

# CBM TECHNIQUES IN THE SULCIS AREA (SW SARDINIA, ITALY)

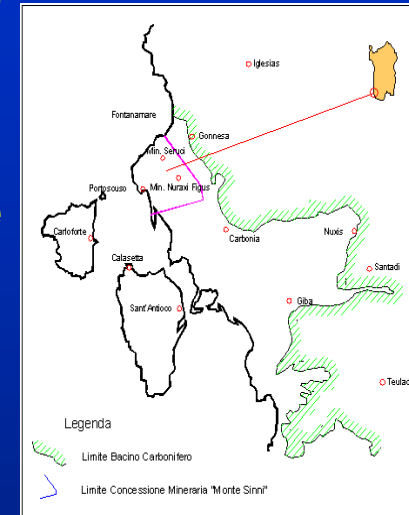


# CARBOSULCIS S.p.A

## A CBM Project in Italy

Carbosulcis S.p.a.

- ❑ The most significant project in Italy about exploitation of Coal Bed Methane, is developing in the coal basin of the SW of Sardinia.
- ❑ The CARBOSULCIS spa Company, owned by Sardinian Government, holds the concession for mining activities in the only active coal mine in Italy.
- ❑ CARBOSULCIS is located in a highly industrialized area, concerning with metallurgical and chemical production, and power generation.
- ❑ Carbosulcis Company directly attends a project for CBM technology applications not only in its coal basin mine concession, but in the whole eocenic basin, with the main National Institutes of Research.
- ❑ Carbosulcis Company holds quality and environmental certifications and belongs to several international committees about CCTs.



# **CARBOSULCIS spa**

## ***The Italian Mining Company in the Coal***

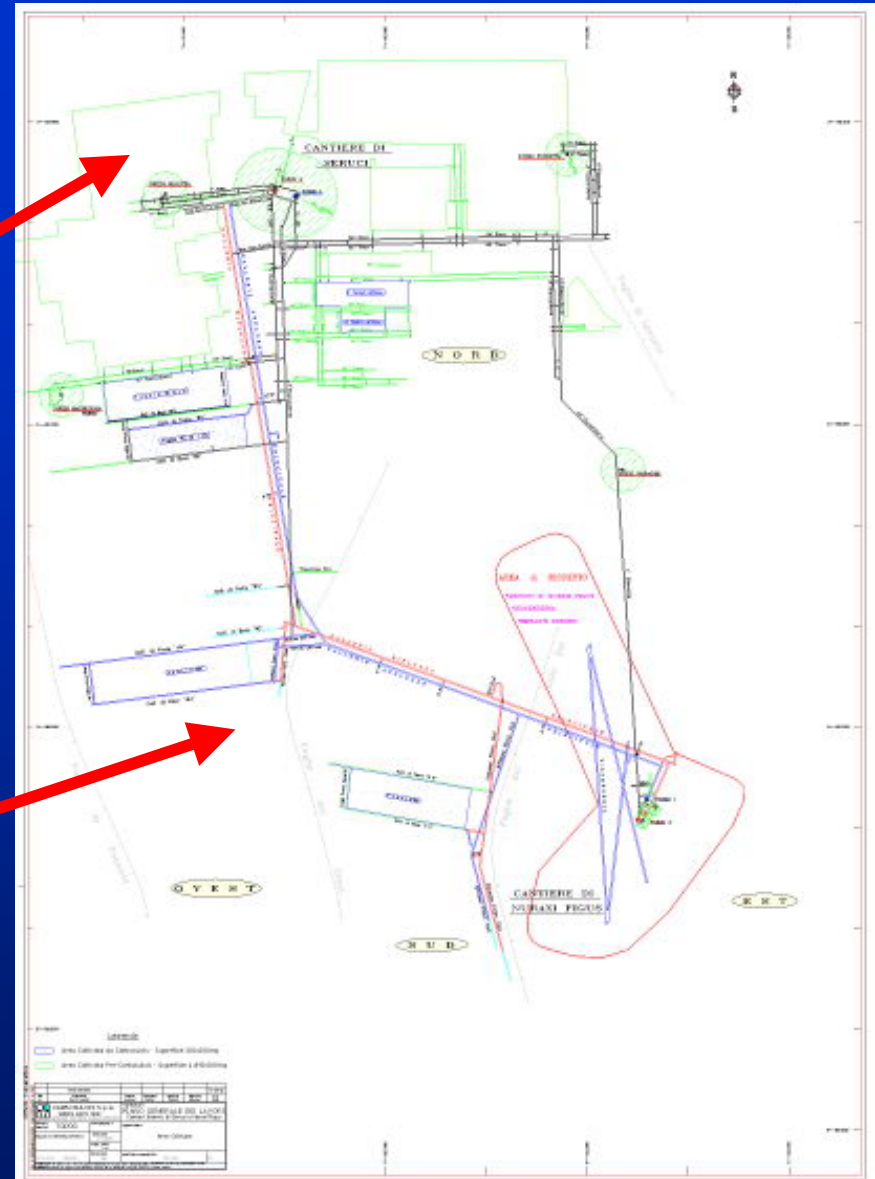
- ❑ The whole Eocenic Caol Basin that embraces the “Miniera Monte Sinni” Coal Minig Concession, is exploited since the end of 19<sup>th</sup> century**
- ❑ 600 million tons of salable sub-bituminous coal from the coalfield of whole Sulcis Area (about 1400 km<sup>2</sup> equally parted between in-shore and off-shore)**
- ❑ About 20 km<sup>2</sup> net mined areas and abandoned drives in the whole coal basin**
- ❑ 60 million of tons of salable coal in the 550 km<sup>2</sup> mine concession area**
- ❑ 1.5 million tons/year of salable coal production potentiality with long wall system technology**
- ❑ 15 km of main mined drives**
- ❑ 30 km of development drifts**
- ❑ 600 employed labour units between surface and underground**
- ❑ Distance from Coal Mine to ENEL Coal Power Station, 3 km**



# Mining plan in the "Miniera Monte Sinni" Coal Concession

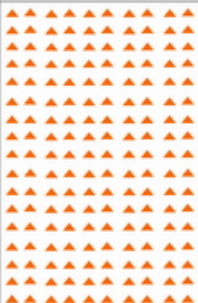
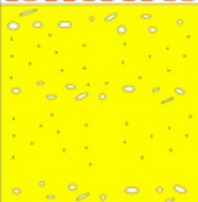

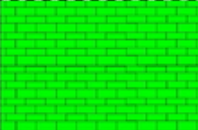
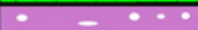
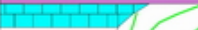

Mined area

Exploiting area





# Stratigraphy

STAGES		FORMATIONS	MAJOR LITHOLOGIES	DEPOSITIONAL ENVIRONMENT		
<b>CAENOZOIC</b>	MIocene	Volcano-sedimentary complex		Pyroclastics rhyolitic ignimbrites andesitic basalts	Volcanics interbedded within continental terrigenous successions	Not studied
	OLIGOCENE	Cixerri Fm. <small>Appr. 450 m</small>		Polygenic conglomerates sandstones siltstones claystones	Alluvial fans braided plains	Alluvial fans
		Productivo Fm. <small>Up to 300m</small>		Siltst. Sandst. Cgl coal freshwater limest marl claystones	Fluvial channels palustrine lacustrine paralic lagoonal	Fluvial channels supralittoral paludal-lagoonal littoral
	(Early) EOCENE	Miliolitic Limestone Fm. <small>30-70 m</small>		Bio-calcareous marl	Hypersaline & mesohaline lagoons	Sublittoral
	Palaeocene	Basal Conglom.		Conglomerates	Transgressive lag	
Mesozoic	Dolomite					
PALAEOZOIC BASAMENT		PERMO-TRIASSIC		Folded metasedimentary formations		Not studied

# **CBM**

## ***Sardinian Project***

**The feasibility study carried out by Carbosulcis, and supplied by Sotacarbo, INGV, IES and ETH, produced interesting conclusions, to be dealt as a starting point for the next step:**

- ❑ Geological fair conditions for CBM production, mainly in unminable areas of the Eocenic basin (*800-1500 m depth*).**
- ❑ Analogies between Sulcis coal basin characteristics (coal, aquifers, deep groundwater, etc...) and the ones corresponding to already exploited sites by CBM plants (Recopol-Poland, USA).**
- ❑ Theoretical estimation about production of CBM and further ECBM, for methane recovery.**

# Coal data details

The Sulcis Coal is classified as sub-bituminous, rich with vitrinite, very important maceral component able to slow down desorption of methane.

The Productive Formation thickness is about 50-80 m, and consists of 10 seams.

Petrographic analysis has been carried out on several samples from different seams in -400 m depth.

The Vitrinite Reflectance is very close to the optimum for maximum CBM potentiality ( $R_o = 0,7\%$ ).

	VITRINITE [%]	REFLECTANCE [ $R_o$ %]
<i>Seam 1</i>	93	0,67
<i>Seam 2</i>	89	0,67
<i>Seam 3</i>	85	0,68
<i>Seam 4</i>	82	0,67
<i>Seam 5</i>	100	0,67
<i>Seam 10</i>	89	0,70



## ***Coal data details***

**The Sulcis Coal moisture varies between 5 and 7 % at the current mining depth, but it highly depends on the depth itself.**

**Increasing moisture causes a reduction of the methane production potenciality, because of its attitude of “competing” with methane in filling up the useful coal matrix voids.**

**The reduction of moisture from 6% to 1%, assumed at higher depth, provides a rise of methane production.**

# Coal data details

<b>MAIN CHEMIC PARAMETERS OF THE SULCIS COAL [Mean %]</b>	
<i>Moisture</i>	<b>6,91</b>
<i>Volatile Matter</i>	<b>44,09</b>
<i>Ash</i>	<b>31,26</b>
<i>Fixed Carbon</i>	<b>19,4</b>
<i>Total Carbon</i>	<b>45,96</b>
<i>H</i>	<b>4,04</b>
<i>N</i>	<b>1,21</b>
<i>O</i>	<b>11,93</b>
<i>S</i>	<b>5,6</b>
<i>PCS</i>	<b>4415 kcal/kg</b>
<i>PCI</i>	<b>4177 kcal/kg</b>
<i>Ui</i>	<b>5,25</b>

# CBM in SULCIS as a whole

ACCORDING TO THE International Energy Agency RESERVOIR SCREENING CRITERIA THE OUTCOMES CAN BE SUMMARIZED AS FOLLOWS:

- **Reservoir homogeneity** ☺ ?
- **Minimal presence of faults and folds** ☹ ?
- **Range of depths (800 – 1500 m)** ☺ ?
- **Coal bed condensed geometry** ☺ ?
- **Sound permeability** ☺ ?
- **Coal composition** (macerals, rank, ash) ☺ ?
- **“Miliolitic Limestone” groundwater composition** ☺ ?
- **GIP (Gas in Place) and its saturation** ☹ ?
- **Moisture content** ☹ ?

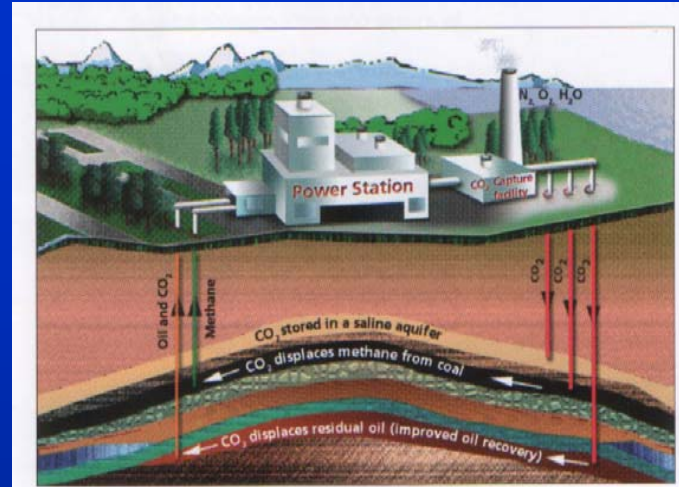
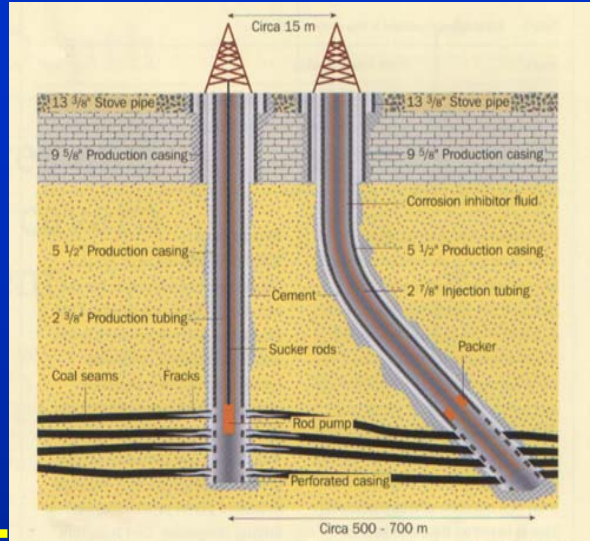
# THEORETICAL ESTIMATION

	ONSHORE	OFFSHORE	TOTAL
<i>Estimated PG by CBM (MMCM)</i>	6687	4566	11253
<i>Estimated PG by ECBM (MMCM)</i>	12037	8219	20256

CBM and ECBM reserves (Producible Gas = PG) in Sulcis. MMCM = Millions of Cubic Meters, MMT = Millions tons.

# ***CBM NEXT STEPS & GOALS***

- ❑ Start a survey campaign “in situ” supported by the outcomes of the previous study.**
- ❑ Application of seismic technology to produce a detailed geologic map of the coal basin, down to depth concerning with CBM exploitation.**
- ❑ Undertake a drilling campaign in-shore and off-shore to verify seismic data.**
- ❑ Implementation of technical and scientific know-how aiming to reach the best technical solutions for Power Generation with CBM.**
- ❑ Find new technological and financial Partnerships.**
- ❑ Make the Sulcis coal basin site a Pole for Scientific Studies about CBM-ECBM developing technologies, and a productive site for CBM exploitation and CBM Power Generation.**



**THE FORECAST FOR  
CBM EXPLOITATION IS  
RATHER ENCOURAGING**



## ***CBM main expectation from M2M***

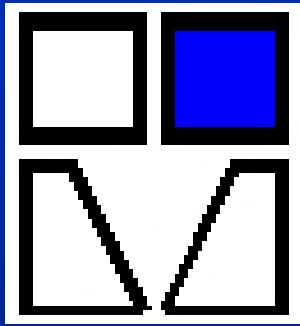
**Methane recovery in a coal basin under mining exploitation concerns with Abandoned Mines and Air Ventilation as well as Coal Beds reservoirs.**

**Carbosulcis is deploying several resources to carry out a concrete project for CBM and further ECBM utilization, but aims to undertake parallel initiatives to reach a wider project for methane recovery as a whole.**

**More than 2 km<sup>2</sup> of mined drives in the present concession and about 20 km<sup>2</sup> of abandoned mines, may represent an important methane reserve to be discovered.**

**The main issue to face is the lack in know-how about VAM and AMM approach, data analysis, techniques, monitoring systems, safety operations, methane recovery methods.**

**In such context Carbosulcis is searching wider instruments to be successful. The coal mine methane subcommittee represents an interesting source of perspectives for its international involvement, with experienced partnership.**



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