How to efficiently implement CCS in Poland? Polish CCS Strategy

Edited by Agata Hinc

CCS PL

demos EUROPA
CENTRE FOR EUROPEAN STRATEGY

How to efficiently implement CCS in Poland? Polish CCS Strategy

Edited by Agata Hinc*

Warsaw, 2011

* Agata Hinc, Project Leader, Low Emission Economy,
demosEUROPA – Centre for European Strategy.

SUPPORTED BY

The report has been prepared within the framework of the project "Carbon Capture and Storage as a preferred technology for mainstreaming the clean use of coal in Poland". The project has been supported by the Global CCS Institute.

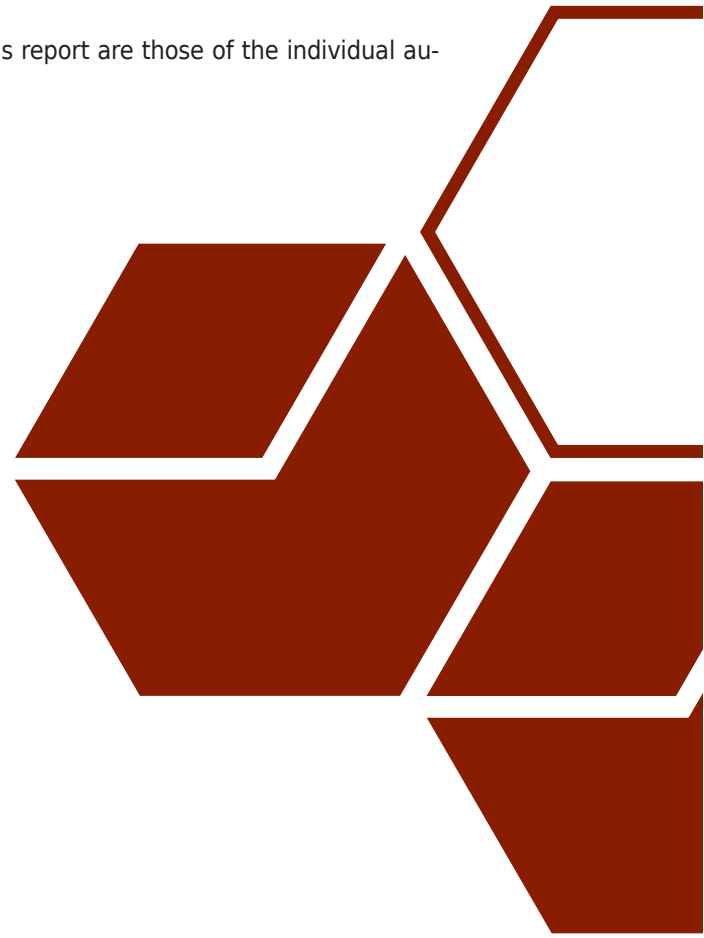
Cover design:
Michał Polkowski
DTP:
A Vista Group
Druk:
Lenz i Załęcki sp. z o.o.

A Vista Group sp. z o.o.
ul. Dembińskiego 10
01-644 Warszawa
www.avistagroup.pl

Acknowledgements

The report has been prepared within the framework of the project "Carbon Capture and Storage as a preferred technology for mainstreaming the clean use of coal in Poland"[1] and edited by Agata Hinc, Project Leader, Low Emission Economy, demosEUROPA – Centre for European Strategy. The editor would like to thank authors of the report's chapters: Cezary Filipowicz, Paweł Magierowski, Andrzej Siemaszko, Leszek Stafiej and Eureniusz Sutor.

All opinions expressed in this report are those of the individual authors.



1 The project has been supported by the Global CCS Institute.

Contents

CONTENTS

List of abbreviations

AGH	University of Science and Technology *(Akademia Górniczo-Hutnicza)*
AUD	Australian dollar
CAPEX	initial capital expenditure
CEEC	Complex Extraction of Energy from Coal
CCS	Carbon Capture and Storage
CCT	Clean Coal Technologies
CIP	Competitiveness and Innovation Programme
CO2	carbon dioxide
EEPR	European Energy Programme for Recovery
EGR	Enhanced Gas Recovery
EII	European Industry Initiatives
EOR	Enhanced Oil Recovery
EPS	Emission Performance Standards
EU	European Union
EUR	euro
GCCSI	Global CCS Institute
GIG	Central Mining Institute *(Główny Instytut Górnictwa)*
ICT	Information and Communications Technologies
IGCC	Integrated Gasification Combined Cycle

LIST OF ABBREVIATIONS

IEA	International Energy Agency
MW	Megawatt
NCBiR	National Centre for Research and Development *(Narodowe Centrum Badań i Rozwoju)*
NER 300	New Entrants Reserve
NFOŚiGW	National Fund for Environmental Protection and Water Management *(Narodowy Fundusz Ochrony Środowiska i Gospodarki Wodnej)*
NPV	Net Present Value
OPEX	fixed and variable operational expenditure
PIG	National Geological Institute *(Państwowy Instytut Geologiczny)*
PPCTW	Polish Clean Coal Technologies Platform *(Polska Platforma Czystych Technologii Węglowych)*
PPF	Polish Clean Coal Technologies Flagship Programme *(Polski Program Flagowy Czystych Technologii Węglowych)*
R&D	Research and Development
RES	renewable energy sources
UCG	Underground Coal Gasification
USD	American dollar
ZEP	European Technology Platform for Zero Emission Fossil Fuel Power Plants

An introductory note

This report is the first study of its kind prepared for Poland, explaining in detail all the key elements of the recommended Polish CCS Strategy. It is the last publication within the framework of demosEUROPA project on "Carbon Capture and Storage as a preferred technology for mainstreaming the clean use of coal in Poland"[2]. Under this project demosEUROPA – Centre for European Strategy organised a series of debates, seminars and conferences with the participations of Polish and external experts, representatives of public and private sector, economists and media to build the platform of dialog on efficent implementation of CCS technology in Poland.

Within the framework of the project we have already published three reports: the first one on legal and political framework[3], the second one on financial framework[4] and the third one on research and development potential for Carbon Capture and Storage implementation in Poland[5].

The authors of this report on "How to efficiently implement CCS in Poland? Polish CCS Strategy" argue that efficient implementation of CCS technology in Poland can deliver long-term reputational and financial advantages to the country. CCS has the potential to not only enhance the capabilities and standing of Polish R&D and scientific centres, but to also help Poland find its place in the global market.

2 www.demoseuropa.eu/CCS

3 A.Hinc, *How to efficiently implement CCS in Poland? Legal and political framework*, demosEUROPA – Centre for European Strategy, 2010. (http://www.demoseuropa.eu/files/CCSreport_demosEUROPA_en.pdf)

4 A.Hinc, *How to efficiently implement CCS in Poland? Financial framework*, demosEUROPA – Centre for European Strategy, 2010. http://www.demoseuropa.eu/files/demosEUROPA_Report2_CCS_en_2.pdf

5 A.Hinc, How to efficiently implement CCS in Poland? R&D and framework for a CCS cluster, demosEUROPA – Centre for European Strategy, 2010. http://www.demosservices.home.pl/www/files/demosEUROPA_report_CCS_R&D_en.pdf

However, a comprehensive plan for the development and roll-out of CCS technology is required. Poland needs a strategic decision at a governmental level to embrace CCS technology as a key tool of Polish energy and climate policy. Once this commitment is made, a map of the most important areas for action can be drawn up. These areas are: political framework, capacity building, institutional framework, legal framework, financial framework, R&D potential and social awareness.

Each of these areas is examined in detail in the report and the authors make specific recommendations on the actions and approaches that could and should be taken to efficiently implement CCS in Poland.

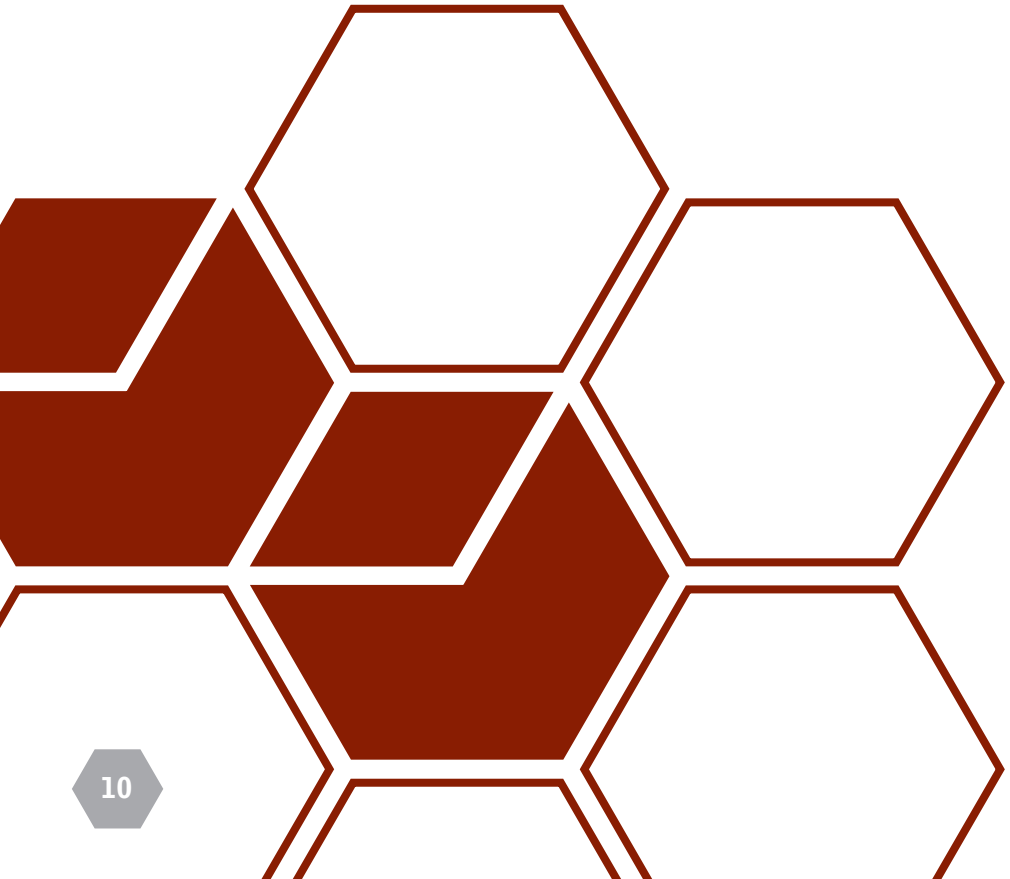
AREA	RECOMMENDATION
Political framework	Strategic decision/Polish CCS Strategy
Capacity building	Polish Clean Carbon Technologies Flagship Programme
Institutional framework	Governmental Plenipotentiary for Clean Carbon Technologies
Legal framework	Complex and systematic changes in existing legislation/Polish “CCS Act”
Financial framework	Public-Private Partnerships
R&D potential	Polish CCS Cluster
Social awareness	Social Communication Programme

AN INTRODUCTORY NOTE

This report is directed at politicians and representatives of public administration, industry and R&D institutes. The report provides a platform for further discussion on specific measures to facilitate the development of CCS technology in Poland. Most of the recommendations are also relevant for other European Union Member States seeking to implement CCS.

I hope you find our report informative,

Paweł Świeboda
President
demosEUROPA – Centre for European Strategy



1 Political framework

Agata Hinc, Project Leader, Low Emission Economy, demosEUROPA – Centre for European Strategy

Coal provides 27% of primary energy supply and generates 41% of the world's electricity[6]. The biggest coal producers in the world are China, USA and India[7]. As indicated by the International Energy Agency scenarios, electricity production from coal will grow until at least 2020[8]. Poland is the ninth largest coal producer in the world (78 Mt). Over 90% of electricity in Poland is produced from this raw material.

The aforementioned data illustrate that a significant reduction of greenhouse gases from both global and Polish emissions can be achieved through Clean Coal Technologies (CCT). Currently, Carbon Capture and Storage (CCS) seems to amass the heaviest interest of all CCT. This is mainly due to the fact that CCS may allow up to 95-99% emissions reduction from coal-based power plants[9]. Carbon capture and storage, due to its complexity, can also serve as a base for developing other Clean Coal Technologies[10].

6 http://www.worldcoal.org/resources/coal-statistics/
7 Data from 2009; http://www.worldcoal.org/resources/coal-statistics/
8 http://www.worldenergyoutlook.org/docs/weo2010/factsheets.pdf
9 http://www.europeanenergyforum.eu/upload/ccs.pdf
10 Further information can be found in the second chapter of this report.

The Special Report on Carbon Dioxide Capture and Storage, commissioned by the Intergovernmental Panel on Climate Change (IPCC), estimates that clean coal technologies have the potential to reduce CO_2 emissions by 220 to 2200 Gt in the XXI,. This means that that 15% to 55% of global efforts related to climate change mitigation can be achieved through CCT (mainly through CCS) [11].

The McKinsey & Company curve[12] prepared for Poland, demonstrates that CCS has the potential to reduce CO_2 emissions in Poland by 15% by 2030, but only if appropriate actions are planned and executed relatively early. At the beginning of 2030, CCS could annually contribute to reducing up to 0.4 Gt CO_2 emissions in Europe and 3.5-4 Gt CO_2 on a global scale[13]. In addition, CCS has the potential to increase Europe's energy security by making European natural resources more environmentally friendly and European economy less dependent on gas imports.

1.1. TRENDS IN THE INTERNATIONAL ARENA

In the case of Clean Coal Technologies, as well as in the case of renewable energy sources, we are dealing with a peculiar shift of moods. In Europe, in conjunction with the CCS Directive of 2008 and the subsequent European Energy Reconstruction Program (EEPR), which allocates 1 billion EUR for six CCS demonstration projects in the EU - support for CCS was continuously increasing over the last few years. However, due to difficulties in implementing certain demonstration projects (mainly due to the lack of public acceptance) and the increasing potential of shale gas (as a "transitional technology"), the development of CCS has not been proceeding as rapidly as expected.

A good example of this is the situation in the Netherlands, which is facing major problems with public acceptance for CCS. The CO_2 storage project near Barendrecht was abandoned partly because of the continuing objections from the local community. This illustrates the extent to which reluctance of the public may hinder CCS implementation. The Barendrecht project was planned to store about 10 million tones of CO_2 during 25 years. The CO_2 would be acquired the Shell Pernis refinery near the port of Rotterdam.

11 Special Report on Carbon Dioxide Capture and Storage.

12 *Assessment of Greenhouse Gas Emissions Abatement Potential in Poland by 2030,* McKinsey&Company, 2009.

13 *Carbon Capture & Storage. Assessing the economics*, McKinsey&Company, 2008.

On the other hand, the UK government announced the introduction of Emission Performance Standards (EPS) for all coal-fired power plants to the British Energy Law. The House of Commons' Energy and Climate Change Committee took up the debate on the EPS in the context of its positive impact on the deployment of CCS. Importantly, despite significant cuts in public spending, the British government upheld its decision to allocate 1 billion GBP for the first CCS demonstration project in the UK.

The U.S. Department of Energy took a closer look at and further clarified the regulations associated with both transport and storage of CO_2. The Environmental Protection Agency and the Special Panel on CCS appointed by President Obama have prepared a handbook on how to select proper structures for CO_2 storage. The State Department has decided to allocate 500,000 USD for the Global CCS Institute project on knowledge and experience sharing. In January 2011, the Department of Energy together with the National Energy Technology Laboratory updated the RD&D Roadmap for CCS, which implies i.e. a strong concentration on the integration of three CCS components: capture, transport and storage.

The Australian Government plans to introduce a new policy, which would impose a duty on coal-fired plants to adapt to the highest emission standards and become CCS ready. But what it is worth noting, Australia - the fourth largest coal producer in the world - which has announced the construction of four demonstration plants and in April 2009 set up the Global CCS Institute, has taken, in the last few months, several decisions which decrease spending on CCS demonstration projects. These decisions were mainly related to a series of floods that hit the country. On 27 January 2011 the Australian government decided to cut public spending, which means some 2.8 billion AUD less on initiatives related to low carbon technologies (including CCS)[14]. Having said that, the Australians are still very active on international forums and support projects related to CCS technology in many countries around the world, including Poland.

Tremendous progress in the field of CCS has been made in China without establishing any special legal or political frameworks. This progress is greatly connected to the ongoing projects run in cooperation with China's foreign partners, such as the China-US Clean

14 http://www.pm.gov.au/press-office/rebuilding-after-floods

Energy Research Center and other ventures aimed at finding locations for storage (inter alia with Geoscience Australia). China began its specialization with coal gasification, but it does not intend to stop there. The pace of developments in China's projects is impressive. For example, it took a little over a year to erect the Shidongkou power plant with CO_2 capture installation and IGCC demonstration project "GreenGen", which is almost finished, took less than two years of construction.

These trends suggest that the dynamic around CCS deployment is not declining. What have changed are the conditions. Difficulties arose in areas of public acceptance or natural disasters and the associated need for fund relocation. Nevertheless, the is no doubt about the need to demonstrate CCS technology within the driving principle of "not picking the winners".

1.2. POLAND IN EUROPE

The European Union has decided to build its position and strength as well as its competitive advantages on a new economic model - based on a low carbon economy – in which new sectors (based on innovative technologies) are key elements to economic growth. This is to enable Europe to face two of its challenges: energy security and climate change. One of the instruments designed to build a low carbon economy is the energy and climate policy of the European Union, under which Member States decided on their specialization in select areas. The specialty of the northern states would be renewable energy, and potentially CO_2 off-shore storage. Southern Europe has good conditions to develop solar energy technologies. Central and Eastern European countries should seize their opportunities associated with on-shore CO_2 storage, shale gas, biomass and geothermal energy.

Poland has a unique chance to follow abovementioned trend – its energy sector is based on coal and only Clean Coal Technologies will allow it to extend the exploitation period of hard and brown coal, before the commercial application of alternative energy sources (including renewables and unconventional gas) is available. The Polish situation is somewhat favourable, as the need for economic transformation and the commitment of reducing greenhouse gas emissions coincide with the need to modernize the Polish energy sector. In percentage values, 37% of Polish energy production

facilities is 20 to 30 years old, 43% is more than thirty years old, while only 8% of the installations are relatively new (5-10 years) [15]. We are at the point of choosing the means - technologies, mechanisms, instruments – which will allow Poland to become a beneficiary of the low carbon transformation of the energy sector.

The Polish Energy Policy until 2030[16] envisages a rational and effective management of coal deposits, located on the Polish territory and the continuous use of coal as the main fuel for power plants. The Energy Policy also provides for the development of modernized coal preparation technologies for energy use as well as the identification and resource base increase of this fossil fuel. If we assume, therefore, the upholding of a substantial share of coal in energy production and the reduction of greenhouse gas emissions Poland will have to use Clean Coal Technologies. As calculated by McKinsey&Company, the Polish energy industry has a great chance for a widespread use of CCS on a commercial scale by 2030[17]. Nevertheless, this will require much mobilization and determination of all the stakeholders.

RECOMMENDATION

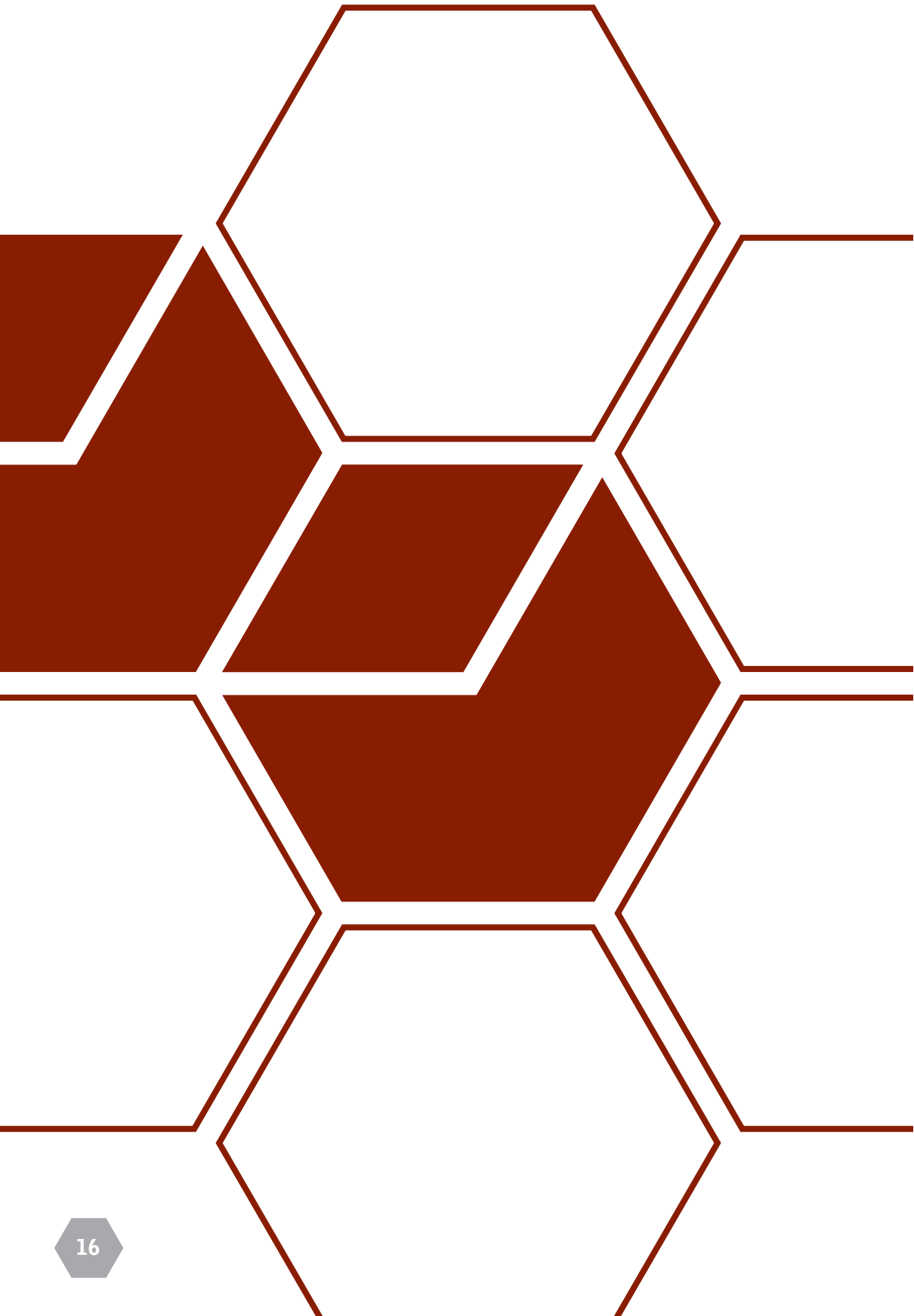
The key CCS stakeholder in Poland - the government - should extend political importance of CCS, so that it becomes one of the key tools for the implementation of the Polish energy and climate policy. In the wake of this decision, the **Polish CCS Strategy** should be prepared. Such strategy would include a detailed scope of activities in key areas related to safe and consistent implementation of Carbon Capture and Storage in Poland:

- capacity building,
- institutional framework,
- legal framework
- financial framework,
- research and development (R&D) potential,
- public awareness.

15 Report *Poland 2030. Development Challenges*, Group of Strategic Advisers to the Prime Ministers, 2009.

16 *Polish Energy Policy until 2030,* Ministry of Economy of the Republic of Poland, 2009.

17 *Assessment of Greenhouse Gas Emissions Abatement...*, op.cit.



2

Capacity building

Andrzej Siemaszko, Director, National Contact Point in Poland

2.1. CONDITIONS OF CCS DEPLOYMENT IN POLAND

Poland has signed up to the EU energy and climate policy, and obtained derogations allowing for smoother transformation of the energy system. There is no doubt that the implementation of CCS technology is associated with enormous costs regarding both development and implementation as well as operation and maintenance, which ultimately must translate into greatly increased prices of electricity. There is also another negative aspect of CCS implementation – the additional amount of energy needed to operate the process of capture, transport and storage of CO_2. Consequently, efficiency losses of 10 per cent are expected for new units in the power plants (and even more for the existing ones), which means a much greater consumption of coal. The widespread deployment of CCS will therefore lead to much faster depletion of our coal resources, or to increased coal imports.

The main argument in support of the current policy is that of mitigating the climate change, which does not seem very compelling or justified to Poland, a country situated in a temperate zone. As there are no strong arguments in favour of CCS technology, many experts, business leaders and politicians start to show reluctance

to embrace the new technology, which naturally becomes an obstacle to the effective implementation of CCS.

With so many challenges facing the CCS technology, important questions must be asked: What interest is there for Poland in implementing CCS? How to minimize costs and increase profits? How to turn challenges into opportunities for our economy? How to ensure that our national coal resources continue to be used for energy production and chemical industry purposes despite the plans to decarbonise the economy?

We can distinguish four areas of political and economic benefits that could offset the costs of CCS implementation and open up new opportunities for us:

- modernisation of energy sector,
- leadership in the development of CCS (or more broadly: Clean Coal Technologies),
- internal diversification of energy sources,
- increased EU financial support,
- Modernization of energy sector

The wear rate of the fixed assets in the Polish power sector is almost 70%. Extremely low-efficient units burn disproportionately high amounts of coal, which also translates into very high emission rates, are operating in Poland. Implementation of CCS technology thus poses an opportunity to retrofit the power plants with high-efficient technologies that, despite some energy losses associated with CCS, would be more efficient than those currently used.

Leadership in research and development of Clean Coal Technologies (CCT)

The EU makes no secret of the fact that the climate and energy policy not only serves to save our planet, but also to capture economic gains. The EU aspires to become a champion in the development of low carbon technologies, which, by offering them on the global market, will help European companies offset huge costs involved in the new technologies development. Poland should also strive to achieve those goals. The development and commercialisation of CCT should become a primary way for Poland to balance and minimise the costs of its low carbon transition.

The development of CCT could leverage the growth of the national economy and help it attain a prominent position among the winners of the unfolding industrial revolution. We should find our Polish research speciality, take the initiative in the development of CCT, and promote our leadership in the EU. The development of individual CCT units, their optimisation and increasing their efficiency will obviously contribute to reducing the investment and operating costs and, by commercialisation on the global markets, may result in financial benefits.

Internal diversification of energy sources

CO_2 can be used to boost the domestic production of natural gas, oil, methane, synthetic gas and hydrogen. This allows for an internal diversification of energy sources, thus making Poland less dependent on imports. This programme may also have a significant damping effect on the growth of energy prices, by promoting the relatively cheaper (domestic) sources of gas. It would contribute to the creation of new industry sectors in Poland, based on chemical coal processing and large-scale use of CO_2 in industrial processes. The programme would provide some compensation for carbon leakage from energy-intensive industries – as they would be replaced by more modern industry sectors.

Increased EU financial support

Being regarded as a front runner in the development of CCT technology would automatically give us a stronger voice within the EU, allowing us to develop and defend a strategy of a more balanced approach to aligning the necessity of CCS implementation with the need to further our economic interests. It is also easier for a technology leader to secure additional financing for development of CCS technology from the European funds (additional support from the Structural Funds, the SET Plan, the new "European Clean Energy Fund"). The leader status would also facilitate passing some more lenient regulations for our country, and obtaining further derogations.

2.2. POLAND'S CCS EXPERTISE

To date, three primary CCS technologies are considered to be implemented within the EU: post-combustion, oxy-fuel and coal gasi-

fication (pre-combustion). For Poland it is important to promote its interests in Clean Coal Technologies that go beyond CCS, where Poland has a lot of expertise and where a vast potential for development of R&D sector exists (CCS is a subset of CCT). We can consider the following key Clean Coal Technologies:

CO_2 capture technologies

Generally, Poland cannot boast any major expertise in CO_2 capture processes, coal gasification technologies developed by the Institute for Chemical Processing of Coal (IchPW) being a notable exception. Therefore, implementation of the two complementary CCS demonstration projects in Bełchatów and Kędzierzyn-Koźle would allow us to test and grow our comprehensive expertise, covering nearly twenty CCS technology blocks.

Coal gasification technology (pre-combustion) is of strategic importance for Poland, as the primary product of gasification process is syngas, which is an alternative for natural gas and the raw material for the huge carbochemistry sector. 25-30 gasifiers can produce enough syngas to offset the total imports of natural gas to Poland. This is of great importance in view of strengthening our energy security, as gasifier plants, while catering for the needs of the power and chemistry sectors, might also be provided with reserves to be used, if necessary, to produce gaseous and liquid fuels from coal and eliminate our reliance on imports. Therefore, with several equivalent CO_2 capture technologies to chose from (provided that the costs are comparable), gasification technology should be given a strong preference.

Carbochemistry, production of syngas, synthetic fuels and hydrogen

Coal gasification in the CCS Demonstration Programme, forming an integral part of the IGCC technology, allows not only to separate CO_2 to be sequestered in the pre-processing system, but also to produce pure hydrogen. Poland could quickly become one of the largest producers of hydrogen - the cleanest fuel. This would open up opportunities to build a “hydrogen economy”.

The synthetic gas obtained in the coal gasification process can be used to produce synthetic liquid fuels for motors, methanol, urea,

plastics, resins. The so called chemical carbon sequestration occurs in these processes, as the element carbon is trapped in the new products. Therefore, combining the chemical processes based on coal gasification processes with IGCC power systems is particularly economical. Currently, a polygeneration power plant project is underway in Kędzierzyn-Koźle in Poland. Poland boasts a great research potential in the field of carbochemistry (IChPW, ICSO, IChO, GIG, AGH).

Survey and development of on-shore geological CO_2 storage sites

Of all EU countries, Poland offers the best conditions for CO_2 storage in deep on-shore saline aquifers. Storage capacity in the Mesozoic-Permian formations is estimated at 90 billion tonnes of CO_2. At the request of the Ministry of the Environment, a National Program is currently underway: "Identifying geological formations and structures for safe CO_2 storage with monitoring program", run by a consortium of PIG-PIB, AGH, GIG, INiG, IGSMiE and PBG. The experience gained from the project and bringing the combined knowledge of all major experts together will contribute to the building of a research potential as required to explore and map the potential CO_2 storage sites, develop operation models, and a monitoring and verification system, as well as gather experience in enhanced hydrocarbon recovery (EOR, EGR, ECBM) using CO_2. Poland can take a lead in identifying and constructing on-shore CO_2 storage sites. To this end, GEOCENTRUM – a consortium bringing together major research and industry institutions - has recently been founded.

Increased production of natural gas and crude oil using CO_2

The Enhanced Gas Recovery (EGR) and Enhanced Oil Recovery (EOR) technologies involve injecting CO_2 in the vicinity of extraction boreholes. In terms of original oil reserves, Poland has large oil deposits: BMB and Kamien Pomorski in Western Pomerania, B3 and B8 deposits located in the Baltic Sea and smaller ones in the Carpathian Mountains and in the front zone of the Carpathians, with the largest one, Nosowka deposit, located in the area of Rzeszow. Deployment of the EOR technology would allow Poland to increase its oil production by 10-15% for individual deposits, whilst disposing of significant quantities of CO_2.

About thirty gas fields with the potential for enhanced recovery using CO_2 injections are located in the west and south-east of Poland. With EGR, Poland could increase its gas production to satisfy 40 - 45% of the existing demand. Poland is a European leader in the EGR technology – this technique has already been used since 1995 to enhance gas recovery in Borzęcin gas fields (PGNiG, ING).

Underground coal gasification

The underground coal gasification technology (UCG) is currently being developed in many countries. The synthetic gas obtained with the use of UCG method can be several times cheaper than the gas obtained by way of the aboveground gasification process. Mastering the UCG technology could pave the way for Poland to tap the vast subeconomic (i.e. too deep, too thin, too diagonal) reserves of hard coal and lignite, located virtually all over the country, large enough to last for hundreds of years. Given the potential for aboveground and underground gasification, Poland may become Europe's largest producer of synthesis gas and hydrogen.

The key to successes may be the deployment of the CEEC (Complex Extraction of Energy from Coal) technology, proposed by the Polish Laboratory of Radical Technologies. It is the world's only method which makes use of the stream of heat produced in the underground gasification, in addition to the stream of syngas, thus delivering outstanding economic performance and very high energy efficiency levels. With this method, Poland could become a global CCT leader.

Underground coal bioconversion

The underground coal bioconversion technology uses the latest biotechnologies (special strains of bacteria), which convert underground coal or peat into biogas, and humic acid (great fertilizer).

Extraction of methane from coal deposits

Given the enormous deposits of methane that accompany the coal deposits and the fact that methane is a greenhouse gas 21 times more dangerous than CO_2, technologies for methane recovery from coal deposits should be deployed. What is needed here is the coal fracturing (grinding) technology, e.g. CEEC). The CO_2-ECBM tech-

nology can be used for methane recovery enhancement. Poland has considerable experience in methane recovery from coal deposits (GIG, PLRT, PolTexMethane, JSW)

In summary, implementation of the two complementary CCS demonstration projects in Bełchatów and Kędzierzyn-Koźle would provide an opportunity to test and gain experience in nearly twenty CCS technology blocks. Add to this the Polish areas of expertise, where we have already gathered great experience (geology, underground gasification, UCG, CTG, CTL, CTH, EGR, EOR, ECBM), we could very quickly become a global leader in the development of clean coal technologies.

2.3. BARRIERS TO THE DEVELOPMENT OF POLISH EXPERTISE

The primary barrier to the development of the Polish CCT expertise is a very poor research infrastructure potential (downgraded test equipment), inadequate human capital (huge staff reductions) and organizational weakness (obsolete system of education, abandoning the strategic research), caused more than twenty years of financial distress. The Polish R&D spending ranks among the lowest in the EU.

Another barrier are the broken links between industry and science, low level of innovation and unwillingness to take risks by businesses. Industries are poised to procure commercially available technologies rather than develop their own. This is due to the lack of strong incentives for pursuit of research activity (with the major corporations having research centres abroad).

Another barrier to the development of our R&D base is the weakness of the financial system (lack of financing instruments for critical technologies) and the legal system (weakness of innovation laws, poor development of Public-Private Partnerships - PPP).

This situation poses a risk that, due to the poor condition of our R&D capabilities, Poland might lose its chance to become a leader in CCT development. This means that the money we spend on implementing CCS will be capitalised on by others, and the CCT research potential will be built outside the borders of our country. What seemed at first to be a trump card for our economy may turn out to be yet another failure. The first signs can be observed in the

NER300 competition to finance the CCS demonstration plants. The basic criterion is the level of private funds, defined as the power engineering company's investment in research and development of new technologies. In the case of Poland, with none of the Polish power engineering companies having their own R&D centres or running own research programmes, this contribution only becomes an expense.

2.4. REQUIRED MEASURES

Public administration

For the smooth implementation of the CCS programme, institutions in charge of CCS initiatives, coordinating the CCS projects, responsible for the planning of CO_2 transport networks, for identification, construction, monitoring and ensuring the safety of CO_2 storage sites, must be established without delay.

As a prerequisite for the CCS programme implementation, a legal framework for the geological storage of CO_2, CO_2 transport, and support for the CCS technology demonstrations (special law) must be developed. It is crucial to create a financial and legal framework for the financing of CCS deployment (CO_2 trading, 'blue certificates"), for public aid (structural funds, government guarantees), and for support of research programs and demonstration projects.

Research institutions

Clean Coal Technologies is practically the only research area where Poland could develop into a European or even global leader. The Polish research institutions should integrate their potential, focus on the joint implementation of several strategic research programs (underground coal gasification, syngas based production of synthetic gas and liquid fuels, chemical sequestration of CO_2, geological mapping, construction of CO_2 storage reservoirs and developing the enhanced hydrocarbon recovery technology). For this purpose, a coherent national programme funded by the National Centre for Research and Development (NCBiR) and investment funds should be established. By concentrating expenditures, expanding R&D capacity and promoting CCT ideas in the European agenda, we will have a chance to develop the Polish research expertise ("the Polish Nokia").

Industry

When pursuing the Polish clean coal technologies we should strive for their practical application in the power engineering and chemical plants. A new Polish speciality: construction and installation of low-carbon power plants and systems should be established on the basis of CCT. The first benefit will be the optimised reconstruction of the energy sector with participation of Polish companies using Polish technologies (profits and jobs in Poland). The gained experience could also be instrumental in facilitating and promoting exports of complete low-carbon power and industrial systems, services (preparation of sites for geological storage of CO_2) and technologies, thus capturing significant financial benefits.

Financial institutions

The past experience shows the need for three different financing instruments to be adapted to financing the various phases of the CCT development: demonstration (and subsequently commercial) CCS plants, CCT pilot and demonstration programmes, and CCT research programmes. In the first case a mechanism is developed to pass some of the profits from CO_2 emissions trading to CCS financing ("Blue Certificates"). In the third case of research, the key role is to be played by the National Centre for Research and Development (NCBiR), which should launch a multi-annual strategic CCT research program. Instrumental should also be the participation in the European Union's Seventh and Eight Framework Programme (priority: "clean coal technologies").

The greatest challenge is the support of CCT pilot and demonstration projects ("internal diversification of energy sources"). We have no appropriate instrument here. What is need is establishing a special Clean Energy Investment Fund (financed from CO_2 emission trading). Following the example of European Industrial Initiatives (EII), establishment of a private public partnership to finance the individual elements of the program, might be considered.

International cooperation

The Polish presence in European fora should be actively stimulated, our own vision of low carbon economy that, while meeting the environmental objectives, would not undermine the competitiveness of

the economy of Poland and Eastern Europe, should be elaborated. We should cooperate more closely with the countries relying on coal, and even create a strong lobby to support the clean coal power industry, providing inputs to the energy policy and legislation. Collaboration with our southern neighbours can be deepened by creating a Central European CO_2 Cluster to establish a common CO_2 transport and storage sites network (e.g., connecting the Czech Silesia power plants to the Polish network).

We should also actively participate in the European programmes, such as CCS Demonstration Programme or EEPR, as they commit significant resources to the development of CCS technology. The European programmes also help address legal, organizational, technological, publicity, or social acceptance issues. One of the crucial features of these programmes is the emphasis on knowledge sharing (e.g. Knowledge Sharing Network), allowing for the exchange of valuable comparative financial and technical information covering individual blocks of the CCS technologies which are critical for optimising decisions on CCS deployment.

RECOMMENDATION

In pursuit of Carbon Capture and Storage in Poland and in our transition to a low carbon economy we should not rely on haphazard or random actions. Due to the enormous scale and complexity of issues involved, a comprehensive, coordinated Polish Flagship Programme for Clean Coal Technologies (PFP) is required to provide a framework for the development and deployment of Clean Coal Technologies in Poland. The PFP should be one of the main components of the National Emission Reduction Programme.

This Programme should have a broader focus than just promotion of CCS: it should also include development of new (underground and aboveground) coal gasification technologies, allowing for the production of synthetic gaseous and liquid fuels and for boosting the domestic production of oil and gas using CO_2. The Programme implementation could decrease our reliance on fuel imports and help us achieve a high degree of internal diversification of energy sources (i.e., in addition to our own natural gas, methane and oil, also synthetic alternatives produced from coal might be offered). The effects of CCT commercialisation and the increased coal processing efficiency would significantly offset the costs of CCS deployment. All the stakeholders – national and local governments, research centres, industry and financial institutions - must be involved in the implementation of the Flagship Programme.

3

Institutional framework

Eugeniusz Sutor, Head of Development Office, ZAK S.A.

Any industrial activity in the world must be performed in compliance with the law. Hence, the operators are obliged prepare technological options complying with applicable standards and regulations. The more progressive companies often have scenarios in place to prepare for potential changes in legislation that might affect their business. Bearing this in mind, we should approach the CCS issue professionally, taking into account the commercial nature of the technology. Since we acknowledge - without burying our heads in the sand - the global nature of the problem of greenhouse gas emissions and we want to address it, then the only question that remains to be answered is whether the initiatives to address it should be taken globally or regionally? The answer to this question seems quite simple. Regardless of the international agreements, actions tend to be taken on a regional level, as the economic operators are primarily guided by self-interest. When we take a closer look on the CCS initiatives in the EU, even though there is a common goal, the regional interests are diverging. For instance, it will be difficult to agree on joint activities between France with a 4% share of coal in its electricity generation mix and Poland with a 92% share, even though both countries strive to minimise the environmental footprint of their industrial activities. Nonetheless, Carbon Capture and Storage lies in the interest of the European Union as a whole.

3.1. AREAS OF ACTIVITY REGARDING CCS

The CCS issues, due to their innovative nature and complexity, must be addressed from many different angles. Therefore, an appropriate institutional framework to allow coordination of work in key areas of activity relating to Carbon Capture and Storage must be prepared:

Technological and technical aspects:

CO_2 sources

The majority of manufacturing activities associated with the so-called heavy industries involve carbon dioxide emissions to the atmosphere. Production of electric power and heat based on raw materials is a source of CO_2 emissions. The same applies to many sectors of chemical industry which heavily rely on raw materials such as coal, natural gas or other primary organic raw materials, used in the particular stages in the manufacturing chain of various products offered to the consumer. CCS offers a way to greatly reduce or eliminate CO_2 emissions to the atmosphere.

Capture

Methods of CO_2 capture from gases of different compositions are not a novelty and are commonly used in industrial practice. The applied technologies must be modified depending on the medium from which CO_2 is separated. It determines the level of investment expenditures and operating costs of particular solutions.

Transport

CO_2 transport is not generally used to carry the required quantities of captured CO_2. In industrial practice, transport is ensured by means of pipelines. Since CO_2 is expected to be transported on a large scale, system solutions should be provided to address the issues of transport, involving construction of pipeline networks. Hence the key problem regarding the transport will be investing in pipelines.

Storage

Captured CO_2 can be stored in geological structures connected with aquifers or in sites where natural hydrocarbons (crude oil and natural gas) used to be or still are being extracted. Especially the latter methods are being used today, supporting the extraction of hydrocarbons by enhancing the recovery efficiency and the yield rate of deposits. Carbon dioxide is stored in place of the extracted hydrocarbons.

The physical and chemical parameters of CO_2 determine the depth at which it may be stored and render it necessary to constantly monitor the storage site, even after completion of the sequestration process. So, the key issue when storing CO_2 is the knowledge about the geological structures and identification of potential CO_2 storage sites and storage conditions.

Public acceptance

Due to the fact that the above mentioned operations, transport and storage in particular, take place with the use of natural environment, they cannot be conducted without public acceptance. Many countries' experiences show that the issue of public dialogue, aimed at securing public acceptance, is equally or even more important than the technical solutions applied and the effectiveness of actions taken. Public dialogue should be conducted at both the global and regional levels.

Legislation

Like any new activity, revision of current legislature is required to provide a legal basis for CCS operations. Due to the nature of the activities that require state licensing (transport and storage), prior regulation of these activities is necessary.

Provision of financing

Due to innovative and – in the initial phase – demonstrative nature of the activities, public funding must be provided to put the project in motion. Since the demonstration projects will be, after completion thereof, operated commercially, the commitment by sponsors is equally important.

Research and development

Adequate research and development programmes should be put in place to address the issues relating to CCS solutions, before and during the implementation of demonstration initiatives. Even the proven capture solutions taken over from other technologies and applied in the modified IGCC technology must be optimised with the use of R&D inputs. These issues are all the more critical where CO_2 storage is involved. Due to interdisciplinary nature of the problem, several specialised centres and institutions should be invited to provide inputs on all possible topics including geology, mining, chemistry, materials science, environmental protection, sociology, and legal issues.

Environmental protection and safety

Due to the handling of very large masses and the industrial exploitation of the environment, the operation safety aspect and the need to ensure integrity of the environment condition are given high priority in dealing with CO_2 emission reduction using the CCS technology.

3.2. SYSTEMIC SOLUTIONS

Bearing in mind the proposed large scale deployment of the CCS technology to significantly reduce CO_2 emissions to the atmosphere, notably in the commercial and industrial power engineering sector (especially in Poland), as well as in chemical and other industrial operations being significant sources of CO_2 emissions (steel works, cement industry, etc.), the only viable solutions are systemic solutions. No single initiative, unless undertaken for demonstration purposes, makes sense or will provide a global solution to the problem, by eliminating or mitigating it in a publicly acceptable manner.

When answering the question “how to effectively deploy CCS in Poland?” in the context of institutional framework, we need to address two elementary questions: (1) What are the goals and tasks to be achieved? (2) Who should manage them? Managing by objectives is a process of setting, implementing and evaluating them. The question of whether there is a strategic document defining CCS goals in Poland must be answered in the affirmative. On 10 November 2009 the Council of Ministers approved the document

entitled “Polish energy policy until 2030”, hereinafter referred to as the POLICY. To ensure implementation, inter alia, of provisions of the POLICY, a draft document entitled “Implementation Programme Clean Coal Demonstration Technologies” - hereinafter referred to as the IMPLEMENTATION PROGRAMME, is being prepared by the Ministry of Economy. When approved, this document will provide a framework for the practical implementation of the POLICY by setting the particular goals to be achieved. Both of these documents will provide institutional framework for the implementation of CCS in Poland.

The POLICY provides for the following CCS measures:

Measure 2.9 “Supporting research and development of technologies permitting to use coal for liquid and gaseous fuels production, mitigating the negative environmental impact of the processes of obtaining energy from coal as well as coal fuel cells technologies” Implementation methods for this measure include promoting pilot projects in coal gasification, including implementation of strategic programs by the National Centre for Research and Development, and support of innovative projects under the Operational Programme “Innovative Economy” for the years 2007–2013. The bodies responsible for these activities are: minister in charge of the economy, minister in charge of science, research and the developmental entities, commercial entities.

Measure 6.3 “Meeting the commitments for the power and heat sectors arising from the new ETS Directive”, which provides for a national investment plan to allow reducing CO_2 emission volumes, taking into account the development of clean coal technologies. The bodies responsible for these activities are: minister in charge of economy, minister in charge of environment.

Measure 6.4 “Using the income from auctions of CO_2 emission allowances to support measures aimed at reducing greenhouse gas emissions”, which was established to set priorities as to the use of proceeds from CO_2 emission allowances auctions, including support for improving coal gasification technologies and construction of CCS facilities and research in this field. The bodies responsible for these activities are: minister in charge of economy, minister in charge of environment, minister in charge of science.

Measure 6.5 "Introducing standards for building new power plants under the system of preparation for carbon capture and setting national capacity of geological storage of carbon dioxide" which provided for, among other things, Poland's participation in the work of the European Commission on devising the standards for the construction of new power plants under the CCS ready system, implementation of the Directive on the geological storage of carbon dioxide into the Polish legislation, conducting a public awareness campaign on the most significant aspects of the CCS technology and the implementation of the programme for identifying the formations and structures for safe geological CO_2 storage and monitoring. The bodies responsible for these activities are: minister in charge of economy, minister in charge of environment.

Measure 6.6 "Active participation in implementing the initiative of the European Commission to build large-scale demonstration facilities for carbon capture and storage (CCS) technologies," which provides for, among other things, undertaking comprehensive activities on the EU forum aimed at including two Polish CCS facilities on the European Commission list of demonstration projects, determining support instruments for Polish CCS projects, making the decision on financing the development of CCS technologies under the Operational Programme Infrastructure and Environment, the launch of two CCS projects and the preparation of the national flagship programme on development of clean coal technologies, including CCS. The bodies responsible for these activities are: minister in charge of economy, minister responsible for regional development and energy companies.

Measure 6.7 "Applying CCS technologies to support crude oil and natural gas extraction", in which a decision was made to devise a programme indicating, inter alia, potential sites of application of CCS technologies to support crude oil and natural gas extraction, including an implementation schedule, considering the possibilities and potential inclusion of those works in the National Research Programme. The bodies responsible for these activities are: minister in charge of economy, minister in charge of environment, minister in charge of the treasury, minister in charge of science and petroleum industry companies.

Measure 6.8 "Intensifying research and development regarding the CCS technology and new technologies which allow using cap-

tured CO_2 as a raw material by other industry branches" in which a decision was made to, inter alia, secure funds in the amount at least PLN 100 million for subsidising the research and development works in this field, to establish a co-operation platform between science and business via the National Centre for Research and Development, and announce competitions for projects eligible for support. The bodies responsible for these activities are: minister in charge of science and the National Centre for Research and Development.

Measure 6.13 "Supporting measures in respect of environmental protection with the use of, inter alia, European funds", in which a decision was made to support the environmental protection projects aimed at reduction of emissions with the environmental protection and water management funds. The bodies responsible for these activities are: minister in charge of environment and province governments.

As we can see, the POLICY provides for some measures relating to CCS. But they are not sufficient. First, this is a document of strategic rather than operational focus, and as such fails to propose activities to be taken in specific areas (except for nuclear power). Secondly, by the very nature of things, this document fails to secure funds for carrying out the tasks and objectives. The gap is to be filled by the IMPLEMENTATION PROGRAM. The draft document of the IMPLEMENTATION PROGRAM provides a further elaboration of the provisions of the POLICY and clarifies the specific objectives and tasks to be performed with respect to Clean Coal Technologies, including CCS. The draft IMPLEMENTATION PROGRAMME of the Ministry of Economy clearly defines specific measures for the effective implementation of CCS technology in Poland:

Investment opportunities in Clean Coal Technologies, taking into account various combinations of support from the EU and the Polish government, should be assessed without delay. This assessment should include simulations of economic impact of implementing clean coal technologies to determine the boundary parameters for programme implementation and its feasibility.

- Joint actions taken by energy companies to construct demonstration facilities in various versions (post-combustion, pre-combustion, oxy-combustion) should be promoted to reduce the financial burden for economic operators in pre-implementation phase.

- A national system for geological CO_2 storage should be created and the missing regulations supplemented. In addition, this expertise should be made available to the energy companies which plan for their development but have no know-how in this regard.

- Legal conditions (BAT reference document for the energy sector) should be established for the issuing of integrated permits for CO_2 capture, transport and storage.

- Economic impact on the Polish economy of the expected development of CCS technologies should be thoroughly analysed, bearing in mind, that the political decision taken by the European Union to embark on an emission trading scheme and economic stimulation of CCS development will enforce such mechanisms that the market price of the carbon credits stands at 40-60 euro/t of CO_2 to offset the costs of CCS .

- An integrated plan for modernization and investment in the energy sector should be developed, bearing in mind that Europea n Commission may impose a requirement for making new-build power plants CO_2 capture ready.

- Strong development of coal gasification processes should be planned after 2013, which, in addition to traditional combustion, are considered to be a more effective technique when CCS technology is applied, including gas-steam applications.

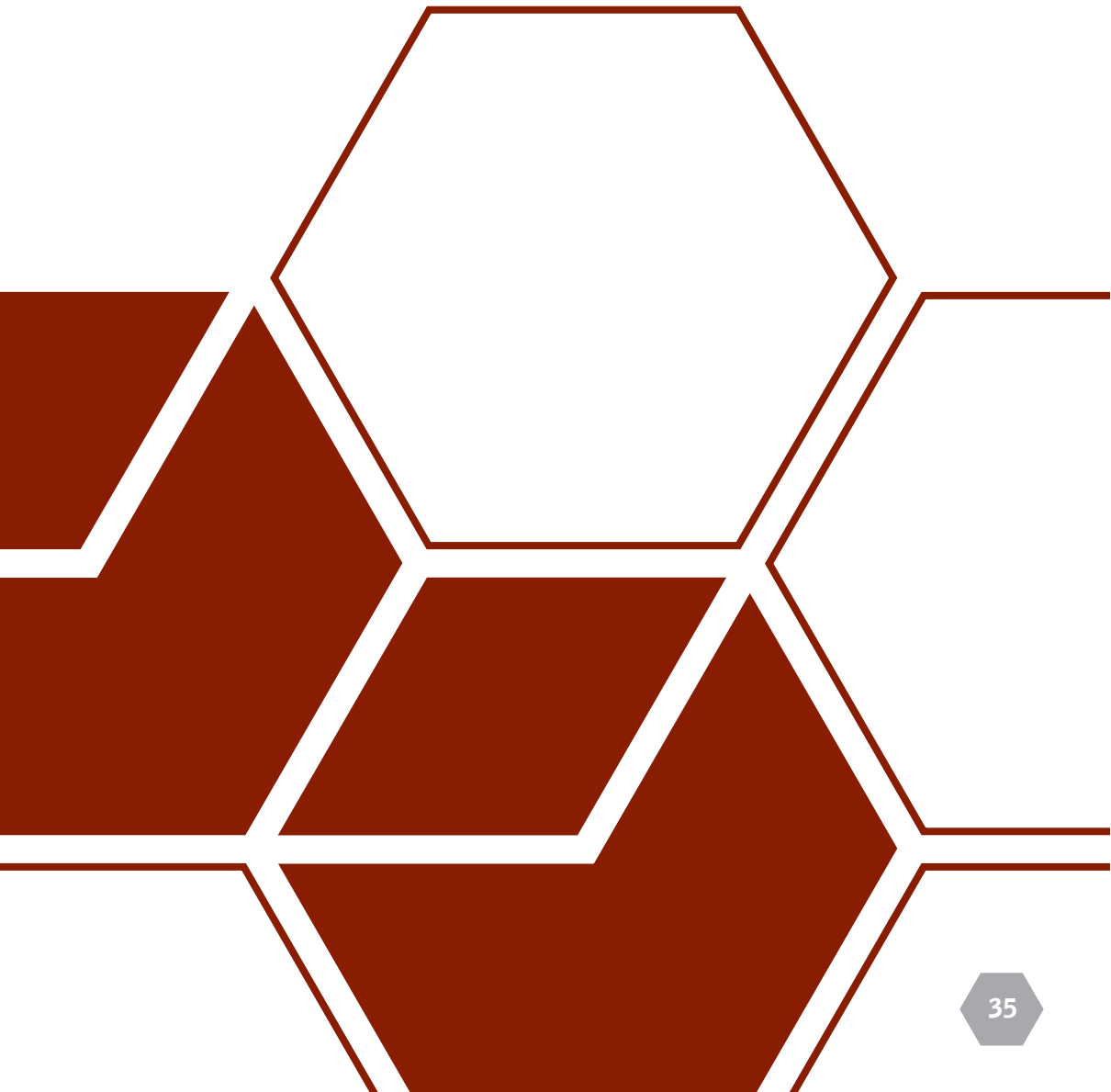
- The most effective strategy to help reduce CO_2 emissions of energy production from renewable sources, including biomass burning, which, in contrast to the CCS increases the profitability of energy production, contributing to the slowdown in price growth.

- International cooperation in the field of analysis and selection of the best technological solutions for the clean use of coal should be fostered, for instance, the achievements of the American Clean Coal program which has been in place since the eighties of the last century, or the work of Global CCS Institute in Australia, could be examined.

- Non-technological CCS aspects should be further investigated. In cooperation with academic and research communities, a public awareness campaign should be initiated to provide information

on the safety issues arising from storage of carbon dioxide CO_2 in geological structures."

In order for the IMPLEMENTATION PROGRAMME to be effectively carried out as an operational program, it must have a budget for the proposed activities. After enactment, the budget of the IMPLEMENTATION PROGRAMME should form an integral part thereof.



RECOMMENDATION

Effective deployment of CCS technology in Poland needs involvement of administrative bodies including all the ministers mentioned in the POLICY - those in charge of economy, environment, science, regional development and treasury. Another institution to be involved is the National Centre for Research and Development which should be in charge of the process of organizing consortia of scientific institutions and economic operators within the area of Clean Coal Technologies.

Economic operators themselves, being affiliated in non-governmental industry organisations, provide an excellent forum for activities with the use of Public-Private Partnerships for the CCS technology implementation in Poland.

A vast number of measures described above are to be implemented by the administrative bodies, scientific institutions and the industry. However, in order for these measures to get optimised, **one central leader for these measures must be defined.**

This is not about taking over the powers of the existing bodies and institutions; it's about the need to coordinate the measures they take. Since the measures are taken on behalf of the Polish government by several ministries, an institution of a **Government Plenipotentiary for Clean Coal Technologies becomes indispensable.**

An example of such solutions in the form of the Government Plenipotentiary for Polish Nuclear Energy, established by the Council of Ministers' Ordinance of 12 May 2009 (Journal of Laws of 2009, No. 72, Item 662), is already a fact.

The Government Plenipotentiary for Clean Coal Technologies provides a key, missing institutional link for effective deployment of carbon capture and storage in Poland.

Legal framework

4

Pawel Magierowski, Lawyer, Baker & McKenzie

One of the primary conditions for successful implementation of the CCS technology in Poland is to adopt appropriate regulations that would enable efficient, yet safe completion and subsequent operation of projects using the new technology. In particular, such regulations should ensure transparency and certainty of the rights and obligations of all parties involved in CCS projects, and provide adequate levels of protection and safety for people and environment, establish a support system to allow the CCS technology deployment and, finally, help build public acceptance and confidence in the new technology.

The whole CCS process involves several steps – from capture of carbon dioxide at industrial facilities, transporting it to the storage site, to injecting it in suitable geological formations for permanent storage. The proposed legal framework should address all aspects relating to each of the above mentioned steps of the CCS process.

4.1. CCS DIRECTIVE

Poland, as the European Union member, will develop its legal framework for CCS largely based on the Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Direc-

tive 85/337/EEC, Euratom, the European Parliament and Council Directives 2000/60/EC, 2001/800/WE, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1010/2006 ("CCS Directive"). This situation is in so far favourable as by adopting the national legal framework for CCS, Poland will be able to extensively rely on solutions adopted at the EU level, rather than create entirely new legal constructs.

The CCS directive is in fact the first legal act of the European Union to regulate the issues of geological storage of carbon dioxide. The CCS directive provides the legal basis for the deployment of the CCS technology in the EU countries through the implementation of demonstration projects. This in turn could provide detailed results from the application of the CCS technology in specified geological conditions, so that decisions about the scale and nature of its future use can be made. The CCS Directive should be transposed into the national law (i.e. the adoption and entry into force of relevant regulations) by 25 June 2011.

The CCS directive focuses mainly on aspects related to the stage of geological storage of carbon dioxide, while the stages of carbon dioxide capture and transport (e.g. access to the CO_2 transport network, access to underground storage sites, and issues indirectly related to the capture of carbon dioxide at the plant) are given less emphasis.

The CCS Directive covers first and foremost the following issues:

- selection of storage sites for geological storage of captured carbon dioxide,
- exploration permits necessary for the storage site selection,
- permits for geological storage of carbon dioxide (including the terms of issue and the content, and also terms of permit modification or cancellation),
- operation of storage sits, closure and post-closure obligations (including monitoring, reporting, inspections, measures in case of leakages, transfer of responsibility to the competent authority or providing adequate financial security),
- third party access to carbon dioxide transport networks and storage sites,
- designation of competent national organs responsible for carrying out the obligations under the CCS Directive,

- transboundary cooperation in transport or storage of carbon dioxide,
- register of storage sites,
- reporting by Member States.

In addition, the CCS Directive amends many other acts of EU law in order to allow the safe deployment of the CCS technology, in particular:

- Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, by extending its scope of application to include the captured carbon dioxide transport networks, storage sites and capture installations,
- Directive 2000/60/EC establishing a framework for the Community action in the field of water policy,
- Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants, by extending its scope of application to include a requirement to provide CCS assessment and a requirement to set aside land for carbon capture facilities („carbon capture readiness-CCR"),
- Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage, by extending its scope of application to include the operation of storage sites for the captured carbon dioxide,
- Directive 2006/12/EC on waste, by excluding from its scope of application the CO_2 captured and transported for the purposes of geological storage,
- Directive 2008/1/EC concerning integrated pollution prevention and control, by extending its scope of application to cover capture of CO_2 streams from CCS facilities.

4.2. IMPLEMENTATION OF THE CCS DIRECTIVE IN POLAND

The current national legislation does not regulate the issues of carbon dioxide geological sequestration and hence the EU legislation must be transposed.

Due to the need to transpose the CCS Directive into the Polish legislation, assumptions for a draft act amending the Geological and Mining Law and other laws (the "Draft Assumptions") have been developed. From a formal point of view, these assumptions are only the first step in the process of preparation of relevant draft

bills. The works on the Draft Assumptions have been underway for many months and they have not yet been formally adopted by the Council of Ministers. Given the fact that once adopted, the final versions of the proposed legislation will have to be prepared and moved through the whole legislative procedure (Parliament – Senate – President), now there seems to be a real risk that the CCS Directive will not be implemented by Poland in due time and there will be a delay in this regard.

The primary objective of the regulation covered by the Draft Assumptions is to create the legal framework for activities involving safe underground storage of carbon dioxide. Transposition of the Directive into the national legislation is also needed to carry out the demonstration phase of the CCS projects in Poland (presently for two projects - in Bełchatów by PGE Górnictwo i Energetyka Konwencjonalna S.A. and Kędzierzyn-Koźle by ZAK and PKE Tauron Group). Implementation of these projects will allow to obtain detailed results regarding the application of this technology in particular geological conditions and a further decision on the scale and nature of its future use, and, in particular, whether it is reasonable to allow its large scale use in business, and whether the proposed regulation should continue to be applied or repealed. So, a provision was made in the Draft Assumptions to the effect that the regulations providing for the underground storage of carbon dioxide should limit the use of this technology to demonstration projects only (until 2026). In this regard, the proposed solution is based on the approach taken in the law regulating CCS in Germany (the so-called “sunset clause”).

In accordance with the Draft Assumptions, the activity involving underground storage of carbon dioxide will be subject to the Geological and Mining Law, which governs geological and mining business activities in Poland (such as prospecting, exploration of mineral deposits, extracting minerals from deposits, non-reservoir storage of substances, storage of waste in geological formations and in underground mining excavations.) Implementing the EU rules on underground storage of carbon dioxide into the national law will therefore first of all require amendments to the Act on Geological and Mining Law. This solution implies that the legal framework for CCS (and implementation of the CCS Directive) be introduced by amending the existing legislation (as is the case of the Netherlands or France). A different approach to the adoption of the proposed

legislative changes would be to create a new and separate law on CCS (as in Germany). Both options were considered when preparing the Draft Assumptions. However, given the fact that, so far, all aspects of geology and mining activities in Poland have been regulated in a single act (so as to ensure transparency) and considering that due to the similar nature of activities regulated by the CCS Directive and the Geological and Mining Law, the new Act would have to contain numerous references to the existing regulations (with adverse effect on its clarity), it was ultimately considered reasonable to transpose the CCS Directive (and thus provide a framework for CCS) into the existing regulation, which has been reflected in the Draft Assumptions. We may of course be wondering whether the adoption of separate laws would not be a more viable solution for the deployment of the CCS technology in Poland. However, an approach whereby the existing legislation is amended should not be less effective, provided that such amendments comprehensively address all CCS issues and are consistently implemented.

According to the Draft Assumptions, the scope of proposed amendments to Geological and Mining Law should cover the following issues:

- Establishment of a form and scope of permit (license) for prospecting and exploration of underground storage complexes for carbon dioxide and underground storage of this gas with establishment of an authority competent to grant such permits (minister in charge of environmental issues), and authorities involved in granting thereof;

- Definition of requirements for the contents of applications for the licence (including a requirement to enclose a development plan for carbon storage site);

- Adaptation of rules on mining ownership and mining use for prospecting and exploration of underground storage complexes for carbon dioxide and underground storage of carbon dioxide;

- Determination of financial security to guarantee the fulfilment of all obligations under the licence granted (a prerequisite for granting permits for underground storage of carbon dioxide);

- Establishment of rules for setting up and return of financial security and the manner of using it;
- Establishment of conditions for change, review, the scope limitations, transfer, withdrawal, refusal, licence invalidation;
- Establishment of requirement to prepare geological and surveying documentation;
- Establishment of requirements for storage site development plan, including site monitoring plan, corrective measures plan and provisional post-closure plan;
- Determination of duties of the operator during operation and after cessation of CO_2 injection and expiry of the license for underground storage of carbon dioxide;
- Determination of conditions for CO_2 injection and for control and monitoring of underground storage sites;
- A register of mining areas covered by the licenses and a register of closed storage sites;
- Definition of the categories of geology, mining and mine rescue qualifications for persons engaged in, supervising and managing work related to underground storage of carbon dioxide;
- Establishment of requirements for assuming responsibility for the site (e.g. in case of withdrawing the licence, in the post-closure and post-monitoring period) and determining the authority to assume such responsibility;
- Determination of guidelines/procedures for cooperation with the European Commission in administrative proceedings related to the underground storage of carbon dioxide.

Although the main legal framework for CCS would be included in the Geological and Mining Law, there is still a number of issues that fail to be sufficiently covered, and, therefore, in order to provide a comprehensive regulation, the Draft Assumptions also envisage amendment of other laws in parallel with the revision of Geological and Mining Law. In particular, the Business Activity Freedom

Act, Acts on Access to Information on the Environment and Its Protection, on Public Involvement in Environmental Protection and on Environmental Impact Assessments, or the Energy Law Act, are proposed to be amended.

Under the revised Business Activity Freedom Act, the list of activities for which licences must be obtained, is expected to be expanded to include new activities – prospecting and exploration of underground storage complexes for carbon dioxide and underground storage of carbon dioxide.

Amendments to the Act on Access to Information on the Environment and Its Protection, on Public Involvement in Environmental Protection and on Environmental Impact Assessment provide for the broadening of the scope of data to be provided in publicly available lists to include licences for prospecting and exploration of underground storage complexes for carbon dioxide and underground storage of carbon dioxide, records of inspections of underground carbon dioxide storage sites and data from the register of closed carbon dioxide storage sites. In addition, there is to be a requirement to obtain a decision on the environmental constraints (which will also involve the need to provide an environmental impact assessment and to prepare an appropriate report) prior to obtaining a license for underground storage of carbon dioxide, and (upon fulfilment of certain conditions) a licence for prospecting and exploration of underground storage complexes for carbon dioxide. Finally, it is also proposed that a CO_2 capture readiness assessment (to be performed by operators of all power combustion plants with a capacity of 300 MW or more, who were granted construction permits after the date of entry into force of the CCS Directive, i.e. after 25 June 2009) should be carried out under the environmental impact assessment procedure and form part of the environment impact report (and if the conditions examined in the context of this assessment are satisfied, the operators will be required to ensure that suitable space for the facilities necessary to capture and compress CO_2 is set aside).

Important issues concerning the transport of captured carbon dioxide to be stored underground are to be regulated by way of amendment of the Energy Law. These issues include in particular: providing access for potential users to CO_2 transport networks and underground storage sites. The proposed changes are designed

to broaden the powers of the President of the Energy Regulatory Office (ERO President) to include the tasks involving the regulation of CO_2 transport services, access to services of CO_2 transport and underground storage, (including monitoring and control of CO_2 transport and providing equal and open access to CO_2 transport networks and underground storage sites, granting and cancelling of licenses for providing CO_2 transport and underground storage services, approval and control of fees for provision of CO_2 underground storage services). In addition, criteria for refusal of access to transport networks or underground storage sites are to be determined.

Notwithstanding the above-mentioned amendments to the existing legislation, the Draft Assumptions also provide for revision of many other acts, including:

- Act on Explosives For Civil Uses (extending its scope of application to include enterprises engaged in prospecting and exploring geological storage complexes for carbon dioxide),
- Waste Act (amending its scope of application to exclude the captured carbon dioxide intended for underground storage),
- Environmental Protection Law (enabling the activity of a National Administrator of Underground Carbon Dioxide Sites to be funded by National Fund for Environmental Protection and Water Management (NFOSiGW) and providing for financial securities in connection with the underground storage of carbon dioxide),
- Construction Law - carbon capture readiness (CCR) requirement to be met when applying for a building permit),
- Act on Prevention and Remedying of Environmental Damage (extending its scope of application to include activity involving underground storage of carbon dioxide),
- Real Estate Management Act (recognition of underground storage, prospecting and exploration of underground carbon dioxide storage complexes and construction and maintenance of pipelines and equipment for the transport of carbon dioxide as public purpose activity),

- Spatial Planning and Development Act (extending the scope of information to be provided in regional and national development plans to include information on documented underground CO_2 storage complexes),

- Community scheme for greenhouse gas emission permit trading (introducing a system of accounting for emission allowances in case of leakages of carbon dioxide in connection with underground storage).

Given the numerous challenges currently being encountered in the implementation of transmission projects, the construction of CO_2 transport networks will have to be covered by a completely new law on transmission corridors, which should facilitate implementation of such projects.

All revisions of law stipulated in the Draft Assumptions to ensure transposition of the CCS Directive, including changes to the Act on Geological and Mining Law and other laws, address the CCS issues in a rather comprehensive manner. In this regard, they largely correspond to the scope provided for in the IEA CCS Model Regulatory Framework. It is important that the final scope be consistently included in the proposed regulations that can be quickly implemented. Undoubtedly, the legal framework adopted for CCS (especially those provisions which address technology safety issues, public participation or access to information) will be one of the elements that will allow to build public support and confidence in CCS (though it should not be deemed as a substitute for awareness campaigns).

Summary

The works on the implementation of the CCS Directive in Poland are making slow progress (the works on the assumptions to new regulations have not been formally completed), and there is a serious risk that the CCS Directive will not be implemented by Poland in due time (by 25 June 2011). It is assumed that the CCS Directive will be transposed into the national legal order by amending the existing legislation rather than creating a separate regulation for CCS. This approach should work just fine as long as the proposed changes are comprehensive and are eventually implemented in a consistent and harmonized manner. Although, at the current stage, the new CCS regulations are to apply to demonstration projects

only, they strive to address all CCS issues in a largely comprehensive manner. If all the proposed changes are ultimately embraced by the legislation adopted in the near future, there is a chance that a comprehensive legal framework for CCS will be created, thus providing a critical factor in gaining public acceptance for the new technology.

RECOMMENDATION

It is assumed that the CCS Directive will be implemented into the Polish legislation by amending the existing laws, rather than creating a separate regulation for CCS. Such an approach will be effective only if **the proposed changes are implemented in a consistent and harmonized manner by 25 June 2011.** For this to happen it is necessary to significantly speed up the preparation of draft acts listed in the draft assumptions for the Act amending the Geological and Mining Law and other laws, and swiftly complete the entire legislative process (Parliament - President).

Given the numerous challenges currently being encountered in the implementation of transmission projects, it is important that the construction of CO_2 transport networks is governed by a completely **new law on transmission corridors**, which should facilitate implementation of such projects.

5

Financial framework[18]

Agata Hinc, Project Leader, Low Emission Economy, demosEUROPA – Centre for European Strategy.

Europe's – including Poland's - industry is very likely to be able to make widespread use of CCS technology on a commercial scale, however this will require intensive development of technologies, solving of the problem of storage and creation of the appropriate business models. The speed with which the technology is developed will affect emissions reduction levels directly. The appropriate number of demonstration projects on a commercial scale will be vital in order to test and perfect the capture technologies known today and to minimize the risk connected with storage in various geological structures. All the above activities will require high investment costs.

5.1. COSTS

The costs connected with development and implementation of CCS technology can be divided into a number of phases:[19]

18 This chapter was prepared on the basis of a report "How to efficiently implement CCS in Poland? Financial framework" by demosEUROPA - Centre for European Strategy and the Institute for Structural Research.

19 All of the costs given further in this chapter are based on the analysis carried out by McKinsey&Company, of which the findings are presented in the report *Carbon Capture&Storege. Assessing the economics*.

- The cost of CCS in earlier demonstration projects will generally considered to be high – ranging from 60-90 EUR per ton of captured and stored CO_2. This is connected with the small scale of those projects and with the high research and development costs of the ventures.

- The cost of construction of early full commercial scale CCS projects is approximately 35-50 EUR per ton. It is possible that the cost will be even lower if the CCS technology is also developed quickly in other parts of the world or if there is a breakthrough in technology leading to a significant drop in the cost of capturing CO_2.

- In 2030, due to advances in know-how and greater effectiveness of the scale, the cost of CCS for new energy installations should fall to 30-45 EUR per ton of CO_2 and come to more or less the price of emissions licenses at that time.

The costs of individual projects may vary in light of their specific character. The cost of the three principal capture technologies (pre-combustion, post-combustion and oxy-fuel) is similar at this point, however it should be expected that the cost of retrofits and industrial installations will be higher than newly constructed installations.

Due to the high cost of demonstration projects and relatively low initial price of emissions allowances an economic gap will appear - 0.5-1.1 billion EUR for the project (according to current net value). This gap will have to be filled through public funding.

Although the majority of the technologies needed to introduce CCS are ready to be used at the moment, there is not yet even one fully integrated commercial scale CCS project. Capture technologies are based on technologies that have been applied for many years in the chemical and refinery industry, but integration of those technologies into energy production is relatively new, and therefore requires a greater know-how base. Transportation of CO_2 via pipelines over long distances has been practice in the United States for over 30 years – there are over 5000 km of pipeline there for transportation of CO_2 used for enhanced oil recovery. The potential for development of CCS once the initial commercial phase has been completed and the future cost of CCS installations will depend on a number of

factors, for instance the effect of development of know-how, the economy of the scale, availability of places for storing CO_2 and the speed with which the technologies spread around the world.

The total cost of the early commercial projects is estimated to be EUR 35-50 per ton of stored CO_2, of which approximately EUR 30 will be the cost of capture, approximately EUR 5 transportation and approximately EUR 10 permanent geological CO_2 storage.

The high cost of CO_2 capture is caused by the cost of purchasing additional capture equipment, as well as limited power station efficiency due to a greater level of energy consumption (for capture). Additional capture equipment – such as for example a separation unit in oxy-fuel or a cistern in post-combustion – will increase the initial capital expenditure (CAPEX) as well as subsequent operating costs. The estimated total loss of efficiency of the power station is around 10%, which means 40% efficiency of a power station instead of 50% (thanks to advances in technology new power stations will achieve 50% efficiency in 2030). Additional CAPEX will be approximately 14-19 EUR per ton of CO_2, (which is the amount of the costs related to CCS), fixed and variable operational expenditure (OPEX) is 5-7 EUR, while the costs arising in connection with additional fuel will be approximately 2-6 EUR per ton of CO_2.

The cost per ton of captured and stored CO_2 will depend on the size of the power station to which the CCS installation is connected. The lower the capacity of the power station, the higher the cost of capture and transportation of one ton of CO_2. It is estimated that the cost for a power station of a capacity of 200 MW is 70 EUR, for a power station of a capacity of 300 MW – 60 EUR, for a power station of a capacity of 400 MW – 55 EUR, for a power station of a capacity of 500 MW – 50 EUR, and for a power station of a capacity of 600 MW - 45 EUR. During the capture phase, the effect of the development of know-how once the first 20-30 commercial projects have been implemented may help to achieve a reduction of approximately 12% of CAPEX costs and limit loss of efficiency to 1%.

The costs of transportation by onshore pipeline come to approximately 4 EUR per ton – more than 95% that cost is CAPEX. Transportation costs can be reduced by increasing and expanding the transmission grid in individual countries, as well as throughout the entire EU. Due to the fact that firms around the world have a great

deal of natural gas transportation know-how – the effects of development of know-how should not have a great impact on the price of CO_2 transportation.

It will be possible to lower the cost of CCS to 30-45 EUR per ton of CO_2 for new power stations if there are 80-120 power stations with CCS operating in Europe by 2030. With respect to the global spread of technologies (500-550 projects by 2030) the cost could be lowered by a further 5 EUR per ton of CO_2. The cost can be lowered further if there is a breakthrough in technology in the most expensive part of the process – capture.

Initial estimates of the cost of implementation technology which are presented in this chapter were calculated by the firm McKinsey for potential power stations around Europe. In view of the unusual characteristics of the energy sector in various countries, these calculations will vary slightly.

5.2. MODEL OF FINANCING

The optimal model for funding CCS should assume that in order to achieve technological maturity and financial profitability CCS projects are created on the basis of capital derived from three sources: the private sector, the state, and the European Union (and other international organizations). The level of outlays should depend on which of these entities is best at performing a given element of the investment.

With respect to CCS the fixed costs, the risk of which the state should take on, are the costs of storage of CO_2 and monitoring of storage sites. With respect to operating costs the state should take on the risk of the minimum price of CO_2 emissions in the long term. R&D expenditures should be financed to a large extent from EU funds, as in the case of 50% of the difference in capital expenditures between a project with and without CCS. This is connected with greater efficiency in the collection of knowledge and experience throughout the entire Community in comparison with the scenario in which each Member State works on the technology independently. The Polish government should subsidies half of the difference in operating expenditures. Other costs should fall to the private sector.

The EU budget should be used to cover a portion of the costs related to tightening of standard emission level legislation. It would be advisable to share the costs of technical adaptation so that power stations could preserve liquidity, solvency and profitability. Also, in the event of temporary loss of financial liquidity by firms the government should subsidies a portion of the current operating costs (for instance in the form of tax relief) in order to minimize the risk of the firm going bankrupt. The level of that funding should be appropriate for the difficulties in which the firm finds itself. For the purpose of optimization and rationalization of expenditures governments should grant aid only to those newly built power stations intended to install CCS.

During the stage of construction of CCS demonstration plants, the funds for the actions listed below need to be provided from the state budget, the EU budget and budgets of other international organizations:

- assessment of CO_2 storage potential;
- construction of large scale demonstration projects;
- construction of infrastructure for transmission of CO_2;
- research and development.

At the moment businesses interested in constructing CCS demonstration projects have the option of applying for funds from, among others:

- reserves for new entities (NER 300);
- The European Energy Programme for Recovery - EEPR;
- The European Trading Scheme – ETS;
- 7 of the Framework Program for the years 2007–2013;
- Competitiveness and Innovation - CIP;
- structural funds and a cohesion fund for subsidizing energy projects within the Infrastructure and Environment Operating Program and the Innovative Economy Operating Program for 2007 – 2013;
- the European Investment Bank;
- the Global CCS Institute;
- the Norwegian Financial Mechanism;
- the National and Regional Environment Protection and Water Management Fund.

On 26 January 2011 the European Commission released a Communication about possible impact of regional policy on sustainable

development as a one of three pillars of Europe 2020 Strategy. In the first annex of the Communication the Commission formulates recommendations for Member States on current and forthcoming UE funding period. The Commission underlines that the Member States should consider an allocation shift in funds spent on building a low carbon economy.

There is a risk that part of the funds from the Operational Programme Infrastructure and Environment might not be used in Poland. At the moment, there is a chance for reallocating them and spending on CCS projects. There's a possibility of transferring money from priorities where funds are not used to priority IV, which – as Marek Zaborowski from Bellona Foundation points out – was very popular among entrepreneurs and has already run out of financial resources. One of the goals of the priority IV is the improvement of air quality and cuts in GHG emission in fuel combustion processes.

Another source of possible funds for CCS projects in Poland is the third phase of European Emission Trading Scheme (ETS), which covers a period of eight years (2013-2020). From the beginning of 2013 ETS is supposed to be strengthened and widened. So far it remains unknown how emissions allowances would be divided between companies. Furthermore, the precise plan on using the financial resources obtained from allowances auctioning has not been worked out yet.

Ernst&Young estimated that in 2013 the Polish government would have at least 5.3 bln PLN more from trading the emissions. In 2013 70% of emissions allowances for Polish companies would be complimentary and another 30% will be auctioned by the Polish Treasury. According to Ernst&Young assessments budget of Poland in 2015 will be boosted by extra 7.4 bln PLN whereas in 2020 – by extra 13.3 bln PLN from emissions auctioning. The Polish Treasury may decide to spend part of this income on CCS installations.

An additional source of external funds for business might be commercial banks and investment funds. Presently banks have two conditions:

- receipt of funding from the European Commission as part of the NER 300 program;
- favorable findings of a feasibility study.

Additionally, there is a possibility of introducing by the government new instruments in order to ensure that the efficiency of the CCS technology implementation process is sustained:

- Direct subsidies to the project – that the public sector funds a given portion or value of the investment project directly. With respect to EU projects this system of merits has a relatively long tradition, even in Poland, therefore it should be relatively easy to introduce. The advantage of this solution might also be a lack of certainty as to the level at which the public sector will participate in the investment. In practice these subsidies can take several forms, for example in the USA a special fund has been set up on which money is collected from increased taxes for electricity. These funds are then designated for funding of CCS projects.[20] Regardless however of the manner in which funding is provided projects should be monitored exactly when the funding is used, not only in the context of reduction of CO_2 emissions but also the impact of the new investment on the liquidity and solvency of a firm and potential options for increasing the power station's efficiency without outside assistance. A fundamental goal of the subsidies is to help with adaptation to new economic conditions which might have an adverse effect on businesses' operations and be the result of introduced legislation.

- Tax relief – the public sector allows a firm to deduct some costs from tax. In principle this solution works in a similar way to funding, except that for the deduction to have any impact on the rate of return of the venture, firms have to achieve a positive financial result. Another drawback is the increased complexity of the tax system and resulting increased risk of the effect of seeking of annuity, i.e. undertaking projects for which tax relief is available and abandoning those (potentially more efficient) for which there is no tax relief.

- Loan guarantees and loans on preferential conditions – the public sector provides better conditions for funding of a project for a power station (lower cost of external funding). Government loan guarantees result in less credit-related risk, which translates into a lower level of interest on the loan. Loans on preferential conditions can in turn be granted by banks in which the government

20 M.R. Hamilton, H.J. Herzog, J.E. Parsons, *Cost and U.S. public policy for new coal power plant with carbon capture and sequestration,* 2008

has a majority stake (in Poland Bank Gospodarstwa Krajowego is a bank of this kind). Although it may appear to involve easier funding and greater cost-effectiveness of the project (from the firm's point of view), in reality this solution is tantamount to acceptance of an expected negative figure for future expenditures and public revenue from a given project, because the lower bonus for the loan risk is insufficient to cover the anticipated losses. In this sense therefore both loan guarantees and loans on preferential conditions are a form of subsidy from the public sector. The Advanced Coal Project Investment Credit and Coal Gasification Investment Credit introduced in the USA are an example of this. These are granted for projects aimed at storage of at least 65% CO_2 emissions. Another solution that illustrates this and application of which is being discussed in the USA is the Clean Energy Investment Bank. This would be set up from public funds and would fulfill the standard roles of an investment bank.[21]

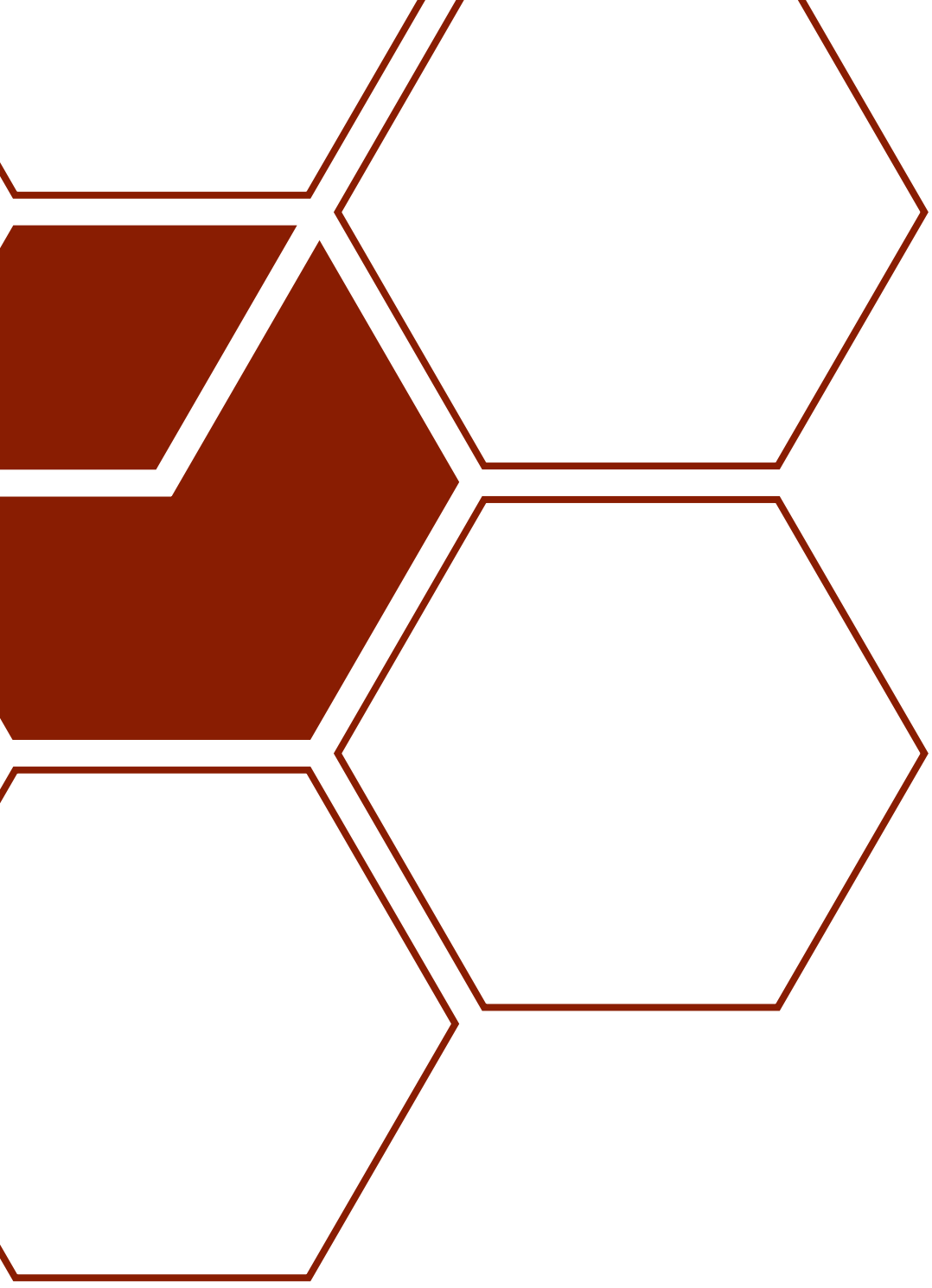
What is more, the great potential for additional funding for CCS projects will be associated with the reform of the EU budget (discussion of which will start in 2011 – during Poland's presidency of the Council of the European Union). During this time Poland would be able to bring forward transformation of the Cohesion Policy in such a way that it would help less developed Member States meet challenges arising in connection with transformation to a low carbon economy. Poland could also move for creation of a new fund in the EU budget – an instrument that would provide funding for innovative low carbon technologies, with particular emphasis on Clean Coal Technologies.

21 M.R. Hamilton, H.J. Herzog, J.E. Parsons, *Cost and U.S. public policy…,* op.cit.

RECOMMENDATION

Likewise in the case of every innovative technology, development of CCS will be costly. Therefore, the Polish government should actively engage in making public funding more available for CCS projects. In the first place, low hanging external funds should be used (inter alia NER300, Operational Programme Infrastructure and Environment, Norwegian Funds). Secondly, the government should prepare a system of instruments supporting CCS technology development (inter alia direct subsidies to projects, tax relief, loan guarantees and loans on preferential conditions). Additionally, CCS (next to other low carbon technologies) should be one of the priorities when planning the use of income from trading the emissions allowances within the third phase of the EU ETS. Poland should also make sure that appropriate funds dedicated to CCS are ensured in the next Multiannual Financial Framework of the European Union.

Development and implementation of CCS is a public benefit activity and therefore **CCS projects should be carried out within the framework of Public-Private Partnership**, in which public and private capital would be used until full commercialisation of the technology.



Research and Development potential

6

Cezary Filipowicz, Director, "GeoCO$_2$"

6.1. RESEARCH AND DEVELOPMENT FIRST AND FOREMOST

The EU Member States, regardless of their energy mix, seek opportunities to reduce CO_2 emissions. One of the most innovative, most discussed and, for many, controversial methods is Carbon Capture and Storage. The oil industry giants are eying this method as a source of enormous future revenues in Europe, and, while trying to keep a low profile and not be a party to the debate, they are lobbying to secure their interests in the future.

The North Sea oil deposits are running out, and, while the natural gas resources are expected to last for longer, the depleted gas reservoirs would provide the best possible storage sites for CO_2 that are almost unlimited in terms of capacity. Such a solution will be a real "perpetual motion business" for the oil tycoons. Rather than bearing the multi-billion costs of decommissioning the rigs and tens of thousands of boreholes as well as thousands of kilometres of pipelines running to the shores of the countries surrounding the North Sea, after the reserves in the North Sea have been depleted, the same infrastructure can be used to transport the CO_2 captured by the industry throughout Europe and restore the environment. The only, though far from easy problem, which remains

to be solved is that of constructing new or taking advantage of the existing trans-boundary onshore pipelines. Lobbyists in favour of such a solution can easily determine the storage capacity of the depleted gas fields and demonstrate that they are tight and secure as the natural gas stored there has not escaped for millions of years.

An additional advantage of CO_2 storage under the seabed is the lack of residents who, in the case of onshore storage, are reluctant to embrace the concept of underground storage of carbon dioxide in the vicinity of their homes. Spreading misinformation, playing on the fears of residents and lack of public acceptance for CO_2 storage in deep geological onshore structures, all serve the interests of lobbyists of offshore storage. Another very important edge of the proponents of CO_2 storage in depleted gas or oil fields, with the North Sea being the only site with adequate capacity in Europe, is the funding of research programmes for carbon dioxide storage in geological structures and injection technologies. Exploration of saline aquifers is only an expense and to find an institution willing to provide the funding is no easy feat, whereas the same exploration of depleting oil and gas resources, in addition to the research and technology improvements aspect, can, due to the recovery enhancement and fuller exploitation of the existing oil and gas resources, bring additional revenues which frequently exceed the costs involved.

For Poland, which produces more than 95% of its electricity from coal and thus is one of the biggest CO_2 emitters in Europe and has no oil rigs or pipelines in the North Sea, or even access to that sea, this poses a great problem and challenge.

So, what can we do? The simplest solution is to hope that somehow things will work out for the best, passively watch the events unfold and trust that the concept of human-induced climate change is refuted and that the EU gives up its efforts to reduce CO_2 emissions, and, if these hopes do not materialize, come to terms with the need to pay the penalties and pass on their cost to electricity users. If the payment of penalties does not satisfy the EU, the only solution remaining for Poland will be to get connected to the trans-boundary gas pipelines and, rather than penalties, pay for the transport and storage of CO_2 under the North Sea and rail against the EU policy.

The second solution, though costly and imposed by the EU policy, is to regard the need to reduce CO_2 emissions as an opportunity for

modernization of the Polish energy sector by developing clean coal technologies, promoting distributed generation based on renewable energy sources (e.g. domestic production of biomass) and taking the lead in exploration of deep geological structures for the safe storage of carbon dioxide. Poland has institutions and research potential to rise to these challenges. Modernisation of the power sector, although most important, is not the subject of this paper. One of the examples is the Scientific-Industrial Consortium "GeoCO$_2$".

Poland declared itself ready to participate in two EU-funded CCS demonstration projects. For the past few years, on the initiative of the Ministry of the Environment, a research project funded by the National Fund for Environmental Protection and Water Management: "Identifying formations and structures for safe geological storage of CO_2 along with their monitoring programme" has been underway to identify the structures for use in demonstration projects. In 2010, as part of preparatory work towards the implementation of its own demonstration project, Bełchatów Power Plant funded geophysical surveys and drilling programmes at two potential storage sites for CO_2. However, no CO_2 injections were performed to test the injection technology and CO_2 migration in the reservoir rock, or to verify the assumptions on migration patters and confirm the integrity of loam cap that should prevent CO_2 from migrating to the upper layers and ensure safe storage.

Any decision-making body (management and supervisory boards) of the companies implementing the demonstration projects can hardly be expected to take the risk of very costly construction of carbon dioxide capture plants without having carried out tests of potential storage sites, coupled with CO_2 injections, and without being absolutely certain that CO_2 storage is possible, safe and publicly accepted. On the other hand, letting only those companies that have committed themselves to carry out the demonstration projects bear all the cost of CCS activities has no business justification, as it would create undue competitive advantage for companies, which remained passive in CCS development and committed their funds only to profitable ventures. Therefore, the founding institutions of Scientific-Industrial Consortium "GeoCO$_2$" have prepared a pilot project addressed at several commercial power plants affiliated in the Economic Society of Polish Power Plants, planning future investments to satisfy the requirements of the Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the

geological storage of carbon dioxide. The interested parties have managed to develop a unique mechanism for funding the research project by the power plants sharing the costs in proportion to the amount of electricity they produce, and thus in proportion to the amount of CO_2 emitted by them.

The pilot research project is not an attempt to prove a preconceived notion – its goal is to deliver tangible test and monitoring results providing a basis for objective and rational decisions regarding the implementation of CCS in Poland, and assist in implementing the provisions of the abovementioned Directive into Polish law. These results will also provide objective material for a fact based discussion between the proponents and opponents of CCS, unlike the situation right now, where – in the absence of empirical knowledge - intuition and emotion are given free reign. The research and monitoring data will provide the power plants with documentary material that satisfies the requirements of the Directive, and which, at the same time, is going to be used in doctoral and post-doctoral dissertations and scientific publications, and be presented at national and international conferences and symposiums. The acquired knowledge and skills will serve to perfect the injection, storage and monitoring technology and to reduce the costs. They will make the Polish science's and industry's contribution to tackling the global issue of reducing CO_2 emissions.

The consortium members, when establishing "GeoCO_2", were not seeking external financing to get the project off the ground. The first months of operation were financed from their own resources, and the preparatory works on the pilot project were carried out by the staff provided by the consortium members. The "GeoCO_2" Consortium itself was established to carry out a single research project and was to be resolved after the project completion. The Polish CCS Cluster[22] can be established independently. However, Scientific-Industrial Consortium "GeoCO_2" could provide a structure for the creation of a CCS cluster on the basis of its participants and accumulated experience, to become, under the supervision of a future government plenipotentiary, an instrument in effective implementation of the Polish CCS Strategy with active participation of industry – the power industry in particular.

22 The author refers to the proposal for a cluster presented in the report "How to effectively implement CCS in Poland? R&D and framework for a CCS cluster." prepared by demosEUROPA - Centre for European Strategy.

6.2. POLISH CCS CLUSTER[23]

Agata Hinc, Project Leader, Low Emission Economy, demosEUROPA – Centre for European Strategy.

Poland has huge CCS research and development potential. Whether it is used properly and whether it will render an increase in innovativeness in Poland depends mainly on how key CCS stakeholders (on the government, state administration, academic and R&D side and in business) manage with the range of obstacles that stand before them.

There is a range of challenges for full use of Poland's research and development potential with respect to CCS. These challenges are extraordinarily diverse in nature, and consequently an individual entity is not able to manage with all of them. Research and development centres currently carrying out work on particular stages of the CCS process are experiencing obstacles which are:

- technical in nature – difficulties with gaining access to apparatus and software, and an insufficient amount of data,
- organisational in nature – coordination of work between different kinds of facilities,
- related to timing – the deadlines for implementing projects are very tight,
- legal in nature – complicated and restrictive procedures and lack of the relevant legal regulation,
- related to preservation of the natural environment – work performed in the Natura2000 zone,
- social in nature – the problem of public acceptance of the works being carried out,
- financial in nature – problems with creating the budget for the entire investment,
- related to an inadequate number of qualified personnel,
- political in nature – no clear political message.

All of the obstacles described above can be mitigated by closer cooperation of the principal interested parties on the administrative, business, academic, research and development, and NGO side, in the form of a cluster. Sensible teamwork will always bring better

23 Prepared on the basis of a report "How to efficiently implement CCS in Poland? R&D and framework for a CCS Cluster" by demosEUROPA - Centre for European Strategy, 2010.

results than a collection of a few individual business enterprises. With respect to CCS this theory is confirmed further due to the need to act in several areas at the same time, and use of know-how gained in individual projects and their proper coordination will make it possible to work on both the capture and transmission and storage of CO_2 with greater efficiency. Moreover if properly managed, state policy can be implemented not only with regard to CCS alone, but also with regard to increasing the innovativeness of the Polish economy.

Poland's Achilles' heel in the field of innovativeness is that in most cases research projects do not translate into commercial prospects. There are relatively few joint initiatives between business and science that will result in delivery of new technology or a new product on the market. Creation of clusters has proved to be a successful solution to this problem in many countries around the world. It may be a solution for Poland as well.

RECOMMENDATION

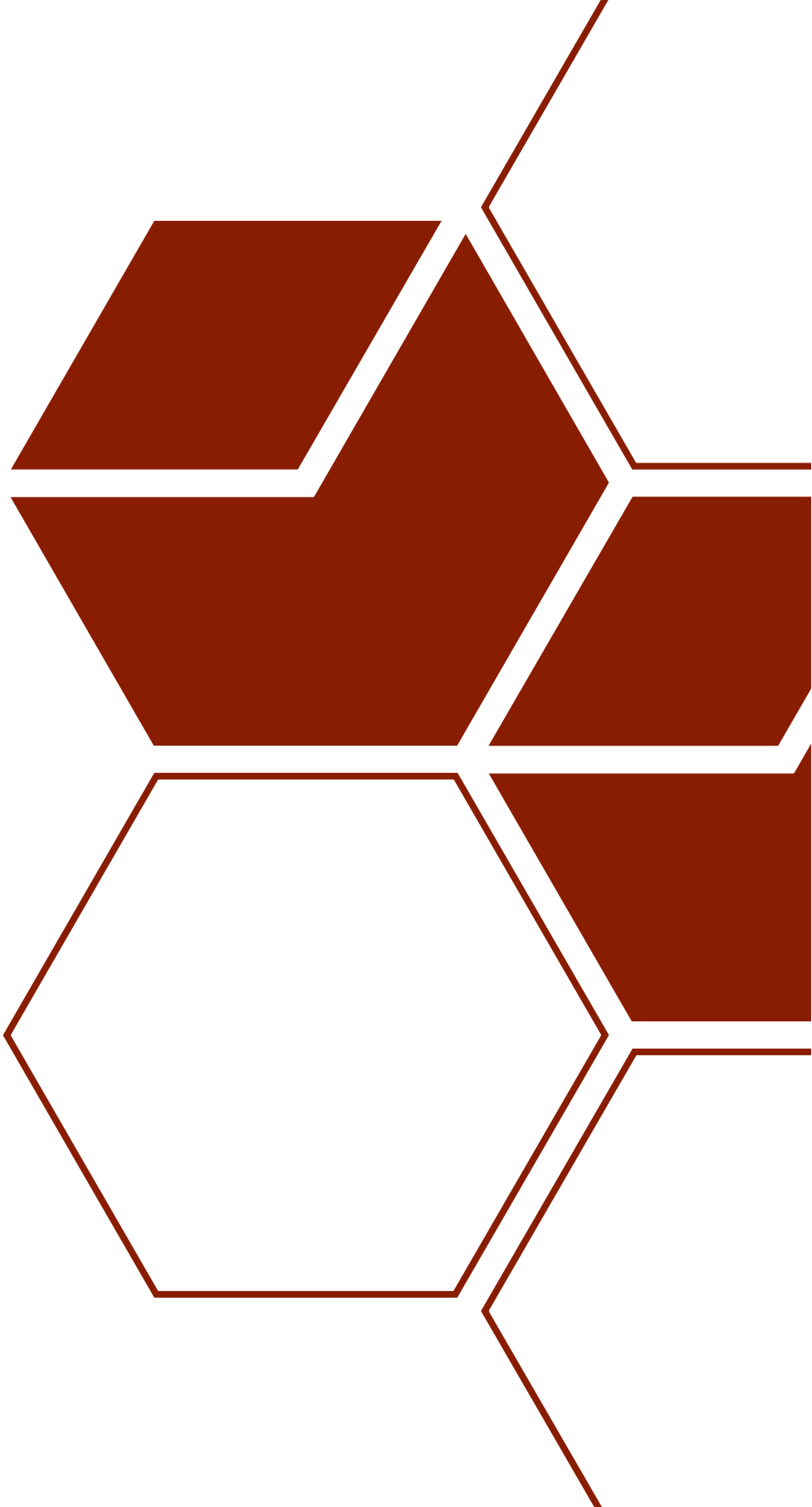
Closer cooperation and joint actions are the road to success of CCS technology, and by the same token also to the success of all the stakeholders. Therefore, **in the energy sector the advisable mechanism is the Polish CCS Cluster** – an institution that would be created to make the CCS technology development process in Poland more efficient by coordinating measures taken in various areas – creating the political, legal and financial frameworks, technological progress, building infrastructure and storage sites, building social acceptance, development of intellectual capital, and closer internal and external cooperation.

The Polish CCS Cluster could not only bring successful implementation of CCS technology in Poland, but it could become a model solution for use of Poland's research and development potential in other strategic areas.

The Polish CCS Cluster – like all of the other clusters – must be a commercial venture. Its principal task should be to make optimal use of the existing technology and to develop new technology to allow greater CCS safety and efficiency.

The Cluster's commercial activity should be based on:

- performance of commissioned works – research programmes commissioned by business enterprises;
- sale of the developed technologies;
- drawing up of expert opinions for national entities as well as for international firms/organisation;
- consulting;
- organisation of training and courses;
- licensing.



7

Public awareness

Leszek Stafiej, President, DKS Stafiej Partnerzy sp. z o.o.

Public awareness[24] is a prerequisite for successful implementation of the CCS technology in Poland. Social groups and entities involved in the process of reducing CO_2 emissions in Poland are fully aware of the global threats that emissions of this gas on an industrial scale pose to humans and the environment. Guided by the sense of social responsibility arising from knowledge, mission, position and concern, the scientists, politicians, civil servants, social activists and some media, are looking for optimal solutions to this problem. They can argue about the degree of effectiveness of CCS technologies, advantages and possible disadvantages of this method, but, what they don't argue about, is the need to reduce the excess CO_2 in the atmosphere.

It is also obvious that only a small minority of people in Poland concern themselves with the issues related to environmental protection. As their effect on the overall public awareness is insignificant, the warnings addressed at the general public seem like a voice crying in the wilderness. Even if these topics garner some attention

24 The term "public awareness" defines opinions, attitudes, symbols and superstitions about spiritual life and natural and social reality shared by most members of the community. The widely accepted views determine the way of thinking and the intellectual culture of the society. This triggers different behaviours depending on the given group, milieu or social class.

from the popular media, they tend to be reported in a sensational manner, causing anxiety and hysteria, which sometimes does more harm than good.

Meanwhile, the majority of people are not aware of the eminent threat, associating CO_2 only with a leaking furnace, or are unable to fully grasp the magnitude of it, because they fail to realize that the problem affects them personally. An average Pole has no fear or sense of responsibility. The majority of people don't know or understand the term CO_2 capture and storage, and certainly not the English language acronym "CCS" which is commonplace in the Polish technical usage. Although the majority of people do not know or understand the problem, we should not resent them for that. In a democratic society the majority has the right not to know or to forget, without being punished for that.

However, if it turns out that the deployment of CCS becomes a necessity, and what is more, such deployment is to take place in close vicinity of the property of a citizen representing the ignorant majority of people, then the citizen begins to be afraid. It is mainly the fear of the unknown. The citizen is concerned about his own safety, peace, independence, property, health, and about what the future holds for him and for his offspring. The greater the unknown, the greater the fear. The greater the fear, the more prejudices. So the first natural reflex of the citizen is to disagree and protest. And it is their democratic right to do so. For, in a modern democracy, it is those few who are conscious and responsible who have a duty to convince the majority of what is right, wise and good for the further development of the civilization.

Therefore, if the experts and those who are privy to expert knowledge agree that the implementation of the CCS technology in Poland is right, wise and good for our future growth, then they should also join in the process of educating the unknowing people about CCS.

The task of convincing the unaware is far from easy. Even harder it is to convince the frightened and the prejudiced. It isn't enough to be right to take up this challenge. We must be prepared to carry the majority of our fellow citizens across the desert of ignorance, mistrust, fear and superstition, into the realm of mutual understanding, trust, responsibility and collaboration. This far and arduous journey

requires, in addition to knowledge, understanding and faith, also a great deal of resolve, emotional intelligence and willingness to sacrifice. It also requires openness, honesty and patience. Fortunately, at the end of a long journey we can look forward to a reward in the form of recognition of common goals and a new division of tasks. Striving for a common goal in an atmosphere of mutual trust moves the community to a higher level of social development.

Civic dialogue

Raising broad public awareness about the need to limit carbon dioxide emissions by means of CCS involves a fundamental social change in the way we think about the individual responsibility of each one of us, the everyday users and beneficiaries of the industrial civilization. The new state of awareness is to move the general modification of behaviour in the desired direction. So profound a change will not happen on its own. It won't even happen by offering extensive information. It requires that a complex interdependent mechanism of information, education and persuasion, which lead to a social dialogue, with various social groups communicating on common goals, be set into motion. The process of raising public awareness must be implemented through a comprehensive, carefully drafted, efficiently executed programme of social communication. This programme is designed to help citizens notice, understand and accept the common goal. It should inspire confidence and encourage partners to participate in the social division of tasks.

The complex nature of communication lies in the fact that the programme, along with public consultations required by law, is supposed to build up the social capital of trust. It should allow presentation of all views and opinions, encourage mutual clarification of doubts, and understanding and respect for diverging opinions and interests. It must also help to prevent or mitigate conflicts and disputes, turning them into optimal solutions. Only then will the communication programme become a platform for a constructive civil dialogue. Civil dialogue is a way of creating, building and maintaining relationships between the state and civil society – usually represented by NGOs – to implement a partnership of all interested parties in seeking, agreeing on and achieving common public policy goals.

CHAPTER VII

The process of building an effective civil dialogue includes the following four steps:

- Step 1. Recognition and diagnosis,
- Step 2. Information and education,
- Step 3. Debate: review of opinions,
- Step 4. Strategic dialogue: common goals.

Step 1
Recognition and diagnosis

The first step in the communication programme of civil dialogue partners is to recognise and analyse the state of awareness of participants and their perceptual readiness. In the case of public undertakings, such as CCS, the following stakeholders are usually engaged in the dialogue: self-governments, businesses, investors, researchers and practitioners of the method, environmental protection institutions, non-governmental organizations involved in environmental protection, media and organizations representing local communities. Based on recognition and analysis of the state of awareness and attitudes of these parties towards the issue and the project associated with it, a communication strategy, i.e. a system of communication among the partners, adequate to their perceptual readiness, is established.

Perceptual readiness is a state of awareness on the given subject allowing the perceiver to take and properly understand the message. Perceptual readiness is born and matures gradually. It starts from unconscious incompetence (they do not know that they do not know), through conscious incompetence, acquisition of competence, conscious competence (they know that they know), ability to apply competence, to finally reach the state of competence: namely the proper application of knowledge in appropriate circumstances together with recommendation readiness and ability. Different groups tend to have different levels of perceptual readiness. Therefore the content and form, time and manner of communication should be tailored to fit the perceptual readiness of specific audience. Adapting messages sent at various stages of civil dialogue to fit a particular state of awareness and perceptual readiness of the recipients requires the mutual recognition/diagnosis of partners. The duty of recognition primarily rests with the initiators of conscious change. It is so because the initiator of the project and the investor, sometimes also the local government, know more about

the circumstances and requirements of the given project than the local communities which are to become its hosts, neighbours and even beneficiaries. This is also the case of CCS.

If the dialogue is to establish partner relations with the environment it must be preceded by a survey of the climate surrounding the proposed public investment, especially if the decision to pursue the project is likely not to be popular with the local communities. The survey should provide data to produce maps of specific stakeholder groups, determining their demographic profiles, social and professional knowledge about and attitude towards the project, views, concerns, biases and prejudices, and interests associated with the project. The actual composition and status of the local social relations must be determined, including the role of local governments, NGOs and individual members of the community, i.e.: businesses, residents, political or religious activists, social activists, scientists, artists and celebrities, representatives of the media, hobbyists, or even eccentrics. In particular, the profiles of active representatives, both the proponents of opponents, should be determined, indicating all motivators likely to change their attitudes. When recognizing the sources of knowledge of individuals or communities, their strength and ability to influence the rest of the population should be assessed. But since the community is largely composed of individuals who are unaware, undecided or indifferent, the assessment of the number of such people and identification of their motivators can be helpful when reaching out to them or persuading them to adopt a certain point of view.

Next, a preliminary list of disputes and conflicts that have already occurred or are likely to occur must be prepared. The stakeholder map should take into account all the other relevant circumstances and events likely to influence the attitudes of local community towards the project. Preferably, the map should identify expected behaviours of stakeholders before and during the dialogue and propose response scenarios for the expected and unexpected behaviour, to ensure that the dialogue is kept alive and progressing. The diagnosis should use all available tools, including desk research, research at request, site visits, surveys, interviews and questionnaires. Specialized research centres should be commissioned to carry out the research, without sparing time or resources. The more accurate the stakeholders map and the broader its scope, the greater the chances of developing an effective communication

strategy will be. An adequate stakeholder map reduces the business risk associated with the project. The stakeholder map should allow for diagnosis of the project social environment. This diagnosis should provide a foundation for designing effective information and education outreach strategies of the second stage of the dialogue, which is an important part of the public consultation.

Step 2
Information and education

The purpose of the second phase of the dialogue is to reach out to the interested communities, so that they can assimilate and understand the proposed project and all its aspects. It should be emphasized again that the mere exchange of information, i.e. sending and receiving the message, is not sufficient to have a successful partner dialogue. Also required is the education allowing the recipients to properly understand the information and conditions of planned or recommended decisions. The CCS technology involves many complex aspects, and a specialized knowledge or trust and confidence in the experts is required to understand them. In practice, the latter is often given greater weight. Thus, both information and education programmes should be launched following a communication strategy devised on the basis of diagnosis of perceptual readiness of individual stakeholders.

In the initial phase of dialogue surrounding CCS, the global, national and local context of the need to employ this method should be explained in terms of a "higher necessity". The effectiveness of the dialogue also depends on the way – both the form and content – in which these contexts are presented. The quality of communication and the ability to provide compelling and attractive arguments play an important role, too. When arguments are presented in an attractive manner, the recipients are, irrespective of their perceptual readiness, better able to absorb the information and are more willing to ask questions, voice their doubts and reservations. In this way, the maturing of competent partner attitudes is being fostered. It is important, at this stage of dialogue, to reduce to a minimum the distance between those who "look down" because they know and understand everything, and those who don't know anything and look at everything with suspicion, suspecting deceit, trick or injustice.

As the rules for statutory consultations and good communication practices dictate, patience should be shown and the form and content of the message - including language – aligned with the perceptual readiness of the recipient. The communications should be "recipient friendly", both in their form and content, so that recipients are willing to learn them. Interactivity should be stimulated so that recipients can respond by asking questions or raising objections, knowing that their every response is heard with attention and respect and will be included in the decision-making process. On the other hand, highly technical and formal language and bureaucratic ritual and jargon should be avoided as they intimidate, discourage or antagonize the recipient, making the dialogue all the more difficult.

The tools of communication recommended to be used at this stage include, in addition to the statutory tools of public consultation, a whole range of available forms of presence in electronic media, publications, press releases, leaflets and ambient events. Direct meetings with stakeholders are extremely important at the further stage of the dialogue process. The participants of such meetings are usually very active, with the loudest voices belonging to the opponents and those who fear that the project is likely to jeopardise their interests. The meetings provide an opportunity for presentation of goals, targets, plans and outcomes of the project. They also give the opportunity to make a catalogue of the most frequently asked questions (FAQ). These voices should be heard with attention and due respect, and after careful consideration answers should be provided so that the person asking the questions always knows that his or her role in the community is respected and his or her interests and views are taken into account.

Very important elements of the information and education process are meetings with experts. Where increased publicity effect is to achieved, meetings with political and media authorities should be organised as long as they openly support the proposed solution. Media communications and printed materials are more likely to deliver their message if they contain iconographic elements: pictures, video footages, drawings, charts and other illustrations. Wherever possible, audio podcasts, recorded interviews or messages, or even background music should be used. Sound is an effective tool to support every message. Surveys and questionnaires provide another important tool for gathering information, in an interactive way, about the knowledge and views of the stakeholders. These

tools are recommended to be used repeatedly, at every opportunity, because they give the dialogue participants a valuable sense of being involved in the decision making process.

It is not enough to only meet the minimum requirements of the law and announce the project plan by hanging it out, as so often it happens, in the city hall, and expect all interested parties to see it. Distribution of information and education packages must be, like their contents, adapted to the ways, habits and needs of particular stakeholder groups. This should be accomplished by professional media plans, which – based on the systematic analysis of particular media user groups – should ensure that communications be targeted at specific audience groups, thus optimising the cost of publication.

Due to the complex nature of communication issues, the local government should appoint an information and educational coordinator who could significantly contribute to the success of civil dialogue. The coordinator acts on behalf of the local government, investors, institutions and NGOs that support the project in pursuit of their statutory missions. The coordinator, either alone or in cooperation with specialized agencies, will manage all communications relating to the project in accordance with the adopted strategy. He or she may also be a spokesperson for the stakeholders initiating and implementing the project. Copywriting, development of ads, posters and leaflets, website, radio or even TV footage and distribution of these communications in the media are all quite easy today. Almost any ambitious civil servant can do it independently and economically, but it takes a professional to do it effectively, without wasting public money. Therefore, where the right people are to be reached with the right message, professional companies should be commissioned to do the job.

Under the direction of the coordinator, an information centre or office should be established which should operate at a place and time available to all the stakeholders. The information centre will keep a line of communication open with all the communities concerned, providing current information about the project, distributing publications, responding to requests, demands or possible emergencies and conflicts.

Initiators, co-authors and co-executors of all information and educational activities should be both the local governments obliged to

carry out public consultation and investors and non-governmental organizations supporting the project for statutory reasons.

The output of the second step of the dialogue will be the review of the stakeholder maps and the communication strategy prepared on the basis of diagnosis. As the social awareness changes under the influence of ever greater amount of information and education, so does the configuration of attitudes towards the project. The maps should therefore be kept up to date with diagnoses of groups of proponents, opponents, undecided or neutral, indicating the trends with respect to quantity (increase or decrease) and structure: leaders, activists, group relations. These studies should only be conducted to identify the social backgrounds for the purposes of partner dialogue. It is advisable to identify groups organized around common interests (both proponents and opponents), by recording the state of awareness and level of knowledge, in particular for the opponents and the undecided, assess the readiness to enter into and pursue a dialogue, indicating, where possible, the specific individuals who are willing to enter into a dialogue and those firmly opposing it.

At the end, the level of risk of conflict should be verified. After the planned information and education measures have been carried out, the results of these measures will have to be examined using the SWOT analysis. Examination results will determine the verification of the communication strategy for the third step of the dialogue.

Step 3
Debate: review of opinions

The third step of the dialogue provides for a public presentation of opinions, positions and concerns of the stakeholders. The public – i.e. representatives of local communities – had already been given an opportunity to obtain the full information on the investment and acquired enough knowledge about the subject, so that all parties are able to communicate at the same level of perceptual readiness. At the first and second stage of the dialogue – recognition, information & education – the initiative was on the party proposing the change – local government, investor, institution or organization established to deal with the given project. The third stage gives the local communities and NGOs involved in the issue an opportunity to publicly voice their comments on the proposed activity. This right is guaranteed under the obligation by local administration to carry

out public consultation procedures and by the requirements of the civil dialogue strategy.

The requirement of ensuring lines of communication imposes on the administration an obligation to provide each party with an opportunity for public presentation of their comments (hall, amplification equipment, etc.). A majority of reports from public consultations carried out in Poland seem to indicate that this process runs smoothly and efficiently, without causing any controversy, dispute or conflict. Despite this, protests of residents have been repeatedly reported by the media. We remember not only the loud protests against the construction of a highway across the Rospuda, but also the controversy surrounding the execution of road construction projects in Warsaw, the S-69 Bielsko-Biala-Zywiec route, and the public opposition to the construction of sewage treatment and waste incineration plants (Czajka in Warsaw, Luszowice, Wroclaw, Koszalin, Szczecin). Protests usually go quiet, with the following soothing reports documented: “Following the municipal consultations, requests and comments from residents on the proposed alignment of the road were submitted to the designer. Having analysed all the comments and requests, and consulted them with the owner, all comments and requests that were deemed reasonable and feasible have been incorporated into the design. “(Cedzyna – Lagow expressway).

In Poland, agreements are reached surprisingly fast, compared to most consultations conducted in the Western countries. The strategy of civil dialogue imposes an obligation that all forms of consultation, direct meetings with stakeholders in particular, are carefully prepared. For this purpose, an independent facilitator or moderator should be appointed in the first place. This moderator should provide the debating parties with expertise on procedures and practices of the debate. The facilitator or facilitators should moderate each public debate, including the round table debates conducted at the fourth stage of the dialogue. Appointing a facilitator should guarantee impartiality for the exchange of opinions, streamline the consultation process and enhance the culture of public debate. After the comments raised by the interested parties have been heard in an efficient manner - thanks to the mediation of facilitators – the dialogue parties should once again verify the map of stakeholders, especially in terms of controversies and anticipated conflicts or disputes. Only then the participants may proceed with the fourth step of the dialogue.

Step 4
Strategic dialogue: common goals

The purpose of this dialogue step is to identify the common goals, the ways of attaining them, division of tasks and responsibilities and the extent and manner of distribution of compensation, if any. If the current stakeholder map indicates any likelihood of violent conflicts, the fourth step should begin by inviting the parties to a workshop or seminar on constructive conflict resolution and negotiation management.

Since the first common objective is to have a fruitful dialogue that will lead to an agreement between the parties, the participants' first task should be to develop the procedures for debate. These procedures, together with elements of debate ethics, usually take form of a code or rules of civil dialogue. The debate participants will prepare a draft code under the direction of the facilitator. The recommendations of the Code shall include, inter alia, a definition and hierarchy of objectives, participating entities, schedule, method of selecting representatives of the parties, debate procedure and the manner of publicizing the debate, rules for exchanging views and for presenting positions (including, for example, a declaration that all the stakeholders should be allowed to speak and all possible solutions should be considered, following an accepted hierarchy of goals and objectives, maintaining the parliamentary forms of debate, refraining from arguments ad personam, honesty and fairness in the presentation of evidence, etc.), a division into specialized working groups, the manner of making binding decisions and agreements.

After the code has been presented to all the debate participants and its provisions approved, the debating parties should, if the debate participants deem it appropriate, be divided into sub-tables dealing with different tasks. Depending on the substantive content of the debate, the following tasks may be assigned to the sub-tables: project coordination, including gathering information about the consultation process, organizing meetings and discussions, planning next steps in the consultation process, settlement of any procedural and ethical disputes in accordance with the code;

- addressing specific issues related to the investment project (e.g., social, technological issues, nuisances, compensation, etc.);
- mediation between interest groups aimed at taking binding decisions;

- project implementation support committee;
- oversight over the agreement implementation.

The sub-tables operate according to schedule, informing each other of the agreed proposals. The proposals are approved at the plenary round table debates, which are also held according to schedule.

Conflicts over diverging opinions, positions or interests are likely to occur during the debate. In such situations, depending on the phase and weight of the conflict, the control team draws up, under the direction of the facilitator, a common conflict map and develops a strategy for the conflict resolution. The parties in dispute may, under the direction of the facilitator, enter into negotiations to find a win-win solution to the conflict.

After the disputes have been closed and conflicts resolved, the facilitator closes the debate. The parties should draw up and sign a joint agreement, and then assign the appropriate teams to monitor and support the project.

Good practices

Public communication on environmental protection and sustainable development has a short tradition in Poland. There were a few spectacular or notable campaigns, but none of them was able to bring about a lasting change in attitudes, not to mention a change in behaviours. This is so because the only projects we get involved in are ad hoc projects, which fail to be integrated into larger, carefully devised and consistently implemented, long-term public education and awareness programmes, which would permanently change the public consciousness and behaviours.

There is no doubt that implementation of carbon capture and storage in Poland requires a series of media campaigns, but these campaigns should be regarded as only one of the tools of a broad public awareness programme to promote CO_2 emission control.

The problem of CO_2 emissions is a global one. Examples of similar programs can be found all over the world. Good practices should be put in place. They should be investigated and analysed, contacts with their authors should be established, and their experience utilised.

The process of CCS technology implementation, not only in Poland but also in other countries around the world, will not be easy, because in a democratic society it is not enough to be right, one must also be able to convince others of the merits of one's position.

Conclusions:

1. The public consultations, started early in the process of the project implementation in the spirit of civil dialogue, allow to accomplish even the most complex projects.
2. Working in partnership with community stakeholders allows to reach an agreement for implementation of the project which is the most viable in economic, social and environmental terms .
3. Consultations in the spirit of civil dialogue allow to build a social capital of trust which pays off, paving the ground for the implementation of subsequent public investment projects in local communities.

RECOMMENDATION

The process of raising public awareness must be carried on through comprehensive, carefully drafted and efficiently executed Public Communication Programme. The Programme should be designed to help citizens notice, understand and accept a common goal. The programme should also:

- inspire partner confidence and encourage participation in the social division of tasks,
- allow presentation of all views and opinions,
- encourage mutual explanation of doubts, to understand and respect the diverging positions and interests,
- assist in avoiding or mitigating conflicts and disputes, turning them into win-win solutions.

Then, the Public Communication Programme becomes a platform for constructive public dialogue. Civil dialogue is a way of creating, building and maintaining relationships between the state authorities and the civil society – usually represented by NGOs – to ensure partnership and cooperation of all stakeholders in seeking, agreeing on and achieving common public policy goals.

Conclusions

In the context of coal's role in the structure of global energy production, the new dimensions of energy security and efforts associated with major reductions of greenhouse gas emissions, clean coal technologies are becoming one of the most important elements of the new energy model. In the case of Poland, Carbon Capture and Storage will be indispensable in allowing for a low-carbon transformation of the Polish economy - in line with the strategy of the European Union. Moreover, CCS can bring both material and immaterial profits to Poland. However, to make this a reality, harmonised sets of measures and initiatives under the umbrella of the Polish CCS Strategy need to be implemented.

POLISH CCS STRATEGY

AREA	MEASURES AND INITIATIVES
political framework	● The government decides to grant CCS a high political status as one of the key tools for the implementation of the Polish energy and climate policy.
capacity building	● A comprehensive and well-coordinated Polish Flagship Clean Coal Technologies Programme is prepared. The Programme provides a framework for the development and deployment of clean coal technologies in Poland.
institutional framework	● In order to optimise the investments and capital expenditures, the Government Plenipotentiary for Clean Coal Technologies is being appointed. The Plenipotentiary, on behalf of the government, exercises control over the implementation of the Flagship Programme, intervenes in case of irregularities, reviews the program and, if necessary, sets new actions and initiatives.

AREA	MEASURES AND INITIATIVES
legal framework	● CCS Directive is transposed into the Polish law by changing the existing legislation. The changes are comprehensive and enter into force before 25 June 2011 in a coherent and harmonized manner. ● A new legislative act on transportation corridors, which governs transport of carbon dioxide, is prepared and enters into force. ● If the amendment of existing legislation becomes impossible to carry out in due time, a separate act, which allows for an efficient implementation of demonstration projects is created.
financial framework	● The Government is actively engaged in increasing public funds available for CCS projects. Firstly, external founds available in the nearest future are used (including NER300, Operational Programme Infrastructure and Environment, Norwegian Funds). ● The government plans to develop a system of support for CCS (including direct subsidies to the project, tax credits, loan guarantees and loans at preferential terms). ● The government decides to allocate a part of the revenue from auctioning emission allowances (under Phase III of the European Emissions Trading Scheme) to CCS. ● CCS projects are implemented on a Public-Private Partnership basis.
R&D potential	● A Polish CCS cluster is established. The cluster aims at streamlining the process of CCS development in Poland via coordination of activities carried out by public, private, academic and particularly research and development units. Its main task is to make optimal use of the existing and developing new technologies, which will increase the safety and effectiveness of CCS.
public awareness	● A comprehensive Social Communication Program is developed and implemented. The program is designed to help citizens in perceiving, understanding and accepting a common goal. Due to the fact that CCS implementation is in the interest of the whole country and not just individual entities, the Program is given the status of a government program.

Bibliography

Documents and reports:

Assumptions for a new Polish Geological and Mining Law (*Assumptions for the draft law amending the Polish Law – Geological and Mining Law and other laws transposing the Directive of the European Parliament and Council 2009/31/EC of 23 April 2009*)

A. Hinc, *How to efficiently implement CCS in Poland? R&D potential and framework for a CCS cluster*, demosEUROPA – Centre for European Strategy, 2010.

A. Hinc, *How to efficiently implement CCS in Poland? Financial framework,* demosEUROPA – Centre for European Strategy, 2010.

A.Hinc, *How to efficiently implement CCS in Poland? Legal and political frameworks*, demosEUROPA – Centre for European Strategy, 2010.

An Ideal Portfolio of CCS Projects and Rationale for Supporting Projects, L.E.K. Consulting, Sydney 2009.

Carbon Capture&Storage. Assessing the economics, McKinsey&Company, 2008.

CO_2QUALSTORE Report, Guideline for Selection, Characterization and Qualification of Sites and Projects for Geological Storage of CO_2, Version 4, DET NORSKE VERITAS, Norway 2009.

D. Helm, C.Hepburn, *The economics and politics of climate change*, Oxford University Press, 2009.

Energy Technology Essentials; Claudia Kemfert, Katja Schumacher, *Climate Protection in the German Electricity Market: Opportunities for Coal Technologies Through CO_2 Capture and Storage?,* International Energy Agency, 2005.

Facts and Figures. The link between EU's economy and environment, European Commission, 2007.

Green Paper of the Social Council for the National Programme of Emission Reductions, 2010.

How the energy sector can deliver on a climate change agreement in Copenhagen, International Energy Agency, 2009.

M.R. Hamilton, H.J. Herzog, J.E. Parsons, *Cost and U.S. public policy for new coal power plant with carbon capture and sequestration,* 2008.

Meeting the Energy Challenge. A White Paper on Energy, HM Government 2007.

Assessment of Greenhouse Gas Emissions Abatement Potential in Poland by 2030, McKinsey & Company, Warsaw 2009.

The Polish Energy Policy until 2030, Ministry of Economy, Warsaw 2009.

Poland 2030, Development Challenges, Board of Strategic Advisors to the Prime Minister of Poland, 2009.

Report 1: Status of Carbon Capture and Storage Projects Globally, Global CCS Institute, Canberra 2009.

Report 2: Economic assessment of carbon capture and storage technologies, Global CCS Institute, Canberra 2009.

Report 3: Policies and Legislation Framing Carbon Capture and Storage Globally, Global CCS Institute, Canberra 2009.

Report 4: Existing Carbon Capture and Storage Research and Development Networks around the World, Global CCS Institute, Canberra 2009.

BIBLIOGRAPHY

Report 5: Synthesis Report, Global CCS Institute, Canberra 2009.

S. Bachu, *Review of the current legal and regulatory framework in Alberta for large-scale implementation of CO_2 geological storage*, Report Submitted to Alberta Environment, Canada 2007.

S. Becker, J. Lu, *Royalty rate and industry structure: some cross-industry evidence,* 2009.

Special Report on Carbon Dioxide Capture and Storage, Intergovernmental Panel on Climate Change PCC, New York 2005.

T. Kerr, B. Beck, *Technology Roadmap: Carbon Capture and Storage*, International Energy Agency, Paris 2009.

Technologia wychwytywania i geologicznego składowania dwutlenku węgla (CCS) sposobem na złagodzenie zmian klimatu, Lewiatan, Warszawa 2009.

The illusion of clean coal, The Economist, March 2009.

Towards Carbon Capture and Storage. A Consultation Document, Department of Business, Enterprise and Regulatory Reform, HM Government 2008.

World Energy Outlook, International Energy Agency, OECD, 2009.

White Paper of the Social Council for the National Programme of Emission Reductions, 2010

Directives:

Directive of the European Parliament and of the Council 2009/31/WE of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EWG, Euratom, European Parliament and Council Directives2000/60/WE, 2001/80/WE, 2004/35/WE, 2006/12/WE, 2008/1/WE and Regulation (EC) nr 1013/2006.

Directive of the European Parliament and of the Council 2008/1/WE of 15 January 2008 concerning integrated pollution prevention and control.

Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment.

Directive of the European Parliament and of the Council 2004/35/WE of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage.

Directive of the European Parliament and of the Council 2003/87/WE of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.

Acts:

Australia: Offshore Petroleum and Greenhouse Gas Storage Act 2006, Act No. 14 of 2006 as amended, compilation prepared on 23 February 2009.

Canada: Climate Change and Emissions Management Act, Coal Conservation Act, Conservation and Reclamation Regulation, Environmental Protection and Enhancement Act, Environmental Assessment Act, Oil and Gas Oil and Gas Conservation Act, Mines and Minerals Act, Pipeline Act, Water Act.

Germany: Draft law regulating the capture, transport and permanent storage of carbon dioxide, the Federal Cabinet on 1 April 2009 version adopted.

Poland: ACT of 4 February 1994 GEOLOGICAL AND MINING LAW, Consolidated text: Journal of Laws 2005, No. 228, item 1947 with subsequent amendments: Journal of Laws 2006.

U.S.: A BILL, H. R. 1689, To accelerate the development and early deployment of systems for the capture and storage of carbon dioxide emissions from fossil fuel electric generation facilities, and for other purposes, 111TH CONGRESS 1ST SESSION, March 2009.

BIBLIOGRAPHY

Great Britain: Climate Change Act 2008 and Energy Act 2008

Links:

Australian e-Government Technology Cluster
http://www.nicta.com.au/business/market_engagement/industry_clusters/egovcluster

Carbon Capture and Storage in North East England
http://www.progressive-energy.com/images/carboncapture.pdf

CCS as a preferred technology for mainstreaming the clean use of coal in Poland
http://www.demoseuropa.eu/CCS

CCS Network
www.ccsnetwork.eu

CCS R&D Programme Annual Report 2009, Vattenfall
www.vattenfall.com

Zero Emission Platform
www.zeroemissionsplatform.eu

Europe's Energy Portal
http://www.energy.eu/#dependency

Finnish Cleantech Cluster
http://www.cleantechcluster.fi/en/

Global CCS Institute
www.globalccsinstitute.com

Interagency Task Force on Carbon Capture and Storage, the White House
http://www.whitehouse.gov/administration/eop/ceq/initiatives/ccs

National Centre for Research and Development
www.ncbir.pl

One North East
http://www.onenortheast.co.uk/

The IEA CCS Regulators' Network
http://www.iea.org/work/2009%5Cccs_regulatory%5CKerr.pdf

Authors

Cezary Filipowicz is a director of established in June 2010 consortium "GeoCO2", whose aim is to examine the possibility of safety storage of carbon dioxide in Poland. Previously he had worked in Polish Geological Institute. Between 2006 and 2008 he had been vice-president of the Board of Director of PKN Orlen. He was responsible for the extraction and trade of oil. He has got PhD in geology. He had been working as an academic at the University of Warsaw for a long time.

Agata Hinc is "Low Emission Economy" Project Leader at demosEUROPA – Centre for European Strategy. She is in charge of demosEUROPA projects carried out within the framework of "Energy and Climate" programme, relating to building a low carbon economy, Carbon Capture and Storage technology and European Emissions Trading Scheme (ETS). Her research is also focused on EU external relations (especially with developing countries). An author of articles, commentaries, reports and studies on energy and climate change, development policy and the European Union external relations. A graduate in European Studies at the University of Warsaw.

Paweł Magierowski is an attorney in Baker&McKenzie law firm in Warsaw. He works on a wide range of corporate and commercial transactions, with particular attention to the energy industry and other infrastructure projects. He graduated from the University of Warsaw. He specializes in mergers and acquisitions, private equity transactions, joint ventures, project developments, commercial agreements, dispute resolution and regulatory matters.

Andrzej Siemiaszko is a Director of National Contact Point for Research Program of the EU specializing in the area of research, technology development and innovation as well as the EU cohesion and regional policies. He is responsible for the management of NCP Poland (umbrella organisation, hosting all NCP coordinators) as well as of regional network with 200 nodes at universities and industry. In 2003-2006 he was an advisor to the Minister of Science and from 2006 to 2007 he was an advisor to Prof. Jerzy Buzek. He participated in the creation, programming and implementation of structural funds in Poland. He is a Polish delegate to the Government Group of the

European Technology Platform for Zero Emission Fossil Fuel Power Plants. He has organised several international conferences on Clean Coal Technologies. He has a PhD in mechanical engineering and is an author and co-author of more than 50 scientific papers.

Leszek Stafiej is an independent advisor on social communication, media and marketing. He serves as a Head of DKS Stafiej Partnerzy group. As an expert on social communication he has worked for for the Ministry of Foreign Affairs, Ministry of Regional Development, Ministry of Defence, BBC and other institutions. He gives lectures at several Polish universities (UJ, SGH, SWPS) and is an author of seminar courses and social education programmes on business ethics, communication, regional marketing, and corporational responsibility. He was also a coordinator of communication during PKN Orlen privatisation process and Director of the Social Dialogue Programme in Cracow.

Eugeniusz Sutor is a Head of Development Office, Zakłady Azotowe Kędzierzyn SA. He is a graduate of the Silesian Technical University with a degree in chemical engineering and holds post-graduate diplomas in the field of material-and energy-efficient chemical technologies and value based management of a company from the Silesian Techinical University and the Warsaw School of Economics respectfully. He is responsible for the implementation of the Carbon Capture and Storage Technology in Poland.

Paweł Świeboda is President of demosEUROPA – Centre for European Strategy. Graduate of the London School of Economics and the University of London. He served as the EU Advisor to the President of Poland in the years 1996-2000. He then headed the Office for European Integration in the Chancellery of the President. In the years 2001-2006 he served as Director of the Department of the European Union in the Ministry of Foreign Affairs where he was responsible for EU accession negotiations and subsequently institutional reform in the EU and negotiations on the Financial Perspective. He is a Member of the Lisbon Council, Member of the Advisory Board of the European Policy Centre, and Member of the Advisory Board of the Baltic Development Forum. He is a member of the Advisory Group which assists the Polish government in its preparations for the EU presidency in 2011. He is also an author of numerous articles on European integration and international relations. He has a column on foreign policy in "Gazeta Wyborcza", Poland's largest daily.

demosEUROPA – Centre for European Strategy is an international, non-partisan policy-orientated research institution which aims to provide answers to the challenges facing the European Union, its Member States and the citizens. It is a forum for ideas about the political, social and economic dimension of European integration and international relations. One of the key objectives is to promote an active, engaged and unequivocally pro-European role of Poland as a Member State.

The activity of demosEUROPA is based on the belief that only by being at the heart of Europe, will Poland best serve the interests of its business community and citizens.

demosEUROPA publishes policy papers and reports formulated on the basis of interactive discussions, conferences and seminars.

demosEUROPA – Center for European Strategy
Idźkowskiego Street No. 4/6
00-442 Warsaw
www.demoseuropa.eu
email: demoseuropa@demoseuropa.eu
tel.: +48 22 401 70 26
fax.: +48 22 401 70 29

demosEUROPA
Centre for European Strategy

ul. A. Idźkowskiego 4/6
00-442 Warsaw
Poland

demoseuropa@demoseuropa.eu
www.demoseuropa.eu

tel. +48 22 401 70 26
fax +48 22 401 70 29