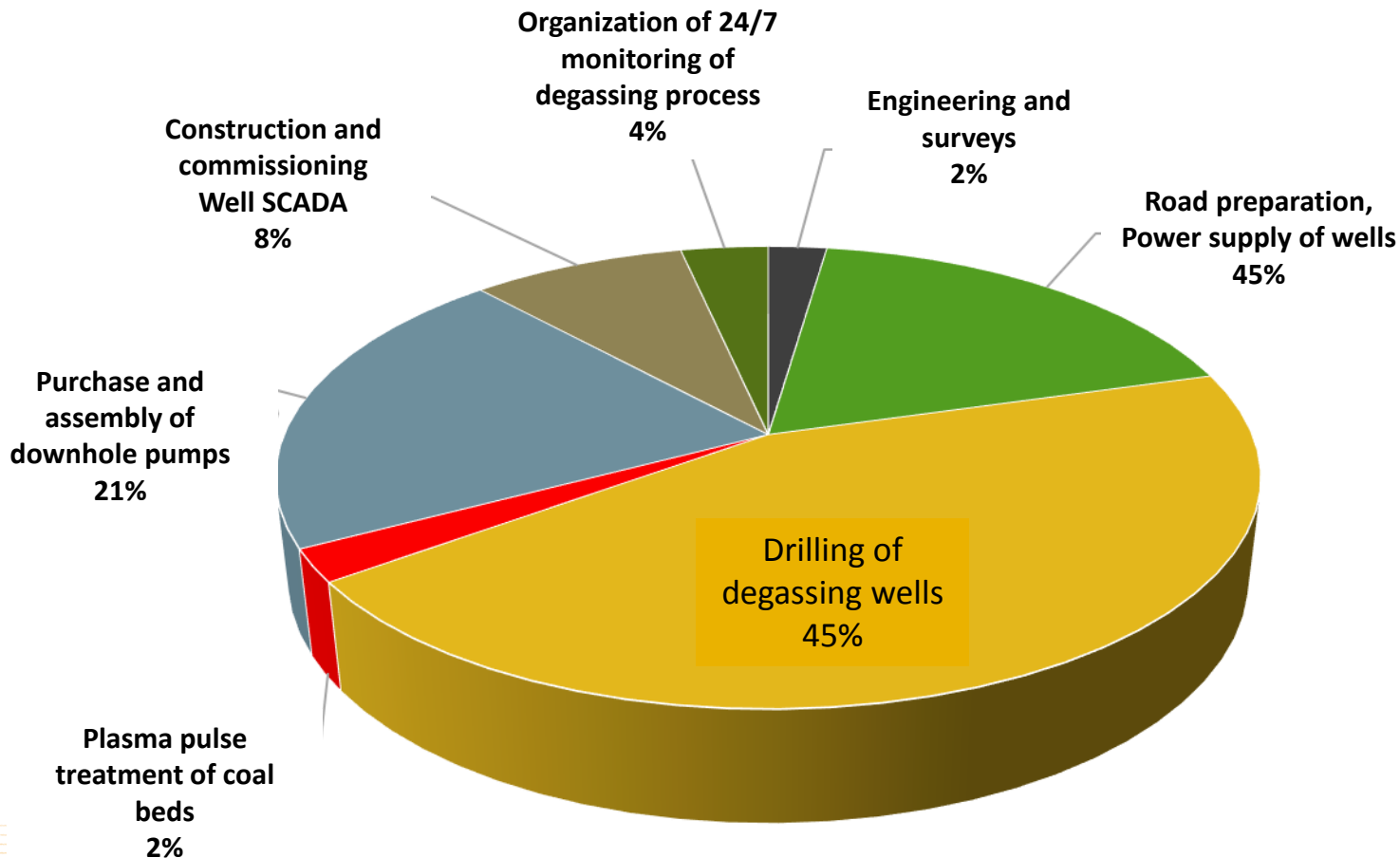
Production increased from 9 to 15  
MCF/D (coal type – anthracite)



[Please click on pictures to watch video](#)



# EXAMPLE OF PROJECT COSTS STRUCTURE





# ECONOMIC EFFICIENCY

- Extracted pure methane is ready for use (no additional preparation required)
- Wells are further used as intended for dome degassing
- Period or readiness of mining streak is reduced
- Increases the rate of penetration of coal mining machine
- Reduces the cost of traditional degassing
- Increased safety of underground works