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Financial Scenarios Report

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PUBLIC REPORT

GETICA CCS DEMO PROJECT

Romania

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EXECUTIVE SUMMARY

In Romania, the energy sector accounted for 66.44% of total national greenhouse gas (GHG) emissions in 2009 (ANPM, 2011). Carbon dioxide (CO_2) is the largest contributor to the total national GHG emissions. For this reason, Romania needs to implement new technologies to reduce CO_2 emissions in the energy sector. Two key approaches to achieving this are:

- new green energy production capacities, i.e. renewable energy; and
- reducing the emissions of existing power plants, i.e. Carbon Capture and Storage (CCS)

Given that electricity generation in Romania is primarily based on coal, implementing CCS would greatly reduce CO_2 emissions while keeping coal fired power plants operational.

This Financial Scenarios Report analysed the optimum solution to financing a large-scale CCS project. It considered the challenges of finding and securing financing sources for the project.

The Getica CCS Demo Project is planned to be implemented at the Turceni Power Plant, an existing base-load plant and one of the strategic electricity suppliers of the Romanian National Power System. The power plant and the adjacent lignite mines are part of the Oltenia Energy Complex, a state owned company.

The Getica CCS Demo Project will comprise the full chain of components for CCS, including:

- CO_2 capture and compression plant;
- transportation by pipeline; and
- geological storage.

The CO_2 capture plant (CCP) will be based on absorption of CO_2 from flue gas using the Chilled Ammonia Process (CAP), with 85% capture efficiency. The CCP will compress the CO_2 for transportation by underground pipeline at supercritical fluid conditions. Storage will take place in suitably identified onshore saline aquifers, within a 50 km radius of Turceni Power Plant (PP).

The key CCS performance values are:

- Net power output without CCS – 275 MW
- Net power output with CCS – 193 MW
- CO_2 captured annually – 1.3 Mtpa
- Total CO_2 captured – 20 Mt

The investment cost of the Getica CCS Demo Project has been estimated in the Feasibility Study and includes:

- 60% - capture plant cost
- 4% - transport cost
- 14% - storage cost
- 22% - other development and owner's costs

The project will be implemented and operated by a new Project Company (PC), set up especially to this aim. The shareholders are three existing state-owner companies, with considerable experience in power generation and oil & gas.

The PC will have a commercial contract with the Oltenia Energy Complex, through which:

- it will charge Oltenia for the service of capturing, transporting and storing the CO_2 in suitable identified storage sites; and
- it will buy the steam, electricity and utilities from Oltenia for the operation of the CCP. The paid rate is envisaged to cover the energy loss due to the implementation of CCS at Unit No. 6.

The existing financing sources, at European Union (EU) and national level, were analysed in terms of financing structure of the project, project eligibility, origin of financing (public/private), availability of funding, availability in time, degree of certainty.

Three scenarios were created, based on the prospected funding sources for CCS projects. A qualitative assessment was performed and, based on this assessment, the optimum scenario was chosen.

The proposed financing scenario is based on the NER 300 grant and funds from the EU Emissions Trading Scheme (ETS) incomes from auctions. Other sources envisaged to cover the investment costs are smaller grants, equity and loan. The scenario is a combination of funds with the highest probability of success and covers the implementation costs of the Getica Project and the operating and financial costs for the prospected lifetime of the project.

The funding of the Getica project is highly dependent on the CO_2 price and the support of the Romanian Government by establishing incentive schemes for CCS. Especially in the case of the CO_2 price, the Romanian demo project has no control over that factor, thus no leverage to minimise the risks.

The Getica CCS Demo Project will add value to an emerging technology to be applied both for existing and new power plants. It will also contribute to achieving the EU target of reducing GHG emissions by 20% in 2020.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

2D	two-dimensional
3D	three-dimensional
AAU	Assigned Amount Unit
ANPM	The Romanian National Agency of Environmental Protection
ANRE	Romanian Energy Regulatory Authority
CAP	chilled ammonia process
CAPEX	capital expenses
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
CCP	CO_2 Capture Plant
CCS	CO_2 capture and storage
€	Euro (currency)
EBRD	European Bank for Reconstruction and Development
EEPR	European Energy Programme for Recovery
EIB	European Investment Bank
EPC	Engineering, Procurement and Construction
ETS	Emissions Trading Scheme
EU	European Union
EURIBOR	Euro interbank offered rate
FEED	Front End Engineering and Design
FP7	7th Framework Programme
GCCSI	Global CCS Institute
GHG	greenhouse gas
GIS	Green Investment Scheme
Gt	gigatonnes (x10^9 tonnes)
ISPE	Institute for Studies and Power Engineering
km	kilometer
m	meter
m^3	cubic meters
MCA	multi-crtieria analysis
METBE	Ministry of Economy, Trade and the Business Environment
MoU	Memorandum of Understanding
Mt	million tonnes
Mtpa	million tonnes per annum
MW	megawatt
MWe	megawatt (electric)
NER	New Entrants Reserve
NH_3	ammonia
O&M	operations and maintenance
OPEX	operational expenditure
PC	Project Company
PCC	post-combustion capture
PP	power plant
tpa	tonnes per annum
ZEP	Zero Emissions Platform

1 INTRODUCTION

1.1 Regulatory Background

The European Union (EU) climate and energy package is an integrated policy approach that aims to fight climate change and increase the EU's energy security. It comprises a set of policies and measures transposed in clear objectives, known as the "20%-20%-20%" target, comprising:

- a compulsory target of reducing greenhouse gas (GHG) emissions by 20% in 2020;
- a compulsory target of a share of 20% renewable energy in the EU's energy configuration in 2020;
- a plan for reducing the primary energy global consumption in EU by 20% by 2020;
- establishing a price on carbon through the EU Emissions Trading Scheme (ETS); and
- a competitive internal energy market.

This sets the background on which carbon capture and storage (CCS), as a carbon dioxide (CO_2) emissions mitigation measure, can be implemented. The EU has taken important steps to advance CCS deployment by putting in place financial support schemes for the initial demonstration projects, through the European Energy Program for Recovery (EEPR) and the planned allocation of parts of the 300 million EU Allowances set aside from the New Entrants' Reserve (NER) of the EU-ETS.

Taking into account the EU incentives for the development of CCS, Romania wishes to implement CCS, applied to power plants, to reduce CO_2 emissions.

1.2 Project Overview

The Getica CCS Demo Project will be implemented at Turceni Power Plant (PP). Turceni PP is a base-load plant and one of the strategic electricity suppliers of the Romanian National Power System. Turceni PP and the adjacent lignite mines are part of a state-owned company, the Oltenia Energy Complex.

The project will be located in Gorj county, in Romania's South West Development Region. The South West Development Region comprises five counties: Dolj, Olt, Valcea, Mehedinti and Gorj. Gorj has a population of 2,279,849, representing 10.6% of Romania's total population.

The nearest city to the project location is Târgu Jiu, located around 55 km from the Oltenia Energy Complex.

Turceni was initially equipped with seven 330 MW units. Currently the power plant operates between four to six units, depending on the market demand. Under the long-term investment strategy, only four units will continue to operate.

The Getica CCS Demo Project comprises a full chain CCS system. CO_2 emissions equivalent to 250 MW gross electrical output (around 1.5 million tonnes per annum (Mtpa) of CO_2) will be captured from an existing 330 MW unit (Unit No. 6) of the Turceni PP. The captured CO_2 will be transported and injected in onshore deep saline aquifer formations.

1.2.1 CO_2 Capture

Post-combustion capture (PCC) is proposed for Unit No. 6, to be based on the absorption of CO_2 from the flue gases using the Chilled Ammonia Process (CAP). The CO_2 capture efficiency will be in excess of 85%.

The average CO_2 captured from Unit No. 6 will be about 1.3 Mtpa with a total 20 Mt CO_2 captured and stored over the lifetime of the project (15 years)[1]. Due to the implementation of the capture technology, the net efficiency of Unit No. 6 is estimated to drop from 33% to 22%. This represents a relative decrease in the net efficiency of 33%.

1.2.2 CO_2 Transport

The CO_2 Capture Plant (CCP) will compress the CO_2 for transportation by pipeline at supercritical fluid conditions. The carbon steel underground pipeline will transport the CO_2 over a distance of 40 km. External corrosion of the buried pipeline will be mitigated by a combination of coating and cathodic protection.

1.2.3 CO_2 Storage

The captured CO_2 is planned to be stored in suitably identified onshore saline aquifers, within a 50 km radius of Turceni. Only saline aquifers have been considered as potentially suitable for CO_2 storage in the area of investigation, located at depths greater than 800m and no more than 3,000m. Within the 50 km radius, one zone (Zone 5) has been identified as the most suitable for the future storage complex and another zone (Zone 1) as a back-up storage site.

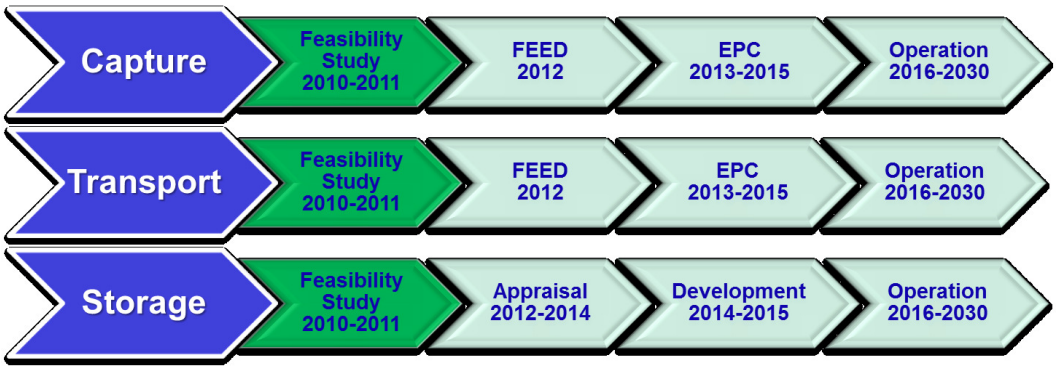
The total storage capacity of Romania has been identified at around 22.6 Gt of onshore CO_2 storage (18.6 Gt in saline aquifers and 4 Gt in depleted oil and gas reservoirs).

Further details on the project's specifications can be found in the Feasibility Study Report (refer Table 1-1).

1.3 Project Development Plan

The Getica project's planned operation start-up date is December 2015. The major phases up to operation are presented in Figure 1-1 below.

Figure 1-1 Getica CCS Demo Project Key Implementation Phases



[1] These figures take into account that the first year of operation will be mainly dedicated to optimising the overall process and thus the project will operate below its rated capacity.

1.4 Current Status

At the time that this Financial Scenarios Report was developed (April 2012), the Getica CCS Demo Project had successfully achieved the following milestones:

- selection of the first Romanian CCS demonstration project location (Turceni PP);
- Feasibility Study and Storage Assessment;
- application for the NER300 Programme first round funding; and
- signing of a Norwegian Financial Mechanism Memorandum of Understanding (MoU) between Norway and Romania, providing financial support of €40 million for the Getica CCS Demo Project.

Currently, the project is preparing for the Front End Engineering Design (FEED) kick-off, prospected for Q3 2012. The grant funding from the Norwegian Financial Mechanism will be allocated to the execution of this stage.

1.5 Report Objective

This Financial Scenarios Report aims to provide the best solution to finance a large-scale CCS project. It considers the challenges of finding and securing financing sources for the project.

1.6 Referenced / Associated Documents

The following documents have been previously produced as part of the development of the Getica CCS Demo Project (Table 1-1).

Table 1-1 List of Referenced / Associated Getica CCS Demo Project Documents

Release Date	Title / Description	Location
Dec 2011	Feasibility Study Report – CO_2 Capture	http://www.globalccsinstitute.com/publications/getica-ccs-demonstration-project-%E2%80%93-feasibility-study-report-%E2%80%93-co2-capture
Nov 2011	Permitting Report	http://www.globalccsinstitute.com/publications/getica-ccs-demo-project-%E2%80%93-permitting-report

2 COMMERCIAL OVERVIEW

2.1 Commercial Arrangements

The project will be implemented and operated by a new Project Company (PC), set up especially for the purpose of delivering the Getica CCS Demo Project. The shareholders are three existing State-owned companies, collectively with considerable experience in power generation and oil & gas:

- Oltenia Energy Complex (CE Oltenia SA) – electricity producer;
- Transgaz National Company for Natural Gas Transport (SNTGN Transgaz SA) – natural gas transportation; and
- Romgaz National Company for Natural Gas Exploitation (SNGN Romgaz SA) – natural gas extraction and storage.

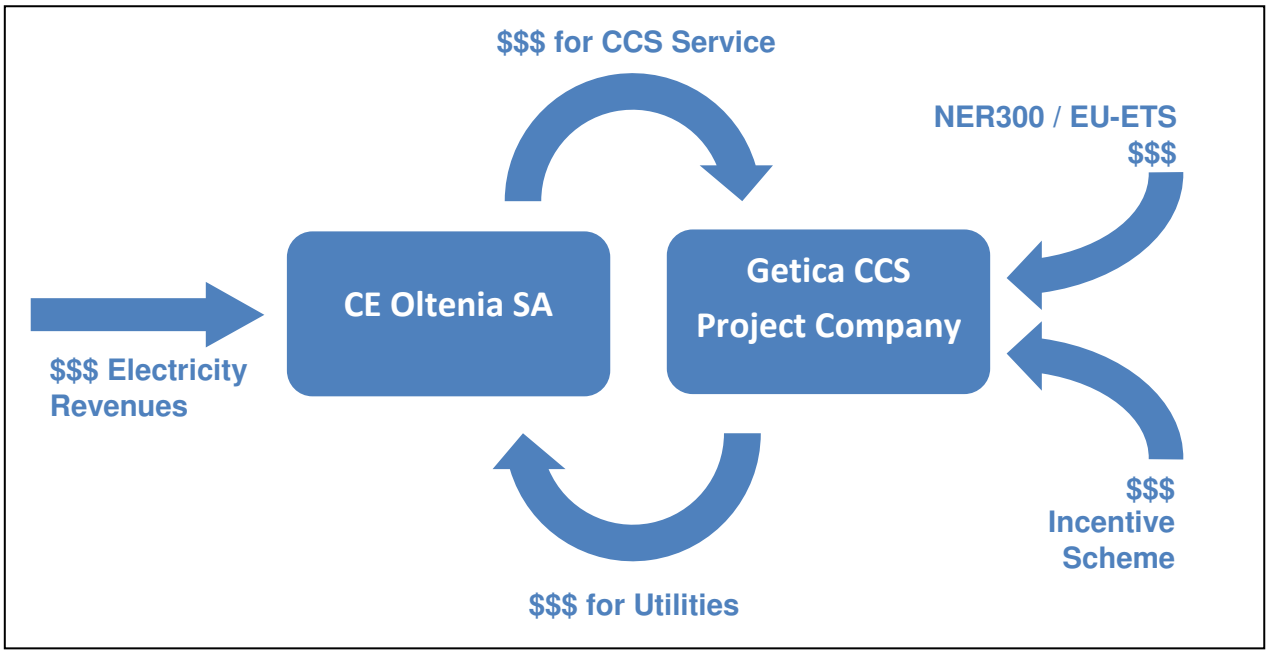
The three entities within the PC will provide equal contributions of project financing, and act collectively as the project developer and future operator.

As operator of the Getica CCS project, the PC will have a commercial arrangement with the power plant where:

- payment for the CCS 'service' is made by CE Oltenia SA to the PC. This payment will be based on 1.3 Mtpa as the average quantity of CO_2 to be captured and stored; and
- payment for the utilities (steam, electricity) required to implement CCS is made by the PC to CE Oltenia SA. The paid rate is envisaged to cover the energy loss of the power plant due to the implementation of CCS at Unit No. 6.

This commercial arrangement, along with the inflows of potential funding sources is presented in Figure 2-1.

Figure 2-1 Commercial Relationship Oltenia - Project Company (Operation Phase)



2.2 Investment costs

The investment costs for the Getica CCS Demo Project include each of the components of the full CCS chain – capture, transport and storage. They also include a knowledge sharing component.

Investment costs from the Getica CCS Demo Project Feasibility Study are presented in Table 2-1, and carry a +/-20% level of accuracy. The following key elements have been considered for the investment costs: capital equipment, site infrastructure, studies, engineering and design, installation and commissioning, permitting, taxes, project management, knowledge sharing (Communication Strategy), contingency and owner's costs.

Table 2-1 Investment Costs

Component	Weight of total estimated cost (%)
Capture (compression component is 2.5% of total Capture cost)	60
Transport	4
Storage	14
Owner's costs	2
Development costs	19
Public awareness, communication and knowledge sharing	1
TOTAL	**100**

The development costs include:

- FEED and detailed design;
- studies (e.g. risk analysis);
- permits, authorisations, taxes, legal quotas;
- consultancy and tendering process organisation;
- site surveys (geotechnical, geological, topographical etc, seismic 2D and 3D acquisition and processing, coring and sampling);
- appraisal wells; and
- project management.

2.3 Operating costs

As with the investment costs, the operating costs for the Getica CCS Demo Project include each of the components of the full CCS chain – capture, transport and storage. They also include a knowledge sharing component.

The operating costs based on the Feasibility Study for the Getica CCS Demo Project are presented in Table 2-2.

Table 2-2 Operating Costs

Component	Weight in annual OPEX (%)
Capture	90
Transport	2
Storage	8
TOTAL	**100**

The operating costs across the CCS chain include:

- for CO_2 capture and compression, fixed and variable operations and maintenance (O&M), utilities, staff costs, knowledge sharing, and contingency. Utilities costs (electricity and steam, water, other) represent on average 82% of the total operating costs for capture. Out of the utilities costs, the cost of CO_2 compression is on average 14%.
- for CO_2 transport, fixed and variable O&M, utilities, staff costs, knowledge sharing, contingency; and
- for CO_2 storage, fixed and variable O&M (including maintenance, micro-seismicity and environmental monitoring), utilities, staff costs, insurance, knowledge sharing and contingency.

2.4 Cost Estimate Basis and Assumptions

The bases and main assumptions for the cost estimates are listed below.

Commercial operation

- The project is going to be implemented by the PC.
- The operating period of the CCS full chain is 15 years, the same as the operating period of the unit. The design lifetime of the project exceeds the allotted duration of NER 300 funding. Other funding sources are envisaged to support the project in the last five years of its operation.
- The estimate of costs for electricity and steam delivered by Turceni PP to the CCP is determined based on the difference between the operating revenues of Turceni PP with CCS and without CCS, considering that this value equals the value of the financial losses of CE Oltenia SA due to the steam extraction for CCP.

Power Plant and CCP Performance

- The annual operating time for Unit No. 6 of the Power Plant starts at 7,600 hrs/year (equivalent to 87% time availability) and decreases continuously over the operating

period, reaching 6,800 hrs/year after 10 years and 6,600 hrs/yr in the last year. These operating periods are based on the current operating conditions of the Turceni PP and take into consideration forecasts of the electricity market.

- The gross efficiency of Unit No. 6:
  - without the CCP, is estimated at 38% in the first year of operation, decreasing over the operating period to 34% in the final year of operation; and
  - with the CCP, is estimated at 34% in the first year of operation, decreasing over the operating period to 28% in the final year of operation.
- The annual operating period of the CCP is 95% of the annual operating period of the Turceni PP. The 5% difference allows for unscheduled outages.
- In the first year of operation, the annual operating period is 50% of the annual operating period of the Turceni PP. Similarly, in the first year of operation, the CCP operating capacity is 50% of the CCP nominal capacity;
- The CO_2 capture rate is minimum 85%. The desired capture rate is primarily controlled by adjusting the lean/rich solution flow rates between the absorbers and the regenerator based on the design lean/ rich R ratios (mol NH_3/mol CO_2). Based on a fixed lean R-ratio as determined by the regenerator bottom temperature the rich R-value varies depending on the flue gas flow and the solution flow rate.
- The CCP can run with the power plant at 100% capacity.
- The CCP turndown ratio is 50% of the design flue gas flow rate.
- The power plant is independent from the CCP and can still operate with the CCP offline.
- Maintenance costs for capture are estimated at 1.5% of the capture capital expenses (CAPEX).

CO_2 Transport Pipeline

- The lifetime of the transport system is 40 years;
- The annual operating period of the transport system is 97% of the annual operating period of the CCP. The 3% difference allows for unscheduled outages.
- Maintenance costs for transport are estimated at 1% of the transport CAPEX.
- Royalty costs for the transport component represent 10% of the transport operational expenditure (OPEX).

CO_2 Injection and Storage

- There are five injector wells. This number could change, depending on the observed injectivity, which itself will depend largely on the actual level of heterogeneities in the target reservoir.

- Maintenance costs for storage are estimated at 0.02% of the storage CAPEX.
- Royalty costs for the storage component represent 3% of the storage OPEX.
- Contingencies applied for each of the capture, transport and storage investment costs are:
    - Capture – 10% of the Capture CAPEX
    - Transport – 10% of the Transport CAPEX
    - Storage – 15% of the Storage CAPEX
- Contingencies applied for the operational costs are:
    - Capture – 15% of the Capture OPEX
    - Transport – 5% of the Transport OPEX
    - Storage – 15% of the Storage OPEX

3 FINANCING SOURCES

Wherever possible, the investment costs for the Getica CCS Demo Project will be covered by direct funding (grants). Direct funding opportunities exist given the demonstrative nature of the project and the EU's objective of advancing CCS towards commercial operation.

As introduced in Section 1.1, an important action undertaken by the EU as part of its integrated approach to climate and energy policy is the EU carbon trading scheme, the EU ETS[2].

For the purpose of determining the appropriate funding scenario for the Getica CCS Demo Project, the carbon price was assumed to be €15/tCO_2-e. The assumption for the carbon price was made when the financial scenarios were assessed (i.e. Q4 2010/Q1 2011).

Under present conditions, the carbon price does not provide an adequate financial incentive for CCS. According to the Zero Emissions Platform (ZEP), the CO_2 price will become an incentive for CCS technology deployment at values over €35/tCO_2-e (ZEP, 2011).

Given the current economics of CCS and that it is still a nascent industry, CCS development is being driven by EU climate change policy rather than the market.

A detailed investigation of the possible sources of funding at an EU level was undertaken to assess which sources best fit the Project needs, in terms of time compatibility and level of funding. The potential financing sources for the investment period are:

- NER 300;
- Norwegian Financial Mechanism;
- EU ETS incomes from auctions;
- National Public Sources;
- EU 7th Framework Project (FP7);
- Green Investment Scheme (GIS)
- European Investment Bank (EIB) loan; and
- Equity.

Potential financing sources for the operation period are:

- NER 300;
- EU ETS incomes from auctions;
- Incentive scheme; and
- Fee for CCS service.

Table 3-1 presents the timing and available amount for each funding source considered.

[2] The EU ETS promotes the reduction of GHGs at least cost by companies with activities that generate GHG emissions. Within the EU ETS, an 'allowance' represents the right to release a tonne of CO_2 (equivalent) in a defined time interval. For the first two phases of the EU ETS (2005-2007 and 2008-2012 respectively), each Member State had to develop a National Allocation Plan, which determines the national cap and allocation for sectors and installations, existing and new.

Subsequent phases of the EU ETS will have eight year terms. The third phase of the EU ETS, starting in 2013, will bring new provisions as stipulated in the Directive 2009/20/EC amending Directive 2003/87/EC to improve and extend the scheme. Some of the most important provisions are that:

Table 3-1 Overview of Potential Funding Sources

No	Source	Timing	Financing limits	Total Potential Funding for Getica Project (€ millions)
1	NER300 (EU Commission, 2012)	2012-2025	50% from relevant cost	262.5[3] - 675[4]
2	Norwegian Financial Mechanism (FMO, 2012)	2012-2014	85% of programme cost	105
3	EU-ETS (auctions) (EU Commission, 2011)	from 2013	-	~ 230 (per year)
4	EIB loan (EIB, 2012)	-	50% from eligible cost	-
5	National Public Sources (METBE)	-	-	-
6	Equity	2011-2015	-	-
7	GIS (REC, n.d.)	2011	-	~1,200
8	FP7 Energy Call part 2 (EU Commission, 2012b)	2012-2013	-	20
9	National incentive scheme	from 2016	-	-
10	Fee for CCS services	from 2016	-	-

There are various challenges associated with accessing some of the funding sources. For example, the GIS is based on the demand of Assigned Amount Units (AAUs) as specified in the Kyoto Protocol. To this day, Romania has not signed any MoU with another country regarding the selling of AAUs, which makes this financing source unlikely to materialise.

An incentive scheme is expected to support the operating phase of the project. A 'feed-in tariff' or bonus scheme that promotes clean energy through specific legislation is to be established. Moreoever, the Ministry of Economy, Trade and the Business Environment (METBE) will propose an incentive scheme, for CCS technologies, to be implemented by the Romanian Energy Regulatory Authority (ANRE).

Other incomes of the PC include the fee for CCS services paid by CE Oltenia SA for capturing and storing CO_2 from Turceni PP's Unit No. 6. These revenues are estimated based on an average CO_2 reduction of 1.3 Mtpa over a period of 15 years, at approximately €27.7/tCO_2-e over the entire project life.

[3] Total quantity of allowances for the first call (140 million allowances) divided across eight CCS projects and assuming a carbon price of €15/tCO_2-e
[4] Based on maximum limit of 45 million allowances per project and a carbon price of €15/tCO_2-e

4 FINANCING SCENARIOS

4.1 Basis and Assumptions for Scenario Development

The bases and main assumptions for the development of Financing Scenarios are listed below.

- NER300 is considered the main source of funding for the Getica CCS Demo Project. If NER300 funds are not secured, the project will face significant challenges in satisfying its financing requirements. It is assumed that, in the case that the NER300 grant is not obtained, the project will be delayed until funding of a comparable level is obtained.
- The Getica CCS Demo Project plans to utilise NER300 funds to cover both the investment and operating costs (for the first 10 years) at a 70:30 ratio.
- Other sources of direct (grant) funding have been considered to cover the high investment costs. A small portion of the investment will be covered from equity due to two reasons:
    - Getica is a demonstration project, with the technology unproven at a commercial scale to date. As a result, investors are unwilling to invest significant capital; and
    - the current state of the national economy means that Romanian companies have few opportunities to make new investments.
- Attracting other investors is important to the Project. The European Bank for Reconstruction and Development (EBRD) offers equity finance to its clients. The EBRD has expressed interest in participating with equity in the Getica Project, as a minor investor.
- The financing sources have various timelines for access to funding. These have been matched with the phases of the project. A mixed private/public funding model has also been considered for the different stages of the project (after the Feasibility Study).
- Public engagement will run in parallel during the FEED, Engineering, Procurement and Construction (EPC), and operation phases. Costs for public awareness, communication and knowledge sharing are included in the total investment and operational costs, as described in Sections 2.2 and 2.3.
- A carbon price of €15/tCO_2-e (in 2011) has been applied, with a linear annual increase. This assumption was made when the financial scenarios were assessed (i.e. Q4 2010/Q1 2011).
- The discount rate applied is in accordance with requirements of the NER300 competition (EU Commission, 2008).
- Return on equity is above the discount rate in order to attract investors.
- The EIB loan interest is set at EURIBOR 6M (the six months Euro interbank offered rate) of +2%.

4.2 Possible Scenarios

Based on the available financing sources considered and on the basis and assumptions from Section 4.1 above, three possible financing scenarios were designed for the Getica CCS Demo Project (summarised in Table 4-1).

Table 4-1 Getica CCS Financing Scenarios

Funding source	Scenario 1		Scenario 2		Scenario 3	
	CAPEX	OPEX	CAPEX	OPEX	CAPEX	OPEX
NER 300	✓	✓	✓	✓	✓	✓
Norwegian Financial Mechanism	✓		✓		✓	
GIS			✓			
FP7			✓			
EU ETS	✓	✓	✓	✓	✓	✓
Equity	✓		✓		✓	
EIB loan	✓					
National public sources					✓	
National incentive scheme		✓		✓		✓
Fee for CCS services		✓		✓		✓

Each of the three scenarios is briefly described below.

Scenario 1 is based on grants which are considered to have a high probability of being awarded to the project. Scenario 1 comprises largely of the NER300 grant and funds from the EU ETS auctions. Other sources to cover investment costs are smaller grants, equity and loan.

Equity coming from the PC represents a small percentage because of the low appetite to invest by Romanian companies. EBRD has expressed interest in participating with equity in the Getica Project, as a minor investor.

A loan is envisaged to cover the remaining costs of the investment. The EIB loan was chosen due to the project satisfying a relatively greater portion of the loan conditions in comparison to other commercial banks. The EIB has expressed interest in financing the Project.

The operating phase of the project is planned to make use of financing instruments that support the development of CCS technologies. These are the NER300 (for the first 10 years of operation), an incentive scheme to be established by the Government and the EU ETS scheme, both used for the entire lifetime of the project (15 years).

Scenario 2 is based on the NER300 grant, funds from the GIS and from EU ETS auctions.

In this scenario, funds from the EU ETS are smaller than in the first scenario to represent an alternative pathway, and the GIS is introduced to compensate for this. Other sources envisaged to cover investment costs are the Norwegian Grant and equity. A small contribution has been included from FP7 for the CAPEX.

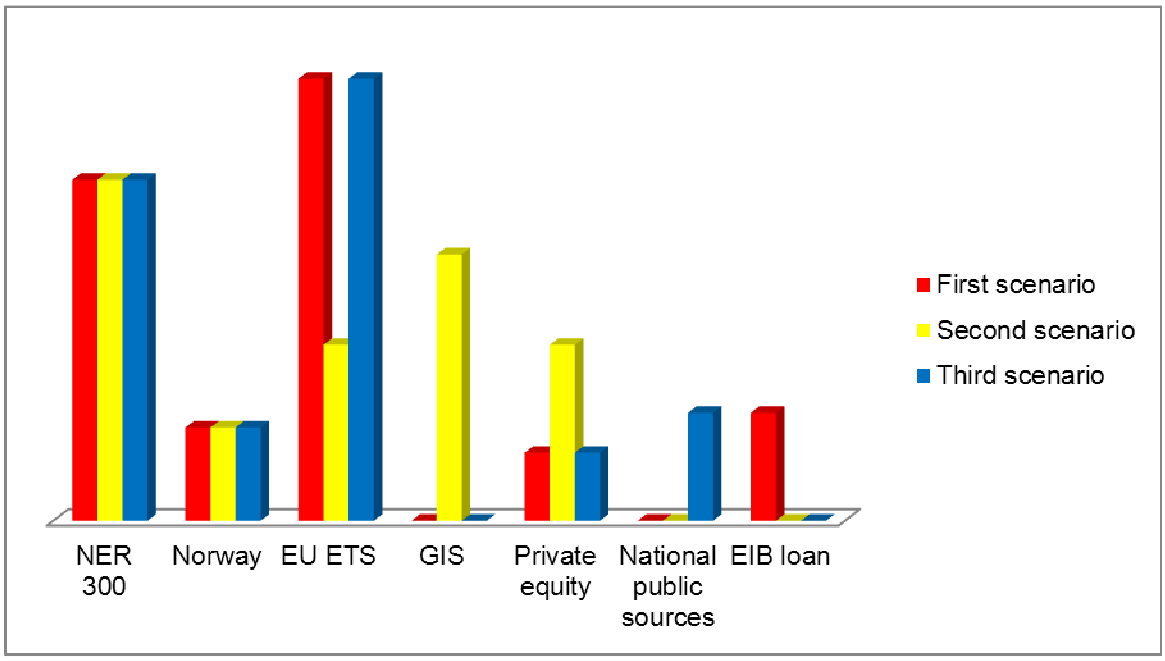
This scenario was built without a loan to avoid financial costs and repayment. Although the GIS has the potential of directing a large amount of funds into the Getica Project, the probability of accessing the GIS funds is low. This is due to the fact that, up to now, no Memorandum has been signed between Romania and another country regarding the selling of AAUs.

Scenario 3 is dependent on a large amount of funding coming from national public sources for the investment phase. Scenario 3 is based on the NER300 grant, funds from the EU ETS auctions and national public sources.

Other sources envisaged to cover the investment costs are the Norwegian Grant and equity. The loan has been avoided in this scenario by including a contribution from the Government (national public sources). This scenario has a low probability of materialising, having in view the low budgets for sectoral programmes and the high costs of the investment.

Figure 4-1 shows a representation of the scenarios described above. It highlights the main differences in terms of the level of support from each funding source.

Figure 4-1 Relative Distribution of Potential Financing Scenarios



The sources envisaged for the operating phase are not described because they are the same across all scenarios. This is because there is little opportunity to pursue other sources substantial enough to cover the annual operating costs. In order to cover the OPEX, the project must rely on aid in the form of an NER300 grant, funds from EU ETS auctions and an incentive scheme to be implemented by the Government.

4.3 Scenario Selection

A qualitative assessment was performed in order to select the optimum financing scenario for the Getica Project. Given the financing of the operating phase is the same across all three scenarios, the scenarios have been assessed based on the financing for the investment period.

The three financing scenarios have been compared using a multi-criteria analysis (MCA), based on the following key criteria:

- the grant intensity rate, which refers to the percentage that a grant covers of the total funding of a scenario. A high grant intensity rate is considered favourable because it lowers financial costs;
- the probability of accessing grant funds; and
- the loan intensity rate, which refers to the percentage that a loan covers of the total funding of a scenario. A low loan intensity rate is considered favourable because it lowers financial costs.

The major steps in undertaking the MCA were:

- establishing the weighting for each criterion (as a percentage) out of a total of 100% (refer Table 4-2);

Table 4-2 Criteria and Weighting of Importance

No.	Criteria	Nominated importance weighting
1	Grant intensity rate	30%
2	High probability of accessing grant funds	50%
3	Loan intensity rate	20%

- assigning a score from zero to ten, under each criterion, where ten corresponds to the total fulfilment of the respective criterion's objective;
- calculating the total score for each analysed scenario, by summing up the results for each criterion. The maximum total is 30 points; and
- ranking the analysed scenarios according to the total score.

The results of the qualitative MCA are presented in Table 4-3.

Table 4-3 Results of the MCA

		Criterion 1	Criterion 2	Criterion 3	Total
		Grant intensity rate	Probability of accessing grant funds	Loan intensity rate	
Nominated importance weighting		**30%**	**50%**	**20%**	**100%**
Scenario 1	Score awarded	10	10	6	***26***

	Fulfilment	30%	50%	12%	***92%***
Scenario 2	Score awarded	6	3	10	**19**
	Fulfilment	18%	15%	20%	**53%**
Scenario 3	Score awarded	10	3	10	**23**
	Fulfilment	30%	15%	20%	**65%**

The assessment of the three scenarios has led to the conclusion that the best financing scenario for the Getica CCS Demo Project is Scenario 1.

Incorporating the estimated investment and operating costs for the Getica CCS Demo Project, the resulting financing plan for Scenario 1 is presented in Table 4-4.

Table 4-4 Proposed Financing Scenario (Scenario 1)

Funding source	**CAPEX**	**OPEX (15 years)**
	(%)	
NER 300	32	9
Norway	5	
EU ETS	46	10
Equity	7	
EIB loan	10	
Incentive scheme		36
Fee for CCS services		45
TOTAL	**100**	**100**

The fee for the CCS services is based on an average CO_2 reduction of 1.3 Mtpa over a period of 15 years (~20 Mt total), averaging €27.2/tCO_2 over the entire project life.

5 RISK MANAGEMENT

An initial risk assessment was performed during the Feasibility Study stage of the Getica CCS Demo Project. A preliminary risk register and risk matrix were developed. Overall findings from this preliminary risk process are presented in the Feasibility Study Report.

There are several types of risks associated with energy projects in general, relating to issues such as technology, fuel, environment, operations and local site (including political) factors. Specific to financing, until an energy project is commissioned and capable of operating, there is no revenue source to repay the investment. Without revenue, the project's financers and investors are unable to recover their original investment. Until the plant is operating, the risks increase for the participants as more money is lent or invested in the project. The risk of non-completion is a great risk of the project during the construction stage.

At present, CCS projects have inherently greater risks, given they involve first-of-a-kind technologies and aim to demonstrate such technologies to enable them to be commercial at large-scale by 2020.

6 CONCLUSION

The investment cost of the Getica CCS Demo Project has been estimated in the Feasibility Study and includes:

- 60% - capture plant cost
- 4% - transport cost
- 14% - storage cost
- 22% - other development and owner's costs

The cost estimates cover the full chain of components for CCS:

- CO_2 capture and compression plant;
- transportation by pipeline; and
- geological storage in onshore deep saline aquifers.

Given the Getica CCS Demo Project forms part of worldwide efforts to demonstrate CCS at a large scale, the investment and O&M costs are relatively high. It is expected that, through continued technical development and project deployment, overall costs of CCS projects will significantly decrease by the end of the decade. This will enable the technology to successfully enter the commercial stage.

The assessment of financing sources for the Getica project aimed to maximise the utilisation of sources of direct funding (grants). This would result in lower financial costs to the project and minimise funding risks for the project proponent.

Scenario 1 was identified as the best financing scenario, comprising mainly of NER300 grant and funds from EU ETS auctions. Other sources to cover investment costs are smaller grants, equity and loans.

The funding of the Getica project is highly dependent on the CO_2 price and the support of the Romanian Government by establishing incentive schemes for CCS. Especially in the case of the CO_2 price, the Romanian demo project has no control over that factor, thus no leverage to minimize the risks.

The Getica CCS Demo Project will add value to an emerging technology to be applied both for existing and new power plants. It will also contribute to achieving the EU target of reducing GHG emissions by 20% in 2020.

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