NON TECHNICAL SUMMARY – SEA IOANNINA

THE ROLE OF THE STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT (SEIA)	
	The Ministry of Environment, Energy and Climate Change (YPEKA) conducts a Strategic Environmental Assessment (SEA) in the framework of the open invitation procedure for the research and exploitation of hydrocarbons (H/C) in a land area of the Epirus Administrative Region. The area of interest is defined according to the relative call of the YPEKA under the distinctive title "Ioannina". The SEA is conducted according to JMD 107010/28.8.2006, which harmonizes the National Law with the Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 "on the assessment of the effects of certain plans and programmes on the environment". The SEA aims: • To assess the environmental impact of the research and exploitation activities of hydrocarbons in land area, in order to grant the relative permits. Also, it includes the assessment of the impacts of alternative options of this program. • To provide information to support the decision making of the Greek Government on this program. • To provide directions and guidelines for the participation of the public sector as well as private investors in the process. The present Strategic Environmental Impact Assessment (SEIA) is done under the scope of the SEA and according to the article 5 of the Directive 2001/42/EC *"reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme, are identified, described and evaluated"*. Also the study includes the evaluation of *"the most important environmental impacts of the chosen alternative to be implemented, so that with the adoption of the necessary measures, conditions and procedures for the evaluation of the impact that may have on the environment, sustainable development is promoted as well as a high level of environmental protection".* The alternatives must be realistic and feasible and present different ways to implement the Program that is being

	studied under the condition that they *meet its development requirements.* Based on the above, the scope of the present SEIA is to investigate, on a strategic level, the potential environmental impact from the Research and Exploitation of Hydrocarbons in the "Ioannina" area and either accept the plan or amend it or cancel it in order to maximize social benefits.
BRIEF HISTORY	
H/C Research in Greece	The research for H/C in Greece dates to the beginning of the 20th century. However, the systematic effort begins in 1960 by the then Ministry of Industry with the assistance of the Institute of Geology and Mineral Exploration (IGME) and the French Institute of Petroleum (*Institute Francais du petrole, IFP)* as a consultant. Extensive mainly geological surveys were conducted on land areas of Greece and 17 shallow drills were executed. At the same time, major oil companies received concessions, such as BP (Aitoloakarnania), ESSO (NW Peloponissos, Zakynthos isl. And Paxoi isl.), HUNT (Thessaloniki), TEXACO (Thermaikos gulf), CHEVRON (Limnos isl.), ANSCHUTZ (Thessaloniki – Epanomi) and OCEANIC-COLORADO (Sea of Thrace), which executed more than 40 drills on land and sea. The result of these surveys was the discovery of the first exploitable reserves in the sea area of Thassos isl. – Prinos oil deposit and Natural Gas desposits of Kavala – from OCEANIC (1971-1974). In 1975, the Public Oil Company (DEP S.A.) is established and the first Law for Hydrocarbons research is voted from the Greek Parliament (L. 468/76). In 1985, a DEP S.A. subsidiary DEP-EKY is established and in 1995 L.2289/95 is voted, which revised the Permit status according to the relative European Directive. DEP and DEP-EKY were granted 24 research permits by the Greek State for both land and sea areas, without competition. 73.000 km of seismic 2D and 2.500 km^2 of seismic 3D were conducted as well as 73 exploratory drillings based on seismic surveys. Result of this research work was the discovery of the oil field in the maritime region of Katakolo and the natural gas deposit in Epanomi Thessaloniki, as well as interesting concentrations of biogenic gas. Finally, 4 regions in W. Greece were granted: NW Peloponnisos and Aitoloakarnania to Triton company and Ioannina kai W. Patraikos Gulf to Enterprise Oil company. A total amount of €85 million were invested in seismic surveys and drilling. In

	summary, the exploratory drills were done in the following areas: • **N. Ionion Sea:** a total of 4 drills with final depths from 833 to 3.951 m • **Paxos Island:** a total of 2 drills with final depths of 3.180 and 5.494 m respectively • **Epirus:** the area was investigated with a total of 16 drills both shallow and deep, with final depths from 750 to 4287 m • **Aitoloakarnania:** 2 shallow drills at 300 m and 4 deep drills between 1.500 and 4.573 m The investigations did not produce results, mainly because the drills did not reach the depth that was originally intended by the planning. Two important sites were not researched: at Ioannina due to the abandonment of the deep drill (4.000 m) because of serious technical problems of the Enterprise Oil company and at the W. Patraikos Gulf due to the drill not being performed because Triton company retired. All the companies eventually withdrew in 2000-2001. In 2007, the Greek State issued an amendment to the L.3587/2007 (article 20), with which all the concessions to DEP/DEP-EKY/ELPE (after the privatization of DEP-EKY and the change in the shareholding structure of ELPE S.A.) were revoked and returned to YPEKA, with the exception of the ones that ELPE S.A. is actively involved in the greater Prinos area. The main conclusions arising from the research to date are as follows: • The network of seismic surveys is objectively sparse especially if one takes into account the whole country area and the seismic 2D surveys are low resolution by today's standards. In any case, they provide valuable information and are a very solid basis for future surveys. In contrast, the seismic surveys done in the period 1999-2000 are highly reliable. • The orientation of the drilling investigations was mainly on shallow and medium depth targets, which have proven to provide a limited interest even though they are not surveyed on their whole. In deeper targets (>4.000 m) the outlook is more favorable but they have not been investigated by drilling. The research was mainly focused

	on land areas, while at sea focused to medium sea depths (up to 500 m) and was limited to certain areas of the Ionian Sea, part of the Thracian Sea and Thermaikos Gulf. The above lead to the conclusion that the Greek area cannot be assessed as a researched area and is classified as "frontier area" according to international terminology.
H/C Research in Epirus Administrative Region	The region of Epirus (North sector – Ioannina) is characterized as an interesting area for deep targets but in a mountainous terrain. It is estimated that it will require expensive seismic and drilling surveys to identify oil-probable geological targets at great depths (>4.000 m). ***Dimitra-1 Drill*** One of the most recent drillings for the discovery of a hydrocarbon deposit in the area of Epirus is the Dimitra-1 drilling, which was done under the first round of concessions by the Greek State (1997-2001) from the company Enterprise Oil. The drilling operations began in September 2001 and according to the plan, the drill would investigate a target at a final depth of about 5.000 m. The drilling proceeded to a depth of 3996 m. At this depth it encountered high pressures that could not be overcome and the drilling stopped temporally. Then it was decided to continue the drill with a deviation at a starting depth of 2.807 m. This new drilling encountered high pressure at a depth of 3.566 m with consequent risk of an accident. In February 2002 it was decided to abandon this particular drill and work was completed on 18/02/2002. The overall cost for the drilling operations was approximately €20 mil. Although the drilling was not completed due to technical reasons and the area was returned by the consortium that had the rights, there are indications from the research that the exploitable oil reserves are in the order of 50-80 MMbbls (million barrels) By comparison, Prinos has yielded almost 120 million barrels in 30 years. So, based on existing data, the deposit of the area "Ioannina" that is investigated is smaller than Prinos but on the same order of magnitude. This means, that if the indications are verified, the yield will be between 3.000 and 10.000 barrels daily (when the daily needs of Greece amount to 400.000 barrels) of a total present value of €4-7 billion.
PROJECT FEASIBILITY	

Alternative development choices	In the current Greek reality, the country's growth model will determine, to a large extent, the weight to be given to the exploitation of hydrocarbons and other mineral products. A development, which is based on natural advantages offered by the geographical position, among which is the mineral wealth (along with the renewable energy potential, tourism, etc.), shows considerable advantages over other choices often reported, e.g. a development grounded in cheap labor or the creation of a knowledge-based economy. Development grounded in cheap labor, as proven from international experience: • Is not a necessary and sufficient condition for a competitive economy, because among the poorest countries are included the countries with the lowest wages. • Will not necessarily lead to social welfare, at least not for a large part of the population, with the most characteristic example being, perhaps, the case of China. • Is vulnerable to the competition from other countries that adopt similar politics. The knowledge-based economy can help to create a competitive advantage, while strengthening the national average income and improving social cohesion. However, such a process is the result of a long process, at least 20 to 30 years (see. ie, South Korea) and significant investments in R&D and is not favored by the urgency of the need for a way out of the crisis. The exploitation of the comparative advantages of the country in terms of natural resources appears as a constant development option that can help improve the indicators of the national economy and enhance its competitiveness, while improving the welfare of wider social strata, subject to certain conditions. An important aspect is that the exploitation of natural resources gives a competitive advantage in the economy, which cannot be transferred elsewhere, as opposed to the selection of cheap labor or even knowledge.
Necessity to exploit H/C in Greece	In terms of energy policy, Greece is in line with the relevant EU policy and is guided by the "20-20-20" target, which makes it a key element for the energy planning to develop renewable energy and reduce energy consumption. However, fossil fuels will continue to be an integral component of

	the energy system of the country, even under these strategic objectives, for the following reasons: • **Stability of the electrical grid:** The role of oil power plants remains, to date, important as they cover the needs of non-interconnected islands and provide a useful backup for the system. Despite high cost of operation, the oil plants cover about 8.5% of the electricity needs of the country and is necessary to ensure their fuel with as little cost as possible. Also, during the winter of 2011-2012, due to problems in the supply of natural gas, uninterrupted electricity supply was secured to a considerable extent by the operation of oil plants. • **Coverage of heating needs:** The heating energy of households, industries and tertiary sector are covered in the most part from oil. This is particularly important for mountain areas, which have extremely increased thermal requirements. Additionally it is noted that even if exploited in its entirety, the very high biomass potential that exists in the region of Epirus would be enough to cover 50% approximately of the heating needs of the Region. • **Coverage of energy needs in transport:** According to recent data by the Center for Renewable Energy Sources and Saving (CRES) (2009), the transport sector consumed 57% of the final oil consumption and 39.6% of the final energy consumption in Greece. This energy comes almost in its entirety, from imported crude oil. • **Ensuring the security of energy supply:** The energy dependence of the country, because of imports of crude oil and, secondarily, natural gas reaches 72% (24,85 Mtoe compared to 31,5 Mtoe) and is higher than the E.U. average. Especially for oil imports, crude oil amounted to 18-20 million Tons per year. The percentage of oil and oil products in the Greek energy system is very high, since in addition to transport, which as mentioned consumes about 57%, it also serves the residential sector (20%), industry (13%) and the agricultural sector (10%). It is therefore obvious that ensuring the supply of the Greek energy system with crude oil is a crucial issue. • **Improving fiscal figures:** The energy dependence of the country on imported crude oil, besides the issues of security, is a significant burden on the country's trade

	balance. It is characteristic that between 2004 and 2008, the value of imports of crude oil has doubled (CRES, 2009). Covering some of the oil needs of the country from domestic oil will provide significant benefits on a state level. In addition to the trade balance, domestic production will help to increase the Gross Added Value, to increase the revenue for the state from taxes and leases, to boost employment, stimulate the overall economy due to the indirect and induced effects of income generation the connections of the H/C sector with other economic activities, etc., as reflected through the employment, income and output multipliers. Moreover, as to the necessity of the project parameters that cannot be easily quantified should be taken into account, such as the strengthening of geopolitical power of the country since the mineral resources are limited and spatially localized (this is particularly true for deposits of hydrocarbons due to the sensitive nature of energy), the creation of specialized scientific and technical personnel, etc.
Benefits to the Epirus Administrative Region	The social and economic benefits from the exploitation of H/C for Epirus Region can be equally important as those of the Country. According to financial statements of oil companies, the Gross Added Value (GAV) of the exploitation of H/C represents approximately 70-80% of turnover. Given the estimates on the size of the deposit, the average annual production and the selling price of crude oil, the added value annually is around €200 million. An important part of this added value will remain in the region of Epirus. This represents an annual increase in GAV of the industry sector (excluding construction) in the Region, by about 40%. The benefits to employment will be of equal importance, given the structure of the Region's economy and high unemployment. Also, economic activity will be stimulated through economic integration and the new income will flow to the local market. It is characteristic that in local economies the economic effect multipliers range from 1.5 to 2.3, the employment multipliers between 1.5 to 4.2 (ie. for each direct job created, 2-3 new jobs are created in the wider economy) and the income multipliers between 2-3 (ie. for each €1 of income derived directly from the H/C industry, the generated income to workers in other industries is €1-2).

	Moreover, the exploitation of H/C in combination with other projects (e.g. natural gas pipeline) can make the region an important energy hub and help re-orient the regional economy in sectors with high added value. Finally, apart from the indirect benefits, the considerable amount of compensatory measures should be also discussed because it is socially fair a part of the wealth produced in an area to return to it directly.
Conclusions	Provided that research and exploitation of H/C will be implemented within the context of modern environmental protection requirements for the great natural and cultural environment of the region of Epirus, the exploitation of the deposit "Ioannina", if made, can be a concrete step forward and contribute to the reconstruction and development of the regional economy.
DESCRIPTION OF THE PROJECT	
	The geographical field of application is specified in the open call by YPEKA and includes part of the region of Epirus, a total area of 4.200 km^2. The area is limited to the west by the coast and in the northwest by the Greek-Albanian border. The activities that regard the exploitation of hydrocarbons include three basic steps: • **Prospecting:** locate the hydrocarbons and/or evaluate the possibility to locate hydrocarbons by use of geological maps, with geophysical methods (seismic, electromagnetic logging), with geochemical sampling and with use of remote sensing techniques. • **Exploration:** denser network of 2D and 3D seismic logging, drilling one or more boreholes in order to locate the hydrocarbon deposits and assess the commercially exploitable quantity of hydrocarbons. • **Development and production:** process for the commercial exploitation of hydrocarbons. At this stage the deposit development drills are done and the infrastructure for the production and the transport of hydrocarbons is created. After the end of the exploitation follows the stage of dismantling the drilling facilities and production infrastructure, their removal

	and the restoration of the area. In this case study, the phase of prospecting can be considered to be completed (although parts of it may be done or repeated complimentary), so the activity under consideration include the exploration and exploitation of hydrocarbons (development and production). Subsequently, the main areas of activity of hydrocarbon exploration and exploitation are described with emphasis on anticipated environmental issues arising in each of them. *Seismic surveys* The objective of seismic surveys is to locate underground structures capable of hosting hydrocarbons, to appreciate the amount of hydrocarbons in the reservoir and indicate the best locations for drilling. In seismic surveys, a source causes weak seismic waves (usually a small amount of explosives or a mechanical ground vibrator) and the reflections of waves in the subsurface strata are recorded. *Exploratory drillings* The drilling operations follow the seismic survey. For the drilling, drilling rigs are used, with their size and power depended mainly on the expected depth of the hydrocarbons. From the drilling operations wastes are produced that are composed of rock cuttings and drilling slurry. Also gaseous pollutants are produced from internal combustion engines and noise from the operation of the drilling rig. *Rock cuttings and drilling mud* The drilling muds perform multiple roles: to prevent the borehole walls of collapsing, to seal aquifers, to lubricate and cool the cutting edge, to offset the possible pressures from the hydrocarbon reservoir and to remove the rock cuttings from the drilling. The drilling muds are distinguished based on their main ingredient which can be petroleum, water and synthetic substances. For producing of drilling muds a combination of materials and chemical substances is used, such as bentonite, barite, salt, polymers, etc. in order to achieve the desired

	properties (specific weight, viscosity, etc). The rock cuttings consist of geological formations' pieces which permeate the drilling column and therefore differ in chemical composition and behavior. *Development and Production* The development of an oil field includes additional extensive seismic surveys and drilling operations as the drilling bore is conducted until the oil field is fully developed. The production process also includes the construction of the extracted hydrocarbons' treatment facilities (gaseous and liquid phase separation, water removal, etc.), the installation of hydrocarbons transporting pipelines and the drilling waste treatment facilities. The environmental pressures during the exploitation are caused by seismic surveys, drilling bore construction works, construction of all facilities and related mainly to emissions of pollutants in the soil or air. *Water* One of the most important by-products of the production process is water. The amounts of water result from either drilling subterranean aquifer formations or trapped water in the reservoir. This water contains small quantities of oil, salt from the reservoir and chemical substances used in the production process. Some of the chemical substances are highly toxic, containing heavy metals and can have environmental impact. In other cases, there is also the possibility of natural occurring radioactive materials (NORM) presence in the water. A part of the produced water is commonly used for increasing the hydrocarbon production rate through injections from specific injection drills in the reservoir (secondary production). *Air emissions* Air emissions occur during all phases of hydrocarbons' exploitation processes, including the seismic surveys and exploratory drillings, even though most significant emissions are associated with the phase of development and production of the oil field. Air emissions are mainly exhaust gases from internal combustion engines (for drilling, production, extraction, transportation, etc.) and natural gas contained in oil (flaring).

	The main components of air emissions are CO_2, CH_4, NO_X, VOC, H_2S και SO_2. Of these CO_2 is the gas with the largest amounts produced from the hydrocarbon exploitation processes. *Other Activities* Other activities that can potentially cause environmental nuisance in the area are associated with moving parts, supplies, goods and other equipment by using both light and heavy loading and transportation equipment. These activities cause air emissions, noise and potential waste in the site. It may also be required to widen existing roads and to conduct deforestation of local areas. *Accidents – Emergency Situations* All work should be closely assessed in terms of risk, size, nature and potential consequences of H/C leakage to conduct the appropriate contingency plans. These plans also include a communication with relevant authorities' procedure of any risks. The design of the emergency event treatment plan must be based upon identification, planning and implementation of actions for managing risks, staff training and continuous assessment of the preparedness of emergency response mechanism. In contingency plans all actions in case of leakage must be precisely determined: the communication network, the organizational structure for the emergency event management, the roles of the emergency personnel at individual level, and the procedures for reporting information to stakeholders. The plan must determine with clarity vulnerable and sensitive areas, with special attention to managing polluted wastes or material that may be produced.
ALTERNATIVES	
Configuration Criteria	The configuration framework of alternatives is based on the following: • **Necessity**: is the target of H/C exploitation necessary? What is its significance? Can it be achieved without implementing the program? • **Methodology or procedure**: how can this target be achieved? Are there any other technologies or procedures that can meet the goal with less environmental impacts compared to the obvious choices or the traditional

	methods? • **Location**: Are there any alternative locations for implementing the program? • **Time schedule and detailed implementation:** When, in what form and in what sequence will the plan be implemented? What are the important issues? The existing controls and the existing measures refer to them? What other measures and controls are necessary?
Description of Alternatives	The alternatives assessed according to Guidance 2001/42/EK, in order to environmentally justify the reasons of choosing the implementation of the plan are the following: *Alternative 1: Zero Option* Alternative 1 refers to maintaining the status quo, i.e. the non-implementation of the project. In that case the impacts to the natural and cultural environment and the public health are characterized as neutral, since there will be no additional environmental pressures. The impacts to the local and national economy, as well as specific social indicators (e.g. unemployment) are characterized as negative, since the non-exploitation of the H/C reservoirs will result in direct and indirect loss of jobs, income, revenue taxes and rent, exchange, etc. Note that the effects upon the public health might be negative since, according to scientific research results, depression social phenomena (e.g. increase of unemployment levels) may lead to increased levels of pathogenicity in the population, particularly mental disorders, etc. *Alternative 2: Implementation of the proposed project* This alternative is based on the implementation of the proposed project, based on the existing regulatory framework, supplemented by specific provisions for the preservation of the protected sites and ecologically sensitive areas. The implementation of the Alternative 2 will result in increased pressures to the natural environment due to air emissions, produced wastes during production processes and potential leakage to water bodies. The impacts to the cultural environment and the public health are considered to be neutral under normal conditions. Potentially it can be negative in case of severe

	accident especially towards the hydrographic network. The impact on economic and social indicators are characterized positive, since the exploitation of potential hydrocarbon reservoirs in the Epirus Region can create new jobs, can cause substantial capital inflows and exchange, can boost the national revenue due to taxes and royalties that will be paid, can contribute to the local communities through infrastructure and supporting services that will be required to be constructed, can create specialized scientific and technical staff, can contribute to the development of technological innovations that can be exported to other countries and finally can provide multiple benefits to the wider economy due to the interconnection of the mining industry with other financial sectors. *Alternative 3: Implementation of the proposed project with additional regional and seasonal limitations* Alternative 3 favors the implementation of the projects with more restrictions compared to Alternative 2. More specifically, in addition to implementation of the legislative framework and the statutory conservation of protected and ecologically sensitive areas, it poses additional spatial and seasonal restrictions, relating to: • The creation of a protection zone 300 m either side of the main hydrographic network of the area and 350 m from the coastline. Inside this zone no research, development and production drillings should be situated as well as treatment or storage installations. The area occupied by the proposed protection zone is 354 km^2. Also, as far as possible, the H/C transport pipelines should not run through the protection zone. • Avoid implementation of geophysical and other research activities during time periods that endemic and migratory species of wild fauna and other economic activities that are seasonal in nature (eg tourism), etc., could be disturbed. The impact on the natural environment is milder compared to Alternative 2, given the consideration of seasonality. It also predominates against it, in case of an accident, because it offers a sufficient protection zone for the basic hydrographic network. Regarding the socio-economic impacts and effects on the cultural

	environment and public health, they are practically identical.
Selection Criteria	To assess the potential impacts of all the alternatives, both elements of the natural and human environment of the region of interest were considered and on the other hand, relevant objective targets-criteria for each element were also set, as below (Greening Regional Development Programmes Network, 2006): • **Biodiversity, Fauna and Flora:** conservation of biodiversity, avoiding irreversible interventions, preservation of rare, endemic and protected species of flora and fauna, effective management of important habitats and protected areas. • **Population and human health:** prevent the deterioration of the public health, promote healthy living, protect and enhance human health, improve living and working conditions of local people, reduce social inequalities, promote economic growth in the region, reduce noise and vibration. • **Water and Soil:** restriction of water pollution to levels that will not destroy natural ecosystems, maintain drainage capacity and water absorption, rational management of water resources and improvement on the availability of fresh water, achieve good status in water bodies of the region according to the requirements of the Framework Directive 2000/60, reduce pollution and ensure the quality and quantity of soil, maintain the quality of agricultural land. • **Air:** limit air pollution to levels that do not harm the natural ecosystems and public health. • **Climate:** uphold the targets on greenhouse gas emissions, reduce vulnerability on the effects of climate change. • **Cultural Heritage and Landscape:** protection of historic buildings, archaeological sites and other culturally important features, protection and enhancement of the landscape, protect the area's character and traditional architecture.
Justification of choice of proposed Plan	Alternative 1 does not have negative effects on the environment. However, the impact on the local and national economy, as well as on specific social indicators (e.g. unemployment) is

	characterized as negative, since the non-utilization of H/C deposits will result in the loss of direct and indirect jobs, income, income from taxes and leases, foreign exchange, etc. Moreover, the likely impact on public health will be negative rather than neutral because, as supporting scientific research shows, serious social problems such as poverty and unemployment are associated with an increase of health problems in the population (alcoholism, mental illness, etc.). Finally, the Alternative 1 does not meet the basic objective of the Plan under consideration, namely the exploitation of H/C for the benefit of National and regional economy and society. Alternatives 2 and 3 potentially cause a small negative effect on the biotic and abiotic natural environment, given the strict enforcement of existing legislation. Moreover, the risks associated with emergency conditions (e.g. blowout or pipeline leak) can be minimized by adopting the best technological solutions and the effects can be controlled through proper planning and preparation to deal with such situations. Between the two alternatives, Alternative 3 provides more environmental protection in the aquatic environment, as it provides, in addition to existing restrictions in the legislation, an additional protection zone of 300 m from the main hydrographic network and 350 m from the coastline. This additional requirement ensures an important time window in the event of an accident, to control leakage to water recipients. In terms of human environment, given the compliance with the existing legislation and the faithful implementation of environmental conditions to be established, the abovementioned Alternatives do not adversely affect human health and the cultural environment (and offer significant benefits by improving the critical socio-economic indicators (employment, regional and national income, fiscal indicators, etc.)). Additionally, they reduce energy dependence, ensure security of energy supply and strengthen the country's geopolitical position. Finally, they serve the basic purpose of the program, namely the exploitation of H/C in a composite and balanced growth that promotes the protection and enhancement of the natural and cultural environment of the country and strengthen social and economic cohesion. On the basis of the above, Alternative 3 is selected as the optimal solution, which serves the fundamental objectives of the Program, while ensuring the best possible protection of the natural and human environment.

KEY FEATURES OF THE NATURAL ENVIRONMENT OF THE AREA OF INTEREST	
Atmosphere	In the Region of Epirus, measurements of air pollutants have been done between 2004 and 2005, during four measuring periods ("Assessment and mapping of Atmospheric Pollution in Greece", 2005). The measurements concerned the concentrations of nitrogen oxides (NO_x), Particulate Matter PM_{10} and $PM_{2.5}$, Ozone (O_3), Benzene, CO and metals like Pb, Ni, Cd and As. These measurements showed that: • Regarding the hourly NO_2 concentration for the protection of human health, Igoumenitsa and Ioannina exceeded the lower assessment threshold (LAT) (= 100 μgr/m^3, if exceeded more than 18 times a year), while for the annual concentration of NO_2 for the protection of human health, the upper assessment threshold (UAT) (= 32μgr/m^3) is also exceeded. • In Ioannina, the target concentration for O_3 for the protection of human health (= 120 μgr/m^3 – year of target achievement 2010, exceedance up to 25 times per year), was exceeded. • In Igoumenitsa, the upper assessment threshold (UAT) (= 14μgr/m^3) for the annual concentration of particulate matter PM_{10}, was exceeded. Also, the atmospheric pollution levels were assessed with the use of models that had taken into account as sources of pollution the transportation via roads, airports and harbors and from the industry. The exceedances that were estimated were: • Regarding the annual concentration of Nitrogen Oxides (NO_x) for the protection of vegetation in Greece: ○ In the Prefecture of Thesprotia and in Igoumenitsa in particular, the UAT limit was exceeded as this is defined in Directive 1999/30/EC, namely an annual mean concentration greater than 24 μgr/m^3. ○ In Ioannina, the LAT was exceeded as this is defined in Directive 1999/30/EC, namely an annual mean concentration greater than 19.5 μgr/m^3. • Regarding the Ozone exceedances for the protection of vegetation in Greece, in Thesprotia and in Preveza, the target value AOT40 was exceeded, compared to the reference year 2010, as this is defined in Directive 2002/3/EC, namely concentrations greater than 18.000

	μgr/m^3*h. According to the measurements of the National Monitoring Network of Air Pollutants (EDPAR), which has installed a new metering station in Ioannina which measures SO_2, NO_2, NO_X, O_3 and PM_{10}, the concentrations of all the air pollutants are within limits and this positive picture does not seem to be shifting in the near future. In particular: • Air pollution in Ioannina prefecture and more particularly in Ioannina basin, is comprised of limited production of air pollutants that is not considered substantial. • As polluting activities can be considered the pottery shops, the aggregate quarries and the facilities for production of asphalt. • Air pollution incidents have not been documented, that may originate from vehicle exhausts (small and local scale), even though the city of Ioannina faces a significant traffic problem. Nevertheless, it should be noted that crossing of the three major road projects in the prefecture (Egnatia Odos, Ionia Odos, Ioannina Bypass road) through the Ioannina basin, could result in major rise of air pollution. According to the Environmental Impact Assessment for the Egnatia Odos Project and the City Bypass road, no problems are expected nor incidents of pollution. However, no safe conclusion can be drawn unless a monitoring scheme is established during the construction phase and even more during the operation of these projects.
Climate	The most important climatic element of Epirus is the varied climatic conditions. These climatic conditions are due to the terrain of the study area, which has a major impact on the distribution of meteorological and climate elements. Because of this particular geomorphology a variety of temperatures occurs between regions with different altitude and distance from the sea. The other special features of the climate of Epirus Region are heavy rainfall and high humidity levels that prevail especially during the winter months. The average annual temperature in the region is between 17 °C and 18 °C. The warmest month in the region is August and the colder are January and February. The average annual rainfall in the Epirus aquatic section ranges from 1.000 to 1.200 mm on the

	coast and reaches 2.000 mm in the mountainous parts. The number of rain days during a year varies between 70 and 120 and is higher in coastal areas than in the interior of the region. The snowfall days increase from the coast to the inner land, ranging from 0.6 to 4.8 days per year.
Greenhouse gases	At country level, the emissions of greenhouse gases show a steady increasing trend over the last decade, following the growth of GDP. Among the six greenhouse gases, most important are carbon dioxide (CO_2) and methane (CH_4). In the study area there are no significant sources of greenhouse gases that may affect decisively the country's commitment towards the total greenhouse gas emissions.
Aquatic environment	<u>1. Surface water</u> The study area is part of the Epirus Aquatic Section. Its total surface is 9.384,2 km^2 (land area) and 592 km^2 (Kerkyra isl.). The land area of the Aquatic Section is characterized by the presence of some of the most important rivers of the country. The main hydrological basins belong to the rivers Aoos (2.141 km^2), Arachthos (2.005 km^2), Kalama (1.899 km^2), Louros (963 km^2) and Acheronta (719 km^2) all of which alongside the closed basin of Ioannina (529 km^2), cover the majority of the land area. The hydrographic network of Epirus is comprised of the rivers Aoos, Arachthos, Acheron, Kalamas, Louros and other smaller rivers (Drinos, Vouvos etc.). Large areas drain in in Acheloos river or directly in the Ionian Sea through small streams. In the closed basin of Ioannina, drainage is done in the Lake and the Lapsistas trench, which through the Klimatias tunnel drains the basin's waters to the river Kalamas. Pamvotida Lake and ponds Zirou, Morphi and Tzaravinas alongside artificial lakes Pournariou and Aoos source are also main hydrographic characteristics of Epirus. Another characteristic of the Epirus Aquatic Section is Aoos River, given the fact that it is the only case where our country feeds a neighboring country with water. The above is particularly relevant from a managerial point of view given the fact that Aoos and its tributaries (Sarantaporos, Voidomatis and Drinos) represent 25% of the water potential of Epirus (total of runoff and infiltration). These quantities indicate that the Aquatic Section shows a significant surplus of water considering that to cover all the needs (water supply, irrigation, industrial use etc.) $522x10^6$ m^3 of water

	are needed annually. The availability of water in Epirus is 7.500 m^3/person/year, which is one of the largest in Greece. According to data from the Ministry of Development (YPAN) (2003), the relative comparison between water supply and demand in Epirus is 193 hm^3 and 33 hm^3 respectively. <u>2. Underground water</u> The Epirus Aquatic Section is one of the richest water sections of our country in regard to underground water reserves. The buffer stocks of groundwater were estimated from IGME at $3,2x10^6$ m^3 per year, a quantity that is sufficient to more than compensate the needs of the Region and beyond. According to these estimates, in terms of water balance, the groundwater potential is exploited at approximately 25% which means that there is a large percentage that remains untapped. The hydrological and hydrogeological conditions in the Aquatic Section are influenced by the respective geological, geomorphological and climatic conditions. In the Aquatic Section appear a significant number of geothermal mineral sources, which occur mainly in the east, in formations of the Pindos zone followed westward from the zones Gavrovou and Ionian. In regard to the chemistry of geothermal and mineral waters, it is dependent on the presence of flysch clay phases (which gives many mainly hydrosulfide springs) and the presence of diapiric gypsum, that contribute to the genesis of sulfurous and chloride springs. In particular, the hydrothermal activity in Ioannina focuses on areas Kavasila - Amaranth Pyxarias where the homonymous springs and steam vents. The spas in Kavasila and Amaranth are exploitable. <u>3. Quality of surface and underground water</u> Regarding the quality status of surface and groundwater on an Aquatic Section level, the main problems are the following: • High concentrations of nitrogen are present in the lowland area in the north of Ambracian Gulf, which includes the two major cities of Preveza and Arta and the southern parts of the rivers Louros Arachthos (not part of the study

	area). • High concentrations of all inorganic forms of nitrogen are also recorded in the Rodotopi region (northwest of the city of Ioannina). The nitrate pollution observed in this area is directly linked to its proximity to the Industrial Area, as well as the plant and animal farms that are nearby. • In other areas of the Section and especially south of Igoumenitsa and the basins of the rivers Acheron and Kalama, as well as in the estuaries of Louros Arachthos rivers, concentrations of nitrate, nitrite and ammonium salts are particularly low. This fact, and in particular in regard to the estuaries of Louros and Arachthos rivers, should be connected to both the large flow of the rivers and the self-protection of the alluvial aquifers, due to the presence of clay-mudstone layers in large parts of the old flood plains. In conclusion, all the above do not alter the overall status of water resources in the region, which is characterized quantitatively by the water abundance (beyond any local problems) and quality wise by groundwater of excellent and good quality. This has contributed to a substantial resource wealth, as there are, for example, several companies of bottled water and some 30 fish farms in Kalama river, with an annual turnover of €60 million. It is noted, however, that this assessment is more due to the relatively low pressures and less because of systematic and representative measurements of the quality characteristics of the water bodies. Also, the characterization of the quality as acceptable is based mainly on criteria specific to individual uses of resources (e.g. water abstraction for drinking, irrigation, fish farming) and not on criteria related to the function of ecosystems and the overall environmental state. These criteria have not yet been formed and are one of the objectives of Directive 2000/60 EC.
Geomorphology - Soil	1. Geomorphology There are four main geomorphological zones that characterize the region of Epirus: (1) the coastal zone of the regions of Preveza and Thesprotia, which is characterized by the development of tourism, maritime transport and fishing and gathers significant

	growth potential (2) the mountainous zone that extends along the eastern boundary of the region in the prefectures of Ioannina (Zagoria, Metsovo, Konitsa, north Tzoumerka) and Artis (central and south Tzoumerka) and has potential for tourism development, based on the comparative advantages (traditional settlements, historical - cultural heritage, Scenic Drives) (3) the area of agricultural land with high yield potential, which includes the southwestern part of the region (parts of the prefectures of Preveza and Arta) and which concentrates most of the irrigation projects and (4) the greater surrounding area of mountainous and semi-mountainous areas. The latter zone, which is the most extensive, shows limited growth potential because of the mountainous terrain and geographical isolation. The only flat areas are the prefectures of Arta and Preveza and the valleys of the rivers Acheron and Thyamis. In particular, in regard to the study area, most of it is characterized as mountainous, with the exceptions of the plains to the west, the Ionian coast (where the estuary of Kalama river is located), and the lowland area around the Lake of Ioannina (closed plateau in the west of the central part of Mitsikeli). <u>2. Soil</u> In general, the soils are characterized by low organic matter content. The reduction of organic matter causes structural degradation and soil erosion as well as deficits in nitrogen, which characterizes 87% of the cultivated land. The steep slopes combined with the increased damage of natural vegetation (due to forest fires, overgrazing and cultivation) have led to soil erosion in the highlands. In these areas, the soil is shallow and low in organic matter content and therefore unsuitable for agricultural use. The soil in the valleys is more fertile. Based on the properties of soil, climate and topography, the extent of the territory with potentially high quality represents 19% of the total area, while 18% is soil of moderate quality and 57% is low quality soil. A big part of low quality soil is used for

	traditional farming systems, which are important in maintaining the characteristics of the Mediterranean Landscapes. The main pressures through which soils are degraded in the region are identified in the following: • Farming: The soil is under pressure from farming, because of the use of fertilizers and other chemicals. The problem of agricultural pollution in Epirus is obviously located in lowland areas especially where there are croplands. The most important area of the region lies in the plain of Arta and in the general area around the Amvrakikos gulf. • Livestock farming: Many areas of the region are characterized by intense development in livestock farming. The intensification of farming, in recent decades, is associated with environmental problems such as degradation of the quality of the soil and therefore the degradation of groundwater and surface water quality, mainly due to the non-rational management of livestock waste (liquid and solid). – In the Region of Ioannina, surface disposal of wastewater from pig farms as well as solid wastes from poultry farms creates a significant problem because there is no integrated management. Contaminants laid on the soil reach surface and underground water bodies mainly due to surface runoff as well as infiltration. The water bodies affected are mainly rivers Kalamas and Araxthos and Lake Pamvotis. – In the Region of Thesprotia, grazing (overgrazing) holds the first position in the list of anthropogenic pressures from livestock activity that is developing. Also, the lack of organization of livestock farms and poor or improper management of waste, compose the two key actors responsible for any pressures in the soil. • Urban activity: The pressures on soil from urban activity refer mainly to the management of solid and liquid waste. Generally, the soil of the region is burdened significantly from the wastewater of settlements and other industrial and handcraft activities. Regarding municipal waste, to estimate the deterioration of soil characteristics it is sufficient to note that the areas where the waste of

	various regions was being disposed until recently, in the majority did not meet the requirements of sanitary landfilling under the requirements of both Greek and Community legislation (Directive 99/31). – The Administrative Region of Ioannina lacks basic infrastructure. The disposal of municipal wastewater is done either directly on the ground (septic tanks) or to water bodies and most of the time without any treatment. As regards the management of solid waste the full operation of the Ioannina landfill is imminent (currently being test run). This has contributed to the management of waste in Ioannina having serious problems in the recent decades, both in the collection and disposal, with equally serious negative effects on the environment and public health. – In the Administrative Region of Thesprotia, the management and disposal of wastewater is done by the corresponding Local Government Organization or the Public Body for Water and Drainage (drainage networks, wastewater treatment plants), either by the people (septic tanks). Mostly, wastewater is disposed of untreated into streams or septic tanks. As regards the management of solid waste in the Administrative Region, two landfills are in operation, one in Igoumenitsa which is going to shut down due to saturation (currently serves part of the Administrative Region of Thesprotia) and one in Paramithia which is by-prefectural and serves some of the AR of Thesprotia and Preveza. • Construction of technical works: Regarding engineering projects, most lead to lower or higher soil disturbance, as is the case in the construction of infrastructure projects as well as the intense use (recreation, grazing, etc.). It must be remembered that any form of disturbance of the soil simultaneously degrades it and this should be taken into account. The conditions resulting in disturbed soils are subjected to: the degree of the disturbance, the nature of the geological material and physiographic features of the area. • Erosion: The region of Epirus is a mountainous region with great variations in altitude. In some cases due to the

	steepness of the ground, the soil in the mountains is eroded, shallow, usually poor and unsuitable for agricultural use. In the highlands, steep slopes, combined with the destruction of natural vegetation due to forest fires and mismanagement (cultivation, overgrazing), have caused serious soil erosion. The soil in the valleys is less eroded and more productive. • Desertification: Steep slopes cause strong surface runoff of rainwater and intense erosion where there is not sufficient vegetation. These procedures are the main causes of desertification. Also, a very important factor of desertification is forest fires. The Epirus region shows in the greatest part, moderate potential hazard, except individual areas in the mountains of Arta (Arachthos Basin) and in very small areas in Thesprotia (Kalama Basin) that have a high potential risk.
Ecosystems – Flora - Fauna	1. Ecosystems The following ecosystems are present in the Epirus Region, which, in a horizontal arrangement, correspond to vegetation zones: • Ecosystems of Medio-Mediterranean Zone • Eumediterranean Ecosystems • Submediterranean ecosystems of Prinus and Gavros • Mountainous ecosystems of deciduous oak - Deciduous thermophiles broadleaf Ecosystems - Deciduous cryophilic broadleaf Ecosystems - Mediterranean mountainous coniferous Ecosystems - Cryophilic coniferous Ecosystems • Riparian/Coastal ecosystems • Non-forest Ecosystems • Sporadic Species 2. Flora - Fauna The Epirus region is known for its abundant and rare flora that grows mainly in the mountains and, unlike other areas of Greece, has a unique ecosystem that has remained intact and has not

	been degraded by human activities. In the wider geographical area of Epirus a wide variety of vegetation types are found, from degraded pastures and almost bare mountains to dense forests, some of which are among the largest and most productive in the country. It should be noted that in the high peaks of Epirus, and in particularly in the natural reserves of Vikos - Aoos and of Pindos, endemic and rare species such as the white lily, the yellow Albanian lily, the purple lily, viola the Albanian, the Paflofski cornflower, the lithospermum and the Goulandrio are found. The intense morphology, the existence of ecologically important wetland areas and the existence of large forest areas have resulted in the emergence of a large number of animal species in the region of Epirus. Among the higher mammals observed in forests and woodlands foxes, weasels, rabbits, ferrets, jackals and wolves are included. Also several rare and endangered species such as the brown bear, otter, lynx, wild goat, the deer, the Pindos lizard and the vipers *Vipera ursinii graeca* and *Vipera benus bosniensis* have been recorded. Also, the area presents a remarkable ornithological interest, while in lakes and constant-flow rivers there are important fish species, such as the wild trout. Rich is also the fauna of amphibians and reptiles. For the Region of Epirus the main pressures on the flora and fauna are overgrazing, fires, logging, deforestation, poaching and intense anthropogenic activities such as uncontrolled construction and the opening of roads. Agriculture causes the greatest number of impacts on the natural environment and biodiversity. The majority of the impacts from agriculture regard water pollution, land use change and deterioration of the structure and function of ecosystems. Mining activities may occur in a limited number of cases, however they are associated with extensive impact on the natural environment (erosion, deposition of large quantities of waste, drastic alteration of the landscape). The opening of roads inside natural areas create significant problems some of which are: • Loss and transformation of habitats (ecotopes)

	• Isolation of flora and fauna populations • Creation of manmade habitats and communication paths. The tourism industry presents a potential threat to the natural environment and biodiversity. The promotion of tourism investment as a means to develop economically weak regions, poses risks of changes in land use and degradation of natural ecosystems. Particularly threatened are coastal areas from development activities for massive summer tourism. Recently, mountain tourism also knows a great development of activities (ski resorts). <u>3. Protected areas</u> A large number of protected areas (Natura 2000, national reserves etc.) are found in Epirus region. Specifically, in the area of interest there are: • 27 NATURA 2000 sites • 2 National Reserves, 3 National Parks, 2 Protection Areas, 1 RAMSAR Wetland • 40 wildlife sanctuaries, 2 preserved natural monuments, 44 landscapes of outstanding natural beauty • 2 aesthetic forests and 30 CORINE biotopes The pressures on protected areas are equivalent to the pressures on the fauna and flora (e.g. intense logging, overgrazing, uncontrolled waste disposal, unregulated tourism and residential development, etc.).
Geology – Tectonics – Seismic hazard	As a result of unstable geological formations (flysch), abnormal precipitation in intensity and quantity (high rainfall and abrupt, prolonged snowfalls and long frost), and corrosion phenomena from human activities (grazing), strong landslides – settlements are observed in the mountainous area of Epirus. According to the Charter of seismic hazard zones, the Epirus region is characterized by two different seismic hazard zones, Zones I and II. In Zone II belong Preveza, Arta and most of Thesprotia (coast and west part). On the contrary, almost all of Ioannina Prefecture and a small part of the eastern section of the Thesprotia prefecture are considered and area of low seismicity and belong to Zone I.
Mineral wealth	In addition to the H/C deposits under investigation, the Region of

	Epirus has other important mineral resources. Regarding construction minerals, Thesprotia prefecture has the largest deposits of marble, while the border zone (Municipality Sagiadas) covers the needs in aggregates of neighboring Corfu. Throughout the Greek territory the beige marbles of Ioannina prefecture are well known, with the commercial trademark "Gianniotiko marble". Phosphorus deposits have also been observed in instances from the Albanian border to Preveza. Moreover, in many areas of the coastal zone lignite and peat horizons have been observed, which are not deemed economically exploitable by today's standards.
KEY FEATURES OF THE HUMAN ENVIRONMENT OF AREA OF INTEREST	
Socioeconomic characteristics	The region of Epirus is one of the poorest regions in Greece and the EU, showing a considerable gap in terms of average GDP per capita when compared to that of Greece. The GDP per capita of the region of Epirus, in the year 2009, amounts to 69.3% of the country's GDP per capita (in absolute terms, the GDP per capita of the region amounts to €14.221 compared to €20.531 over the whole country). The fact that inequalities are exacerbated over the years is very significant. Specifically, the ratio of GDP per capita of the region of Epirus in relation to the GDP per capita of the whole country dropped almost by 4 percentage points during 2005-2009. This deterioration of the relative position of Epirus compared to the rest of Greece clearly reflects chronic structural weaknesses of the area regarding autonomous and sustainable development. At the same time, it indirectly highlights the importance of strengthening the infrastructure and the productive fabric of the region. Regarding the Gross Added Value, the Epirus region contributes in a regular basis a percentage of 2.2% of the whole country's Gross Added Value (GAV), during 2005-2009. In the Region of Epirus, the sectors that significantly contribute to the formation of added value are trade, transport and tourism (26%), public (mostly) services - administration, defense, education, health (23%), the secondary sector - mining, manufacturing, electricity and construction (20%) and real estate services (11%). Also, the primary sector contributes at 6%. Aquaculture in the Administrative Region of Thesprotia is the largest primary production process and is mainly exported to countries of the European Union and other countries. Total production of 12,000

	tonnes of fish per year produces over €60 million in profit. The growth rates, both locally and nationwide range at 8% annually, which means a significant increase in the production every five years. The economically active population of the region of Epirus is (based on Hellenic Statistical Authority's data for 2009) is about 146.300 people, which corresponds to 51.6% of the population of the region (in the same year). The economic structure of the region of Epirus is also reflected in the information regarding the employment of the population. In 2009, 27.5% of the working population was employed in trade, transport and tourism, 22.4% in administration, defense, education and health services (mainly public), 19.6% in the secondary sector (with a very small percentage of workers, about 0.2%, employed in the mining-quarrying sector) and 18.7% in the primary sector. Unemployment in the region of Epirus until 2009 was at higher levels (up to 2 percentage points) than the unemployment throughout the rest of the country. Since 2010, however, that seems to be reversed. Unemployment affects most parts of the country, among them Attica (unemployment nearly doubled in 2011 compared to 2009). This is also due to the higher employment in the primary sector in the Region of Epirus, which, though tested by the crisis, holds its workforce.
Land use - Infrastructure	43.2% of the study area is covered with natural areas (shrubs and grasslands and other open areas), 30.4% of the study area is covered with forests, while only 23.42% are rural areas. Regarding the transport infrastructure, making the region a combined transport hub seems feasible by completing major horizontal and vertical road axes (Egnatia, Western Axis). A prerequisite, however, is the creation of vertical axes that will enhance the accessibility to the main roads, and the creation of a rail network to support the transport of freight from the two main ports of Preveza and Igoumenitsa. Also, the region has two airports of Ioannina and Preveza (Aktion). The International Airport of Ioannina mainly serves domestic flights to and from Athens and Thessaloniki. Aktion Airport mainly serves military activities. There are several charter flights during the tourist season, to Lefkada and Preveza. The Epirus region is known for the production of electricity by the

	large PPC hydroelectric plants due to the available water of rivers Aoos, Arachthos and Louros. Specifically, the Hydroelectric Power Plant (HPP) with the same name is located at the source of Aoos, with an installed capacity of 210 MW (2x105 MW), while on the river Louros there is a smaller HPP with installed capacity of 10,3 MW. At the south over the river Arachthos, the HPPs Pournari I (3x100 MW), Pournari II (2Xx16 MW) and the small HPP Pournari III (1,6 MW) are operating. Moreover, apart from the aforementioned 'Louros' and 'Pournari III', according to data from the Hellenic Transmission System Operator (HTSO), small HPPs with a total installed power of 35,2 MW distributed by Administrative Region are operating in the Region of Epirus as follows: 6,9 MW in Arta 4,2 MW in Thesprotia and 24,1 MW in Ioannina. 25% of the total power of the operating small hydroelectric projects of the National Interconnected Transfer System is located in the Region of Epirus. An important part of the energy demand powerload of the region is covered by the local hydroelectric plants, while during peaks, it is exporting clear energy to the system. As for other forms of renewable energy: • Only three projects of total capacity of 18,75 MW have already passed the stage of environmental permitting. • P/V stations of a total capacity of 3,02 MW (of which 0,08 MW are within the Special Program for F/B on roofs) in AR Arta-Preveza and 3,22 MW (of which 0,06 MW within the Special Program) in AR Ioannina-Thesprotia. • At present, there are no investments in biomass at any stage, despite the fact that similar projects are expected to be submitted soon, if the new investing environment significantly supports these investments. In the past, an investment proposal for the utilization of residues of poultry farms in the region of Ioannina was withdrawn. Regarding the wastewater management in the Region of Epirus, all of the A' and B' settlements are have a Wastewater Treatment Plant (WWTP), while only half of the settlements of C' priority are have a WWTP. Specifically, in Epirus there are 7 WWTPs. In order of size these are the WWTP of Ioannina, Arta, Igoumenitsa, Preveza, Parga and then the WWTPs of Filippiadas and Metsovo. Regarding the installations for final disposal of solid waste in Epirus there are only three (3) sanitary landfills in operation:

	• Igoumenitsa Landfill • Arta Landfill • Paramythia Landfill Of these landfills, the Igoumenitsa will be shut down due to saturation.
Cultural heritage	Epirus has a rich historical and cultural tradition, which is indicated by the large number of historical monuments and traditional villages in the area. This tradition dates back in ancient times with the famous oracle of Dodoni, and continued during the Byzantine period and the Middle Ages, as is evident by the castles and Byzantine churches, but also the towers, mansions and bridges that the unions of Epirus craftsmen used to build. The Region and especially Ioannina AR, is characterized by a large number of traditional communities, with many of them still almost intact. In the Region of Epirus particularly important archaeological sites can be found, such as those at Dodona, Nicopolis, the Kassopi and Mesopotamos necromancy (ancient Ephyra). Also, a number of very valuable Byzantine and post-Byzantine monuments are found in Arta, which historically was the capital of Epirus. Finally, important aspects of the traditional culture of Epirus are music, silverware, etc. In many areas, the highly valued landscape is not only a natural but also a historic-cultural resource, because it spatially reflects the development of the area during past centuries and millennia. However, the historical and cultural heritage of the region is not sufficiently highlighted, because the several historical, cultural and archaeological sites have not been developed sufficiently.
National spatial planning	The General Framework for Spatial Planning and Sustainable Development (G.P.CH.S.A.A.) (Official Government Gazette 128/A/07.03.2008) aims at identifying strategies and guidelines for the integration of spatial development and sustainable management of the national territory for the next 15 years. The General Framework aims to create a spatial pattern of growth in the context of sustainability principles, which will be the result of a complex, balanced and spatial consideration of parameters that promote the protection and enhancement of the natural and cultural environment of the country and strengthen the social and economic cohesion and competitiveness. Particular emphasis is given in biodiversity conservation. A basic strategic selection of the general framework is to adopt a

	model of sustainable spatial development based on a matrix of poles and axes of development that will enhance the competitive presence of the country in the global environment and will promote social and economic cohesion, by diffusing the idea of development throughout the nation, as well as that of environmental protection. This matrix, while adapted to the constraints of the geographical terrain, includes the main urban centers, articulates with the regions of development of productive activities and is supported by a comprehensive network of transport, communications and energy. Regarding the energy sector it aims at: • ensuring the full coverage of the energy demands in all parts of the national territory (in conjunction with the continuous effort of saving energy in all sectors), • strengthening the energy safety by full development of renewable energy, promoting the use of alternative fuels and use domestic resources, • effective monitoring of the environmental performance of the energy sector and reducing the impact of the sector on climate change and in the context of our country's commitments. In particular, the integration of strategic range energy infrastructure in the national planning requires the following settings and interventions: • Utilization of energy production with the specific energy advantages of particular regions of the country. • Investigate the feasibility of supplementing the existing oil refineries with new facilities in Alexandroupolis, in conjunction with the construction of the oil pipeline from Burgas. • Completion in accordance with the existing planning of the natural gas system (primary connected with Italy and Turkey with branches in Macedonia, Albania, etc.) and adding new infrastructure. • Radical improvement of the system of production and transmission of electricity. • Promoting a complete energy-saving program.

	Regarding industry (mining - processing), the main aims and objectives consider the following: • Developing a spatial policy for the industry starting off by acknowledging the specific characteristics and spatial needs of the sector and its subsectors. • Enhancing competitiveness and entrepreneurship in the industrial sector through appropriate spatial arrangements and by focusing on activities that cover local needs or have a comparative advantage in international markets. • Promotion of a polycentric model of spatial organization of the industry in order to increase its contribution to regional development and the exploitation of comparative advantages of different regions. • Greening the activities of the industrial sector with the implementation of modern operating and production techniques as well as anti-pollution technology and environmental rehabilitation techniques. • Rationalizing the process of siting an industry a) with host organizations for processing at appropriate locations and supporting them with effective incentives, b) with trade regulations for units with specific location requirements, c) by ensuring their proximity conditions to other activities (especially non-compatible). • Improvement and coordination of institutional estimates of individual spatial policies so as to fully promote entrepreneurship and to achieve transparency and legal certainty during the siting of industrial units. • Stimulating entrepreneurship by developing cutting-edge technologies in the fields of computing, communications and innovation. These aims - objectives are specified in the Special Regional Framework for Industry and the continuation of mining activity in existing territories is provided for and also the possibility of expanding at areas where new sources or new materials are found is ensured, in compliance with the terms of protection of the environment and the operating conditions of neighboring activities. The Framework emphasizes particularly on conflict resolution considering land use and on securing the conditions to ensure co-

	existent activities, taking into account the uniqueness and availability of resources for the development of any productive activity and balancing costs and benefit at a socio-economic and environmental level. For this purpose, by design, it is intended to take into account the specific characteristics of the site and to integrate the environmental dimension in all sectorial policies.
Specific directions of the Spatial Planning of Epirus	The National Spatial Planning provides for the following in Epirus: Development poles: Ioannina is a primary national pole that highlights the following developments: - Making Ioannina a pole in transnational cooperation and cross-border networking. - Strengthening the cooperation with both the metropolitan center of Thessaloniki and the national poles of Larissa-Volos (dipole) and Patras. - Strengthening the cooperation with the Ionian Islands (Corfu, Lefkada), focusing on key sectors for the development of the islands (eg tourism, health). - Support in the areas of higher education, research-technology, sports and health. - Making Ioannina a broader center of a) alternative forms of tourism, with the simultaneous emergence of major, local, natural and cultural resources, b) primary sector activities (especially on whatever concerns organic production methods, designation of origin, etc.) and c) artistic processing of noble metals. Also the multi-pole Arta - Preveza - Lefkada is being developed Development roads: The development of the northern axis and particularly of Egnatia is suggested, including among others primary national poles such as Ioannina as well as the international gateways of the country to the Adriatic / Italy (Igoumenitsa). Also, the development of the western axis is proposed, which will run through the country west of the Pindos mountain complex including poles as Ioannina in conjunction with Igoumenitsa. Transport Infrastructures: Completion of the Ionian route, upgrading the connection of all the capitals of the Region or other major transport areas, located in the vicinity of the upper road axis and connecting the city of Preveza

	with it, upgrade the road linking Igoumenitsa - Sagiada - Konispol - Sarande. Regarding port infrastructures, the upgrade of the port of Igoumenitsa from ferry service of port-passenger ships to complex service port and unitized freight is suggested. Upgrading the existing airport infrastructure and creating new rail route linking Antirrio-Ioannina. Energy infrastructure: Integration of energy infrastructure of strategic range in the national spatial planning requires different settings and interventions, in the context of utilizing specific energy advantages of particular regions of the country for energy production. For the regional areas, the utilization of the water resources of Western Greece - Epirus is referred. Agricultural sector: The regional areas include the plains on both sides of Ambracian and Arta. Industry: Regarding the new units, their concentration in suitable places with organized receptors, while limiting off-plan building is intended. Organized spaces are provided for almost all the Region, but the zones of influence of major urban centers and areas along the growth axis are in the greatest need for organized receptors. In the Special Regional Framework for Industry, the directions as derive from the Annex to the final CMD for the reference area (Epirus region) are: Overall priorities for the spatial development of the industry: The region is also showing lack of growth concerning agriculture and structural weaknesses in all fields. The geographical characteristics (mountainous areas, perimeter placement) played a negative role, but recently its position began to acquire new strategic importance as a gateway to Western Europe, and the construction of major hyper local transport infrastructure (Egnatia, west axis, Igoumenitsa Port) capitalizes this opportunity. The industry, however, is characterized by businesses small in numbers and magnitude, reduced productivity and introverted orientation. Regarding industry, there are medium-term prospects of aid that must be supported. Direct contact with the Balkans provides room for an industrial-commercial penetration,

	but most promising seems the role of Igoumenitsa as an international gateway of Greece. Priorities in terms of industry sectors or categories: The manufacturing base currently is not strongly specified. Firstly, focused sectorial policy is not required, rather than strengthening the horizontal infrastructure. Spatial pattern of industry: The strong components of the spatial organization of the industry will be the existing pole of Ioannina (intensification area) and the Western development axis where at various locations new areas of small-scale industry (expansion areas) may develop. The strongest such a potential pole is the general area of Igoumenitsa. In extensive upland areas the development of hand-craft and home-craft industry should be supported. Organized siting of industry: Due to the low starting level of industrial development, despite the previous point, there will be no great short term needs for organized receptors. However, there should be some receptors, so as to put the progressive development of the industry in good foundations from the beginning. Policy on land use and the dispersed siting of industry: - Prevent roadside development of processing units of the strong elements of the spatial organization of the industry on non-closed highways and other main roads. - The siting of new plants based on the general provisions of the law regarding the off plan building is unacceptable in the area of Ioannina Master Plan and in peri-urban areas of urban industrial centers. - The support of the survival / transformation of existing units, outside the areas mentioned above is appropriate. In conclusion, it is stated that development plans identify weaknesses but do not propose specific growth options, while the estimations lack the probability of exploiting H/C.
Conclusions - trends	It could be said in conclusion that the economic structure of the region is characterized in general by: • Low productivity.

	• Weak primary sector and industry. • Development plans that identify weaknesses but do not propose specific development options. • Absence of the probability of exploiting H/C. Despite the fact that in Epirus a considerable effort has been made in the fields of infrastructure, agriculture and small and medium enterprises (especially in recent years), the GDP of the region still lags while its isolation from the rest of the country and the European Union is not fully resolved. In general, Epirus appears to invest more in infrastructure, less in human resources and much less in the productive sectors, because at least the first two Regional Operational Programmes paid little attention in the use of these agents through the allocation of resources.
EXPECTED ENVIRONMENTAL IMPACTS OF THE H/C EXPLOITATION	
Methodological approach	The environmental impacts' evaluation and assessment of the research and exploitation of hydrocarbons in "Ioannina", within the scope of the chosen alternative, is related to the way in which these operations may affect the existing conditions of the site's environment during the implementation and afterwards. The evaluation of the environmental impacts (long-term, mid-term, short-term, temporary and irreversible, positive and negative, synergistic and cumulative) of the abovementioned activities, was conducted for the following receptors: • Natural habitats, flora and fauna • Soil and subsoil • Aquatic environment (groundwater and surface water) • Air quality • Climate • Landscape • Public health and quality of life • Physical assets (infrastructures and other land uses) • Cultural heritage, including architectural and archaeological heritage
Environmental Objectives	The environmental objectives taking in account while conducting the current SEIA are the following:

	Habitats, flora and fauna: • Conservation of habitats and wild flora and fauna in Epirus Region • Avoid significant impacts or disturbance of protected habitats and of national and international importance species. Soil and Subsoil • Maintain functioning and integrity of the processes and services of the soil • Avoid negative impacts to areas of special geological interest. • Reduction of the environmental footprint. Aquatic Environment (groundwater and surface water) • Avoid negative impacts to surface and groundwater. • Contribution to achieving the objectives set by the FD 2000/60. • Avoid flood risk Landscape • Protection of landscape in accordance to the European Landscape Convention • Avoid of impacts on the "character" of demarcated and non-demarcated landscapes Air Quality • Avoid deterioration of the area's air quality and meet the objectives set by the European Directives and the Greek legislation. Climate Factors • Minimization of greenhouse gas emissions Public health and quality of life • No negative impact on public health • Avoid of nuisance (including loss of access and opportunities for recreation) Physical assets (infrastructures and other land uses) • Avoid adverse impacts on infrastructure in the Epirus

	Region • Avoid adverse impacts on other land uses in the Epirus Region <u>Cultural heritage</u> • Avoid significant impacts on sites of cultural, historical and archeological importance. • Promote awareness and recognition of important archeological assets of the area and where applicable contribution to their reservation.
Potential Significant Impacts	All the significant and non-significant environmental impacts per work and receptor are comprehensively given in the extended text. Following, the key points are summarized. <u>Habitats, flora and fauna:</u> The implementation of the project is not expected to result in and significant impacts or disturbances of protected habitats and species of wild flora and fauna. All habitats protected or not, will be reserved in a good condition, even though some disturbance, albeit temporary may occur. In general, the expected impacts will be small and limited in a respectively small extend and will be reversed to a large extend after the completion of the project and the restoration of the site. <u>Soil and Subsoil</u> The location of the project facilities must result in avoiding local geological elements of interest, flood plains, high quality agricultural land, etc. In general, the impacts are estimated to be limited to a proportionally small area and will be reversed to a large extend after the completion of the project and the restoration of the site. <u>Landscape</u> Both temporary and permanent (until the completion of the works) installations should be sited in a manner that the visual nuisance will be minimized and the effective restoration of the disturbed landscape will be implemented. The impacts will be mostly reversed after the restoration of the

	site. Aquatic Environment (groundwater and surface water) If the conditions under which all the exploration and exploitation works are conducted are normal there are no adverse impacts expected on the surface water and groundwater of the area, given that all requirements for the safe execution of works and treatment of the produced liquid and solid waste will be implemented. Significant risk for the water quality can occur only in case of an accident with a large quantity of oil leakage. The expected impacts under normal operating conditions of the project are fully reversible. In case of an accident a specific action plan for the environmental restoration will be required. Air Quality At a strategic level, the contribution of the project to the degradation of the air quality is considered small. In local or regional level there might be an increase of concentrations of pollutants related to the project, but in any case they should not exceed the statutory limits. The impacts will be generally small and mostly reversible after the completion of the project. Climate The general guidelines for reducing air emissions lead the users to adopt measures for the minimization of such emissions. During the implementation of the project, it is expected appropriate measures for promoting the energy efficiency and the greenhouse gas emissions reduction to be adopted, within the context of Greece's obligations to address climate change. However, the overall contribution of the project at a national level will not be significant. Public health and quality of life The expected impacts in public health are practically insignificant. The existing regulatory framework for the siting, facility design, time schedule for the operations, treatment of wastes and

	emissions, management of accidents and random events, and the construction of the transportation pipelines and treatment facilities is considered to be effective for reducing the potential impacts in public health and in emergency situations. Impacts are expected to occur on the quality of life, however they will be spatially limited and only identified in the facilities' surrounding area. <u>Physical assets</u> No adverse effects are expected in infrastructures or other activities from the project under normal conditions. There may be negative effects only in case of an accident. <u>Cultural Heritage</u> The impacts of the project on the cultural heritage of the region are considered insignificant, in case all protection provisions enforced by law are implemented.
INFORMATION ON THE REGULATORY ACT	
General context	The H/C research and exploitation should follow the existing legislative framework. In the present SEIA, in Ch. 3 a concise reference to the main provisions relating to the various receptors is made (see. Table 3). A more detailed report is found in Annex 5.
Recommendations, guidelines & mitigation measures	Next, a summary of the general recommendations for environmental protection is given per receptor. In the extended text, more specific measures are presented for each activity and possible pollution source, all of which is proposed to be included in the respective Environmental Impact Assessments. <u>Habitats, Flora and Fauna</u> Through the SEA the sensitive areas and protected species in the project area are highlighted. In the authorization phase and execution of research and development, the current rules and regulations regarding the protection status of protected areas and species of flora and fauna will be unswervingly adhered to. <u>Soil and subsoil</u>

	No additional protection measures are necessary, apart from those specified in the relative legislation. Landscape No additional protection measures are necessary. It is considered necessary to undertake a specific landscape study in order to ensure the best results. Aquatic environment Generally, the chances of an accident due to drilling problems are low and the quantities that will leak are basically small. According to studies, crude oil spills in respective events was less than 38 lt (10 gal) in 50% of the incidents and lower than 235 lt (2 barrels) in 84.1% of the incidents. Larger quantities may spill during storage and transportation of petroleum products. In any case, the location of drills and facilities should avoid areas prone to flooding, as well as to observe the condition of creating a buffer zone from the main hydrographic network and the coastline, as proposed. Given that the previous deep drilling in the area encountered high pressures, the design of new drilling should effectively address any potential encounter of high pressures (by using appropriate protective equipment - Blowout Prevention (BOP), by using appropriate drilling muds, by applying the best practices based on international experience, etc.) so that any risk is reduced to the level of practically negligible. Air quality No additional protection measures are necessary. However, the project's contribution to air pollution should be thoroughly studied on an EIA level and appropriate mitigation measures should be proposed based on best practices at an international level. One of the gaseous pollutants that should be monitored regularly is hydrogen sulfide, which occurs frequently in the exploitation of H/C. There is extensive literature on the subject as well as best techniques, which should be considered in the EIA and specific measures in the event of hydrogen sulfide occurrence should be proposed.

	Climate The current regulatory framework regarding transport, energy production and combustion is considered adequate. Additional protection measures are not necessary. Public health and quality of living The need for additional protective measures than those applied in the legislation is not recognized. However it is recommended to consult with the local community so that the location of the works will receive the maximum possible social consensus. Tangible assets The project design should adopt the best execution techniques at all stages in order to minimize the risk of accidents. In any case, the existing legal framework can ensure those affected by emergency events. Cultural heritage No additional protection measures are necessary. The current legislation requires the undertaking of relevant archaeological studies, site investigations and supervision of works for the project activities.
Environmental monitoring and Management System	In recent years, the H/C research and exploitation industry has developed a series of internationally accepted environmental standards, good operating practices and voluntary codes of conduct. The most common and widely accepted guidelines and best practices are those of the International Association of Oil and Gas Producers (OGP) and the American Petroleum Institute (API). Similar instructions have also been issued by other bodies such as the World Bank, the International Organization for Standardization (ISO), the International Chamber of Commerce (ICC), the UN Environment Programme (UNEP), etc. As part of preparing this SEIA it is assumed that the party which will undertake the research and exploitation of hydrocarbons in the Ioannina land area as described in the open invitation of YPEKA, will comply with the best operational practices and environmental protection that are adopted at international level. Also, the party which will undertake the research and exploitation

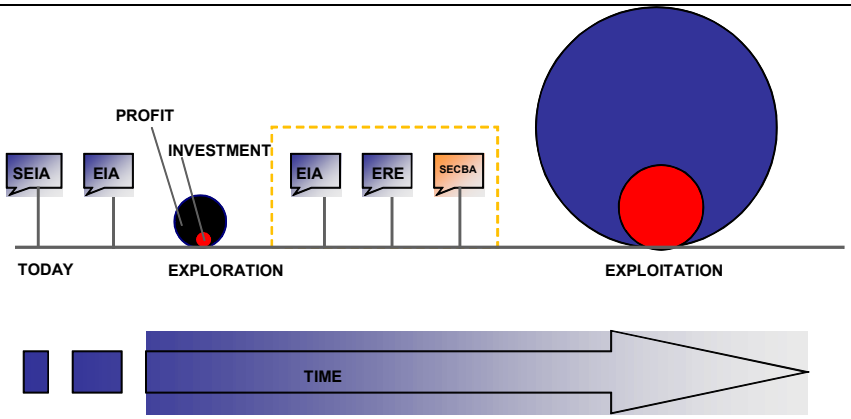
	of hydrocarbons in the Ioannina land area as described in the open invitation of YPEKA, will be required to implement an internationally recognized Environmental Management System (e.g. ISO 14000, EMAS, etc.), which will be certified by an independent, external and recognized certification body In the above context, the project contractor will have to install an appropriate system of environmental impact monitoring at critical receptors, which will relate to: • Monitoring of impacts: used to check the effectiveness of countermeasures, to validate the estimates of the impact and identify unanticipated impacts during project implementation. • Compliance monitoring: includes recording and monitoring of compliance with the approved environmental conditions. If deviations from the environmental conditions are observed or the environmental pressures on environmental media (air, water, soil), flora and fauna, exceed the carrying capacity of the ecosystem, there should be a revision of the predicted environmental conditions, with the aim of optimal protection. The environmental monitoring system must be installed prior to commencement of exploitation to collect all the necessary data to accurately identify the environmental reference conditions. At a minimum, environmental monitoring should focus on environmental impacts, possibly leading to: • Violation of international, national or local legislation or recognized guidelines and standards, • Irreversible damage to human health or the ecosystem, with a view of identifying change trends before the occurrence of the damage. Also, environmental monitoring targets or indicators established by the competent authorities or local authorities should be integrated into the system, even if not directly related to the impact of the project. To optimize the monitoring system at a strategic level, the project contractors should consider, in conjunction with relevant departments or local authorities, any existing structures for monitoring the quality of the environment (e.g. in this case the metering station of the National Monitoring Network for Gaseous

	Pollutants (EDPAR) in Ioannina should be considered, which monitors concentrations of SO_2, NO_2, NO_x, O_3 and PM_{10}, as well as the metering stations of the Egnatia Motorway, etc.). In this case study the proposed environmental monitoring system should, at a minimum, take into account the effects of the project on: • The habitats, the flora and fauna of the area • The soil • The surface and underground waters • The air quality and the greenhouse effect • The noise level • The public health and the quality of living • The infrastructure and other land uses • The cultural monuments It is obvious that in drafting the EIA for the implementation of research projects and subsequently the development and exploitation projects, these indicators may be enriched with additional parameters and be further specified. The environmental monitoring system will monitor, at a minimum, the following parameters: • Gaseous emissions: the quantities of CO_2, CO, SO_2, H_2S, NO_x, CH_4, COCs, HCFCs and PM_{10} • Water: the chemical and biological quality of groundwater and surface water in the vicinity of the works (downstream) will be monitored. Especially for groundwater, the evolution of the level and quality of groundwater will be monitored through boreholes (the number and location of which will be determined by the EIA). In addition, the amounts of produced reservoir water, the quantity and chemical composition of the reservoir water that will be discarded into the environment after treatment and the quantities of water being consumed in the activity in different uses, will all be monitored. • Noise: the noise level will be monitored both in the work places and the borders of the facilities, according to the legislation.

	• Waste: the solid and liquid waste generated from the operations will be listed (it refers to drilling muds, rock cuttings, reservoir water, drilling chemical additives, general waste of equipment and facilities, sewage, etc.). The wastes should be characterized with respect to their risk (inert, non-hazardous and hazardous) and then the optimal management (disposal in landfills, processing, disposal in hazardous waste landfill, etc.) should be selected. Special care should be taken in the event of radioactive material (NORM) in order for them to be disposed with the utmost security. The objective of the contractor responsible for exploiting the H/C in the concession area in the Epirus region should be the minimization of waste, promoting recycling and the efficient waste management. Additionally, the program of environmental monitoring if necessary in the context of environmental permitting should include specific basic research (e.g. biodiversity study, landscape study, etc.). Finally, as part of the environmental monitoring program an annual environmental report should be drafted, which will include the environmental pressures of the project according to the information gathered, the measures taken to mitigate these pressures, environmental objectives for next year, etc. The dissemination of information should include relevant departments, local authorities, social organizations and the wider area population.
DIFFICULTIES ENCOUNTERED DURING THE PREPARATION OF THE SEIA	
	The SEA procedure poses a significant inherent "weakness" and simultaneously "advantage" that necessitates the need to differentiate the methodological approach in relation to typical Environmental Impact Assessments: in contrast to Environmental Impact Assessments (EIAs), SEA is conducted in an early stage and thus all technical and economical characteristics of the project under environmental assessment are uncertain. Also, a SEA usually involves the initial policy planning that is not clearly defined and it is also dynamic and changing. As a result, the SEIA implementation methodology requires a broader treatment of the subject, more widely regarding the plurality of the environmental issues to be assessed but less deep regarding the scope of coverage of all individual issues. The

	"supervisory approach" of the subject still requires a precise and objective assessment and indeed in greater extent than in a standard EIA: this study, as stated by its title, is located in a more "strategic level of organization and perception" of the interference with the landscape of the public interventions, often in a mid-term time scale and in a wide geographical area. During conducting the Strategic Environmental Impact Assessment, the project team encountered some difficulties that had to be managed in order to achieve the best possible result, which are grouped into two categories: • The first issue concerns the lack of an established, systematic set of environmental data and indicators which would allow mapping the environmental status of the region. For properly and fully conducting the Strategic Environmental Assessment for the regional planning a fully possible knowledge of the environmental status of the region is required. The quantification of environmental data is often a difficult stage of all environmental studies conducted in Greece. The available information, when available, are usually spread over a large amount of studies which have been conducted occasionally by different bodies using different methodologies. These studies are not always available, and not necessarily compatible to each other. Specifically, some information were available at a regional level and obtained by relevant studies conducted by the Administrative Region either within the context of specific regulatory commitments or due to the necessity of systemizing its environmental planning in particular and especially important environmental issues. Other data were available only at national level by competent ministries (i.e. Ministry of Development, Ministry of Environment, Planning, and Public Projects) and as a result it was difficult and in some cases impossible to apportion at a regional level. • The second issue concerns the lack of a fully established methodological framework for the impacts assessment and the identification of mitigation measures. The very recent introduction of the relevant requirements in the national regulatory framework hasn't allowed the accumulation of experience in these matters. The

	challenge was met with the extensive bibliographic research both to studies regarding the methodologies for conducting strategic studies and to strategic studies from other countries.
FINAL SUGGESTIONS – BASIC STUDIES AND RESEARCH	
General context	As previously pointed out a major weakness of the SEA is the imprecise knowledge of the characteristics of the implementation program (size, exact location, etc.). On the other hand, this is a key advantage because the preventive approach to potential problems (which in environmental science is the most effective) is maximized. This weakness, however, is extremely important in this case because of two main reasons: the exploitation of H/C can mean very different things from the environmental point of view, depending on the survey results in terms of exploitable deposits. From the non-exploitation (if no such deposits exist) to the confirmation of the assumptions (which means an exploitation based on the characteristics described) to a much larger exploitation if investigations reveal larger deposits. The second reason relates to the specifics of the land survey and especially in a region such as this, with a huge variety of conditions. In such a case, any generalization will necessarily lead to great confusion, even failures. Based on the above, the SEIA followed the following methodological approach: Up and including the research phase, what and how will happen is pretty much known. Besides, in the same area a corresponding program has been performed, almost to its entirety (unfortunately the most crucial part of it was not performed). For this phase, the "visibility" of both the scholars and the local community is good. It should be performed with a more modern way, taking into account past experience, and with environmental conditions that will follow the relevant EIA to be carried out. Besides, the size of the investigation with regard to the size of the intervention and the corresponding environmental impact is submultiple to the size of the exploitation. Afterwards, as explained, aspects will be determined to a significant extent by the results of the survey, which are now not known. For this reason, after the execution of the Research and before Exploitation, a strong and analytical decision process is placed, which will take into account all the data available then. In this decision process the local community should be involved meaningfully and deep and obtain a very powerful role. This approach is shown below:

	
Basic studies and research	Given the significant socio-economic and environmental impacts, the research and exploitation of hydrocarbons must be evaluated from a spherical perspective. Thus, in addition to the required environmental impact assessments, the permitting process should include specific studies of environmental risks from emergencies, financial and socio-economic effects of projects, etc. The level of analysis of these studies varies depending on the maturity of the project. For example, at this stage, the strategic environmental impact assessment is accompanied by an assessment of the socioeconomic impact of the project of exploitation of hydrocarbons on the basis of available literature data (e.g. percentage of participation in regional and national GVA, at regional and national GDP, use of multipliers using bibliography, etc.). Also, the environmental risk assessment is based on qualitative approaches, which identify dangerous situations and their possible consequences, since the real risks in the phase of research are clearly smaller, more limited and controllable. In the authorization phase of research projects, the environmental impact assessments, the risk assessments, etc., which are provided for in the final stage, namely during the licensing of the production phase, should be characterized by completeness and meet the requirements of legislation, taking account the nature of the works (largely reversible operations, in proportionally small area and for relatively limited time). A key role in the licensing of the production phase of the project

	has the socioeconomic cost - benefit analysis of the activity, which will explore the feasibility of the project from the perspective of society. The development of a cost - benefit analysis with an assessment of the impact of the project using appropriate methods of environmental economics is essential in recent years; both for the authorization of the project and for defining the letters of guarantee that must be given in order to ensure the necessary resources for the remedy of environmental damage in case of accident.
Studies prior to the Research stage	Possible oil pollution in the phase of exploration drilling can be caused either by leaking fuel or lubricants from the supporting equipment or from the drilling itself (a phenomenon known as a blowout). Historical data for exploratory drilling estimate the relative probability between $1,23*10^{-4}$ and $1,6*10^{-4}$ per drilling, this means that the phenomenon is likely to occur in 1 to 2 in 10,000 drillings. If the drill is done in a high pressure and temperature (HPHT) field, the likelihood of leakage is increased to $1,01*10^{-3}$, i.e. 1 in 1,000 wells. These possibilities can be reduced very significantly with proper drilling mud control and with appropriate technical means (blowout preventer - BOP). With regard to equipment, the released quantity, if any, is small and does not pose a significant risk to the environment. Still, even this can be avoided if the equipment is properly maintained and the regulations for safe use are kept. Despite the fact that the chances of an accident are low and the quantities of H/C spill is usually small, it is appropriate at this stage to prepare the following studies: • Environmental Impact Assessment: it regards the recording of the current situation of the natural and human environment in the immediate and surrounding research area, the assessment of potential impacts on the biotic and abiotic environment, the cultural environment, infrastructure, etc. Also, it regards the elaboration of alternative ways of implementing research, the proposed preventive measures to avoid impacts as well as the mitigation measures to adverse situations and the design of an appropriate monitoring program of critical environmental variables, etc. • Exploration Well Environmental Risk and Oil Spill Contingency Analysis: it assesses the estimated levels of risk associated with the research drill (or drills). This

	analysis should include the technology used to drilling, it should address potential problems from loss of barriers in the drilling, the assessment of the likelihood of a blowout, the evaluation of technological protection measures (BOP - Blow Out Preventer), the assessment of the leaked oil quantity, the modeling of the flow of leaked oil and an impact assessment for each scenario, the description of appropriate mitigation measures for the amount of leaked oil and environmental remediation measures.
Studies after the research stage and prior exploitation	If the research establishes the existence of economically exploitable deposits, then for the licensing of the development and exploitation projects, comprehensive studies will be required, which should be based on primary data. For example, the analysis of socio-economic impacts will be based on the estimated size of the project in terms of direct employment, economic output, earnings of employees, the GVA, taxes, leases, etc. Also, the indirect and induced effects on the basis of national and regional input-output tables should be calculated, from which the corresponding multipliers are calculated, etc. The environmental risk assessment should be developed using quantitative methods and specialized software (e.g. diffusion of oil spill from a pipeline) to quantify the likelihood of an event per year and the subsequent impact on the ecosystem and human environment of the area (e.g. area to be affected, flora and fauna that may be at risk, economic activities that would be harmed, etc.). Studies required at this stage are the following: • Environmental Impact Assessment: it regards the detailed record of the current status of the natural and human environment in the immediate and surrounding area of the project, the assessment of potential impacts on the biotic and abiotic environment, the cultural environment, infrastructure, etc. Also, it regards the elaboration of alternative ways of implementing the projects, the proposed preventive measures to avoid impacts as well as the mitigation measures to adverse situations and the design of an appropriate monitoring program of critical environmental variables, etc. The contents of the study should be in accordance with the legislation, as in the authorization phase of the research, but the depth of analysis should be proportionate to the size of the project. Therefore, the recording of the status of the environment

	should be based on primary rather than bibliographic data. Also, specific models for the assessment of impacts on the biotic and abiotic environment should be developed, etc. • Environmental Risk Assessment: it regards the assessment of risk levels associated with the exploitation projects under study. The analysis should be carried out on the basis of quantitative methods, which are designed to identify dangerous situations, to estimate the likelihood of these conditions and the calculation of the probability and impact of the consequences of these situations. In this context, a Maximum Credible Accident (MCA) analysis should be carried out for the identification and classification of dangerous situations, which includes hazard identification (HAZID), modeling of risk scenarios, Fault - Event Tree Analysis, determining the likelihood and the effects on the ecosystem, public health and physical property for each scenario, the assessment of measures to reduce risk and establishing management plans for the emergencies and for damage and management of emergencies and for damage remediation. • Social cost – benefit analysis: it regards the assessment of "Net Social Benefit" from the development of a new business and utilizes data from previous studies and financial analysis of the project. In this analysis the key aspects are: o The socioeconomic analysis of the project's impacts, that evaluates issues that are associated with the labor employment, the creation of income, the connection of the project that is being studied with other economic activities, the production of added value and its contribution to the incomes of the State and the Local Government through taxes that are eventually redistributed and they create a potential social capital in the form of infrastructure and provisions in fields such as health and education. o The evaluation of the environmental and social components of the project in monetary terms, with the use of specialized methods, in order to conduct the necessary "corrections" on the market prices

	(private costs and benefits), so that the latter will reflect the real costs of the community due to the production process (social costs and benefits). As part of this analysis all required indicators will be calculated, such as Net Present Value, Internal Rate of Return of the project, based on the social Cash Flow, making it possible to evaluate the benefits and the effectiveness of the assessed project. The socioeconomic cost-benefit analysis should assess the environmental and other components by using primary methods for improving the accuracy and reliability of results.
FINAL OBSERVATIONS	
	As mentioned, the SEA is conducted at an early stage which results in the ambiguity in the technical and economic characteristics of the project subjected to assessment regarding the potential environmental impacts. As a result the methodological context of the SEIA requires broader assessment of the project, wider in terms of plurality of environmental issues addressed and less deep in terms of the scope while covering each individual issue. This inherent "weakness" is also an "advantage" since this study is located in a more "strategic level of organization and perception" of the interference with the landscape of the public interventions, often in a mid-term time scale and in a wide geographical area, and it requires a precise and objective assessment and indeed in greater extent than in a standard EIA. In this context, three alternatives were assessed, from which the final solution for the implementation of the project was chosen, with some additional to the existing regulatory framework terms regarding the siting of the facilities. For the baseline scenario, taking into account the unique natural beauty and the cultural wealth of the Epirus Region, a set of proposed mitigation measures are suggested in order to minimize at a maximum level the significant impacts in all project's stages (exploration, development, exploitation, dismantling and removal of all installations). Part of these measures is also the proper seasonal programming of works in order to avoid impacts on wild fauna species or other economic activities such as e.g. tourism. Furthermore, a robust environmental monitoring system is proposed, which, in

	combination with the environmental certification of the activity, will enforce the monitoring of all critical environmental indicators associated with the activity and the communication of the environmental pressures from the project to stakeholders (competent authorities, local community, etc.). Finally, it is necessary to state the following observations: • The SEIA, even though contributes to implementing the project in accordance to sustainable development principles, cannot ensure the final result by itself. Prerequisite for the successful, from every point of view, outcome of the project, apart from the implementation of all suggestions given in the SEIA and the EIAs following, it is necessary to strictly implement the applicable legislation, to strictly audit from the part of the competent authorities, and the implementation of best practices and modern technologies at every stage of the project. • The current knowledge regarding the size of the project, the type and the intensity of the impacts, etc., is now sufficient, until the completion of the exploration works. However, there is considerable uncertainty due to lack of knowledge regarding the size of the project, for the stage of the deposits' exploitation. Therefore, between these two distinct stages, apart from the EIA, two dedicated studies are inserted, i.e. the quantitative evaluation of the environmental risks (ERE) and the socioeconomic cost-benefit analysis (SECBA) with economic valuation of goods and services of the environment, which relies upon data from the environmental impact and risk assessments and the financial analysis of the project. At this stage the critical question regarding the feasibility of the study from a social standpoint will be addressed. • The role of the local community is crucial at all stages of the project. On this basis, it is considered a sine qua non to ensure a strong public participation procedure between the local community, the State and the entity implementing the project. This process should peak between the exploration and exploitation stages since, among other issues, the appropriate compensation measures should be agreed, in line with the results of the socioeconomic study.