

METHANE TO MARKET PARTNERSHIP
Coal Mine to Market Subcommittee
Country Profile: ITALY

1. INTRODUCTION OR SUMMARY OF COAL INDUSTRY AND CMM RECOVERY/USE

a. Coal Industry

- In Italy natural energy resources are rather poor, and placed in some specific geographic areas. They consist of some deposits of natural gas along the Padana plain, oilfields in the seas of the south Italy, and mines in Toscana, abandoned since the fifties, and in the Mediterranean isle of Sardinia.
- The only operating underground coal mine in Italy is the “Miniera Monte Sinni” in the South West of Sardinia. The company “Carbosulcis s.p.a.” possesses the mining concession for this coal basin. Its last production was estimated within 1,3 million of tonnes/year mined through longwall system. The whole reserve is supposed to amount up to 600 millions tons of sub-bituminous coal, while actually the concession consists of 50 millions tons of mining coal. The mine supplies a coal thermal plant which through its electric power mainly feeds the surrounding industrial site. Actually it is considered a strategic resource site, but the last new policy to revalue coal in spite of oil, according to the new technologies for environment respect, means to increase the coal request and thus the mining production.
- The relaunching of coal is due to growing power request, but aided by the possibility to reduce dioxide emission. This is the direction that Italy is moving to.

b. CMM Recovery/Use

- At the moment the mining production regards activities at the average of 400 m under ground line. At this depth methane percentage is quite low. Anyway the basin develops along SW direction till 800 m depth, where geologic conditions may be different and several project for exploitation are ongoing.
- Some old abandoned underground mines in Toscana, have proved the presence of significant quantities of coal bed methane, not just nowadays but even during the mining activities of the fifties.

2. OVERVIEW OF CMM POTENTIAL, LIST OF EXISTING OR PLANNED PROJECTS AND UPSTREAM/DOWNSTREAM TECHNOLOGIES

- Since now only a few natural deposits of coal methane among different resorts in Italy have been found, but they were not significant to drive a policy to promote CMM drainage enterprises.
New technologies and new monitoring and drilling systems may now drive in an opposite direction respect of the past.
The Sotacarbo”, a coal technology R&D company, the “Carbosulcis” a coal mining company and the “Istituto Nazionale di Geofisica e Vulcanologia”, the national institute for geophysics and volcanology, are now working for new aims. Although the very low gassy of Sardinian mines, there is a project still an embryonic stage which does not exclude the possibility to find methane deposits in depth between 800 m and 1500 m. The interest is due not only to permit the methane draining but in the meantime to capture and sequestrate CO₂. Some activities of the project will be main subjects of CMM research as well. Thus, the CMM could be part, or development, of an ECBM (Enhanced Coal Bed Methane) project.
- The “Istituto Italiano di Geofisica e Vulcanologia” is studying the feasibility of draining methane from the abandoned mines of Toscana but it is still in a beginning stage.
- Now the necessity is to develop and improve know-how and technologies about new feasibility and possibility to recover methane from coal beds, and if possible in the meantime to capture and sequestrate CO₂, verifying if and how these two technologies join together.
- A resource of coal mine methane could come from Sulcis coal abandoned mine too.

3. CHALLENGES AND/OR PRIORITIES TO GREATER CMM RECOVERY AND USE

a. Gas ownership:

- Italian laws permit a both governmental and private company to practice in energy field recovering natural resources and producing power. About ownership, laws confer such companies the right to drain methane as well as to mine coal, according to concessions which must be renewed periodically.
- Not exclusively the company which practices in coal mining must be the same which practices in draining methane, even if it is in the same coal basin.

b. Legal framework

There is no regulation specially tailored for CMM. Therefore it is possible only to explain the existing legal framework.

- **Licensing:** State government is the exclusive owner of all natural resources. Laws manage the field of concessions, rules and ways to operate respect of production processes, men’s health, environmental safety, etc., according to European regulations. Moreover, local administrations can issue laws which limit or enlarge the field of their appliance depending of social, politic, economical, geographical or environmental requirements.
Respect of possible coal methane draining, it is suppose to be under governmental laws interpretation.
- **Royalties:** In Italy royalties for mining activities are only government-owned. It gives concession to public or private companies for practicing in recovery resources

and producing power. Royalties are quite cheap, and depend on the effective mining activity basin extension. Limits and permissions are imposed by government laws.

- **Taxes:** Italian government imposes several taxes on revenues from all the resources for power generation, both to the producer and the consumer.
- **Production Sharing Agreements:** No official agreements have been subscribed yet since right now.
- **Environmental Standards:** Italian laws accord to environmental safety, impose limitations for outlet emissions to atmosphere, for process waters (waste water), for dumps, for noise pollution prevention, and for every possible pollution threat from civil or industrial men appliance. The respect of rules and the monitoring of pollution is made by local governmental agencies (ASL, ARPA, etc..) which provide for giving permission to start up a industrial or civil process after verifying the respect of such limits. Agencies represent the local executive government function in the territory.
- **Safety:** In this subject as well, the governmental authority imposes a basic regulation which refers to the several productive industrial processes. Each one is deeply regulated by specific laws which consider appliance field, risk values for operators in active or passive work, etc..

c. Climate change position

Italy has subscribed the Kyoto Protocol to regulate the production of greenhouse gases in the productive processes. Actually it has been a limitation in the appliance of traditional power generating systems and resources (like coal), and it poses Italy in the condition to improve systems and develop new technologies (gasification, IGCC, etc..), and in such field to find new partners, to reach aims to generate power according to environmental respect, mainly reducing the CO₂ production.

d. Technical difficulties

The main aim that a productive system must achieve is to optimise the way to exploit the resources, and to get a high yield from them. Every study that drives in this direction contributes to technological improvement, social-economic and healthy growth, and environmental safety.

At present Italian effort is to pursue the following technical difficulties:

- Develop survey system for CMM in the Sulcis coal basin both in active mines and abandoned mines in order to promote CMM and ECBM for carbon dioxide sequestration.
- Project analysis models for CMM simulation to estimate methane gas emission and recovery of Sulcis coal basin.
- Improve gas drainage CMM
- Verify feasibility of VAM recovery in the actual mining sites
- Develop systems of monitoring and control of gas drainage.
- Develop systems of measuring emissions at surface mines.
- Identify the possible use of CMM both in power generation and chemical uses.
- Apply IGCC technologies in the traditional power generation systems, mainly in the coal processes.
- Awaken not only public opinion but even politic institutions to the new technologies to promote and to finance coal methane enterprises.
- Improve processes to limit NO_x and SO_x emissions from coal power plants.

- Create a network about know-how exchange mostly toward the countries which have a deeper knowledge about CMM issues.

e. R&D resources

- The R&D of methane capture and supply is funded by Italian Government and it is carried out by private and public organizations.
- SOTACARBO is the R&D company located in the Sulcis area and it is interested in development of coal research. At the moment Sotacarbo is carrying out the following projects:

- “Development of coal syngas production and treatment technologies for producing and utilizing clean fuel gas and in particular hydrogen”. The research project consists of the design, building and testing of a pilot plant for the production of high environmental value fuel gas such as hydrogen, from Sulcis coal. The test facility will be located in the Sotacarbo Research Centre, which is under construction in Carbonia, South West Sardinia.

The construction of the test facility will be carried out by Sotacarbo with the collaboration of Ansaldo Ricerche, ENEA and the University of Cagliari – Department of Mechanical Engineering. It will include the following sections: coal gasification, gas cleaning, CO-shift conversion, CO₂ and hydrogen separation, and energy production. In the first phase of the R&D program, the system will be integrated with a 200 kW internal combustion engine for electricity production. In next phases the system will be also integrated with small size turbines and fuel cells.

The main purpose of the research project is to test and set up the processes in all the sections of the pilot plant. The processes’ aim is to produce clean fuel gas and/or hydrogen from Sulcis coal. These processes are already well known in the petrochemical industrial sector but they are not tested enough with coal.

- Sotacarbo and Carbosulcis have adopted a common agreement for the preliminary study about the peculiarity of the Sulcis coal basin on flowing out methane and CO₂ adsorption. The main activities consist of:
 - updating new ECBM technologies;
 - sampling plan and analysis of the Sulcis coal;
 - analysing the results of the study.

This study is the base of the project called “Methane production from coal beds in the Sardinian mine of Sulcis and CO₂ sequestration ECBM” (PROMECAS Project). The main purpose of the research project is to apply ECBM methods on Sulcis coal basin. The main partners of the project are: Sotacarbo and University of Cagliari – Department of Mechanical Engineering. The Project will be developed with support of ENEA and Istituto Nazionale di Geofisica e Vulcanologia (INGV) too. The main activities of the Project are on the following:

- Improving the knowledge of chemical and physical features of the Sulcis coal basin by the study of its peculiarity on flowing out methane and CO₂ adsorption;
- Improving the geological survey to find out new deep coal seams, to evaluate their mining attitudes;
- Checking the use of ECBM methods on Sulcis coal basin;
- Improving the knowledge of ECBM methods with regard to energy processes and CO₂ sources from human activities;

Afterwards new activities are foreseen, like putting out a test facility, making up the experimental plant and carrying out the tests.

Moreover all the subjects in which at the moment Italy is facing technical difficulties, are the same points of main research effort.

To show how Italy, and specially Carbosulcis is investing in reaching new ways to add value to the mining activities, it would be nice to underline several enterprises which may indicate the availability to important purposes:

- Researching new ways to obtain purest coal for boilers combustion.
- Regenerating by-products and slag to join and improve energy production processes.
- Converting mining underground boreholes within underground waste dumps according to environmental safety.
- Proposing discarding products of the mining process, like primary products in different trade market (building or chemical fields), with directly retail or after a revamping processes.

f. Institutional issues

The possibility to exploit a new resource, especially if it would come jointly an existent activity, put it in a good position respect of laws regulation, both in a economic-financing and in a environmental point of view. It would be hopeful that a specific regulation about methane from several mining activities (CMM,CBM,AMM,VAM) takes place, because it would be the effect of the discovery of a new energy resource.

4. MARKET ASSESSMENT & REFORM ISSUES

As CMM recovery has not started in Italy yet, there are not any CMM transport systems and uses. At the moment is possible to give a brief description of national gas natural transport system as issue regarding the activities of another Subcommittee.

a. Transportation of methane

In Italy there is a gas natural transport grid all over the country except of Sardinia Region. Most of the methane in Italy is distributed and transported by an efficient pipeline. The pipeline infrastructure has been historically set up in the north of Italy. The methane natural deposits of Padania and mid Adriatic Sea, permitted to develop a system consisting in drilling, pumping, and distributing methane to feed at first the several users in the north of the country. At the end of seventies and beginning of eighties the pipeline infrastructure was enhanced to serve the south, too. Though no Coal Mine Methane recovery has been applied in Italy for the loss of such resource, in the most active and important mine site of Sardinia, the pipeline has never carried out, and because of the distance from the national methane pipeline net, Sardinia has never been fed up by methane gas but just by oil by-product gas, transported by conventional road or maritime ways. Only in the last year, the main towns in Sardinia have been arranged with pipeline for sailing distribution.

Moreover a parallel involving project consisting in the possibility to get natural methane from the north African countries, using Sardinia like a strategic point for the distribution among all

the north Mediterranean European countries, could make easier the prospective to use a pipeline infrastructure able to transport both natural and coal bed methane.

b. Prices and tariffs

- **Prices:** Surely the prices for methane from coal would be influenced by several factors. First of all the high investments that new technologies and infrastructure require would be a rising factor for the coal methane trade price. In the other side financial facilitations, according to sustainable development and reduction of greenhouse gas (methane in atmosphere) will contribute to keep the product competitive in the trade market.

c. Competition

Regulation about gas, coal, electricity is different, but mostly involved toward a free trade market.

d. Market access

After several decades of monopoly in retail energy power of governmental companies (ENI, ENEL, etc.), at the end of eighties a policy of privatisation set the market free and permitted new producers and new distributors to join it. The old governmental companies begun a policy of privatisation which provide for transforming themselves in para-governative companies. As a matter of fact they are still owners of the distributing infrastructure, while there is a try-to-be free trade market in production and retailing power.

e. Product support mechanism

For many years the Carbosulcis underground mine has been mostly considered a strategic site for its coal, while the energetic policy drove to oil. Nowadays, the new trade markets, new international economies, and the growing hanger for power energy, are changing this policy and promoting the revalue of coal like a primary resource. Since then the underground mine has been government-owned, and the Carbosulcis has been and still is a government financed company.

Further proposal are to change the Carbosulcis in a private company thanks to the financing of a private agency which permit to deeply take place in the trade coal markets.

About CMM, CBM or ECBM, the whole facility is to be built, and right now the hope is to reach important positive results to start up private enterprises, and involve research as well to make the site an important national reference point in the energetic Italian field.

f. Carbon credits

- **Kyoto Protocol:** Italy ratified the Kyoto Protocol on June 2002 to regulate the production of greenhouse gases in the industrial processes. Furthermore in the countries of European Union international emission trading has started up since 1st January 2005. Each plant, affected by the law, can not generate CO₂ emissions without a government permission. Since 28th February 2005 each plant has got own *assigned amount units* (the amount of CO₂ emissions allowed). Whenever the emissions of a company or generally of a country, are lower than the allowed amount, they could trade in *assigned amount units* surplus. In the other side they have to buy the amount units necessary to fill in emissions. At the moment Italy is waiting for the

approval of own assignment national Plan by European Commission. So that all the leading laws about energy production have been influenced by the limits in emission of carbon dioxide. Coal mining and its use, like a power resource, have been very damaged by such protocol, but as discussed above, the revaluation of coal is to be parallel to the development of technologies able to reduce pollution and greenhouse gas emissions.

- **State government carbon emission limits and incentives:** According to Kyoto Protocol, and to the environmental safety, the Italian government is working for a regulation about power generation in order to support “green” technologies (aero-turbines generators, sea turbines to exploit tides, IGCC, solar panels, etc...), means all technologies with low environmental impact. Green credits will be imposed so that the firms which use modern low impact processes, and generate greater percentage of green power than requested, can improve their business selling their green credits to the ones which use traditional plants. At the end the total percentage of green power keeps steady.

5. **KEY STAKEHOLDERS IN THE CMM INDUSTRY**

As CMM recovery has not started in Italy yet, it could be possible to involve on projects also foreign company, or companies that may solve marginal but not specific processing tasks. The company which work on the following fields can be interested in operate CMM recovery and utilization:

- ✓ Research companies;
- ✓ Mining and energy companies and related;
- ✓ Equipment manufactures and vendors;
- ✓ Services company;

6. **FINANCE**

a. **Internal Mechanism**

Financing System in Italy is both public and private. The government provides for promoting financing facilitations to several energy fields, using a special organism named CIPE Inter-departmental Committee for Economic Programming.

It is supposed that laws about financing new further projects about methane recovery from coal mines, will fall under CIPE competences and direly financed by Government or by UE through Treasury Department.

Therefore Italian Government and European Union support research by different system of project financing.

The CMM research regards both the recovery of fuel and the environmental protection by the reduction of GHG emissions. Nowadays, respect of the importance of the different fields, there are instruments of financing for the scientific research projects that depend on European, national and regional laws.

b. **External Mechanism**

At present external mechanisms are not present.

c. **Private sector investments**

At present private sector investments are not present.

d. Multilateral agreements

Italy has not any multilateral agreement with other countries about CMM.

e. Incentives (subsidies,taxes)

Italian regulation are supplied by several laws for productive investments in different fields. Many laws permit mining concession owners to start up projects about subjects which firstly have to be verified and accepted by the Inter-departmental Committee for Economic Programming (CIPE).

7. CURRENT COOPERATION AMONG COUNTRIES

No cooperation among Italy and other countries are at moment in act about CMM projects.

8. WISH LIST

- Cooperation between the Methane to Markets Partner to promote coal mine methane recovery and utilization.
- Technical support to promote CMM.
- Technical and financial support for programs related to CMM.
- More financings to improve resource and development in new coal mining methane technologies.

9. OUTREACH

There are no outreaches about CMM in Italy.

10. SUMMARY & CONCLUSIONS

In order to develop CMM recovery and use, it is necessary to drive efforts towards the research for the best technologies to apply on the only Italian coal basin located in Sardinia concerning systems of discovery CMM, systems of CMM simulation, systems of gas drainage, system of VAM recovery, systems of monitoring and control of gas drainage, systems of measuring emissions at surface mines, possible uses of CMM both in power generation and chemical uses, etc.

The research activities are possible only by finding right system of financing and strong partnership. Actually several feasibility studies are outgoing, but surely it would be easier to proceed powered by one or more partner which could invest not actually in money but mostly in know-how and technology.