



# **Underground Coal Processing and Dry Geothermy in Poland**

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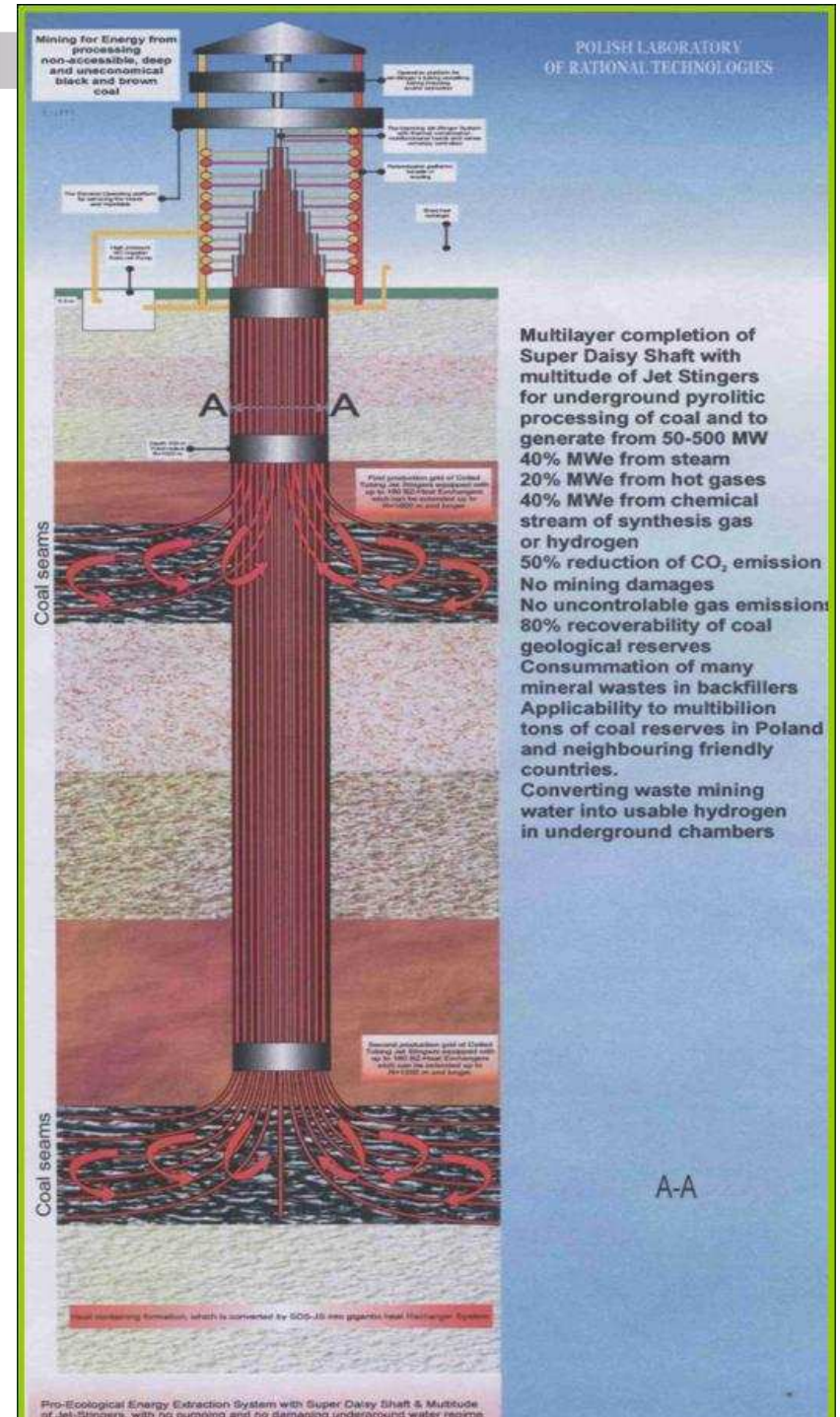


# Pilot for Complex Extraction of Energy from Coal (CEEC)

- ❑ **Polish Laboratory for Radical Technology**
- ❑ **Considered localization: Paruszowiec (Upper Silesia):**
  - ❑ two coal seams at 380m and 580 m)
  - ❑ thickness: 9.0 i 7.0 m
- ❑ **Timeframe for the CEEC pilot : 24 months**
- ❑ **Cost 55-70 million euro**
- ❑ **Parameters**
  - ❑ georeactor 1.6 km<sup>2</sup>
  - ❑ Syngas production 100 mln m<sup>3</sup>/y (or 75 mln m<sup>3</sup>/y hydrogen)
  - ❑ 30-50 MWe
  - ❑ 25 years of exploitation
- ❑ **Cost of power generation      0.020 euro/ kWh**
- ❑ **Cost of syngas:                      0.022 euro/ Nm<sup>3</sup>**
- ❑ **Emission parameter                250 kg CO<sub>2</sub>/ 1 MWh**

□ Super Daisy Shaft (SDS)  
 □ Based on technologies and expertise from 29 Operational Oil/Crude Oil/Sulphur/Salt Plants by prof. Bohdan M. Zakiewicz  
 □ Integration of 11 known technologies

- Large diameter shaft containing all processing pipes
- patents USA: 4,289,354; 4,550,779; 6,318,468; 6,679,326; EU: 143,626; 144,203; PL 48,717; 57,680; 74,993



## Horizontal drillings with Jet-Stingers

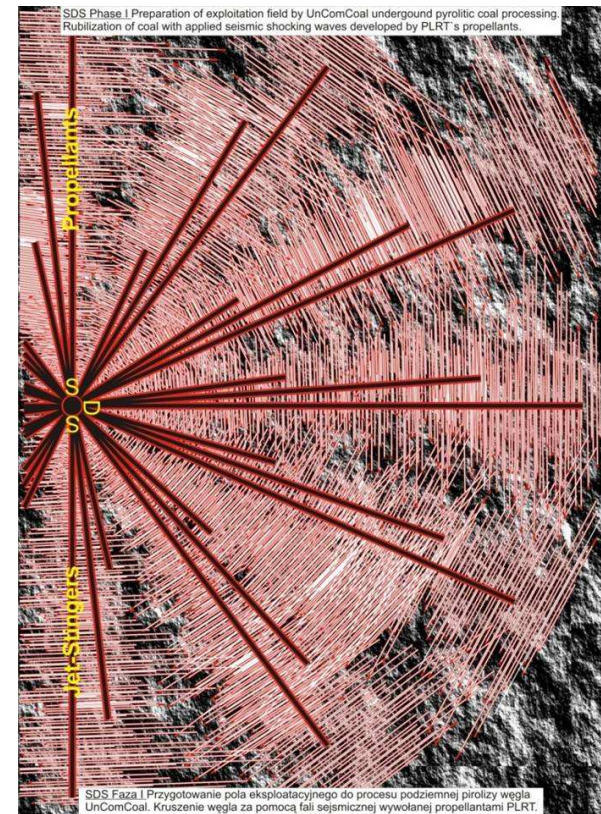
- ❑ coiled-tubings
- ❑ patents USA: 4,289,354;  
4,550,779; 6,318,468; 6,679,326;  
EU: 143,626; 144,203; PL  
48,717; 57,680; 74,993
- ❑ Technology tested for sulphur  
mine Mishraq (Iraq), bitumic  
asphalt Oxnard and Paris Valley  
(California), Glendale (TX),  
Texistipec and Jaltipan (Mexico).



AMKIN  
model DCT 800VTL.

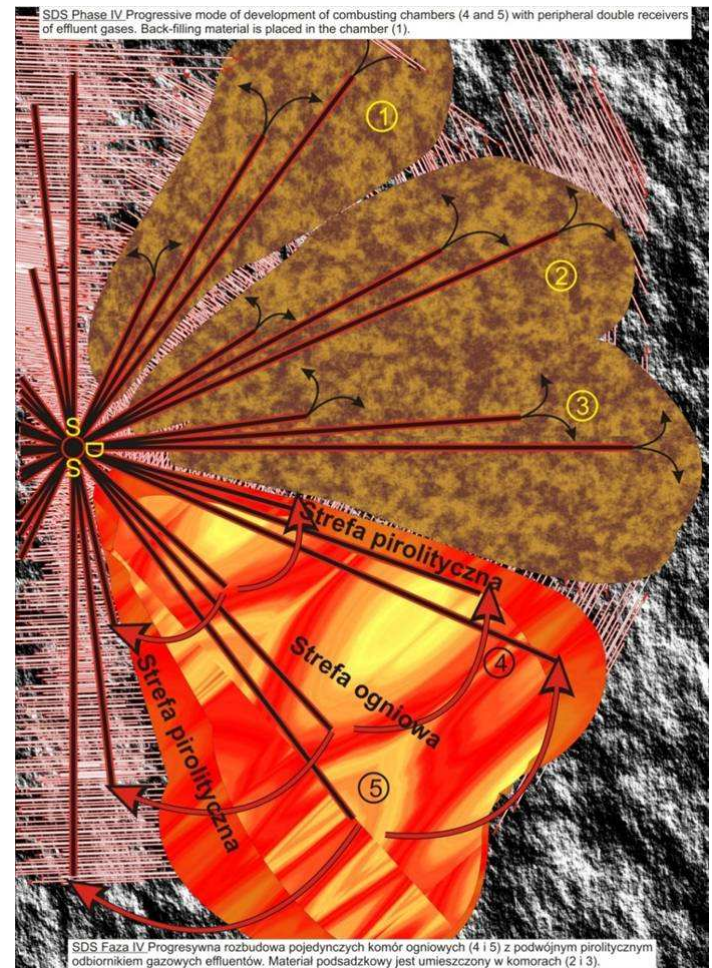
## Rubblisation of coal seam

- ❑ solid propellants
- ❑ Quasi-seismic pirotechnic micro-fractionation of coal (pat. USA: 4,305,463; 6,318,468; 6,679,326;)
- ❑ Technology tested in Paprotnia, Osobnica, Basznia (Poland), Mishraq (Iraq), Oxnard & Paris Valley (California), Dewey (Oklahoma)



## Three chamber processing

- ❑ Combustion chamber (900C)
  - ❑ Pyrolytic chamber (450C – 500C)
  - ❑ Back-filling chamber
- 
- ❑ patents USA: 4,289,354
  - ❑ Cooperation with Petro-Z i Recovery Technologies Corp. w El Segundo, California.





## CEEC advantages

- 1. Efficiency of coal processing up to 66%**
- 2. Three sources of energy**
  - ❑ Chemical of syngas
  - ❑ Thermal of syngas
  - ❑ Thermal of heat exchangers
- 3. Emission performance 100 -250 kg CO<sub>2</sub>/1MWh**
  - ❑ Partial sequestration of CO<sub>2</sub>
  - ❑ Dry, deep geothermy contribution
  - ❑ Biomass co-firing



## Deep dry geothermy

- **Possibility to mix both technologies**
  - Underground coal processing
  - Deep dry geothermy
- **Vertical drilling to 7-10 km deep**
  - heat exchangers
- **Possibility to reduce emission performance to 100 - 250 kg CO<sub>2</sub>/1MWh**
- **20-30 MWe of extremely low cost**



# CEEC

as a clean coal technology  
can be integrated with CCS

parameters	PILOT CEEC PARUSZOWIEC -PLRT	COMMERCIAL CEEC PARUSZOWIEC -PLRT
Power generation	30 MWe	100 MWe
Cost of 1 kWh	0,019 €	0,017 €
Syngas production	100 million m <sup>3</sup> /y	260 million m <sup>3</sup> /y
Cost of 1 m <sup>3</sup> of syngas	0,052 €	0,022 €
Cost of investment	49,9 million €	165.7 million €
Capital return	2,3 y	2 y
IRR	34%	44%
Cost of installation of 1 MWe	1.4 million €	1.6 million €
Development time	24 months	36 months
Exploitation time	25 years	25 years
Emission performance:		
Biomass co-firing		
Partial sequestration of CO <sub>2</sub>		
Deep geothermy		100 kg CO <sub>2</sub> /1MWh
Applied with CCS – net negative carbon effect		-200 kg CO <sub>2</sub> /1MWh