

## IMPLEMENTATION OF EU REQUIREMENTS ON CARBON CAPTURE AND STORAGE IN BULGARIAN ENVIRONMENTAL LEGISLATION

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**ABSTRACT.** The carbon capture and storage (CCS) is an essential part of worldwide efforts to limit global warming by reducing greenhouse-gas emissions. At Community level, a number of legislative instruments are in place to manage some of the environmental risks of CCS. Bulgaria's membership in the European Union involves reviewing and implementation of mandatory legal acts of the EU which are addressed to all Member States. The requirements of the CCS Directive (2009/31/EC) have been successfully transposed into Bulgarian environmental legislation in the end of 2011. Along with the adopted changes to the EPA (mid 2011), the transposition of CCS Directive ended with the adoption of the Carbon Dioxide Storage in Depths of Earth Act in February 2012. However, the legal regulations concerning permanent storage of CO<sub>2</sub> in geological formations are not sufficiently developed because this technology is relatively new to national and global scale.

### ИЗПЪЛНЕНИЕ НА ИЗИСКВАНИЯТА НА ЕС ПРИ ТЕХНОЛОГИИ ЗА УЛАВЯНЕ И СЪХРАНЕНИЕ НА ВЪГЛЕРОДЕН ДИОКСИД В БЪЛГАРСКОТО ЕКОЛОГИЧНО ЗАКОНОДАТЕЛСТВО

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**РЕЗЮМЕ.** Технологиите за улавяне и съхранение на въглероден диоксид (CCS) са съществена част от световните усилия за ограничаване на глобалното затопляне, чрез намаляване на емисиите на парникови газове. В Европейския съюз са въведени редица законодателни актове за управлението на рисковете за околната среда при тези технологии. Членството на България в ЕС изисква задължително изпълнение на тези правни актове, които са адресирани до всички държави-членки. Изискванията на CCS Директивата (2009/31/EO) са успешно експонирани в българското екологично законодателство до края на 2012 г.. Заедно с приетите промени на "Закона за опазване на околната среда" (от средата на 2012 година) е транспонирана и Директивата за улавяне и съхранение на въглероден диоксид, чрез приемането на "Закона за съхранение на CO<sub>2</sub> в земните недра" от февруари 2012 г.. Нормативните актове за постоянно съхранение на CO<sub>2</sub> в геоложки формации, обаче не са добре развити, защото тази технология е сравнително нова в национален и световен мащаб.

### Introduction

The carbon capture and storage (CCS) is an essential part of worldwide efforts to limit global warming by reducing greenhouse-gas emissions. The broad deployment of low-carbon energy technologies could reduce projected 2050 emissions to half 2005 levels – and that CCS could contribute about one-fifth of those reductions. Reaching that goal, however, would require around 100 CCS projects to be implemented by 2020 (this is considered as a critical mass of facilities that will make the CCS activity more cost-effective) and over 3 000 by 2050. CCS regulations need to manage the risks and liabilities of CCS, distinguishing between risks that should be assumed by the operator, those that can be mitigated through regulation, and those that can be transferred. However, risk and liability are not the only drivers for CCS regulations. Issues related to competition, climate regime commitments, tax policy, financial responsibility, property rights and international treaties will also shape the CCS regulatory framework.

The CCS process is based on capturing carbon dioxide (CO<sub>2</sub>) from large point sources, such as fossil fuel power plants, and storing it where it will not enter the atmosphere. The technology for capturing and storing carbon dioxide takes

place in three main stages. During the combustion of carbon fuels, mostly coal, called Oxyfuel, pulverized coal burning emits enormous quantities of carbon dioxide. Greenhouse gas is compressed to 1/500 of its original volume, which is very convenient for its transportation. In such liquid form it can be stored for several hundred meters underground in old depleted oil and gas fields.

- The first stage, the carbon capture, is the separation of CO<sub>2</sub> from the other gases produced when fossil fuel is burnt for power generation and in other industrial processes.

- At the second stage once separated, the CO<sub>2</sub> is compressed and transported to a suitable site for geological storage.

- The third stage is storage of CO<sub>2</sub> by injection into deep underground rock formations, often at depths of one kilometre or more. This stage is associated with long-term monitoring for safe storage of liquefied substance. It is considered that the liquefied CO<sub>2</sub> must be disposed of at least 800 meters underground to reach the so-called supercritical dense state that provides the potential for efficient utilization of underground storage space in the pores of sedimentary rocks.

The issue of environmental legislation concerning the CCS technology can be related to a series of regulations:

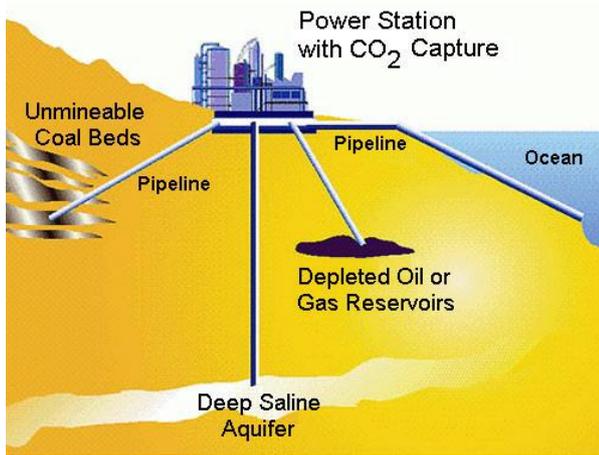


Fig. 1. The Carbon Capture and Storage (CCS) process

- Directive on CCS 2009/31/EC concerning the storage of carbon dioxide in geological formations;
  - Water Framework Directive (2000/60/EC), establishing a framework for Community action in the field of water policy;
  - Groundwater Directive (2006/118/EC) on the protection of groundwater against pollution and deterioration;
  - Directive on mining waste management (2006/21/EC);
  - Directive 2008/50/EC relating to air quality;
  - The OSPAR Convention, Brussels, 2011;
  - The London Convention, "Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972";
  - EU ETS Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community for the European Union emissions trading system;
  - The IPPC Directive 2008/1/EC concerning integrated pollution prevention and control;
  - Environmental Impact Assessment Directive (EIA Directive 85/337 EEC);
  - Environmental liability Directive (ELD 2004/35/EC) on environmental liability with regard to the prevention and remedying of environmental damage;
  - Large Combustion Plants Directive (LCPD 2001/80/EC);
  - Directive 99/31/EC on the landfill of waste;
  - Waste Framework Directive (Directive 2006/12/EC);
  - Seveso II Directive 96/82/EC on the control of major-accident hazards.
- and many others legal acts.

In summary, the CCS Directive 2009/31/EC is concerned with the Safety of storing CO<sub>2</sub> underground, and ensuring that the risk of leaks are minimal and fully understood. This Directive lays down requirements for the lifetime of a CO<sub>2</sub> storage site. It covers measures for dealing with potential CO<sub>2</sub> leakage, the need for storage site permits, and the responsibility for storage sites once they are closed.

Operators of CO<sub>2</sub> storage will need to apply to the competent Authorities in the Member State for the exploration permit, the storage permit, and the application for closure and transfer to the CA.

The storage permit requires

- Proof of technical competence,
- Characterisation of the storage site and storage complex
  - Specifications related to CO<sub>2</sub> streams (total quantity to be injected and stored, composition, injection rates and pressures),
  - Description of preventive measures to prevent significant irregularities,
  - Monitoring plan for the storage complex and the injection facilities,
  - Corrective measures plan for leakages or significant irregularities,
  - Provisional post closure plan,
  - Proof of financial security.

Coal is specifically identified as a permanent storage medium for CO<sub>2</sub>. The others are EOR, Hydrocarbon reservoirs and Saline Aquifers.

And at a high level, storage opportunities will need to satisfy three principle requirements:

- Capacity – sufficient storage volume is available, or can be engineered.
- Integrity – confidence that the site is secure with no significant risk of leakage.
- Injectivity – suitable reservoir properties exist allowing sustained injection at industrial supply rates into the geological formations.

To prove sites in a practical and technical sense, and not in theory. Depending on the particular site, it could require seismic and well-drilling activities designed specifically for CO<sub>2</sub> storage site evaluation, including, potentially:

- Acquisition and processing and interpretation of 2D or 3D seismic data;
- Drilling wells to acquire core, log and cutting samples to evaluate and characterise reservoir and seal sequences, supported by laboratory analysis;
- Injection tests with CO<sub>2</sub> or water and testing pressure regimes in the subsurface.

It is vital to show how CO<sub>2</sub> will be trapped at a site. A prospectivity assessment can also identify if a basin is likely to trap CO<sub>2</sub> through either conventional structural or stratigraphic traps, or through migration assisted storage mechanisms.

## Implementation of EU acts concerning CCS in BG legislation

Bulgaria's membership in the European Union certainly involves reviewing and implementation of mandatory legal acts of the EU which are addressed to all Member States. Environmental legislation related to mining activities is covered in considerable volume of regulatory acts. It may be said that legal regulations concerning that issue are not sufficiently developed because this technology is relatively new to national and global scale. For CCS Storage, the requirements of the Directive 2009/31/EC have been successfully transposed into Bulgarian environmental legislation in the middle of 2011.

## Mining regulations

Regarding regulatory frameworks of the mining activities concerning the environmental protection in Bulgaria the framework law is "The Environmental Protection Act" (last amended on 24.04.2012), which regulates the fundamentals and principles of management the public relations with the environment.

On 03/06/2011 the National Assembly has approved a draft law amending the EPA, which introduced into national legislation the requirements of Directive 2009/31/EC (concerning, carbon storage in geological formations). The changed EPA law requires mandatory environmental impact assessment (EIA for all CO<sub>2</sub> Storage in geological formations, large pipelines for transport of carbon dioxide to storage sites, and large plants for capture of carbon dioxide. All other pipelines and facilities for CO<sub>2</sub> capture according to EPA shall become subject to an assessment of the need for EIA.

Another very important legal reference is the Mineral Resources Act (MRA), last amended on 17. 02. 2012. It sets out procedures for prospecting, exploration and mining, as well as conditions for granting exploration and mining licenses. It also defines the terms for carrying out the research and mining activities and determines the responsibilities and the control. Significant place in this Act is given to the protection of subsurface through the rational utilization of mineral resources in the exploration, extraction and primary processing.

Waste Management Act, dated 18 September 2003, last amended on 12.04.2011, provides environmentally friendly waste management as a set of rights and responsibilities, decisions, actions and activities related to waste generation and treatment and forms of control over these activities. This law determines the requirements to the products, which in the process of their production or after the end use, form hazardous or mass widespread waste. The waste management shall be implemented with objective to prevent reduce or restrict the harmful impact on human health and environment. The act relating to mining is the Regulation on the Specific Requirements to Mining Waste Management, SG 10 of February 6, 2009, last amended of January 21, 2011. This regulation defines the specific requirements and procedures for management of mining waste from prospecting, extraction and primary processing of mineral resources to prevent, reduce or limit their harmful effects on components of the environment, safety and human health.

Another important legal reference is the Protected Areas Act, SG 133/1998, last amended of October 9, 2009. This Act regulates categories of protected areas, their purpose and mode of preservation and use, notification and management, and also prohibiting and permitting regimes in protected areas for any mining work including drilling operations.

## Ground Water Requirements

Regarding regulatory mechanisms concerning groundwater is the Water Act (last amended October, 2011). This law provides a unified and balanced water management as a key component of environment and as a resource in public interest, protection of public health and sustainable development.

Regulation № 1 of 10 October 2007 on the Exploration, Use and Protection of Groundwater (SG 87/30 October 2007) provides a balanced management of groundwaters by ensuring their sustainable consumption based on long-term protection of available water resources, ensuring the supply of groundwater is adequate quantity and quality, creating rules for the exploration and the use of these waters, establishing indicators for protection, prevention and reduction of pollution with dangerous substances, contamination by harmful substances and elimination of the effects of already occurred pollution with these substances. The requirements of Directive 2006/118/EC for the protection of groundwater against pollution and deterioration were transposed into national legislation on 12 December 2006.

Regulation № 5 of 23 April 2007 on water monitoring, SG 44/5 June 2007, last amended on 29.04.2011, establishes the procedure and method to create a network of water monitoring and the activity of the national system for water monitoring. It creates an opportunity of assessment and estimation of surface water and groundwater status. This regulation introduces requirements of Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy and technical specifications for chemical analysis and monitoring of water status.

Another Regulation № 10 on Issuing Permits for Waste Water Discharge into Water Bodies and Setting Individual Emission Limit Values for Point Sources of Pollution, SG. 66/27.07.2001, last amended on 02.17.2012 determines the order and manner for issuing permits for discharge of waste waters from point sources of pollution in the surface water sites to preserve the purity of the water sites from discharged waste waters. Also determines their design category for water use, the quality of the waters and creation of favourable conditions for normal development of the water ecosystems. This regulatory action may be relevant to the CCS projects only during the exploration when it is expected to generate the minimum quantities of waste water from drilling operations.

## Air Emissions

Another significant environmental risk is associated with uncontrolled and/or accidental release in the atmosphere of gas emissions, the obtained Syngas (coal gasification) and of the stored CO<sub>2</sub> in geological formations. In this respect, important legal documents related to the CCS is the Clean Air Act (last amended May 18, 2012). This law regulates the specification of indices and standards of the quality of the atmospheric air, the limitation of emissions, the rights and obligations of the state and municipal bodies, authority control, limit the emissions of pollutants from the transport vehicles and other individual sources. It also concerns legal requirements relating to design, construct and operate facilities with sources of emissions.

Related with this law is Regulation № 1 for emission limit values of harmful substances (pollutants) emitted into the atmosphere from facilities and activities with stationary sources of emissions, last amended August 5, 2005. This document lays down emission limit values for pollutants in the atmosphere from stationary sources of emissions in order to

prevent or minimize the direct and / or indirect effects of emissions on the environment and the associated with these potential risks to human health.

Since the beginning of 2011 the necessary legislative changes have been made for the storage, capturing and transporting of carbon dioxide emitted by large combustion plants in Regulation No. 10 of 6 October 2003 on the Emission Limit Values (Concentrations in Waste gasses) of sulphur dioxide, nitrogen oxides and total dust, discharged to the atmosphere from large combustion plants, SG 93 of 21 October 2003, last amended 08.03.2011. According to these changes the places of storage of CO<sub>2</sub>, technical and economic aspects of transport of CO<sub>2</sub> and the obligation of the operator to provide land for the site and equipment to capture and compress carbon dioxide are regulated for large combustion plants (over 300 MW).

Another regulatory instrument relevant to CCS is the Regulation and procedures for issuing and reviewing permits for greenhouse gases (GG) and monitoring the operators of installations, participating in the GG emission trading quota system (17.12., 2010). In case the expected emissions of greenhouse gases will be near zero, this Regulation shall apply only to monitoring but not to quotas for emissions of greenhouse gases.

To implement the global climate change policy in the national context, Bulgaria has ratified the UN Framework Convention on Climate Change in 1995 and the Kyoto Protocol in 2002. Under the Kyoto Protocol, Bulgaria must reduce greenhouse gas emissions by 8 per cent in the years 2008 to 2012, in comparison to ambient air emissions in 1988.

Bulgaria started implementing procedures under EU Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community for the European Union emissions trading system (EU ETS) on January 2007. The Directive's provisions are implemented by the Bulgarian EPA. The coordinating authority for the implementation of the Directive in Bulgaria is the Bulgarian Competent Authority MOEW.

Under the requirements of the EPA, all plants performing an activity that falls within the scope of the ETS Directive 2003/87/EC (eg, energy activities, metal processing, mineral industry operations, cellulose and paper production) must obtain a permit for greenhouse gas emissions issued by the MOEW.

As a rule, no plants (installations) may undertake any of the above-mentioned activities without holding a permit. The permit includes a detailed description of the plant, the methodology and frequency of monitoring requirements relating to the reporting of emissions and the obligation to return (surrender) the allowances. The issued permit is for an indefinite term and contains requirements for monitoring the emissions and preparing an annual report on the emissions.

All operators of installations that have received a permit are required to provide to the responsible authority a monitoring plan and annual monitoring report on emissions released from the installation during the preceding year. The annual report

must be prepared pursuant to certain directions and formats and is subject to verification. Furthermore, each operator has the obligation until 30 April of each year to surrender to the competent authority (by presenting a verification report) a specific number of allowances equal to the total amount of the emissions released from the installation during the preceding calendar year. Any operator who fails to return the required quantity of allowances by 30 April of each year to cover its emissions during the preceding year shall pay a pecuniary penalty of exceeded emissions of €100 for each tonne of CO<sub>2</sub> equivalent that has not been surrendered. The payment of the sanction does not release the operator from the obligation to surrender the missing quantity of allowances in the next calendar year.

With the amendments to the EPA as from 2010 Directive 2008/101/EC of the European Parliament and of the Council amending Directive 2003/87/EC was implemented with the EPA in order to include aviation activities in the EU ETS. Furthermore, the Act established the legal framework for Bulgaria's participation in international trading of assigned amount units (AAUs) under article 17 of the Kyoto Protocol through introducing a national green investments scheme. The National Trust Eco Fund has thereby been assigned as the leading authority in the implementation of this scheme.

The recent amendments of the EPA (in force from 3 June 2011) concern the partial implementation of the following directives:

The new ETS Directive 2009/29/EC amending Directive ETS 2003/87/EC to improve and extend the greenhouse gas emission allowance trading scheme of the Community for the reason of introducing the trading allowances greenhouse gases emissions during the third EU ETS period 2013-2020; and Directive 2009/30/EC amending Directive on the quality of petrol and diesel fuels 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC relating to a reduction in the sulphur content of certain liquid fuel sand as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC (relating to the sulphur content of certain liquid fuels) with the aim of reducing greenhouse gas emissions per unit of energy of the entire lifecycle of fuels for transport. The transposition of the texts of the Directive on the quality of petrol and diesel fuels refer to the obligations of producers and importers of liquid fuels to reduce greenhouse gas emissions, the ways to achieve this reduction of such emissions, as well as the obligations for reporting on greenhouse gas intensity of the delivered liquid fuels in the country.

Further, the Bulgarian EPA states that for the period 2013-2020, the distribution of free greenhouse gas allowances of plants other than generators of electricity and plants for capture of carbon dioxide shall be carried out in accordance with the decision of the European Commission to determine the validity throughout the European Union of transitional harmonized rules for free allocation of emission allowances.

Pursuant to the requirements of EU Regulation No. 2216/2004 of the European Commission, a national register for maintaining registration of the issuance, ownership, transfer

and cancellation of greenhouse gas emission permits is managed by the Bulgarian Executive Environmental Agency.

#### Interpretation of EU Directives on CCS

Along with the adopted changes to the EPA (mid 2011) mentioned above, the transposition of Directive 2009/31/EC in the legislation of the Republic of Bulgaria ended with the adoption of the Carbon Dioxide Storage in Depths of Earth Act (from 02/17/2012) in early 2012. This law transposes all restrictive conditions (protected areas, hydrological, geological, hydrological, etc.) in the application of this technology, determines the government body issuing the permit for areas in which this technology can be practiced; creates and maintains a register and card authorizations granted for a period up to 30 years. Thereby, the companies that manage the carbon storage would have to follow strictly the requirements related to the carbon dioxide storage in the depths of earth, as prescribed in the issued permit. It must be an obligation of the operator also to prepare periodic monitoring of the repository and to monitor for leakage of gas or its movement and at least annually to prepare monitoring of the territory for storage, the volumes and characteristics of gas flow, and to submit evidence of financial security of the activity. The Act regulates also the prohibition of CO<sub>2</sub> storage as follows: in storage area outside suitable geological formation in the ground, in water column, outside geological formation and in geological aquifers.

In the near future it will be possible to build underground storage for carbon dioxide, where the thermal power plants shall 'inject' the greenhouse gases emitted from their operation, instead of expelling them into the atmosphere and paying for pollution of the environment. The way for investment by global energy companies that are already developing technology for the capture and underground storage of carbon emissions is now opened.

#### Public Perception issues in Bulgaria to CCS

For combining the society's expectations on the environment in the process of sustainable development in accordance with the principles of environmental protection, integrated into sectoral policies (transport, energy, construction, agriculture, tourism, industry, education, etc.), a core of the Bulgarian environmental legislation is the EIA procedure. This procedure is covered by the Regulation on the terms and conditions for carrying out Environmental Impact Assessment, SG 25/18.03.2003, last amended on 01.11.2011. This act sets forth the terms and procedure for making environmental impact assessment (EIA) of investment proposals for construction and other activities under the Environment Protection Act (EPA) or their modifications or extensions with potential significant environmental impacts.

All the places of CO<sub>2</sub> Storage in geological formations, large pipelines for transport of carbon dioxide to storage sites, and large plants for capture carbon dioxide will be subject of environmental impact assessments (EIA) in accordance with the accepted amendments in EPA (mentioned above). All other pipelines and facilities for CO<sub>2</sub> capture according to EPA shall become subject to an assessment of the need for EIA.

## Conclusions

Obviously, Bulgarian national environmental laws and regulations on this and similar technologies are not yet sufficiently précised and it is necessary to make changes that will refer to the proposed method of underground coal gasification and carbon dioxide capture and storage (CCS).

Storage of CO<sub>2</sub> in geological formations is an issue regulated in the Bulgarian environmental legislation as the requirements of the Directive 2009/31/EC have been successfully transposed to the end of 2011.

The necessary legislative changes (08.03.2011) for the storage, capturing and transporting of carbon dioxide emitted by large combustion plants have been made in Regulation No. 10 of 6 October 2003 on the Emission Limit Values (Concentrations in Waste gasses) of sulphur dioxide, nitrogen oxides and total dust, discharged to the atmosphere from large combustion plants, SG 93 of 21 October 2003, last amended 08.03.2011. According to these changes the places of storage of CO<sub>2</sub>, technical and economic aspects of transport of CO<sub>2</sub> and the obligation of the operator to provide land for the site and equipment to capture and compress carbon dioxide are regulated for large combustion plants (over 300 MW).

On February 17, 2012 the National Assembly has adopted the Carbon Dioxide Storage in Depths of Earth Act. This law transposes all restrictive conditions (protected areas, hydrological, geological, hydrological, etc.) in the application of this technology, as the storage restrictions are also regulated.

In conclusion we can say that it is imperative to make a more detailed assessment of possible environmental risks in comparison with economic efficiency of the implementation of the concrete technology. Geological, hydrogeological and other characteristics of each site are unique and general conclusions valid for all objects are not relevant. Each site in all phases of the investment process requires an assessment of the environmental impact.

## REFERENCES

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*Directive 2008/50/EC relating to air quality;*

*Directive on CCS 2009/31/EC concerning the storage of carbon dioxide in geological formations;*

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*Directive 2009/30/EC amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive; 1999/32/EC as regards the specification of fuel used by inland waterway vessels;*

*Directive 97/11/EC amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment;*

*Directive 2003/105/EC* amending Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances;

*Directive 99/31/EC on the landfill of waste*;

*Directive 93/12/EEC* relating to the sulphur content of certain liquid fuels;

*EU ETS Directive 2003/87/EC* establishing a scheme for greenhouse gas emission allowance trading within the Community for the European Union emissions trading system;

*EU ETS Directive 2009/29/EC* amending Directive 2003/87/EC to improve and extend the greenhouse gas emission allowance trading scheme of the Community;

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