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CHAPTER4b.

ENVIRONMENTAL IMPACT OF PROJECTS

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1.Environmental impact introduction

Assessing the feasibility of a project has been conducted on different bases to criteria over time. From 60s based almost exclusively on economic and technical criteria. This led to a development model with a growing deterioration of environmental quality and quality of life, and a decrease of natural resources (in quantity and quality). In some countries (USA, Canada, Japan) requiring the submission of documents annexed to the projects, which incorporated the impact of a particular project on specific aspects of the environment (safety, health, air pollution ...), but an integrative view.

In the second half of the 60, because of the first voices warning of environmental groups, began to include in the projects, studies of cost / social benefit, especially for major infrastructure (roads, airports, dams,) public investment. But the tools of economic analysis of investment led to approval most of the projects and therefore was not sufficient for the growing environmental concern in society.

Since the 70 starts a more complex process in which, besides the technical and economic aspects are considered other factors and criteria for evaluating alternatives and making decisions, resulting in what is known as studies environmental impact. Among others we can emphasize the protection criteria of socio-economic and natural

- ✓ Protection of the physical environment
- ✓ Rational use of resources
- ✓ Appreciation of the social aspects

These and other factors have become more important as we progress in the knowledge of the impact that certain activities may have on the environment and led to the current concept of sustainable development. Hence the need arose to bring the projects from the perspective of integrated environmental management, which can be defined as "the set of actions to achieve the highest level of rationality in decision making processes that may affect the environment or natural resources. This kind of project is extended to all stages of the project and the designer should consider the consequences of the activities at all stages of the project.

At present, the decision-making criteria are marked by their commitments to contribute to sustainable development projects and therefore must be studied from this objective.

2.Sustainable development

The decrease in the ozone layer, global temperature increased by the greenhouse effect, increasing desertification, water pollution, acidification, eutrophication, accumulation of solid waste and so on, are the negative effects of human activity on the planet. These effects are increasing to the extent that human development is faster, and this has been happening since the last century

The planet, like any ecosystem, is about assimilation threshold changes from those who lose their ability to regulate itself. If the world loses its ability to self-regulation, the minor problem for us humans is that it will stop development. It seems that human development, after too many years of uncontrolled development, is reaching those thresholds. If a man wants to continue social and economic development must take into account the environment, or for that matter, the development must be sustainable.

The welfare has two origins:

- ✓ Products of human activity and
- ✓ Natural resources

If these two sources will interfere to find an optimal point because if growth is wasteful, that is, the optimal point should be well below the physical capacity of sustaining the natural environment. If we ask the question of why the deterioration of the environment can answer to the human being lives as part-time tenant on the planet and that in these precarious conditions, it makes little sense that humans worry to avoid degradation.

The first document referred to the need for sustainability was developed in 1972 by the Club of Rome (Meadows et al., 1972). This document posited that without changing the economic and social trends of the population, would limit overall growth before one hundred years. The demographic tensions, environmental and impacting on natural resources that produce the current growth and yield models suggest a gradual process of degradation and impoverishment of land resources.

To change these trends would require, at the global level, new initiatives were taken to meet human needs while protecting and restore the planet's capacity to sustain life. The concept "sustainable development" is

much broader (European Commission, 1996a) that the protection of the environment, since it implies a concern for future generations and for the health and integrity of the environment in the long term.

Sustainable development implies a concern for the quality of life, equality of persons in this, for equity between generations, and the social and ethical aspect of human welfare. This definition implies that development should continue only to the extent that natural systems can handle it.

Today, with the evidence of the climate change due to human actions, periodically international summits try to make change in human and society development. Recently, 2015, the summit was in Paris.

At COP 21 in Paris, on 12 December 2015, Parties to the UNFCCC reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. The Paris Agreement builds upon the [Convention](#) and – for the first time – brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the agreement aims to increase the ability of countries to deal with the impacts of climate change, and at making finance flows consistent with a low GHG emissions and climate-resilient pathway. To reach these ambitious goals, appropriate mobilization and provision of financial resources, a new technology framework and enhanced capacity-building is to be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Agreement also provides for an enhanced transparency framework for action and support.

The Paris Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" ([NDCs](#)) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts. There will also be a global stocktake every 5 years to assess the collective progress towards achieving the purpose of the agreement and to inform further individual actions by Parties.

The Paris Agreement opened for signature on 22 April 2016 – Earth Day – at UN Headquarters in New York. It entered into force on 4 November 2016, 30 days after the so-called "double threshold" (ratification by 55 countries that account for at least 55% of global emissions) had been met. Since then, more countries have ratified and continue to ratify the

Agreement, reaching a total of 125 Parties in early 2017. In order to make the Paris Agreement fully operational, a work programme was launched in Paris to develop modalities, procedures and guidelines on a broad array of issues. Since 2016, Parties work together in the subsidiary bodies ([APA](#), SBSTA and SBI) and various constituted bodies. The Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA) met for the first time in conjunction with COP 22 in Marrakesh (in November 2016) and adopted its first two decisions. The work programme is expected to be completed by 2018. Some of the key aspects of the Agreement are set out below:

Long-term temperature goal (Art. 2) – The Paris Agreement, in seeking to strengthen the global response to climate change, reaffirms the goal of limiting global temperature increase to well below 2 degrees Celsius, while pursuing efforts to limit the increase to 1.5 degrees.

Global peaking and 'climate neutrality' (Art. 4) – To achieve this temperature goal, Parties aim to reach global peaking of greenhouse gas emissions (GHGs) as soon as possible, recognizing peaking will take longer for developing country Parties, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of the century.

Mitigation (Art. 4) – The Paris Agreement establishes binding commitments by all Parties to prepare, communicate and maintain a nationally determined contribution (NDC) and to pursue domestic measures to achieve them. It also prescribes that Parties shall communicate their NDCs every 5 years and provide information necessary for clarity and transparency. To set a firm foundation for higher ambition, each successive NDC will represent a progression beyond the previous one and reflect the highest possible ambition. Developed countries should continue to take the lead by undertaking absolute economy-wide reduction targets, while developing countries should continue enhancing their mitigation efforts, and are encouraged to move toward economy-wide targets over time in the light of different national circumstances.

Sinks and reservoirs (Art.5) – The Paris Agreement also encourages Parties to conserve and enhance, as appropriate, sinks and reservoirs of GHGs as referred to in Article 4, paragraph 1(d) of the Convention, including forests.

Voluntary cooperation/Market- and non-market-based approaches (Art. 6) – The Paris Agreement recognizes the possibility of voluntary cooperation among Parties to allow for higher ambition and sets out principles – including environmental integrity, transparency and robust accounting – for any cooperation that involves internationally transferal of mitigation outcomes. It establishes a mechanism to contribute to the mitigation of GHG emissions and support sustainable development, and defines a framework for non-market approaches to sustainable development.

that the information submitted by each Party undergoes international technical expert review. The Agreement also includes a mechanism that will facilitate implementation and promote compliance in a non-adversarial and non-punitive manner, and will report annually to the CMA.

Global Stocktake (Art. 14) – A “global stocktake”, to take place in 2023 and every 5 years thereafter, will assess collective progress toward achieving the purpose of the Agreement in a comprehensive and facilitative manner. It will be based on the best available science and its long-term global goal. Its outcome will inform Parties in updating and enhancing their actions and support and enhancing international cooperation on climate action.

Decision 1/CP.21 also sets out a number of measures to enhance action prior to 2020, including strengthening the technical examination process, enhancement of provision of urgent finance, technology and support and measures to strengthen high-level engagement. For 2018 a facilitative dialogue is envisaged to take stock of collective progress towards the long-term emission reduction goal of Art 4. The decision also welcomes the efforts of all non-Party stakeholders to address and respond to climate change, including those of civil society, the private sector, financial institutions, cities and other subnational authorities. These stakeholders are invited to scale up their efforts and showcase them via the Non-State Actor Zone for Climate Action platform (<http://climateaction.unfccc.int>). Parties also recognized the need to strengthen the knowledge, technologies, practices and efforts of local communities and indigenous peoples, as well as the important role of providing incentives through tools such as domestic policies and carbon pricing.

Do not forget that sustainable development has an economic dimension, an environmental and a social dimension and that is up to the desires of the human and social developments the possibility of sustainable development. This dimension has become global with all the problems, too benefits, that this represent (Corovid-19 in 2020).

We understand sustainable development (as defined in the Brutland report) as one that meets the needs of the present without compromising the needs of future generations.



Fig. 1.1 Despite numerous international efforts, as the starting conferences on climate change that drafted the Kyoto or Paris or protocol or the UN summits on sustainable development (photo), the environmental issue is still a pending issue.

3. Legal Framework

3.1 Chronological development

The processes of environmental impact assessment have been regulated by law since January 1, 1970 came into force the first integrated environmental legislation in the United States (NEPA: National Environmental Policy Act). This law specifies, among its objectives the need "a national policy that contributes to a good and fruitful harmony between people and their environment" and "promotes initiatives to prevent or eliminate damage to the environment, the biosphere and stimulate the welfare and wealth of people ". That means that not only refers to the physical environment but also the welfare of people and relationships between them. Therefore the EIA should address the social, socioeconomic and physical. U.S. law establishes a minimum content for environmental impact studies:

- The environmental impact of the proposed action.
- The adverse aspects that can not be avoided if the proposal thrives.
- Alternatives to the action filed.
- The relationship between short-term use of local resources and the maintenance or improvement of productivity in the long term.
- Irreversibly affected resources due to the proposal if successful.

In Canada, it was established in 1973, a process for assessment and environmental reviews so as to ensure that:

- The environmental effects must be considered at an early stage of new projects and programs.
- It is necessary to carry out the EIA before compromising decisions or acquire commitments for projects with a potentially negative effect.
- The results of the EIA are used in planning and decision making.

But it did not foresee the need of incorporating human aspects, and it is the exception in current law. Then in 1974, Australia was the country to establish legislation in line, following the model of the USA, like the other countries, currently being established and common practice both in developed countries as well as in many developing countries.

In Europe, the Netherlands were the first country to make EIA mandatory, but the European Union adopted a general procedure until 1985 (Directive 85/337/EEC of 27 June), despite having begun their redaction in 1975.

Spain made the adjustment after joining the EU in 1986 (RD 1302/1986 of 28 June) and did it in a way designed to prevent damage rather than punishment. The core content of the law was concentered in two documents: the Environmental Impact Study and Environmental Impact Statement. Some Autonomous Communities also legislated on this subject, within their competence.

3.2 Current Status

The EU has developed a new directive (97/11/EC of 3 March), after several years of experience with 85/337, which details more about the project obligations (in Annex I), contended the evaluations and completed the list of Annex II of projects in which the evaluation depends on each country, forcing further to develop mechanisms in order to decide which projects will be assessed environmentally.

Spain adapted its legislation again with the approval of RD 9 / 2000 of 6 October. Besides the modifications of the lists in Annexes I and II, including Annex III in establishing the criteria by which the draft contained in Annex II, should be subjected to the EIA process, either by characteristics of the project, by its location or the potential impact.

The law requires that this decision is reasonable and excludes public projects for which the Autonomous Communities, within its powers, have established a requirement.

In Catalonia, the legislation was adapted, before the Spanish, the new European directive by law Intervention Comprehensive Environmental Management (Law 3 / 1998 of March 27).

Recently environmental assessment is regulated in Spain by Law 21/2013, of December 9, on environmental assessment (of plans, programs and projects). Since the legislation changes over time (and is different for each jurisdiction), the project team should consult the applicable regulations for each specific project at the time it is carried out. The web pages of the ministries of environment or similar of each country are usually the first place where it must be accessed for it.

From the legal point of view (taking Law 21/2013) it is understood by:

✓ ***Environment Effect investigation.*** The document prepared by the developer that contains the information necessary to evaluate the possible significant effects of the project on the environment and allows appropriate decisions to be taken to prevent and minimize such effects. This study should identify, describe and assess appropriately, and depending on the particularities of each specific case, the foreseeable notable

effects that the realization of the project will produce on the different environmental aspects and must contain, as a minimum:

- A *description* of the project to be evaluated, with an estimate of the types and amounts of waste discharged and the resulting emissions of matter or energy.
- A *statement* of the main alternatives studied, including alternative zero, or failure to carry out the project, and a justification of the main reasons for the solution adopted, taking into account the environmental effects.
- An assessment of the direct or indirect, cumulative and synergistic foreseeable effects of the project on population, human health, flora, fauna, biodiversity, geodiversity, soil, subsoil, air, water, factors, climate change, landscape, material assets, including cultural heritage, and the interaction between all the mentioned factors, during the implementation, exploitation and, if applicable, demolition or abandonment phases of the project.
- A description of the measures that allow preventing, correcting and, where appropriate, compensating for adverse effects on the environment.
- An environmental monitoring program.
- A summary of the study and conclusions in easily understandable terms to guarantee the possibility of public participation in the process.

Environmental impact studies serve to prevent and communicate the environmental consequences or effects that certain actions, plans, programs or projects can cause to human health and well-being and to the environment.

- ✓ **Environmental impact statement.** It is the mandatory and determining report of the environmental body with which the ordinary environmental impact assessment concludes, which assesses the integration of environmental aspects in the project and determines the conditions that must be established for the adequate protection of the environment and natural resources. during the execution and exploitation and, where appropriate, the dismantling or demolition of the project.
- ✓ **Environmental Impact Assessment (EIA).** The terms environmental impact assessment and environmental impact study are often used as synonyms, although it is convenient to distinguish between the two: The study is the technical document that we have already defined previously and the Environmental Impact Assessment (EIA) is the administrative

procedure by which The impact study is analyzed and the corresponding impact statement is made, as indicated in the legislation.

However, according to Catalan legislation (Law 3 / 1998) means Environmental Impact Assessment "analysis of the environmental effects of the activity that contains a description and, especially, facilities, raw materials and auxiliary processes, products and consumption of natural resources, energy and emissions of all types and their impact on the environment together. It also includes the impact that may result from abnormal operating conditions, incidents and accidents. "That is defined as environmental impact assessment that the Spanish legislation and defined as environmental impact study".

3.3 General definitions

Environmental factors. Supporting human activities:

- Physical-chemical factors (land, water, air, climate)
- Biological factors (flora, wildlife, soil, ecosystems)
- Social factors (demography, land use, public health, artistic and cultural values, etc.)..

Change any modification / alteration of the environment:

Natural change: Modifications occurred in the territory without the action of man.

Induced change: Modifications produced by human activities.

Environmental impact: Every positive or negative effects, that various actions occurring on various environmental factors. It considers the impact of differences between the states that would be the environmental factor for natural change, i.e. of not carrying out action and anticipating the expectation when it takes place. That is the difference between pre- project state and the final state after human action and serves to assess the consequences that have a certain effect on the environment. A project or activity does not always produce the same effects; these depend on the environment in which action is executed.

Capacity or ability of a territory for every human action is an intrinsic characteristic of the territory, derived from the elements that shape climate, orientation, soil type, water resources, flora, wildlife, etc... It can be defined as the capacity of the environment to meet the needs of a particular action or project (water needs, ground services, transport, etc.)...

Environmental fragility can be defined as the susceptibility of the

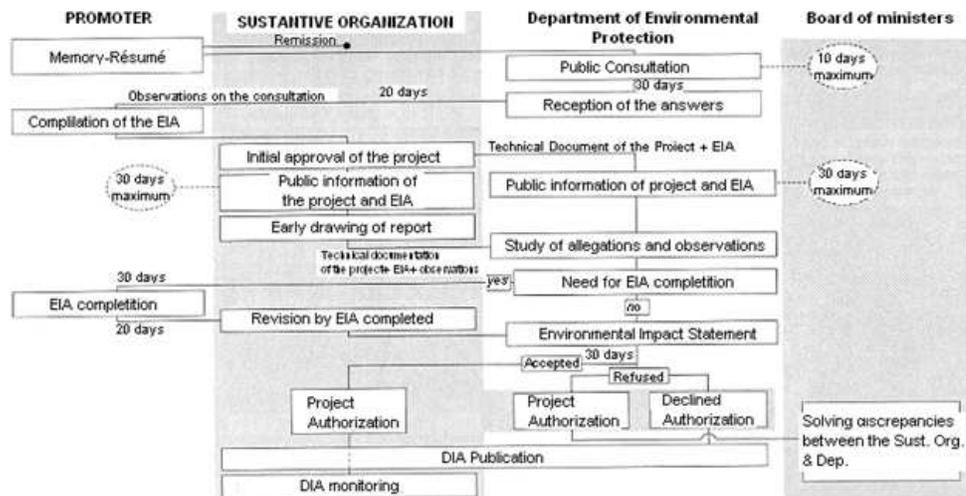
environment to be affected by a particular action. This shapes the same intensity of activity which will cause an impact of major magnitude of environment with a high fragility. From a legal standpoint (Annex 1 of the RD 1131/1988), it means:

Environmental impact study. The technical document needs to be submitted by the developer and on the basis of which produces Environmental Impact Statement. This study should identify, describe and assess properly, and depending on the particularities of each case, the substantial impact anticipated that the realization of project would produce on the different environmental aspects and prime contain, like at least:

- A description of the project to assess
- A description of measures taken to prevent or reduce the negative effects or address the more significantly negative effects of project on the environment.
- The data used to identify and assess the main impacts
- A non-technical summary to ensure the possibility of public participation in the process.

They serve to prevent and communicate the consequences or environmental effects that determine actions, plans, programs or projects may cause to human health, welfare and the environment.

Impact statement. The pronouncement of the competent environmental authority, which is determined with respect to the predicted environmental effects, whether or not to carry out the planned activity, and if so, what conditions should be established in order to adequate protection environment and natural resources. The terms of environmental impact assessment and environmental impact studies are often used interchangeably, although it is useful to distinguish between the two: The study is the technical document which we have defined above and the Environmental Impact Assessment is the administrative



Figs. 3.1 show diagrams of the processes of environmental impact assessment of projects, existing in Spain.

procedure by which the study analyzes the impact and the related impact statement, according to that indicated in the legislation.

3.4 Environmental Impact Assessment (EIA)

Environmental impact studies are intended to identify, describe and assess the likely impacts that the implementation of an action or execution of an activity will have on health, natural resources and environment, with the aim of minimization. They apply to projects (industrial or civil) in its planning phase in order to define its potential effect on the environment, incorporating measures to redress the negative effects already in the design, decide the location in areas of low impact or well prohibiting the execution of projects is not compatible with the receiving environment.

The analysis of these effects can be approached from two perspectives, which are also complementary:

- ✓ **Integrated planning.** No splitting of imposed localization, but the goal is to find those locations. The objective is met with the mapping of environmental impact (map skills and map of impacts).
- ✓ **Specific project or action.** Its aim is to clarify the impact of different alternatives to determine the technology, location, etc.. for a low impact activity and means of minimizing impacts.

One of the main problems for the correct application of instruments of environmental impact assessment is in the low priority given to environmental aspects in studies of alternatives, such as technology, location, operation, decommissioning, etc. Industrial projects are often performed this study only from the point of view of different applicable technologies, but in most cases the location is already decided in advance, which in many cases, the need to implement corrective measures to not have considering the choice of a preferred location.

In this context it is important to assess impacts on all phases of the project:

- Planning
- Design
- Construction
- Operation
- Decommissioning

In the draft design stage or initial approval of a management plan or project should be incorporated into the Preliminary Impact Assessment, for both if you have to choose between different alternatives, such as whether to include corrective action, is much more feasible when the

preliminary activity is that when the project is finished. At each stage the required depth is different and therefore the project moves forward so should do the impact study.

3.5 Purpose of the Environmental Impact Assessments

The purpose of the EIA is to consider the environmental aspect as an element in the evaluation of a project. This factor complements the social, technical, economic, financial... comprising a project. It is a requirement under administrative processes. Should be considered as the projects, due to its nature, its scale and location, have and have had an impact on the environment. Also actions can occur that require actions to their correction, thereby protecting the health, quality of life, diversity of species, ecosystems and natural resources.



Fig. 3.2. The terrestrial biosphere has never been in our hands as much as in these moments. Engineers, during the development of our profession we must have a great responsibility in their care

EIAs are a vital part in every project since the study and analysis of environmental conditions for taking action to protect and conserve the environment during the design phase. That is, is an element of prevention. By acting as an element of prevention should be used as an element of decision from the initial phases of the project and not as a justification for decisions already taken.

The analysis of these effects can be approached from two points of view, which are also complementary. The first is integrated planning, where it is not based on imposed locations, but the objective is to search for those locations (by preparing environmental impact maps). In the case of specific projects or actions, the objective is to specify the impact of the different alternatives. This is used to determine technology, location, etc. of least impact for an activity and the ways of minimizing impacts.

One of the main problems for the correct application of the instruments of evaluation of the environmental impact, is in the little importance that is given to the environmental aspects in the studies of alternatives, both technological, location, exploitation, dismantling, etc. . On the other hand, in industrial

projects this study is usually carried out only from the point of view of the different applicable technologies, but in most cases the location is already decided in advance, which, in many cases, increases the need to implement corrective measures as the choice of an optimal location has not been considered. In this context it is important to assess the impacts in all phases of the project, from planning and design, through construction and operation to the dismantling phase. The EIA, acting as a prevention element, should be used as a decision element from the initial stages of the project and not as justification for decisions already taken. When we are in an installation project, in the preliminary draft or initial approval phase of a management plan or a project, the Preliminary Impact Assessment should be incorporated. This is due to the fact that, whether to choose between different alternatives or to include corrective measures, this is much more viable when the activity is in the preliminary project than when the project is finished. In each of the stages the required depth is different and therefore, as the project progresses, the impact study must also do so.

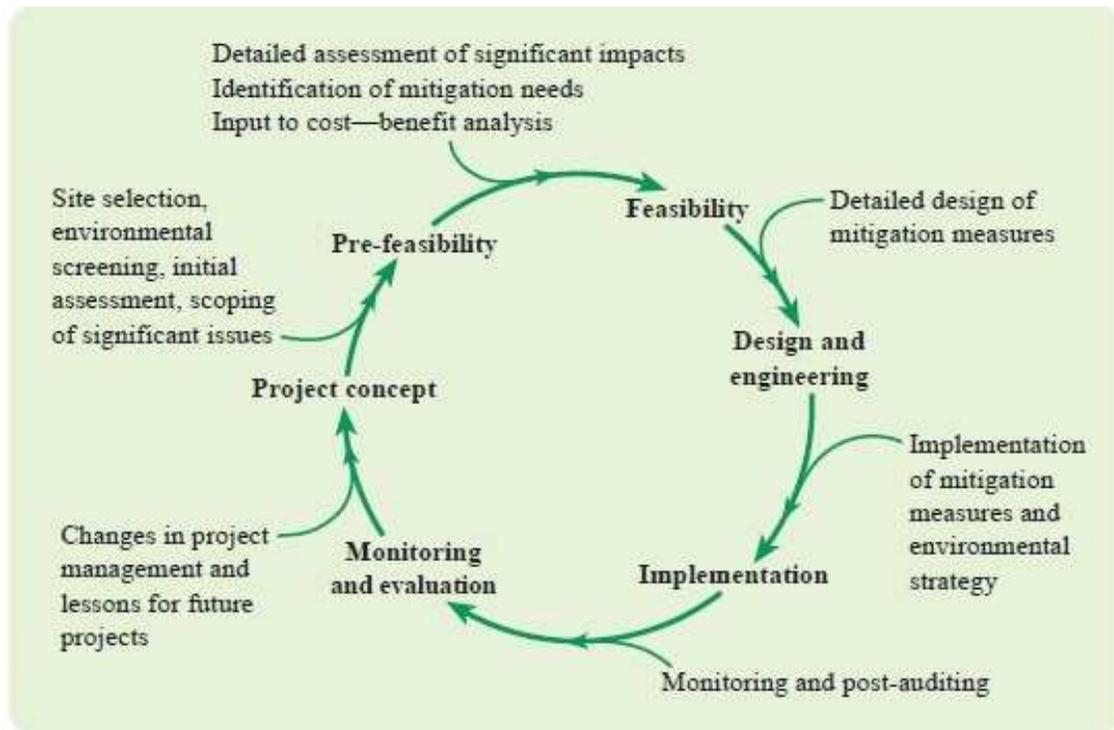


Fig. 3.3. EIA and the project cycle thanks to <https://sustainablecityessustainableworld.blogspot.com/>

Types of Assessments

Depending on the complexity of studying different levels of depth. The degree of depth is not decided by the developer, but the environmental authority.

Environmental Report. EIA can not be considered, but an elementary study of the effects of a project that does not require an EIA. They often include the environmental and remedial action taken. They often asked to ensure that the designer has taken into account the potential environmental impact. If at the execution of the report is found that any impact could be more important than anticipated, the authority may require further evaluation.

Preliminary Evaluation. Allows an initial identification of the impacts and takes the necessary decision whether simplified or detailed assessment, it is not necessary to go deeper or even that the project can not be environmentally feasible. It is performed in the initial stages of the project and are employed in the study of alternatives as a tool for decision making.

Simplified evaluation. It does not require a very high level of depth and ignores some aspects. Which is usually done in the draft design stage or in projects in Annex II of Act 9 / 2000.

Detailed Assessment. It is usually done in projects in Annex I of the Law 9/ 2000 or when it is requested by the environmental authority.

Content of an EIA

The content of an environmental impact study must include:

1-Project Description and in particular:

- ✓ Description of the physical characteristics of the whole project and demands for land utilization in the early stages of construction and operation.
- ✓ Description of the main characteristics of manufacturing processes.
- ✓ Estimate the types and quantities of waste streams expected.

2-If necessary, an outline of the main alternative solutions that have been studied and an indication of the reasons for their choice, in reference to the effects on the environment.

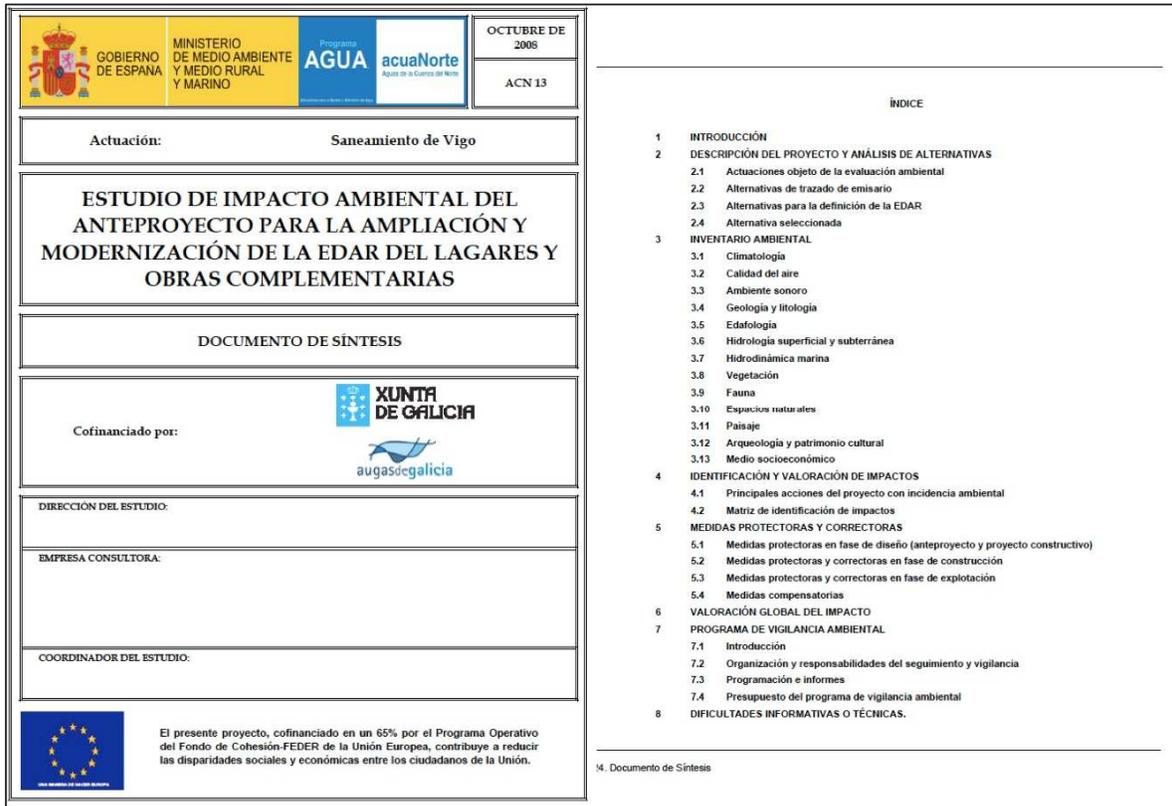


Fig. 3.3. Example cover and index of an environmental impact

3-Description of environmental elements may be affected by the proposed project.

4-Description of the effects that the proposed project is likely to occur on the territory: direct, indirect, cumulative, short, medium and long term, permanent and temporary, positive or negative:

- ✓ The fact of the existence of the project
- ✓ The use of natural resources
- ✓ The generation of waste streams

5-Description of measures envisaged to prevent or reduce and where possible offset significant adverse effects on the environment.

6-A non technical summary.

7-An examination of any difficulties (technical deficiencies or lack of knowledge) encountered in compiling the required information.

Preliminary Evaluation. Allows an initial identification of the impacts and takes the necessary decision whether simplified or detailed assessment, it is not necessary to go deeper or even that the project can not be environmentally feasible. It is performed in the initial stages

of the project and are employed in the study of alternatives as a tool for decision making.

Steps for proucing an EIA

An EIA should always start by identifying the characteristics of the project, from an environmental point of view. This includes analyzing the objectives of the project, to judge whether they can be achieved with other approaches more adapted to the environment or studying alternatives to the project, to see to what extent they have been considered the most adapted to the environment. The technology used in the project, the project development program (construction, development, modifications, abandonment and dismantling) and the requirements of the project during the construction and operation phases must be known. It will also be necessary to analyze the geographical location of the project, verify compliance with current environmental legislation (protected species, discharges, emissions to the atmosphere) and review the inventory of emissions from discharges, waste generation, noise, products handled and final destination of the installation.

The steps must be:

1. Identification of project characteristics
2. Analysis of the receiving medium
3. Selection of evaluation criteria
4. Identification and assessment of impacts
5. Alternatives developed
6. Formulation of remedial measures
7. Communication of results
8. Monitoring of the plant. Environmental Monitoring Plan

There is a legislative tendency to propose lists of actions and projects that must be evaluated, and to separate and propose different procedures (complete or detailed evaluation, simplified evaluation) in the content according to the magnitude of the proposal (action, plan, program, project). The legislation includes lists of projects that must pass an environmental assessment procedure and of which, as a guideline, they should pass it. The European Union published the first lists (Annexes I and II of Directive 85/337 / EEC) and in Spain they were adopted, but also including some other types of projects.

However, the appearance and severity of consequences for the environment does not depend solely on the type, magnitude and characteristics of the project in question, but there are other factors that make small facilities have considerable environmental consequences at the local level, or that the accumulation of activities or the consumption of resources are also of considerable consequences. Therefore, it is

advisable to consider the environmental conditions in all projects.

RD 1/2008 (in force at the time of writing this text) defines which projects must undergo an Environmental Impact Assessment. In some cases, said law directly defines the need for certain types of projects to carry out an EIA. In other cases, the law stipulates that the competent environmental authority must decide whether or not the evaluation is necessary, based on criteria also specified in the law. As an example, Table 4.3 shows for a group of specific projects (industry).

3.5 Identification of projects requiring EIA

There is a legislative tendency to propose action lists and projects to be evaluated, and separate and propose different procedures (full or detailed assessment, evaluation simplified) in content depending on the extent of the proposition (action, plan, program, project). The legislation includes lists of projects that must pass a mandatory environmental assessment procedure and that guidelines should pass it. The European Union published the first list (Annex I and II to Directive 85/337/EEC) and Spain were taken but also including some types of projects.

However, the occurrence and severity of consequences for the environment, not only depend on the type, extent and characteristics of the project in question, but there are other factors that make small plants may have significant environmental consequences locally, or accumulation of activities or resource consumption, are also of considerable consequence. It is therefore advisable to consider the environmental conditions in all projects.

Thus, Community law has extended and amended the list of Directive 85/337/EEC, with those in the Directive 97/11/EC and the Spanish legislation incorporated in Law 9 / 2000, which in its Annex I, shows the projects that must undergo environmental impact assessment, classified into 10 groups:

Group 1	Agriculture, forestry, aquaculture and livestock
Group 2	Mining and quarrying Industry
Group 3	Energy Industry
Group 4	Ore and steel industry and Production and metal processing
Group 5	Chemical industry, petrochemicals, textiles and paper
Group 6	Food Industries
Group 7	Infrastructure Projects
Group 8	hydraulic engineering projects and water management
Group 9	Waste treatment and management Projects
Group 10	Other projects

In Annex II, includes, in 8 groups, projects should only be subject to evaluation of impact upon the decision of the environmental authority in accordance with the criteria outlined in Annex III. The groups are the

same as those in Annex I with the exception of 6 and 9. The criteria set out in Annex III, refer to:

1. The project characteristics:

- The size of the project
- The cumulation with other projects
- The use of natural resources
- The generation of waste
- pollution and nuisances
- The risk of accidents, having regard in particular to substances or technologies used.

2. The location of projects.

- The existing land use
- The relative abundance, quality and regenerative capacity of the area's natural resources.
- The capacity of the natural environment, paying special attention to certain areas (listed in Annex III of the Act 9 / 2000).

3. The characteristics of the potential impact.

- The extent of the impact (both geographically and in terms of population affected)
- The transboundary impact
- The magnitude and complexity of the impact
- The probability of impact
- The duration, frequency and reversibility of impact.

EIA mandatory (Annex I del RD 1/2008)	EIA depending on whether the environmental authority requires it (Annex II del RD 1/2008)	Criteria for requiring the EIA by the environmental authority
<p>a) Crude oil refineries as well the gasification and liquefaction facilities for at least 500 tons of coal from bituminous shales per day.</p> <p>b) Thermal and nuclear power plants: 1. Thermal power plants and other combustion facilities with thermal power of at least 300 MW. 2. Nuclear power plants and other nuclear reactors, including the final decommissioning or decommissioning of such plants and reactors</p> <p>c) Installation of reprocessing of irradiated nuclear fuels.</p> <p>d) Industrial facilities for the production of electricity, steam and hot water with thermal power greater than 300 MW.</p> <p>e) Pipelines for the transportation of gas and oil with a diameter of more than 800 millimeters and a length greater than 40 kilometers.</p> <p>f) Construction of overhead lines for the transport of electrical energy with a voltage equal to or greater than 220 kV and a length greater than 15 kilometers.</p> <p>g) Facilities for the storage of petroleum products greater than 100,000 tons.</p> <p>h) Installations for the use of wind power for energy production (wind farms) with 50 or more wind turbines, or that are less than 2 kilometers from another wind farm</p>	<p>a) Industrial facilities for the transportation of gas, steam and hot water; transportation of electrical energy by overhead lines (projects not included in Annex I), which are longer than 3 kilometers.</p> <p>b) Industrial manufacture of coal and lignite briquettes.</p> <p>c) Installations for the production of hydroelectric energy (when, according to what is established in Annex I, any of the works that constitute the installation does not require it).</p> <p>d) Oil and gas pipeline installations (projects not included in Annex I), except on urban land, that have a length greater than 10 kilometers.</p> <p>e) On-site natural gas storage. Tanks with a unit capacity greater than 200 tons.</p> <p>f) Underground storage of combustible gases. Installations with a capacity greater than 100 cubic meters.</p> <p>g) Facilities for the processing and storage of radioactive waste (not included in Annex I).</p> <p>h) Wind farms not included in Annex I.</p> <p>i) Industrial facilities for the production of electricity, steam and hot water with thermal power greater than 100 MW</p>	<p>1. Characteristics of the projects: The characteristics of the projects should be considered, in particular, from the point of view of: (a) the size of the project, (b) the accumulation with other projects, (c) the use of natural resources, (d) the generation of waste, (e) contamination and other inconveniences and (f) the risk of accidents, considering in particular the substances and technologies used.</p> <p>2. Project location: The environmental sensitivity of the geographical areas that may be affected by the projects should be considered taking into account (a) the existing use of the soil, (b) the relative abundance, quality and regenerative capacity of natural resources of the area, (c) the carrying capacity of the natural environment, with special attention to wetlands, coastal areas, mountain and forest areas, nature reserves and parks and areas classified or protected by the legislation of the State or Autonomous Communities or areas of special protection</p> <p>3. Characteristics of the potential impact: The potential significant effects of the projects must be considered in relation to the criteria established in the previous sections 1 and 2, and bearing in mind the extent of the impact (geographical area and size of the affected population), the transboundary nature of the impact, the magnitude and complexity of the impact, the probability of impact and the duration, frequency and reversibility of the impact</p>

Table 3.1. Types of energy projects in Spain that require a mandatory Environmental Impact Assessment or where the competent authority is the one who must decide based on established criteria (summary) according to RD 1/2008.

ANNEX A. Types of impacts

Human activities may generate impacts of different types:

- Impact of land use change:

Reason: Occupation of territory Effects:

- Irreversible
- Destruction of soil
- Destruction of vegetation cover
- Loss of wildlife
- Modification of drainage
- Changes in the stability and evolution of natural systems

- Impacts of pollution:

Reason: Bridging the assimilative capacity Effects:

- In chain (from air to soil or water deposition, rain. Etc. The soil food web by ingestion of the food chain air inhalation, soil percolation to aquifers, etc.).
- Transmit distance
- On the flora
- On the fauna
- About architectural values
- On the leisure
- ...

- Impacts on natural resources

Reason: Consumption Effect:

- Shortage of some materials. Resource depletion
- Water scarcity
- ...

- Other Impacts

- Increased population. Land and infrastructure requirements
- The need for roads. Land needs
- Increased traffic. Increased air pollution and noise.
- ...

ANNEX B. Initial questionnaire

Annex B contains a questionnaire with some questions that need answering for the scope and scale of the project, the magnitude of their potential impact and scope of the study to be performed. Below is a list to facilitate the **Identification of project characteristics**

- ✓ Analyze the project objectives, to assess whether other approaches can be achieved with more adapted to their environment.
- ✓ Consider the alternatives to the project, to see to what extent they were considered particularly suited to the medium.
- ✓ Verify compliance with existing legislation on environmental (protected species, discharges, emissions to the atmosphere).
- ✓ Analyze the geographic location of the project.
- ✓ Requirements of the project during construction and operation phases
- ✓ Technology used in the project.
- ✓ Inventory of emissions, discharges of waste generation, noise, product managed and final destination of the installation.
- ✓ Development Program of the project (construction, development, modification, abandonment and decommissioning)

Below are lists of questions it is advisable to ask (and answer) when you start the study of possible environmental impacts of a project. This list is not exhaustive.

Problem definition phase

At the beginning of a process of completing the EIA, in its preliminary stage, there is a set of basic questions that must be made in order to know the size of the project, the magnitude of their potential impact and scope of the study to be undertaken, such as :

- What type of project will be carried out? (urban, infrastructure, resource exploitation, industrial, etc.).
- What is the characteristic dimension of the project?
- What area will occupy the proposed project?
- Is punctual type (located on a specific area of the territory) or linear (one axle on the territory)
- How large is the area potentially affected.

- What part of this area will be affected by the project and what area is intended to what is the project itself?
- How long will the project take?
- What are the most prominent characters, from the standpoint of the project?
- What are the most prominent characters from the environmental viewpoint, in the affected area? Influence the project in Florida? How?
- "The project will affect wildlife? How?
- "The project will affect the existing ecological features? How?
- What is the purpose of the environmental assessment?
- Are there any statutory or legal limitations affecting the natural environment?
- What information is available about the characteristics of the environment in the area where they will carry out the project?

This should lead us to define first and as a key element, the territorial scope which should confine the study, and an initial discrimination of the significant elements of the binomial-project environment, which may be involved.

Items to be evaluated in a draft industrial characteristics

Assimilative capacity of the location

- ✓ Assimilative capacity of the location can be considered as the capacity of the location to absorb the discharge of effluents without damage in the short and long term. (This capacity varies depending on the characteristics of the possible different types of effluent).
- ✓ Have you considered alternative sites or locations in an effort to prevent or mitigate environmental degradation?
- ✓ Are there water studies, geological and meteorological localization to anticipate and minimize potential damage to humans, flora and fauna? More specifically, will the wastewater be discharged directly or indirectly to the outside? What will the receiving environment? Have there been studies of the physical, chemical and biological, of the receiving water, such as temperature, flow regime , dissolved oxygen, chemical oxygen demand?
- ✓ Does it create waste in the proposed plant? Is it scheduled to characterization? Where is the plan to treat them, in case they are incurred?

Design Phase: Process

This includes the basics of the process to be used in the proposed mill, or energy supply sources, water supply. The environmental aspects of a project starting with the decision to use a certain process.

The manufacturing unit operations should be designed to maximize yields

and recyclability, and minimize the generation of waste streams. The power supply analysis should consider the materials available in the area, besides the traditional ones.

- ✓ What elements should be incorporated into the design of the plant from an environmental standpoint?
- ✓ Have you considered the possibility of using a clean technology, the entire process, or to one of the processes involved?

Construction phase

Includes all operations to bring forward during the construction of the plant, including temporary constructions.

- The construction plan has taken into account ecological factors?
- Are there any actions to minimize environmental damage by road construction, excavation, landfill, etc..?

Operation Phase

- Are there any mechanisms for safe handling of hazardous materials, if they exist?
- Is there any risk of explosion or accidental discharge?
- Is there an internal security plan, incorporating all necessary operational mechanisms?
- Special measures have been taken in the systems of storage of hazardous materials?
- Are there any appropriate precautions to prevent loss of the storage tanks?
- What types and quantities of waste streams should the plant produce?
- What systems or pollution control are expected?
- Are the discharges, if any, exist in aquatic systems are compatible with present and future uses for them, especially during periods of drought?
- Can waste streams have synergistic effects with other materials?
- The waste streams contain potentially toxic materials?

- Should expect effects of discharges of wastewater into the receiving environment, such as growth of algae, fish kills, etc..?
- Do you plan your monitor? Through specific measures, periodic, or real time?
- What systems are designed to remove toxic materials?
- In case of waste treatment system thinks it used?
- Have you considered or recycling of such waste?
- What arrangements have to train plant personnel in managing the environmental aspects of it?
- How odors be controlled?

Phase decommissioning or abandonment

- The system is scheduled for dismantling or disposal?
- Do you know the environmental impact of waste generated in the decommissioning or abandonment?
- Is it necessary or conditioning of waste and / or land?

Raw materials

- What materials will be used?
- How will these materials obtained? Are mining operations or obtaining required shall also be subject to an EIA?
- Where the sending system (transport) of raw materials to the intended location, were taken into consideration the possible environmental impacts? Special attention should be given to transport and handling of hazardous materials and packing systems.
- Is there a plan or a draft environmental aspects of mining, transport and storage of raw materials

Social and cultural aspects

- How and what do extent the presence and operation of the plant alters the environment of its location, affects of the economic and social activities?
- Will be established or exacerbated problems of urbanization?
- Will there be an increase in traffic?

Aspect of health

- The facility will produce emissions that directly or indirectly affect health?
- What is the new health problems may arise?
- Can transport or atmospheric, or water systems, pollution affect the health, local or regional level?
- What steps have been taken to ensure workers a health and safety program?

Final waste

- What management is expected to be final waste?

Expansions

- What is the form future projects associated with the object of study, may affect the environment?

ANNEX C. Impacts on the environment

Impacts are always characterized by their effects in relation to the state of the environment in the situation before the implementation of the activity. The changes in the environment due to human activity may be basically of two types:

- Direct: Destruction of vegetation cover for direct action, animal hunting, fishing, grazing, quarrying, elimination of geomorphologic structures, etc.
- Indirect: By interfering with the normal development life cycles, such as contaminants, food disappearance, increased human presence, noise, etc..

To perform the evaluation of potential environmental impacts of the project chosen will be necessary to know in detail the initial state of the environment concerned. We understand the environment concerned that deals with the implementation of the project, which is affected during its implementation and its complementary works and altered during the operation and abandonment of the activity. This detailed analysis requires a thorough study of fundamental aspects of the environment that may be affected by the project implementation.

The stage of knowledge, analysis and environmental assessment, environmental inventory called, aims to describe any information that may be useful for identification of the system, its components, its conditions and developmental traits. In principle, subject to inventory the physical and chemical, biological and perceptual (landscape) of the territory, needed to define its structure and understanding of its operation and characteristics relating to human activity, and so on.

These collect and convey information operationally necessary and sufficient to describe the medium. Quality of results depend of the next steps and, ultimately, final decisions. The level of detail is conditioned by aspects of time frames for the completion and its cost. The factors and environmental indicators that are used to learn these features act very differently depending on the level of perception and therefore, according to the scope and scale of work covered. Depending on the extent of assessment required, the environmental inventory of the receiving environment can be established at different levels: minimum, desirable and dedicated. Logically, the duration of their implementation is not the same, while the minimum level of interest can be made in a short period of time, the specialized level requires long periods of time. To complete an exhaustive information on the environment concerned usually requires additional work done by specialists:

- Specific studies
- Fieldwork
- Collection and analysis of samples
- ...

This analysis is based, for each medium, in various disciplines and knowledge of each of the aspects in an integrated manner, characterizing the environment. These are:

- Middle abiotic
- Living Environment
- Middle anthropic

Detailed knowledge of the initial state of the environment concerned will adopt, based on this information, design or layout alternatives that best reconciles the project with the environment.

Assessment of environmental quality

There are several issues that arise in dealing with the assessment and could lead to the following questions:

- What is the meaning of quality of media characteristics inventoried?
- Who does or should do the assessment?
- How can be this assessment?
- How can they be comparable assessments of the different features?
- How do the different characteristics contribute to the overall environmental value of a specific point?

It draws regularly classifications or categories that can help assess the various elements that make up a particular environment. In this type of categorization is absolutely necessary to clearly define the meaning and relevant aspects of the various categories selected.

To assess the environmental quality, especially of the atmosphere and the aquatic environment has been carried to the definition of environmental quality criteria (also called quality objectives) and environmental quality standards, partly legally collected

Environmental quality criteria (CEC): "set of requirements that must be satisfied in a particular medium or a portion thereof, for the prevention, long-term health and environmental protection.

Environmental Quality Standards (ECA): "legally prescribed levels of pollution that should not be exceeded in a particular environment or part

thereof".

Information to be considered for knowledge, analysis and assessment of the receiving environment

1. GEOGRAPHICAL LOCATION (LOCATION): General and Detailed Map of the area concerned (a biotic)

2. DEMOGRAPHICS (POPULATION) and towns: Table and graph the time evolution of the population. Detailed map with the location of urban centers, pointing to their importance and accessibility. (anthropogenic)

3. OROGRAPHY: topographical map of the area concerned. (abiotic)

3. GEOLOGY: General Map and Detailed. (a biotic) (Geomorphology, soil, litho logy).

4. CLIMATE: (a biotic): Map showing the location of weather stations analyzed parameters indicating and measuring apparatus. Temperature (mean, maximum and minimum), precipitation (distribution, Maxims, Days per year, etc.), humidity, wind (intensity and direction), Solar Radiation, Cloudiness, Isometric (preferential zones, intensity, days per year, etc.) all this for the longest period of time depending on the meteorological data

series, represented in tables and graphs. It is convenient to use at least a monthly basis in order to know the typical evolution of the annual cycle.

5. HYDROLOGY (abiotic). Measuring points (Ticketing), volume, floods. Minimum monthly. represented in tables and graphs, along with a detailed outline of the watershed (must consider the main elements).

6. FLORA: Listings and Map (s) of distribution. (Biotic)

7. WILDLIFE: Listings and Map (s) of distribution. (Biotic)

8. UNIQUE NATURAL AREAS: Map (s) or site plan, noting its importance. Photos. (Biotic)

9. LANDSCAPE VALUE: Map (s) or site plan, noting its importance. Photos. (Anthropogenic)

10. CULTURAL HERITAGE: Map (s) or drawing, noting its importance. Photos. (Ant)

11.LAND USE: Distribution Map. (Anthropogenic)

12.BREEDING: Map(s) or plan of distribution, indicating its importance. Graphs and tables showing the evolution of the census. (Biotic)

13.INDUSTRY: Map (s) status and distribution chart of importance in terms of different sectors photos. (Anthropogenic)

14.TOURISM: Map (s) or site plan, noting its importance. Photos. (Anthropogenic)

15.ENVIRONMENTAL WATER QUALITY: Water quality stations, indicating parameters analyzed and methods of measurement. Map or floor plan. Graphics evolution.

16.Air Quality: air quality stations, indicating parameters analyzed and methods of measurement. Map or floor plan. Graphics evolution.

17.INFRASTRUCTURE: Network of roads, highways, expressways and highways. Railways. Airports. Energy infrastructure. Environmental infrastructure of urban waste water treatment or other treatment of waste (Urban, industrial, etc). Fire prevention infrastructure. Other. This represented on maps, drawings and diagrams, pointing out their importance and geographical location.

18.Other aspects (noise, vibration, archeology, paleontology, urban planning, quality of life, etc).

19.MINING: Map (s)or site plan, noting its importance. Photos. (Antrop)

4. Bibliography

Alonso, S.G., M. Aguilo, A. Ramos (1983). Guidelines and techniques for estimating the impact. Work of the Chair of Planning, ETSIM-UPM, Madrid, 225 pp.

Battelle Columbus Laboratories (1972). Environmental evaluation system for water resource planning. NTIS: PB-208822, 189 pp.

Canter, L.W. (1997). Manual of environmental impact assessment. McGraw-Hill. New York.

Colegio Oficial de Ingenieros de CCPP of Catalonia, Valencia, Extremadura and the Balearic Islands (1,990). The environmental impact. Barcelona.

Conesa, V. (1995) Methodological guide for the Environmental Impact

Assessment. 2nd Edition. Mundi-Prensa.

DGMA (1982). Environmental impact assessments. Environmental Thematic Units. Madrid, 80 pp.

DGMA (1989). Methodological guidelines for the preparation of environmental impact studies. Monographs of the Directorate General Environment No 1 Roads and Railways., No 2 Large Dams; afforestation No 3 Madrid, 165 pp., 199 pp, 181 pp.

Estevan Bolea. Maria T. (1984). Environmental impact assessment. Mapfre, Madrid, 609 pp.

Garcia Alvarez, A. (1,994). Practical Guide to Environmental Impact Assessment. (Projects and activities involved.) Ed Amaru. Salamanca

Gómez Orea, D. (1978). The physical environment and planning. CIFCA notebooks. 2 vols, Madrid. Volume I 143 pp. and Volume II 163 pp.

Gómez Orea, D. (1992). Environmental impact assessment. Spanish Agricultural Publishing House, SA, 222 pp.

Gómez Orea, D. Environmental Impact Assessment. Agricultural Spanish Ed. Madrid, 1994.

González, M.M. and Mendoza, E.M. Guia per l'ambientalització dels Projectes de Fi de Carrera. ETSEIB. Ed UPC. 1999.

Hernández Fernández, S. (1981). Ecology for engineers. The environmental impact.

Jain, R.K., L.V. Urban and G.S. Stacey. Handbook of environment impact analysis. Environmental Engineering Series. Rostrand Van Reinhold, 320 pp.

Leopold, L.B., F.E. Clarke, B.B. Hanshaw and J.R. Balsley (1971). A procedure for evaluating environmental impact. Geological Survey Circular 645, Washington, 13 pp.

MOPT (1,992). Guide for Preparing Physical Environment Studies: Content and Methodology. Madrid.

Munn, R.E. (1979). Environmental impact assessment. Principles and Procedures. SCOPE 5 (2nd Ed) John Wiley & Sons, 191 pp.

OECD (1979). Les études d'impact sur l'environnement. Paris, 78 pp.

WHO (1982). Evaluation rapide des sources de pollution de l'air, de l'eau et du sol. Geneva.

Ortega Dominguez, R. Rodriguez Muñoz, I. (1,994). Manual of environmental management

Ramos, E. (Editor) (1979). Physical planning and ecology. Models and Methods. University Library, E.M.E.S.A., Madrid.

Rau, J.G., Wooten, D.C. (ed.). (1,980). Environmental Impact Analysis Handbook. New York. McGraw-Hill.

Micaló Riera, Pere (2000). Environmental Impact Assessment. Cuadernos de Medio Ambiente. Ed Rubes. Barcelona.

Salvato, J.A. (1,992). Environmental engineering and sanitation. USA.

Seoanez Calvo, M. I col. (1,996). Environmental engineering applied to the continental environment. Spain.

Wathern, P. (ed.). (1,988). Environmental Impact Assessment. Theory and Practice. Hymand Unwin Ltd.

