Risk Regulation: Legal Requirements, Conceptual Foundations and Practical Experiences in Italy. Case Study of the Italian Energy Sector

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No. 90 / November 1997

discussion paper

ISBN 3-932012-13-1

ISSN 0945-9553

table of contents

Preface

One of the central issues in the controversial debate on energy systems is the evaluation of risks associated with different options for energy supply and demand. Models of risks evaluation help to promote a rational discussion about the criteria for judging the acceptability of energy options. These normative criteria should meet the test of intersubjective validity, i.e. they should be, at least in principle, agrreeable or acceptable to all affected parties. Any decision on acceptability is also a decision about the allocation of risks, because it determines the relationship between the costs for suffering the potential consequences of the remaining risks and the costs for risk reduction.

Any judgment on acceptable risk levels relies on explicit or implicit criteria to evaluate the appriopriateness of each risk evaluation model. Such a comparison of models for risk evaluation requires a selection of meta-criteria. We chose the following meta-criteria: efficiency, incentives for risk reduction, applicability / feasibility and distributive fairness. All models of risk evaluation have been analyzed and evaluated on the basis of these four meta-criteria. The purpose of the exercise has been to generate a comparative review of different evaluation models and to point out the relative advantages and disadvantages of each model according ot the meta-criteria.

In a democratic system a risk evaluation model may encounter support only if the interests of those who produce risks are equally important to the interests of those who suffer from these risks. Our starting point for analyzing risk evaluation models has therefore been the individual utility of both, the risk producers and the risk bearers. Individual utilities constitute the final yardstick for evaluating risk acceptability in an ideal world. The crucial question, however, is

how to aggregate individual utilities for collective decision making and how to include external effects. There are four basic models that promise at least a partial solution to the problem of collective decision making (see Fig. 1/ sorry Fig. 1 is not available at the moment).

The first basic model refers to governmental regulation. A governmental agency is given the mandate to determine an acceptable risk level. This level is binding for risk producers and risk bearers. From an economic perspective „risk“ is conceptualized as a public good that needs governmental intervention. This baisc model includes risk evaluation methods such as comparisons, quantitative or qualitative setting (Best Available Control Technology = BACT ; As Low As Reasonable Achievable = ALARA) and economic valuation (cost-effectiveness-analysis, cost-benefit-analysis, decision analysis).

The second basic model refers to methods by which acceptable risk levels are negotiated between risk producers and affected individuals. The role of governmental agencies is confined to determine the legal conditions for those negotiations and to assure that they take place in a fair setting. The participants of those negotiations tend to internalize risks by selecting a risk reduction and management strategy on which all affected parties can agree, in principle. If all affected parties are involved in the negotiations, external effects of imposing risks on third parties are effectively internalized. This model comes closest to the market approach to risk management. Beyond direct negotiations, liability law is used for ex-post compensation of potential victims. It can be based on two different principles: causality (weak or strong) or intent and negligence.

The third basic model refers to the elicitation of criteria by experts. This model can be combined with the governmental approach to risk regulation. The idea is that experts in various fields should be empowered to set standards or to define the threshholds between acceptable and non-acceptable risk levels. Instruments within this model include expert panels, Royal Commissions and similar propfessional councils. Formal procedures such as Delphi, Consensus Conferencing, or Meta Analysis are used to determine a collective judgment.

The fourth basic model builds upon discursive approaches to risk management. These models emphasize democratic decision making enhanced by competent knowledge input and fair

representation of social interests and values. Although there is some similarity to the market model of negotiation, the main idea is not to bargain between different interests, but to develop a common solution to the risk problems. This solution should be based to the exchange of arguments among the people who will be affected by the decision. Discursive methods include consensus conferences, citizen juris, citizen panels and similar forms.

Each of those solutions to risk evaluation has its advantages and disadvantages. The theoretical approaches to risk evaluation can be compared with the actual practice of risk regulation procedures in several countries. These procedures are described and analyzed in the following reports:

- **Energy risk evaluation in France** (Marc Poumadère, Ecole Normale Supérieure de Cachan, Claire Mays, Institut SYMLOG, Cachan), discussion paper No. 89

- **Risk Evaluation: Legal Requirements, Conceptual Foundations and Practical Experiences in Italy. Case Study of the Italian Energy Sector.** (Natascia Petringa), discussion paper No. 90

- **Risk Assessment in the Netherlands.** (Giampiero E.G. Beroggi, Tanja C. Abbas, John A. Stoop, Markus Aebi, Delft University of Technology), discussion paper No. 91

- **Risk evaluation in the United Kingdom: Legal requirements, Conceptual Foundations, and Practical Experiences with Special Emphasis on Energy Systems.** (Ragnar Löfstedt, University of Surrey, Guildford), discussion paper No. 92

- **Risk evaluation: Legal Requirements, Conceptual Foundations, and Practical Experiences in the United States.** (Dale Hattis, William S. Minkowitz, Clark University, Worcester, Mass.), discussion paper No. 93

- **Risk Assessment in the Federal Republic of Germany.** (Ulrich Hauptmanns, Universität Magdeburg), discussion paper No. 94

Each study describes the required legal and procedural processes for risk evaluation in each country with special emphasis on energy systems. The authors analyze the reasons and the philosophy behind the adopted procedures. Furthermore, each study documents the practical experiences with the present practice of risk evaluation and collects the critical remarks that have been published in the literature or that have been expressed to them in personal interviews. Finally, each study concludes with a critical evaluation and assessment of the legal requirements and the practical applications of risk evaluation.

The various reports convey an extensive insight into the theoretical foundations and practical experiences associated with risk evaluation procedures. All volumes together provide a substantial contribution to the ongoing debate about risk evaluation and harmonization of risk regulations within Europe and beyond.

Gerhard Pfister and Ortwin Renn, November 1997

I. INTRODUCTION: GENERAL STATUS OF ENVIRONMENTAL RISKS IN ITALY

Risks have increased significantly with the progression of modern technology. It is now necessary to make *socially acceptable decisions* about high risk technologies. We can either invest in risk reduction measures (*preventive approach*); accept risks and attempt to mitigate the inevitable ones (*i.e.* live with risks); or distribute risks *equitably* -- a costly approach. Risk-taking is a socio-political decision, however, there is still a great deal to learn about it. Managing technological risks (*politics of safety*) is afflicted by the problem of uncertainty. There is uncertainty about the definition and characteristics of risk; the scientific approaches to measure risk; the perceptions and cognitive patterns surrounding risk; and the decisional criteria used to manage risks.

Risk analysis is defined as the "identification of potential hazards to individuals and society and the estimation of the likelihood of any particular hazard occurring, using data, statistical analysis, systematic observation, experiment and intuition" (Renn, 1985, p.113). Risk assessment is the scientific process of defining the compenents of the risk in precise, usually quantitative terms. In technical risk assessments, this means specifying what is at stake, calculating the probalilities for (un)wanted consequences, and aggregating both components by multiplying the probalilities by the magnitude of the effects. Risk management refers to the process of reducing the risks to a level deemed tolarable by society and to assure control, monitoring, and public communication. Since risk refers to a potential of “real“ consequences, it is both a social and a representation of reality (Renn 1997, p. 14). Risk analysis also includes the following tasks: (1.) select the most appropriate data; (2.) decide how to aggregate vast amounts of data available; (3.) identify a yard-stick to compare risks; and (4.) effectively communicate risk information and possible alternatives to policy and decision-makers. The objective of this last point is to reduce the uncertainties surrounding risk regulation, and present the "best" alternatives available in an unbiased and understandable fashion. Yet, there is no *single* or *optimal* method for making risk acceptability decisions. This is

because societal factors differ from country to country and hence influence risk perception.

Even those countries perceiving risks in the same way, often disagree on **how** risks should be controlled and **who** should control them, hence, *technological determinism* must be abandoned. Technology alone does not suffice to regulate **all** risks. There is "no integrative theory that provides guidelines on how to model and measure the complex interrelationships among risk, risk analysis, social response, and socio-economic effects", however, there is little doubt that social factors play a significant role on risk (Kasperson *et. al.* 1988).

Risk analysis [1] and **evaluation** (especially for large-scale technologies) have played a negligible role in Italian environmental policy and decision-making. One major cause is that there is no established *definition* of risk nor are there adequate *measures* to evaluate environmental risks. Social systems continuously create and destroy definitions of risk and methodologies to study risk (Sartori, 1991). Secondly, there is the absence of a proper institutional infrastructure to deal with environmental risks. In Italy, there is still no conception of a research base to study cultural, institutional, political, or participative aspects of risk management. Finally, the social and political instability in Italy has been a major cause of why, to date, there is no appropriate methodology for managing risks; other priorities have pervaded. It is only recently, due to the pressure exerted by EEC Directives for the "harmonization" of environmental laws, that Italy has begun to demonstrate an interest in this field.

1.1. Philosophies Surrounding Environmental Risks in Italy

[1] *Otway* defines **risk analysis** as the use of available data, supplemented by calculation, extrapolation, theory, and expert judgement, to define the risks to people due to their exposure to hazardous materials or operations.

Otway claims that different countries have different regulatory approaches to risk because of their diverse governing style and institutional structure. Historical interests as well as national culture are also of significant importance. There are various systems which dominate and characterize our modern societies. These systems greatly influence the way risks are managed. The most obvious differences in risk policy are those between the U.S.A. and Europe. The United States style is characterized by a strong *interest group* participation, whereas, in Europe, risk policy is highly paternalistic and dependent on economic and administrative feasibility. *Otway* and *Renn* identify five regulatory systems: (i.) the adversarial system; (ii.) the consensual system; (iii.) the authoritative system; (iv.) the bureaucratic system; and (v.) the corporatist system. Italy is most typical of a combination of the *authoritative* and *bureaucratic system*. Centralized structures (*i.e.* the Ministries) make the final decisions, however, efforts are slowly being made to broaden discussions with other entities. It is also true that there has been negligible interaction with public groups, thus, reinforcing the authoritative system.

Values also significantly shape risk regulation. Since values influence research priorities, and so far there has been little priority on risk evaluation, it follows that the scarce information Italy has on risk, is what the Italian government has **chosen** to acquire. Our status of information will remain as such until government priorities orient themselves in favor of more risk research. Political interests prevail, whilst *science* continues to remain secondary!

The philosophy surrounding risk as well as other environmental issues, in Italy is based almost exclusively upon EEC legislation. The **Seveso Directive**, later enunciated in **DPR No. 175 (May 17, 1988)** [2], imposes strict measures for risk evaluation. It requires statistical and probabilistic information on possible accidents or risk events from various industrial activities. Whereas, in the energy sector, **EEC Directive No.**

[2] **DPR No. 175/1988** enacted the **EEC Directive No. 82/501** (June 24, 1982) relating to industrial risks. **EEC Directive No. 337** (June 27, 1985) formally imposed EIA for specific public and private activities. **DM** (May 20, 1991) created further modifications of these laws.

337 (June 27, 1985) legislated the inclusion of Environmental Impact Assessment (EIAs) [3] for energy projects. **DPCM (December 27, 1988)** later defined the norms for the designing of environmental impact assessment and the formulation of its judiciary compatibility with **Article 6** of **Law No. 349 (July 8, 1986)** relative to **DPCM No. 377 (August 10, 1988)**. In particular, Annex IV of **DPCM (December 27, 1988)** specifies the requisites necessary for the localization and licensing of thermoelectric and turbogas plants. Atmospheric emission standards legislated under **DPR No. 203 (May 24, 1988)** [4] and **DM (July 12, 1990)** also outline the licensing and authorization procedures necessary; this issue will be addressed later.

From personal communication with ENEL, SNaM, and other energy-related entities, it is evident that environmental risk studies are a requisite to their projects. [5] Environmental risk evaluation however does not occur separately; it is an integral part of conventional EIA methodologies, whereas *safety issues* (*i.e*. accidents) are addressed separately.

1.2. Objectives of the Report

[3] **EEC Directive No. 337** (June 27, 1985) Environmental impact assessment of specified public and private activities states the following.
"...the environmental impact assessment will identify, describe and assess in an appropriate manner...the direct and indirect effects of a project on the following bodies:
(i.) Human beings, flora, and fauna
(ii.) Soil, water, air, climate, and landscape
(iii.) Interaction between the factors mentioned above
(iv.) Material assets and the cultural heritage
* Information to the public ..."any request for development consent and any information gathered according to the Directive are made available to the public; the public concerned is given the opportunity to express an opinion before the project is initiated."

[4] The targets of **Article 1, 2** of **DPR No. 203** (May 24, 1988) include:
(a.) All installations that can produce emissions in the atmosphere.
(b.) Commercial characteristics of fuels and their use.
(c.) Standards and guidelines for atmospheric pollutants on outdoor air and the associated methods for testing, analyzing, and evaluation.
(d.) Standards for emissions and methods for testing, analysis, and evaluation.

[5] In Italy there is a clear differentiation betwwen risks. "environmental risks" and "safety issues" are dealt with differently.

The overall objective of this research paper is to offer new outlooks on risk evaluation/management in Italy. Several methodologies adopted in other countries (such as Germany and the United States) are likely to contribute significantly to this area and these will be addressed as a means of comparison as well as a means to integrate them into Italy's environmental program, where appropriate. A more thorough look at the objectives of this paper are the following:

- Assess the status of environmental risk analysis and risk evaluation in Italy.
- Clarify Italy's *rationale* and approach to risk evaluation.
- Identify the obstacles and limitations surrounding risk evaluation with special emphasis on defining the social, economic, and political constraints under which risk decisions are made.
- Utilize the Italian energy sector as a case-study to illustrate the procedural and normative criteria which energy facilities have to meet in order to be licensed and be granted authorization for operation.
- Set forth a series of recommendations on how to promote and improve risk evaluation in Italy.

Particular attention will be placed on *environmental risk* as opposed to *safety.* since thermoelectric plants and other energy facilities (with the exception of liquefaction of natural gas) do not reside in the "high risk" category. The **Seveso Directive** and its subsequent adjournments such as **DPR No. 175 (May 17, 1988)** touch upon energy facilities peripherally.[6] In discussing the energy sector (this report's case-study) it needs

[6] **ANNEX 1** of **DPR No. 175** (May 17, 1988) Industrial plants contemplated under **Article 1** of **EEC Directive No. 82/501**
(1.) Installations for the production, transformation, or treatment of organic or inorganic chemical substances that are used, or which use the following processes: alkylation, amination with ammonium, carbonylation, condensation, dehydrogention, esterification, halogentation and production of halogens, hydrogenation, hydrolysis, oxidation, polymerization, sulphonation, desulphonation, production and transformation of sulphurate derivatives, nitration and production of nitrogenous derivatives, production of phosphorous derivatives, production of antiparassitic agents and pharmaceutical products, distillation, extraction, solubilization, and mixing.
(2.) Installations for distillation or refining, or other types of transformations of oil or oil products.

to be clarified upstart that *environmental risks* rather than *safety issues* (such as fires, explosions etc.) will be addressed. Different approaches are used to evaluate *environmental* and *safety* issues; this paper will focus mostly on the former.

(3.) Installations for the total or partial removal of solid or liquid wastes *via* combustion or chemical decomposition processes.
(4.) Installations for the production, transformation, or treatment of gas fuel, such as gas from liquefied oil, liquefaction of natural gas, or synthesized gas.
(5.) Installations for dry distillation of coal and lignite.
(6.) Installations for the production of metals or metalloids *via* aqueous or electric energy routes.

II. ENVIRONMENTAL IMPACT ASSESSMENT : THE CONVENTIONAL METHODOLOGY FOR ENVIRONMENTAL RISK EVALUATION

2.1. Status of EIA in Italy

EIA is mandatory for several activities. **Article 1** of **DPCM No. 377 (August 10, 1988)** states that EIA is required for the following activities: (1.) crude oil refineries , gasification and liquefaction of coal installations producing more than 500 tons of carbon and/or bituminous waste per day; (2.) thermal plants and other combustion plants having a thermal capacity of at least 300 MW, as well as nuclear plants and other types of nuclear power reactors (excluding those research plants for the production and refinement of fossil fuels below 1 KW of thermal capacity); (3.) permanent storage or final disposal of radioactive wastes; (4.) melting of steel and cast-iron; (5.) extraction and processing of asbestos (*amiant*); (6.) highways, motorways, and trading ports; (7.) integrated chemical installations; (8.) installations which reduce toxic and noxious wastes *via* incineration plants, chemical treatment, and landfilling of toxic and hazardous wastes; and (9.) dams and hydrological infrastructures to store water with a height of more than 10 metres and/or a capacity above 100.000 cubic metres. EIA is a multi-stage process to assess environmental risks; a process and tool for project planning and decision-making. Specific legislation has been adopted by the State following the **June 27, 1985**, **EEC Directive No. 337** on EIA.

There are many advantages and disadvantages which can be accrued from EIA. EIA attempts to resolve the many uncertainties surrounding risk. The primary role of EIA should be to increase the transparency of environmental decisions made; to understand the vulnerability of social risks on individuals; simplify individual and public conflicts regarding risks; as well as establish a framework to study the complex nature of risks in a more rational way (Di Friedberg, 1991). There is a great deal to learn

from comparative studies, therefore, it is worthwhile to divert resources and efforts towards analyzing the different methodologies various countries use to assess risks.

Critics of EIA in Italy argue that EIA has acquired a purely formal role in environmental project/planning. *Lewanski* (1991) claims that the contribution of EIA as an instrumental tool for decision-making is highly questionable, and that its effectiveness is scarce. This is due to the rigid and inflexible nature of the existing *ever-so-bureaucratic* institutional infrastructures. Italy relies on an *authoritative* and *over-bureaucratized* model which lacks the pragmatism and versatility to respond to change or social forces.

The utility and benefits of EIA will be felt, ***if and only if***, there is a degree of trust and cooperation amongst interested entities and the public. Preventive and mitigatory strategies are essential for the success of any environmental program. Granted, trust will not occur overnight. One option is to resort to professional mediatory specialists, who can facilitate risk decisions. Re-establishing the credibility of the public in the decision-making body is a target which should not be under-estimated.

2.2. Incorporation of Risk Assessment/ Evaluation within EIA

> "The most appropriate action is the modification of EIA regulations/ procedures to include specific risk-related requirements that address risk and hazard assessments, and the inclusion of contingency plans, as appropriate in EIA studies." (Canter, 1991 p. 15)

Risk assessment (RA) and **environmental health impact assessment** (EHIA) are now emerging as valuable complements of EIA. They are not clearly defined and

evident in EIA, however, they have a great deal to offer to the conventional EIA methodology. They go beyond the mere establishment of quality standards and carcinogenic effects, to incorporate ecological and non-carcinogenic risks (Canter, 1991).

RA is used to predict consequences in terms of risks and hazards, (undesired or unexpected), that are generated from an activity. Accidents are inherent in most large-scale technologies. Zero risk is a myth, and consent (*i.e.* acceptance of risks) plays a large role. Let us take industrial activities as an example. Enclosed is a summary of the situation in Italian industries in 1981.

Table 1 Situation of Risk (1981) in Italian Industrial Activities

Elaboration of Data (in INAIL, Statistical Data No. 4, 1982)

INDUSTRY	Accidents	Occupation Related Deaths	Total	Number of Workers	Annual Risk of Death per Worker
Chemical Industry	48	28	76	558.210	$1,36 \times 10^{-4}$
Electricity Plants	29	2	31	161.189	$1,92 \times 10^{-4}$
Wood and Related Products	31	7	38	281.265	$1,35 \times 10^{-4}$
Metallurgy and Machinery	181	132	313	164.069	$1,91 \times 10^{-4}$
Mining and Mineralogy	99	235	334	276.359	$1,21 \times 10^{-4}$
Textiles and Clothing	22	4	26	758.480	$3,43 \times 10^{-4}$

Industrial Transport	237	8	245	738.382	3, 32 x 10^{-4}
TOTAL	647	416	1.063	4.414.954	2, 41 x 10^{-4}

To be added 1.066 deaths in those agricultural activities relating to industrial practices, in construction, and in other indeterminate activities having 3.145.349 additional workers, with a corresponding average annual risk of death of 3, 39 x 10^{-4} per worker and a cumulative average annual risk of death of 2, 82 x 10^{-4} per worker.

Source: Ragusa, S. (1986) Introduzione All' Analisi del Rischio nell' Industria. (Safety Improvement, Milan)

Traditional risk assessment includes risk identification, dose-response assessment, exposure assessment, and risk characterization, however, it is slowly expanding further. RA now includes environmental problem assessment and remediation strategies.[7] There is no "golden rule" on how RA should be integrated into EIA. Government agencies need to decide **where**, **how**, and **what** aspects of RA should be incorporated. It is up to the discretion and judgment of the competent authorities in charge how this should be done.

The objective of RA is to identify those courses of action which will *minimize* risks as much as possible. It also encourages integrated thinking, and emphasizes *contingency planning* and *emergency response measures*. Comparative risk assessments can then be used to demonstrate the *trade-off's* between different risk reduction measures. Once risk assessments have been made, they can then be compared -- a process known as risk evaluation. **Risk evaluation** is the comparison of the risk in

charge with others commonly encountered in that form (Canter, 1991). It follows that once total uncertainties are evaluated, research efforts can be directed towards those risks constituting the greatest uncertainty! Prevention and mitigatory strategies can then be adapted accordingly. However, it is worth mentioning that RA alone cannot improve safety unless it is integrated within an adequate safety management system.

[7] Canter proposes the following formula: EIA+RA=ERA (Environmental Risk Assessment)

III. RISK EVALUATION IN ITALY: THEORIES, METHODOLOGIES, AND LEGAL PROVISIONS

3.1. How Can Risks Be Evaluated?

There are several types of risks: self-hazardous behavior, co-generation of risks, risks generated by production of externalities, risks imposed on others, risks generated by nature or economic conditions, and risks generated by government policies. *Lovati & Lovati* argue that there are two types of risks: (1.) risks on individuals (having *immediate* or *latent effects*); and (2.) risks on man and/or the environment (having *immediate* or *latent* effects). They divide risks into four Categories (A-D):

Table 2 Categories of Risk

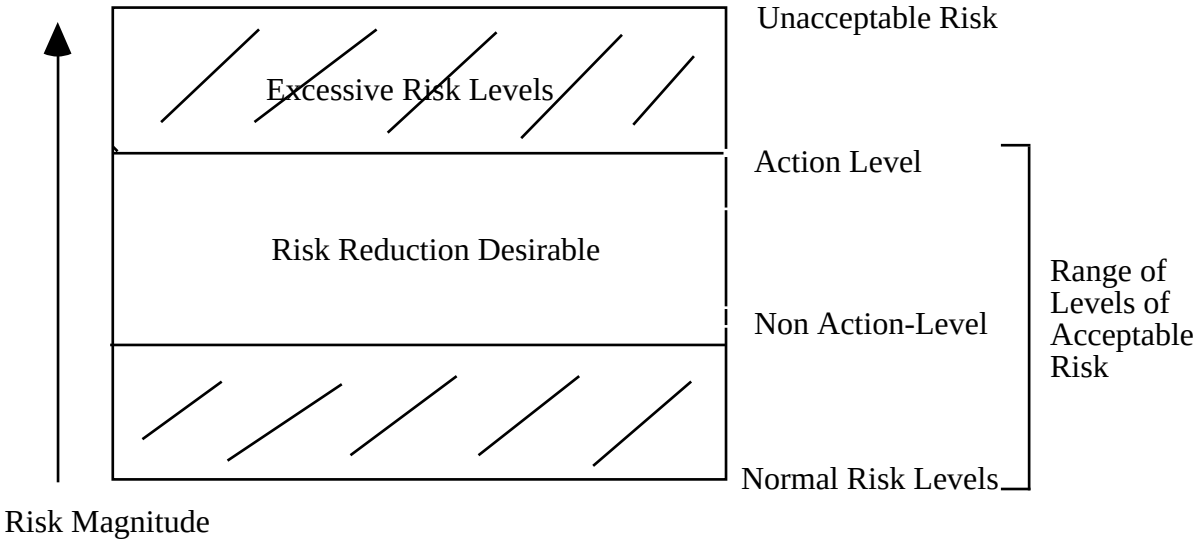
	RISK TYPE:	**CHARACTERISTICS:**
A	• Affect individuals. • Impacts develop rapidly and have immediate effects.	• Common accidents: no media coverage. • Minimal impact on the environment. • Victim is usually the cause of the accident.

B	• Affect individuals. • Impacts develop over a long period of time and have latent effects.	• The victim subconsciously accepts the risk he/she incurs. • Risk is associated to life-style. • Need for better education and information. • To reduce risks, continuous mitigation and improvement in lifestyle is imperative.
C	• The source of damage is instantaneous or short. • Impact on groups and/or the environment.	• Accidental risk: the risk is caused by a series of events (*i.e.* chain reactions) • Humans are not a cause of the event. • Great deal of media coverage. • To reduce risks, engineering approaches, safety measures, and regulatory approaches are necessary.
D	• Impacts develop over a long period of time. • Groups/communities and the environment are affected over a long period of time.	• Irreversible effects on man and the environment. • Need for strong legislative and preventive measures.

Source: Synthesized from Lovati, A. and Lovati, A. (1984) L' Analisi del Rischio. Nuovo Approccio all' Ingegneria della Sicurezza con Particolare Riferimento agli Incidenti Rilevanti Industriali. (EPC, Rome)

However, irrespective of the type of risk, it is necessary to establish levels of *acceptability*. The objectives of a rational *"politics of safety"* approach cannot be to reduce **all** risks (*individual* and *collective* risks) equally (*i.e.* at the same level), rather, it is necessary to allocate resources to those risks that pose the greatest danger. *Rowe* proposes five options for acceptability: (1.) the ***threshold condition***, which holds that a risk is perceived to be so small that it can be ignored; (2.) the ***status quo condition***, which assumes that risks are inherent and a part of human life; (3.) the ***regulatory condition***, which requires government (*i.e.* Ministerial or Agency intervention); (4.) the ***de facto condition***, which accepts historic (*i.e.* past) levels of risk; and (5.) the ***voluntary balance condition***, whereby risks are voluntarily accepted and considered worth the benefit (Rowe, 1979). Levels of acceptability will therefore be dependent on the extent to which people are apprehensive or confident about that risk. From *Rowe's* illustration, it is evident that as the magnitude of a risk increases, so will the desire to take action. If risks go beyond the "Action Level" they will be regarded as *unacceptable.*

Figure 1



Levels of Interest for Setting Acceptable Risk Levels

Source: Taken from Rowe, W.D. (1979) "What is an Acceptable Risk and How Can it Be Determined?" in Goodman, G.T. and Rowe, D. (eds.) (1979) Energy Risk Management. (Academic Press, London)

Cost is also a determining factor of risk acceptability. There comes a time where further reduction of risk is too costly and requires overly-sophisticated technologies which constitute exorbitant investments (Ricci, 1987). Hence, the investing of additional resources to reduce risks becomes unprofitable.

In the energy sector, achieving *acceptable levels* of risk constitutes analyzing the risks of different energy systems and identifying the most cost-effective measures to minimize risks. Quantitative techniques such as *Cost-Benefit Analysis* (CBA) is the conventional methodology used. The objective is to choose the strategy that will minimize risks "As Low As Reasonable Achievable" -- *ALARA principle* (Novegno and Niehaus, 1985). Safety decisions will be based on the optimization of *cost-benefit* choices. Hence, one can conclude that: (1.) acceptability levels constitute a *trade-off* between the limited resources available and desired levels of risk; and (2.) acceptability levels of risk will be determined by judgmental value. Once the cost-benefit graph has

been generated, it will be necessary to decide **where** (on the curve) a level of risk acceptability should be established (Novegno and Niehaus, 1985).

There are *no universally acceptable* options (*i.e*. risks, costs, and benefits). The "best" alternative will always entail some degree of risk. In addition, it is important to be aware that choices are **not** irreversible. Intervening factors may encourage a desire to change the original choice made, errors may be discovered, new safety devices may be invented, values may change, etc. (Fischoff *et al.*, 1981). All this sheds a positive light onto the risk arena, implying that risk levels are flexible in nature and can be regulated accordingly.

Once these comparative studies are completed, it is then necessary to present them to policy-makers as a means to incorporate them in national energy plans. Decision-makers are presented with a decision support system (DSS) validated data, models, and options to chose from. However, it is important to bear in mind that this information alone does not suffice to guide policy and decision-making. Other factors such as economics, industrial development, social pressure etc., will influence national energy plans.

The challenge is *"How Can These Risks Be Evaluated?"* Evaluating risks is a complex task. It requires value judgments and decisions about *trade-off's*. Risk evaluation involves: (1.) risk analysis; (2.) risk perception; (3.) risk management; and (4.) risk communication. ***Risk analysis*** attempts to convey the adverse effects (*i.e*. risks) of a technology choice. The general calculation applied to estimate risk is RISK = PROBABILITY x MAGNITUDE ÷ TIME. Four methodologies are commonly used in risk analysis: (i.) the engineering approach; (ii.) decision-analysis; (iii.) policy analysis; and (iv.) risk perception studies. Enclosed is a short summary of these methodologies.

Table 3 Methodologies Used in Risk Analysis

METHODOLOGY:	CHARACTERISTICS:
ENGINEERING APPROACH	• Risk is measured as *probability* x *magnitude* ÷ *time*. • Quantification of risks based on the type of technology being handled. • Relies on systems analysis and statistical analysis. • Uses epidemiological studies and dose-response assessment; experimental data; *fault* and *event-tree* analysis. • Neglects social and equity issues. • Ignores human error.
DECISION-ANALYSIS	• Utilitarian (*i.e.* economic) approach based on costs and benefits. • Takes into account many risk dimensions. • Judgmental value is used to place weights on cost and benefit estimates -- *Cost-Benefit Analysis.*
POLICY ANALYSIS	• Sees risk as a social construct. • Concerned with distribution of power and decision-making. • Considers social and political factors as determinants of risk.

RISK PERCEPTION STUDIES	• Psychological analysis of risk. • Assessment of different priorities placed on risk. • Focuses on social and cognitive processes surrounding risk.

There are five steps in risk analysis: (1.) identifying those impacts that are *adverse* or *beneficial* using subjective social judgment in assessing possible consequences; (2.) setting priorities (making *trade-off's*); (3.) assessing the magnitude of harm using mathematical computerized models, etc.; (4.) calculating probabilities; and (5.) determining who will be affected (Renn, 1992a). However, it is important to bear in mind that all steps in risk analysis are influenced by a considerable amount of subjectivity and professional bias.

Risk perception incorporates decision analysis, cognitive analysis, socio-psychological analysis, as well as systems and policy analysis. These methodologies generally attempt to understand the motivations and cognitive influences surrounding risk. Social values, norms, and intrinsic values, all play a significant role on risk perception. Social/peer pressure as well as public information are also important factors.

Many scholars have tried to resolve the uncertainties surrounding risk perception however, there is still a great deal to learn about the way people perceive and evaluate risks. The following questions still remain unanswered: (1.) How do psychological; social, and institutional factors affect risk perception and human behavior toward risk?; (2.) To what extent is risk perception affected after the occurrence of a risk event? (3.) How is risk perception transformed into risk communication? (4.) How are individual

risk perceptions aggregated and transformed into collective risks? and (5.) How are these incorporated into the decisional process? (Pascucci, 1988).

By better understanding *individual* responses to risk, *collective* responses towards risk can be more readily anticipated. One important point that most agree on is that people's perceptions frequently fail to match up with the actual dangers that risks pose. Some properties of risk may evoke special attention, while others will be ignored. There are certain factors which affect risk perception: (1.) the expected number of fatalities or losses; (2.) catastrophic potential; (3.) context in which the risk occurs; (4.) the beliefs associated with the risk (*i.e.* cosmology or world-view); and (5.) equity issues. The more risks are seen as unfair to the exposed population, the more they will be judged as unacceptable. Herewith are some factors that reduce and increase risk awareness.

Table 4 Factors that Affect Risk Awareness

FACTORS THAT REDUCE RISK AWARENESS	FACTORS THAT INCREASE RISK AWARENESS
• Activities that are conducted voluntarily.	• Events generating involuntary risks.
• Personal control of risk.	• No personal control over the hazard.
• Clearly identified causes of risk.	• Uncertainty about the outcome of the exposure.

• Accidents easily defined by physical properties and laws.	• No personal experience of the event in the past; fear of unknown increases anxiety.
• Those events with no consequences on future generations.	• Risk causing-agent cannot be detected by human senses.
• Non-catastrophic consequences.	• Loss is the result of technical failure.
• Activities with no alternatives.	• Delayed effects of the risk exposure.
• Simple technologies.	• Future generations are affected.
• Technologies that are accepted by the local people.	• Benefits of the technology are not highly visible or received by an external group.
• Low-memorability events.	• Large, catastrophic accidents affect an entire community.

Source: Taken from Ragusa, S. (1986) Introduzione all 'Analisi del Rischio nell' Industria. (Safety Improvement, Milan)

Otway, H. (1988) "Safe Technological Systems: Reflections on the Conditions for Their Social Acceptability," pp. 407-415 in SEGERSTÅHL, B. and KRÖMER, G. (eds) (1988) Issues and Trends in Risk Research. Proceedings of Two Meetings Held at IIASA, *"Technological Risk in Modern Society," March 18-20, and "Safe Technological Systems," May*

11-12, 1987. (International Institute for Applied Systems Analysis, Laxenberg)

However, irrespective of what attenuates or heightens risk perceptions, it is well-known that people tend to over-emphasize low probabilities and under-estimate those that are high. *Covello, V.T.* in fact argues that, "Man...in evaluating the size of a risk, takes into account a host of complex quantitative and qualitative factors, that are interacting and interdependent..." (Pascucci, 1988, p. 57) Overall, it is common knowledge there is great inconsistency surrounding risk perception and risk acceptability. This greatly complicates the process of risk management.

In Italy, very little has been done in the area of risk perception/large-scale technologies. [8] VASA, a study unit of ENEA has been involved in establishing an extensive research base on the theories, methodologies, and practices, for preventing socio-economic impacts of large-scale electricity plants at national and international level (Sartori and Squillacioti, 1986). This is one of the first initiatives in this area, however, efforts should be exerted to expand this field even further.

Risk management is of strategic importance especially in dealing with large-scale activities such as energy technologies. However, it is affected by several limitations.

- The laws and norms surrounding risk management are frequently incoherent.
- The various entities in charge of risk regulation adopt different approaches which increase dishomogeneity.

[8] This was further confirmed by many researchers, scholars etc., interviewed for an ENEA study by Sartori, S. and Squillacioti, M.T. (1986) "Ricognizione Ragionata sui Lavori Svolti o in Corso nel Campo dei Rischi Tecnologici." (ENEA, Rome)

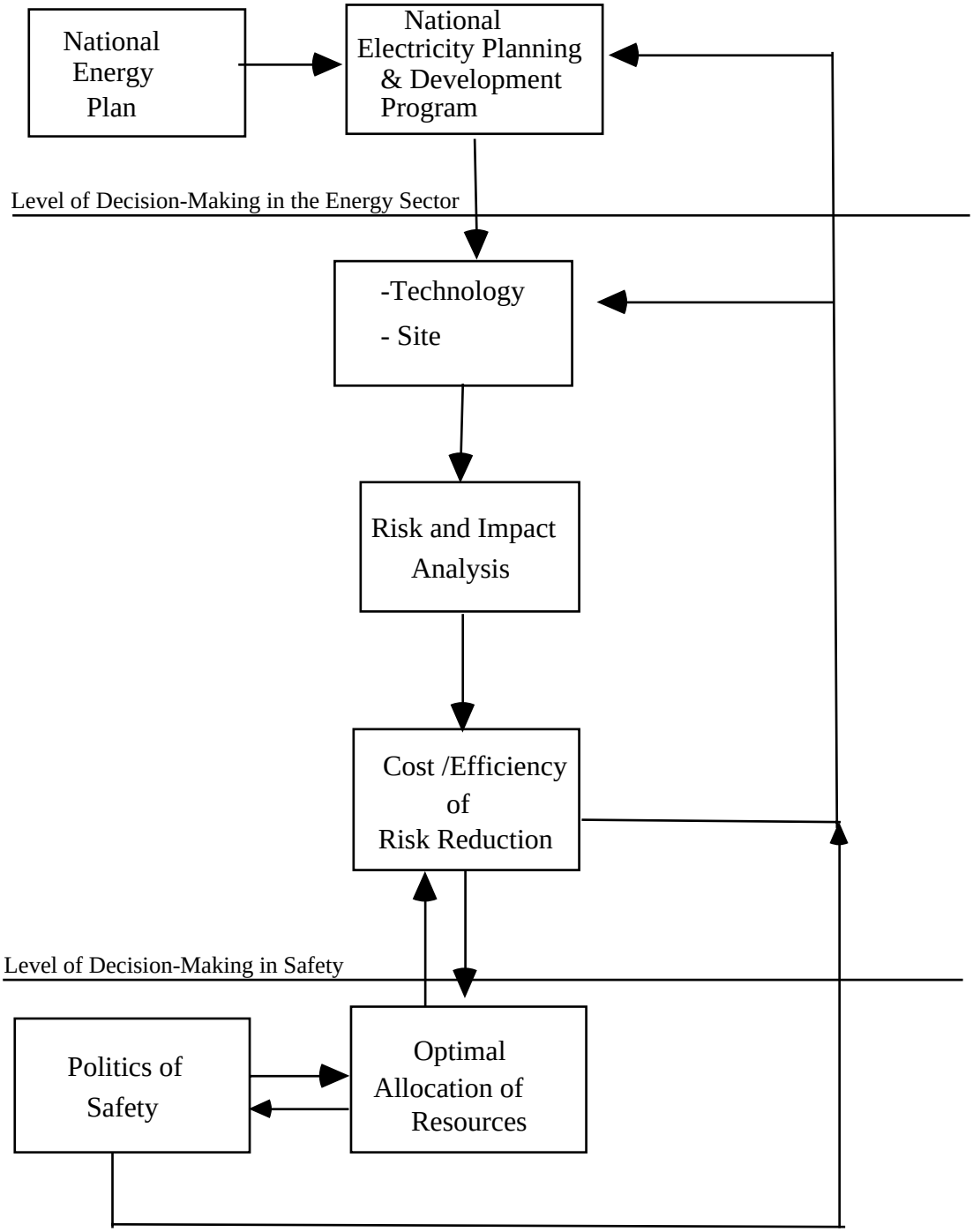
- The setting of appropriate standards and norms is complex in nature.
- The costs of data collection and evaluation frequently exceed the resources available.
- The costs of risk reduction are high.
- Risk allocation is generally unequitable and vulnerable to public opposition.
- Risk management is overly-dependent on regulation. (Pascucci, 1988)

Risk management requires multi-disciplinarity as well as a transparent, legitimate, and participatory decision-making approach. Unfortunately though, large-scale technologies are characterized by inherent limitations -- (*i.e.* not all risks can be controlled), and the responsibility to manage them resides in the hands of a few decision-makers. *Chaucey Starr*, father of risk management, has offered valuable measures to quantify and compare risks. *Starr* argues that public acceptability of risk depends on the confidence the public has on those who manage risk, as well as on the risk estimates they are presented with.

In the energy sector, important decisions have to be taken regarding the type of technology to adopt, localization of the site, and criteria/safety measures to be implemented. Below is an illustration of the general risk management process in the energy sector.

Figure 2

General Structure of a Risk Management Process in the Energy Sector



Source: Taken from Novegno, A. and Niehaus, F. (1985) "La Valutazione del Rischio nel Settore Energetico," *Notiziario dell'ENEA.* Anno 31 (6-7): 55-61

Finally, ***risk communication*** is defined as:

> "...any purposeful exchange of information about health or environmental risks between interested parties. More specifically, risk communication is the act of conveying or transmitting information between parties about (a.) levels of health or environmental risks; (b.) the significance or meaning of health or environmental risks; or (c.) decisions, actions, or policies aimed at managing or controlling health or environmental risks. Interested parties include government agencies, corporations and industry groups, unions, the media, scientists, professional organizations, public interest groups, and individual citizens" (Renn, 1992 p. 467).

Risk communication is fundamental for shaping public opinion as well as people's perceptions about risk. However, to be effective, it must be able to change world-views and existing convictions. It is a well-known fact that once individuals have created an opinion about a certain risk or technology, all information which they are presented with, will be subsequently judged as erroneous and be rejected (Ragusa, 1986). People want information that gives them a feeling of control over their lives and which reduces their hopelessness *vis-a-vis* a technology.

Segerståhl goes beyond. He differentiates between "professional communication" and "public communication". He defines *professional communication* as that which takes place between organizations and units (*i.e.* established rules and procedures); whereas he refers to *public communication* as a flexible process which is dependent on local circumstances, times, culture, etc. (Segerståhl, 1988). *Otway* goes a step further. He identifies two kinds of public communication: (1.) communication to

persuade people to accept policies, technologies, and risk (*i.e.* encourages passive compliance and is manipulative in general); and (2.) communication to inform the public how to avoid or mitigate risks. This type of communication helps people form their own opinions about risks (Otway, 1987).

3.2. Classification of Risks

Classifying risks is a difficult task. Social systems classify risks very differently, hence, it is necessary to identify **how** and **where** a society places its priorities. No established criteria currently exists, yet there is evidence that many nations adopt similar strategies and risk-reduction measures despite their social and cultural differences. Several scholars have proposed different ways of assessing risks however, for virtue of space, these cannot be summarized herewith. Rather, *Professor Renn* synthesizes the seven approaches for risk assessment as follows: (i.) the technical of actuarial approach; (ii.) the toxicological and epidemiological approach; (iii.) the engineering approach; (iv.) the economic approach; (v.) the psychological approach; (vi.) the social theories approach; and (vii.) the cultural theory approach.

3.3. Methodologies of Risk Evaluation in Italy

Under **Article 12** of **DPR No. 175 (17 May 1988)** (actuation of **EEC Directive No. 82/501** dealing with industrial risks), [9] the President of the Council of Ministers

[9] **EEC Directive No. 501** (June 24, 1982) EEC Directive on large-scale accidental risks associated with specific industrial activities.
The stipulations of this Directive mandate the following actions to be taken:
(1.) A competent authority must be established.
(2.) Identification of major hazards and adoption of safety measures must be adopted.
(3.) Manufacturer must submit a "Safety Report" and supply all information needed for the establishment of emergency plans.
(4.) Evaluate the "Safety Report" and conduct inspections during plant operation.
(5.) Provide *on-site emergency plans* and inform the public on the risks posed by the activities as well as on immediate measures to be taken in case of emergency.

decreed specific provisions for risk. The first section of this decree addresses the various measures which need to be taken to minimize risks; whereas, the second section describes various methodologies for risk evaluation.

Before installing any industrial or plant, it is imperative to describe the type of technology as well as the risks which are likely to derive from that technology. If the technology in question is a *new* one, it is mandatory to identify **who** is responsible, **what** kind of experimentation has been conducted to evaluate risks, and the *state-of-art* **information** available on that technology, as a means to keep risks as *low* as possible.

In addition to specifying the capacity of the plant, **Article 12** requires that all health and associated risks be clearly identified and listed. If similar plants have already been established elsewhere, data from past installations need to be readily available. *Uncontrolled events* and *secondary effects* also need to be accounted for, as well as possible combined-effects with other plants. Finally, meteorological, geophysical, marine, and seismic data need to be assessed. All *precautionary measures* to prevent *accidental risks* need to be recorded as a means to ensure preparedness for those risks and accidents that might occur due to human error. The report must be up-dated every three years. The following *checklist* outlines the most important *accidental risks* which need to be addressed:

- Toxic emissions release
- High risk probabilities of fire and explosion

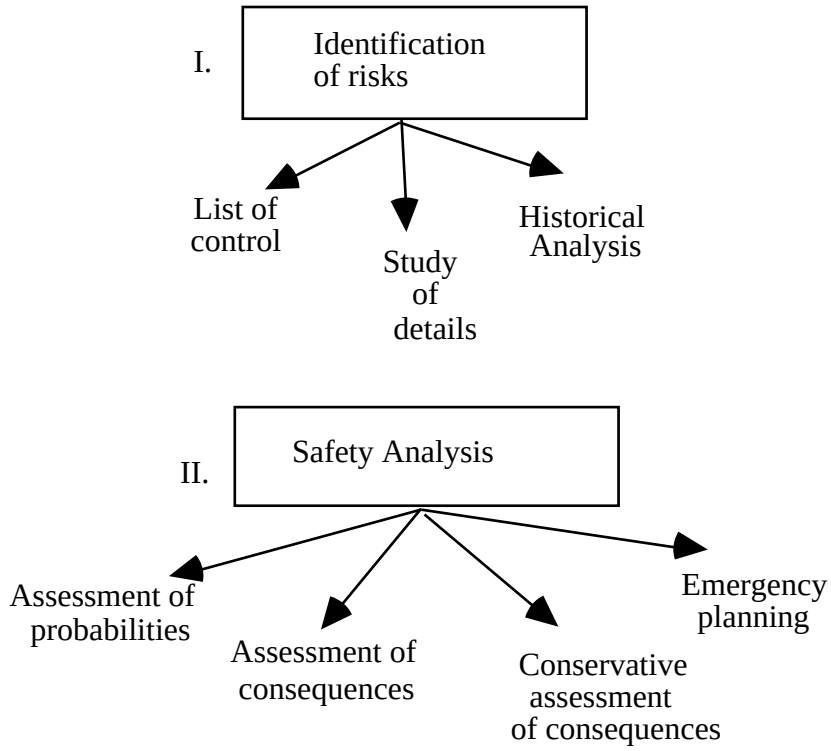
(6.) *Off-site emergency plans* must be prepared by the authorities.
(7.) Major accidents must be notified to the Commission.
(8.) The Commission must keep record of major accidents.
(9.) All provisions should be subject to revision.
• A forum must be created for the exchange of information in order to ensure the establishment of common standards in the implementation and the control of community legislation.
• The Directive establishes those provisions that must be included in the notification procedure, but it does not specify applicable methods of analysis and criteria for acceptability. These are left to the discretion of national legislation, even if a mutual exchange of information on safety issues is promoted.

- Containment failures
- Failure in the emergency system
- Improper prevention and evacuation measures
- Barriers to access in the event of an emergency situation
- Absence of risk insurance and compensation

The second section of **Article 12** outlines the methodologies used in risk evaluation. It divides risk in two parts: (1.) identification of risks and (2.) safety analysis. **Article 12** of **DPR No. 175 (17 May 1988)** clearly differentiates between risks (*i.e.* environmental risks) and safety issues (*i.e.* explosions, fire etc.). It conducts a series of different kinds of studies for each stage. The **identification of risks** criterion involves: (i.) list of control; (ii.) study of details; and (iii.) historical analysis. Whereas, the **safety analysis** involves: (i.) assessment of probability; (ii.) assessment of consequences; (iii.) conservative assessment of consequences; and (iv.) emergency planning. The objectives of these methodologies are to identify those *immediate* or *latent* risks which will adversely affect workers, the surrounding population, and the environment.

Figure 3

Methodologies of Risk Assessment in Italy



I. IDENTIFICATION OF RISKS

List of controls are useful to identify those undesirable events that are caused by adverse *internal* and *external* factors. There are several factors that can lead to risks. The contribution of list of controls (*i.e.* checklists) is significant since it identifies potential risks and facilitates the recognition of those risks that might pass unobserved.

Study of details are systematic analyses to study undesired events using Operational Analysis and Systems-Failure Analysis (*Analisi di Operabilità e Analisi degli Effetti di Guasto*). Whereas for existing technologies, or new technologies adopting existing techniques, **historical analysis** can be used to identify accidents,

causes and consequences, as well as preventive measures taken to minimize accidents, human and managerial error. Information for **study of details** can be generated from systematic analysis of industrial activities, national databases, and international technical reports.

II. SAFETY ANALYSIS

Safety analysis focuses on accidental risks. Identifying the probability of a hazardous event from occurring is possible when the following requisites are available:

- Frequency of initiating events are known.
- Database information is available.
- Confidence analyses such as *fault-tree* and *event-trees*, cause-effect diagrams, etc., are made.
- Comparative studies on similar installations are conducted and used.
- *Sensitivity analysis* (based on probability of risk occurrence from human error, management, or lack of preventive techniques) is carried out.

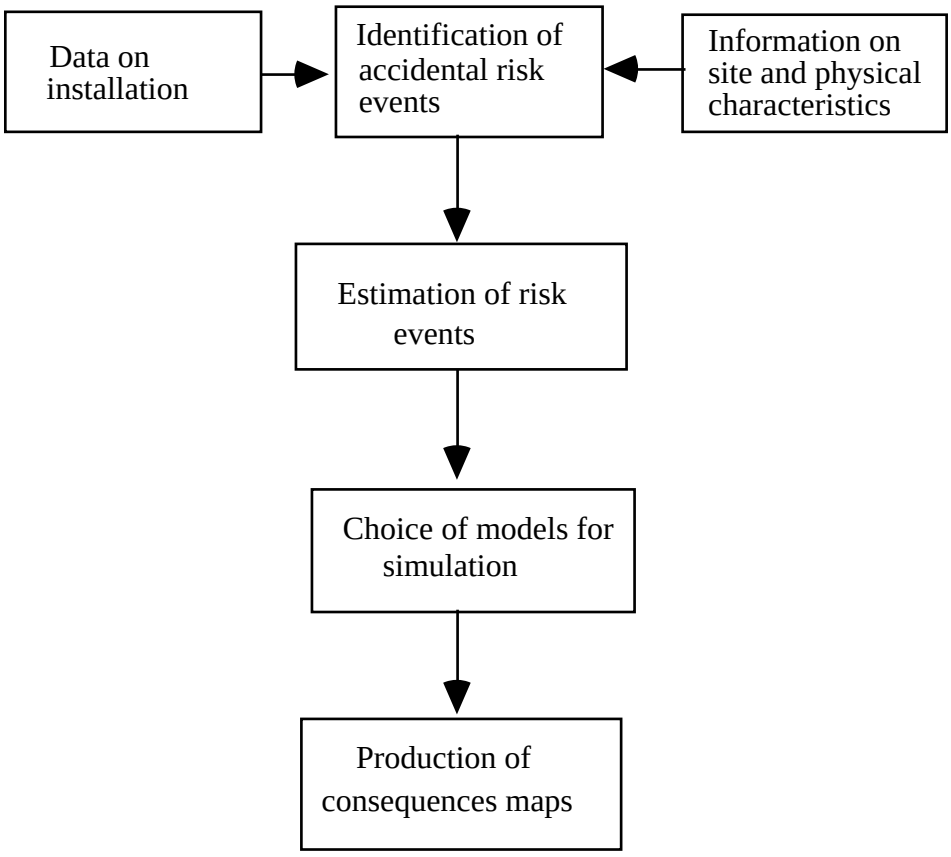
Safety analysis is most effective if there is ample data/information on the installation being dealt with, however, if no such data exists, semi-quantitative data can be used to estimate the probability of a risk event. Data from similar plants as well as information from other cases can also be used to anticipate risks.

Assessment of consequences depends on the judgmental value placed on the risk probability. During this phase, the area of potential risk as well as the risk on people, objects, and the environment are identified and estimated. The purpose of this

identification phase is to avoid adverse *"chain reactions"* or *"domino effects"* of risks over time. The figure which follows clearly illustrates the process of **assessment of consequences**.

Figure 4

Flow-Chart: Assessment of Consequences



Source: Taken from *Gazzetta Ufficiale della Repubblica Italiana* (1989) "Applicazione dell'Articolo 12 del Decreto del Presidente della Repubblica. 17 Maggio 1988, No. 175, Concernante Rischi Connessi a Determinate Attività Industriali." (Ufficio Pubblicazione Decreti, Rome p. 44)

There are various models to study the impacts of risk occurrences: Source Model (*Modello Sorgente*); Transmission Models (*Modelli di Trasmissione*) to study the

physical effects; and Assessment of Consequences (*Modello di Valutazione delle Conseguenze*). The **Assessment of Consequences** is used to study the *adverse* effects of risks on people, objects, and the environment, however, the choice of model and/or models to be used, is based on the availability of the following information:

- Physical, physio-chemical, meteorological, and climatic data
- Initial hypothesis, calculations, and parameters the model uses
- Quality of data available
- Margin of error (*i.e.* confidence level) of one model *versus* others
- Bibliographical references available

The **Source Model** examines the spacial/temporal evolution of those events that have immediate and localized adverse impacts. The risk is attributed to the *source* rather than to *secondary* or *intervening* variables and the objective of this model is to locate the origin (*i.e.* source) of the risk.

The **Transmission Model** instead examines those risk events that have long-range physical effects. Such effects are presented in the form of maps during the **assessment of consequences** phase. The maps are overlaid on territorial maps as a means to illustrate **where** the adverse impacts will be localized. Sometimes conservative estimates can be used to assess consequences. Estimates based on conservative hypotheses regarding the *source* facilitate the assessment process. However, it is important to bear in mind that these models as well as others, have many inherent limitations. Errors, stochasticity in the natural world, and uncertainty, greatly affect the reliability of model simulations. Below is a list of additional common shortcomings associated with models:

- Lack of relationship between models and reality

- Aggregation error: use of a few variables to represent multiple complex systems
- Adoption of incorrect functional forms
- Setting inappropriate boundaries to represent the "real" world
- Incorporation of *biases* and judgmental value
- Parameter errors
- Unavailability of field-data to use for comparison
- Lack of specialized personnel and time to develop a reliable model
- High costs
- Information paradox: the greater the model, the greater the uncertainty

Finally, various strategies for **emergency planning** are necessary in risk evaluation. How emergency planning occurs, the organization of emergency planning, the technologies and resources necessary for emergency planning, the types of emergencies, and the documentation and up-dating of "Plans of Action", are all integral aspects of risk evaluation (Gazzetta Ufficiale della Repubblica Italiana, 1989).

3.4. Legal Requirements and Provisions for Risk Evaluation

Establishing "*acceptable risk*" is not an easy task because it is necessary to harmonize **individual** and **social** levels of risk acceptability. In determining *individual risks*, one needs to estimate the probability of a human death per year; whereas, in determining *social risks,* it is necessary to estimate the number of deaths per hazardous event. However, there are many variables which confound these simple figures. In fact, it is well-known that a single event resulting in multiple deaths is thought to be much riskier than multiple risk events resulting in a single death -- a phenomenon caused by *risk perception*. Moreover, there is the notorious problem of placing a value on human

life. Generally, it is agreed that those technologies having a risk of 10^{-2}, are considered **high risk**; those between 10^{-3} and 10^{-5}, **moderate risk**; and below 10^{-6}, **low risk** (Ricci, 1987). To date, these figures are rather subjective, and it is necessary to deal with them with great caution.

With regard to environmental problems, in Italy, it is predominantly the Ministry of the Environment that manages *environmental risks*. Under **Law No. 349 (July 8, 1986)**, the Ministry of the Environment was delegated official power to deal with environmental problems. **Article 10, 1** of this Law states that the duties of this Ministry include: (i.) carrying out pollution prevention measures and reclamation schemes; (ii.) conducting conservation programs; (iii.) providing EIA services, informing the public about the environment, and writing a report on the "State of the Environment"; and (iv.) performing general administrative and personnel services. In addition to these general functions, the Ministry of the Environment is required to set specific *environmental standards* that comply with EEC Directives as well as protect human health and the environment.

> "The Ministry of the Environment, in collaboration with the Ministry of Health, proposes to the President of the Council of Ministers, maximum levels of acceptability for concentrations and exposure levels of chemical, physical, and biological effects; in addition to noise levels, relative to **Article 4** of **Law No. 833 (23 December 1978)**. The setting of these limits are presented to the President of the Council of Ministers by the Minister of Health, along with the Minister of the Environment, and the Minister of Labor and Social Administration." (**Article 2, 14** of **Law No. 349** of **July 8, 1986**).

Overall, setting *acceptable risk* levels is a subjective process in any country. Scientific research and quantitative analysis help to develop legislation, however, their reliability to ensure a guaranteed protection is rather limited.

IV. RISK EVALUATION: CASE STUDY OF THE ITALIAN ENERGY SECTOR

4.1 ENEL Example: Environmental Risks and Thermoelectric Plants

There are precise provisions for dealing with risks in the energy sector. However, rather than continuing further, it is necessary to differentiate between *"environmental risks"* and *"safety issues"*. Let us take energy facilities such as thermoelectric plants as an example. ENEL (the national electricity entity), is now obliged to furnish two reports as well as a complete Environmental Impact Statement (EIS) *prior* to the construction and operation of a new thermoelectric plant. The two documents are risk reports (*i.e.* risk evaluations) [10] regarding the safety criteria of the installation. One of these reports is submitted to the Ministry of the Environment (legislated under **DPR No. 175**) and the other is submitted to the Fire Department (legislated under **DPR No. 577** in 1988). The report submitted to the Ministry of the Environment is a "risk-identification" report -- a quantitative analysis which includes assessment of consequences and the probability of frequency of a series of risks. Whereas, the report submitted to the Fire Department is a *"Safety Report"* which outlines all *emergency* probabilities and their probability of occurrence. If any modifications (*i.e.* changes) are made along the way, ENEL is responsible to keep the Fire Department informed and adjourned at all times. This report is examined by the Fire Department and the plant cannot operate *prior* to the issuance of a license. Once a thorough inspection has been made by the Fire Department, the Department then issues a license for operation.

In addition to these reports, the *Unità Territorio Ambiente Division* of ENEL must submit a comprehensive Environmental Impact Statement (EIS) to the Ministry of the Environment. This EIS also circulated to the Ministry of Defense, Region, Province and

Comune, and in cases where the proposed installation will border a body of water, the EIS is also submitted to the Ministry of Mercantile Marina. [11] Within 90 days, an EIA commission composed of the Fire Department, ISPESL, ENEA, ANPA (formerly ENEA-DISP), CNR, the Supreme Health Institute, the Ministry of the Environment, and Region, [12] together the Environmental Impact Statement (Dell' Anno, 1991).

There are four official stages that ENEL must go through in order to attain "environmental clearance" for a new installation. The first is the technical inquiry (*istruttoria tecnica*) conducted by the Ministry of the Environment. The "President" running this technical inquiry is obliged to: (1.) decide whether the EIS, presented by ENEL, is acceptable; (2.) carry out meetings with *private* and *public* entities; (3.) conduct *public hearings* over a 3-month period; and (4.) prepare a summary of all activities held (Dell' Anno, 1991). *Public hearings* are held in conjunction to the *technical inquiry* as a means to collect public views, with the intent of including their interests and concerns within final decision-making. **Article 4, 5** of **Law No. 393 (August 2, 1975)** also stipulated that ENEL conduct, within the Region of activity, *communal hearings* and that it disseminate information to inform the public of its activities. The public must be informed and regularly up-dated on those issues involving *environmental risks* and *safety* (Greco, 1990). Yet, it is well-known that this phase remains purely a formality.

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[10] *Lovati, A. and A.* define **risk evaluation** as a complex series of actions to keep under "control" or "dominate" those risks that are commonly known as safety issues.

[11] Please note that the EIS is a Report on its own; it is independent of the two risk Reports.

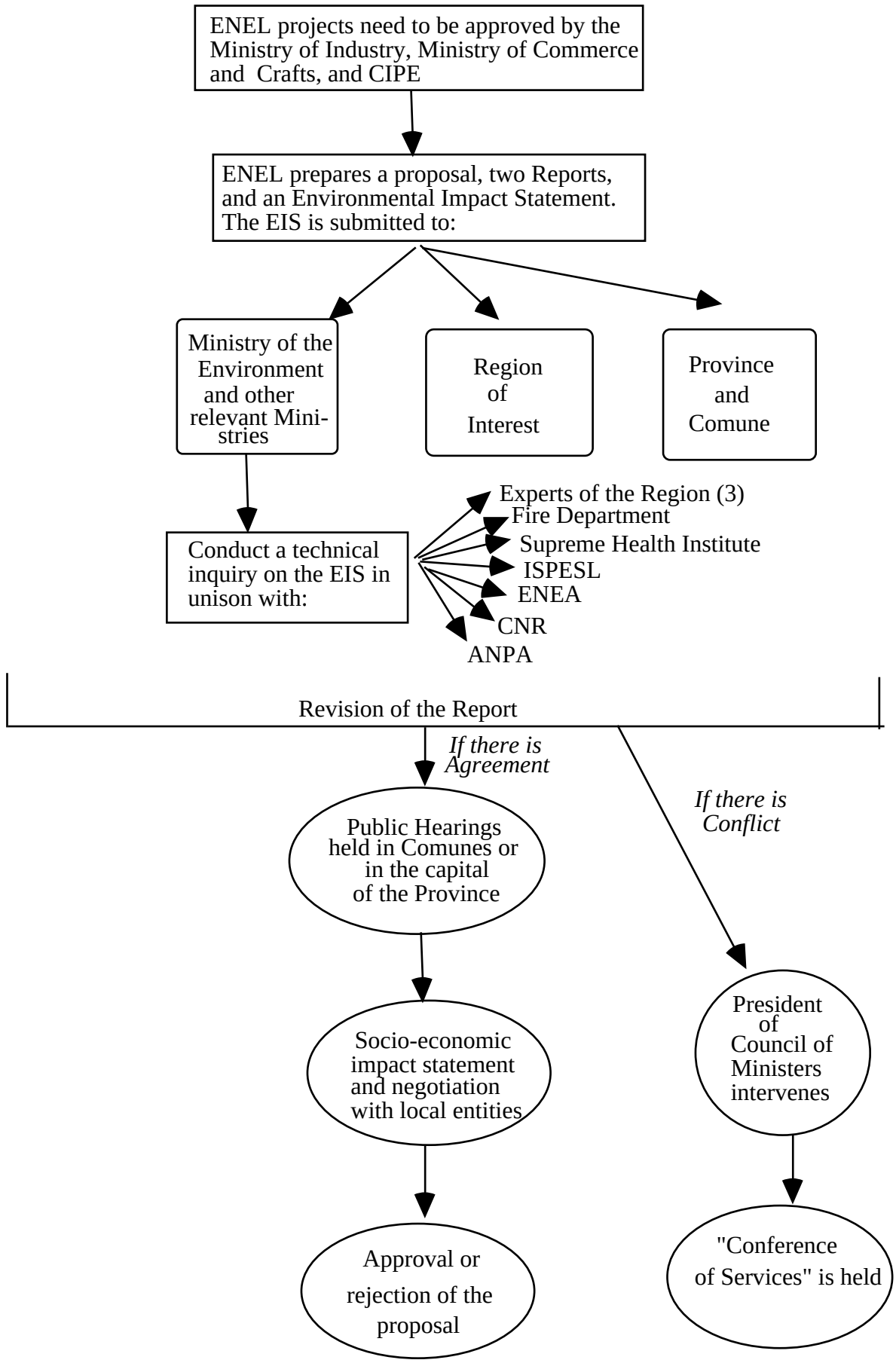
[12] **Article 16** of **DPR No. 175** (May 17, 1988)
Highlights the role Regions must play in program/planning of industrial activities. They must:
(i.) Act as a consultative organ.
(ii.) Receive and examine the industrial notice and Report for the installation of a new plant.
(iii.) Respond to the proposals and set up meetings with local entities and public interest groups.
(iv.) Verbalize their approval or rejection of the plant.
(v.) Suggest changes and/or make requests for more information.
(vi.) Communicate relevant information to the Ministry of Health and the Ministry of the Environment as a means to up-date the national inventory on industrial risks.
(vii.) Ensure that all activities conform with the measures of safety already established.
(viii.) Monitor the activity of the workers.

The third phase is the socio-economic impact assessment associated with construction and operation of an installation. In this phase, ENEL negotiates with the local entities present in that Region to discuss the *costs* and *benefits* that will be accrued from the new installation.

Finally, the last phase, conducted primarily by the Ministry of Industry in collaboration with other Ministries, is to ***approve*** or reject the construction and operation of the proposed installation. This process has been synthesized in the flow-chart which follows. [13]

[13] **Article 14, 1** of **Law No. 241** (August 7, 1990) stated that "Whenever it is necessary to conduct a debate for the various public interests involved in the administrative process, the adminstrator in charge must set up a Conference of Services *(Conferenza di Servizi)*"

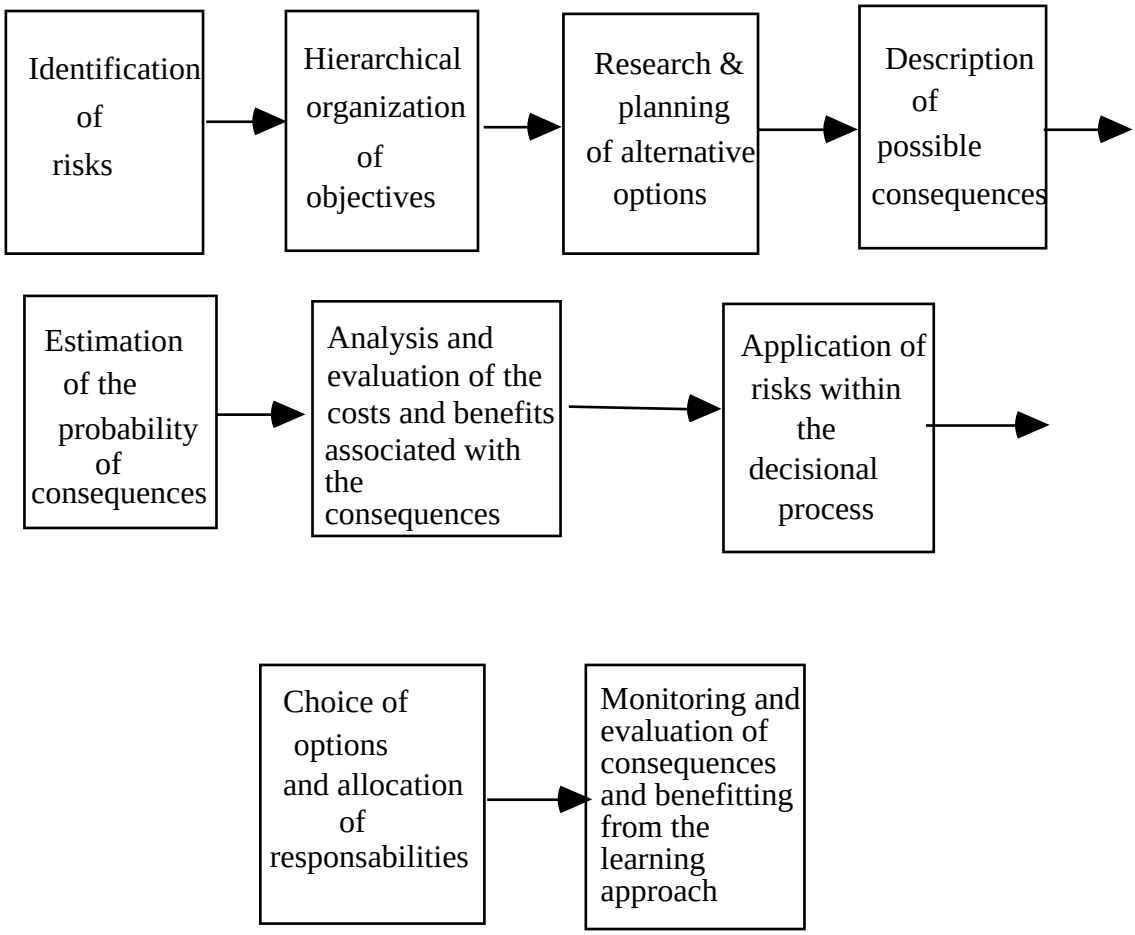
Figure 5 Installation of a New Thermoelectric Facility



4.2. Decision-Making in the Energy Sector

Choosing amongst large-scale technologies such as energy facilities is a complex task. Decision-makers are forced to choose amongst a myriad of alternatives. Hence, the obvious question which comes to mind is: *How are decisions made?* Rather, than give an extended explanation of this process, I have synthesized a typical decisional pattern for technology choices.

Figure 6 Process of Decision-Making



Source: Created from Pascucci, R. (1988) "La Percezione dei Rischi Tecnologici e Ambientali." (ENEA, Direzione Centrale Sud, Rome)

However, the decisional process is never so simple as illustrated above. There are a host of authorizations and licensing procedures which accompany the installation of most facilities, especially new energy facilities.

4.3. Procedures for Licensing of Energy Facilities

Licensing and authorizing the construction and operation of new energy facilities constitutes much more than illustrated in Figure 5 ("Installation of a New Energy Facility"). There are a series of norms which need to be adhered to. Atmospheric emission standards and environmental impact assessment are two criteria which have to be met for the operation of any energy facility. **DPCM (March 28, 1983)**, [14] **DPR No. 203** (**May 24, 1988)**, [15] and **DM (July 12, 1990)** [16] are the most renown laws which deal with atmospheric emissions, whereas **DPCM (December 27, 1988)**, particularly Annex III and Annex IV, which mandates EIA for thermoelectric and turbogas plants, deals predominantly with environmental aspects. A host of other laws complement these ones. However, it is worth expanding on **DPR No. 203** and **DPCM (December 27, 1988)**, since they are building blocks of licensing procedures in Italy.

DPCM (December 27, 1988) is of fundamental importance for the licensing and authorization processes of energy facilities. **DPCM (December 27, 1988)** outlines the

[14] **Decreto del Presidente del Consiglio dei Ministri - DPCM** (March 28, 1983) Maximum limits of acceptability for concentrations and exposure of pollutants in outdoor ambient air. (Established on the basis of **Article 4** of **Law No. 833** (1978) which reformed the health system and introduced amendments on the standards of acceptability for air quality, previously defined).

[15] **Decreto del Presidente della Repubblica No. 203 - DPR** (May 24, 1988) Carrying out **EEC Directives 80/779**, **82/884**, **84/360** and **85/203** concerning norms for air quality, relative to specific pollutants, and pollution produced from large-scale industrial activities, regulated under **Article 15** of **Law No. 183** (April 16, 1987).

technical norms for designing environmental impact assessments (EIAs) and the formulation of judiciary compatibility of **Article 6** of **Law No. 349 (July 8, 1986)** adopted in accordance with **Article 3** of **DPCM No. 377 (August 10, 1988)**. In particular, Annex IV is of primary importance.

Annex IV outlines the procedures necessary for installing thermoelectric and turbogas plants. It not only defines in a comprehensive manner, all environmental criteria which need to be met, but also "absorbs" **DPR No. 203** enacted seven months earlier **(May 24, 1988)**. Hence, in a way, **DPCM (December 27, 1988)** takes a more *holistic* and stringent approach. Annex IV outlines the procedure for licensing of thermoelectric and turbogas power plants. **Article 1** of Annex IV **DPCM (December 27, 1988)** states the following: "the localization and authorization of any modifications made on existing thermoelectric plants, by ENEL, are regulated by the following norms carried out in the last part of **Article 17, 2** of **DPR No. 203** (**May 24, 1988)**." [17]

In addition, **Article 17, 1** of **DPCM (December 27, 1988)** states the following: "For the operation of thermoelectric and turbogas plants and any modifications resulting in the emissions of new substances in the environment, as well as for those activities of control, it is necessary to apply **Articles 8**, **9**, **10**, and **11** of **DPR No. 203 (May 24, 1988)**." Meeting emission standards is of critical importance *new* and *existing* plants. **DPR No. 203 (May 24, 1988)** was the first law to establish these standards. The following standards are taken from Annex I and Annex II of **DPR No. 203 (May 24, 1988)**. [**DM (July 12, 1990)** later set minimum emission standards for different types of industrial activities].

[16] **Decreto del Ministero dell' Ambiente - DM** (July 12, 1990) Guidelines for the control of pollutant emissions from industrial plants and the setting of minimum emission standards.

[17] **Article 17, 2** of **DPR No. 203** (May 24, 1988) states the following: "The authorities in charge at the Ministry of Industry, Ministry of Commerce and Crafts, foreseen for the construction and operation of installations...are released once the Ministry of the Environment, Ministry of Health, and Region of interest have given their approval. After the approval of the national energy plan, new energy installations will have to adhere to the provisions of this decree; the procedures of which are hereby defined."

Table 5

ANNEX I of **DPR No. 203 (May 24, 1988)**

Limits for Air Quality

POLLUTANT:	**LIMITS:**	**TIME-HORIZON:**
Sulfur Dioxide (SO_2)	Median of average concentrations in 24 hours within a span of one year: 80 µg/m^3	April 1 - March 31
SO_2	98% of average concentrations in 24 hours within a span of one year: 250 µg/m^3	April 1- March 31
SO_2	Median of average concentrations in 24 hours during winter: 130 µg/m^3	October 1 - March 31

Nitrogen Dioxide (NO_2)	98% of average concentrations in one hour during the year: 200 $\mu g/m^3$	January 1 - December 31

(*****) All measures must be taken to avoid exceeding these standards for more than three consecutive days; in addition, it is necessary to prevent and reduce all exceedences.

(*****) This table **excludes** mathematical notes accompanying it.

Table 6

ANNEX II of **DPR No. 203 (May 24, 1988)**

Standard Guidelines for Air Quality

POLLUTANT:	**LIMITS:**	**TIME-HORIZON:**

Sulfur Dioxide (SO_2)	Arithmetic mean of average concentrations in 24 hours within a span of one year: from 40 to 60 $\mu g/m^3$	April 1 - March 31
SO_2	Average value within 24 hours: from 100 to 150 $\mu g/m^3$	from 00 to 24 hours daily
Nitrogen Dioxide (NO_2)	50 % of average concentrations in one hour within one year: 50 $\mu g/m^3$	January 1 - December 31
NO_2	98% of average concentrations in one hour within the year: 135 $\mu g/m^3$	January 1 - December 31
Particulates (measured with black smoke method)	Arithmetic mean of average concentrations in 24 hours within a span of one year: from 40 to 60 $\mu g/m^3$ black smoke equivalent	April 1 - March 31

Particulates	Average value of 24 hours: from 100 to 150 µg/m^3 black smoke equivalent	from 00 to 24 hours daily

Source: Gazzetta Ufficiale No. 53 (1988) Decreto del Presidente della Repubblica (May 24, 1988) "Attuazione delle Direttive CEE numeri 80/779, 82/884, 84/ 360 e 85/203 concernenti norme in materia di qualità dell' aria, relativamente a specifici agenti inquinanti, e di inquinamento prodotto dagli impianti industriali, ai sensi dell' Art. 15 della legge 16 Aprile 1987, No. 183." (Ufficio Pubblicazione Legge e Decreti, Rome)

V. BARRIERS AFFECTING RISK EVALUATION IN ITALY

> Collingridge argues that..."decisional processes concerning social control of technologies do not easily fit in with issues such as certainty, risk, and uncertainty, rather the decisions are allocated under varied situations of ignorance." (Sartori and Squillacioti, 1986, p. 13)

5.1. Political Barriers

It is evident from government spending, that research in the environment, in general, has played a marginal role. In 1989, the Ministry of the Environment summoned the Institute for Economic Planning (ISPE) to conduct a study on government spending in the area of the environment. The results clearly showed that the State spent 61% of its funds on landscape schemes, 36.5% on water projects, and a mere 2.2% on Research and Development (R&D) and monitoring/evaluation schemes. Environmental policies have continued to be subordinate to economic and industrial interests, hence in light of the past mistakes, its seems sensible to orient our resources and efforts towards renewed environmental priorities (Capria, 1991).

The *"politics of safety"* in all countries, is subject to many limitations. These include: risk acceptability levels, equity issues, socio-economic and political constraints, conflict of risk regulation *versus* development, as well as a need for public participation in decision-making. The political instability of Italy has certainly affected Italian legislation in all sectors, including that of the environment. No rational approach has been adopted to evaluate environmental risks, rather the prevailing methodology has been one of *emergency response* (Capria, 1991) as well a complacent reliance on EEC regulations.

The first step towards expanding the role of risk evaluation in Italian environmental legislation, is to redirect government priorities towards greater research in this area. Capturing the interest and attention of decision-makers needs to be the first step, for it is a well-known fact that initiative will take place ***if and only if*** there is a political *will* or *interest* to do something! Political-institutional innovations in the areas of public participation, public information, and public acceptability; new concepts and approaches (*i.e.* "active politics") towards risk regulation and risk management; extended social research in the area of risk perception concerning technological risks, etc., are all means by which the existing political system can tackle risks.

Overall, there has been little governance for risk. Technology choices have been subordinate to political whims rather than to rational decisions. *Ragusa* (1986) offers an interesting argument along this line of thinking. He claims that countries that hope to achieve an energy independence (*i.e.* an *autocratic energy position*), are more predisposed to accept "higher risks" and accept technologies such as nuclear energy etc. to achieve that goal. He uses France as an example to illustrate this position. Hence, he concludes that Italy's dependency on imported energy (*i.e.* its disinterest in achieving an energy independence) may be one reason why Italy has abandoned the nuclear route -- *i.e.* a "higher risk" technology choice.

5.2. Legislative and Institutional Barriers

> *"* [T]here is often a mismatch between typical technical, scientific, and political analyses of the public risk and the legal institutions and procedure through which responsibility for public risk is actually allocated..." (Hazard, 1993 p. 236)

Generally, there are four major problems associated with risk management.

(i.) There is an inadequate understanding of the concept of risk.

(ii.) There are no concise comparative tools to evaluate the different methodologies used to study risk.

(iii.) There is no multi-disciplinary approach to study risk.

(iv.) There is no adequate infrastructure to conduct risk evaluation. [*Canter* proposes the use of *focus groups* to "explore risk perceptions, evaluate perceptual cues and information processing, pre-test risk communication materials, select risk communication channels, design risk mitigation policies, and/or assess risk communication effectiveness."] (Canter, 1991, p. 9)

But where does Italy fit in all this? The Italian Ministry of the Environment was founded on July 8, 1986, under the **Law No. 349**. [18] This law assigned various duties to the Ministry of the Environment. **Article 1, 2** of **Law No. 349** literally states the following:

> "It is the duty of the Ministry [of the Environment] to ensure, in an organized fashion, the promotion, conservation, and the preservation of those environmental assets that are in the fundamental interests of everyone, as well as to ensure *quality of life*. In addition, it is necessary to conserve and value cultural heritage, and to defend our natural resources from pollution " (LEX, 1986, p. 1411).

[18] **Law No. 349** (July 8, 1986) Establishment of the Ministry of the Environment and norms relevant to environmental damage.

The **Law No. 349** has been subject to a great deal of criticism over the past years. One of the major reasons is that the Law addresses several important issues in an abstract manner. It fails to adequately address the following points:

- The role of environmental organizations in the area of environmental damage/compensation.
- The role which environmental organizations can play in civil law.
- The degree to which environmental organizations can partake in legislatory activities.
- **Which** methodologies need to be adopted to quantify environmental risk.
- **Who** is responsible for identifying environmental damage experienced by multiple parties.
- The duties of the State to amend environmental damage.
- The fate of the "damager".
- The authority of the legislator.

The points highlighted here are select shortcomings of **Law No. 349**. Other legislation such as **Article 2050 of the Civil Code**, reinforces the objectivity of this Law even further. The Article states the following:

> "...[W]hoever inflicts damage on others during any risky activity by his will, or by the nature of his activity, has the duty to compensate those offended, unless he can prove that he adopted all possible measures to reduce that risk."

Once again this clause fails to suggest concrete guidelines as to what constitutes "environmental damage" and what "compensatory measures" really imply. Another notorious legislative constraint is the lack of enforcement mechanisms surrounding risk.

5 .2.1. Time Dimension and Risk Management

Over-bureaucratization, has been a notorious *flagellum* afflicting Italian policy-making; this has undoubtedly affected the environmental sector as well. The time needed to coordinate the various environmental entities involved as well as the time required to pass laws, is considerable. This factor goes against the renown *precautionary approach*. In fact, Italy typically resorts to emergency response strategies. *Tie-in-strategies* to mitigate future (*possible*) risks, are still atypical of the Italian style of policy-making.

Integrating European laws into national policies is also time-consuming. [19] Since EEC Directives have to be integrated within the existing political structure, the implementation process is greatly prolonged and the original intentions of the Directives are frequently lost along the way.

5.2.2. Coordination with Other Entities

The Ministry of the Environment as well as other entities, are responsible for the realization of environmental activities [20], thus complicating and retarding the process of environmental policy and decision making. The public administration of the Ministry of

[19] The **Seveso Directive** (1982) is a prime example of this, especially in Italy's case.

[20] **Article 2, 20** of **Law No. 349** (July 8, 1986) states "The Ministry of the Environment, in concert with the Ministry for the Co-ordination of Scientific and Technology Research, as well as other interested

the Environment is the *moving hand.* Along with other Ministries such as the Ministry of Health, it is responsible for setting standards/controls however, the extent of involvement of the private sector in the decision-making process is negligible. Greater efforts are therefore needed to increase communication and cooperation with the private sector.

In 1979, industry united in a joint-effort known as l'Unione Italiana di Riassicurazione. This "pool" of industries was established to manage risks. Its role was to adequately up-date existing infrastructures and to limit environmental damage to the extent of economical feasibility. The "pool" kept well-informed on the existing legislation and ensured that all environmental activities remained in compliance with the existing laws. Collaboration in the area of *environmental friendly technologies* was also established, hence the industries created a competitive arena for risk reduction and prevention (De Strobel, 1990). The inherent problem, however, was in its limited interaction with the State.

Increasing cooperation and sharing the costs of environmental risk research (*i.e.* risk evaluation) with the State, is one example of how this barrier can be eliminated. There are a great deal of benefits which can be accrued from cooperation between government and the private sector -- an avenue which has yet to be exploited. Hopefully, ANPA (the new environmental agency) will help to intensify this cooperation.

The absence of effective peripheral environmental administrative units, also magnifies centralization. Collaboration with the Regions has remained minimal since the **1917 DPR 616 Decree**. This decree greatly limited the functions Regions could execute in the area of environmental policy and decision-making. The Constitutional Court defined regional intervention as "loyal cooperation" between the State and

ministries, contact national research programs in the area of environment and coordinate the participation of Italy in those research projects defined by the EEC."

Regions (Caravita, 1992), yet, it never established concrete guidelines for its participation. It is necessary to create decentralized administrative units, as well as delegate increased responsibility and sovereignty to the individual Regions. This process has slowly been occurring. [21]

5.2.3. Public Participation /Access to Information

> "...[R]isk analysis is a political tool and the acceptability of a technology is a political issue in which the public can play a more constructive role than it has already been allowed to play. If we are able to accept this, instead of recurring to political expedients, to the irrationalities of interest groups, and to the manipulations of media, then our specialization can contribute to the advancement of democracy."
>
> (Institute International J. Maritain, 1993, p. 102)

[21] **Article 4,1** of **DPR No. 203** (May 24, 1988) for example highlights the role that Regions must play in the area of atmospheric control. It states that: Excluding the competencies of the State, the protection of the environment from atmospheric pollution is the responsibility of the Regions, that act according to the principles contained in this decree and other laws of the State. In particular, the Regions are responsible for:
(a.) The formulation of mitigatory strategies to prevent, conserve, and protect the territory, with respect to standards of air quality.
(b.) Setting and adopting emission standards (including those standards and guidelines determined by the State) within specific conservation programs; it is necessary to limit or prevent an increase in air pollution deriving from urban or industrial activities.
(c.) The setting of air quality standards in concordance or equal to emission standards already established, or below these standards, maintaining environmental protection programs, especially for those specific areas where it is necessary to ensure greater environmental protection.
(d.) Setting of emission standards for installations on the basis of "Best Available Control Technology" (BACT) and maintaining guidelines set by the State and the relative established standards. In absence of regional agreement, maximum levels of emissions, defined in the guidelines, shall not be exceeded, unless under the substitutional powers of State authorities.
(e.) Setting of more stringent standards of emission for areas which are particularly polluted as well as specific criteria for the construction and operation of certain technologies.
(f.) Guide and coordinate systems of control for atmospheric pollutants as well as organize the regional inventory of emissions.
(g.) Produce an Annual Report on air quality for the Ministry the Environment and the Ministry of Health, for the purposes indicated in **Article 3, 4**.

One of the major shortcomings of Italian risk policy-making is that regulations and norms are generally made in the absence of public participation. The closest the law has ever come to address the issue of public participation, is **Law No. 241 (August 7, 1990)**.[22] This law attempted to integrate public participation within administrative processes. Theoretically, public participation (*uti cives*), manifests itself in two forms: (1.) cooperative participation and (2.) conflictual participation. Both interested and conflicting parties are eligible to take part. *Public hearings* have only now acquired legitimacy, however, their effectiveness and relevance remain questionable.

Nowadays, the *"right"* of public intervention (public or private entities) has been recognized; as has the *"right"* for public information. The **DPR No. 175**, relevant to industrial risks, is an example of this. **Article 17.2** states that the Prefect "screens" the industrial reports and then ensures that the community of interest be informed of the activities which will take place (**Article 4**), the measures which will be taken to prevent accidents, as well as the emergency planning strategies which will be carried out. Whilst, **Article 9** of **Law No. 241 (7 August 1990)** states the following: "any subject, having public or private interests, or acting on behalf of an interested association or committee, sharing discord with the existing proceedings, has the right to intervene in the administrative process" (Greco, 1990). The Article is void of any details which outline **how** and in **what** way this participation can be effective or valuable. The mere enunciation of *"participatory rights"* is meaningless without concise guidelines on how it should be instituted and implemented. **Article 14, 3** of **Law No. 349 (8 July, 1986)** claims:

> "Any citizen has the right to access any information available on the State of the Environment, in conformity with existing laws, at the offices of

[22] **Law No. 241** (August 7, 1990) New norms relating to the administrative procedures and rights of access to administrative documents.

> public administration, and can obtain copies without incurring the costs of photocopying and the costs assigned by the administration in charge."

In spite of this Article, issues of public access to information are highly subjective in nature. They are mere enunciations which are greatly limited by clauses. In **Article 24, 1** of **Law No. 241 (7 August 1990)**, for example, it is stated that:

> " Public access is excluded for those documents protected by Secrecy of State, legislated under **Article 12** of **Law 24 No. 801** (October 1977), as well as in those cases where secrecy or divulgence of information has been prohibited. " (LEX, 1990, p. 1569)

Another similar example is **Article 7, 3** of **Law No. 142 (8 June 1990)** which authorizes the Mayor or the President of the province to *limit* access of information to people, groups, or other actors. Hence, in-so-much that there is a right to *access* information, there is also a right to *limit* access to information.

The **EEC Directive No. 90/313 (June 7, 1990)** also attempted to tackle this issue of access to information, however, despite its ambitious objectives, it also included many restrictions. The **EEC Directive** set concrete stipulations on public access to information. Its goal was to guarantee access to information relative to the environment and belonging to public authorities, and to disseminate this information. It also claims to "make available that information relative to the environment, to any citizen that physically or legally requests it, without needing to justify his/her interest" (Butti and Butti, p. 468). The Directive, however, placed restrictions on the following information:

- The privacy of public authorities
- International documents

• Public security information

• Cases under trial or investigation, or those which had been subject to these processes

• Commercial and industrial privacy including personal or reserved data

• Material provided by third parties

• Any material (that if dispersed) could provoke worse impacts on the environment (Butti and Butti, 1991)

There are no defined procedures which define public involvement in administrative activities. [23] Furthermore, there is no provision which outlines public presence at internal debates, nor are there services for public information.[24] It is generally agreed that when given sufficient information on risks (*i.e.* those associated with a technology) and the means for resolving uncertainties, the public can more easily *reject* or *accept* risks. Let us take a look at two renown case-studies in the Italian energy sector: (1.) Project Rete 2 for Reggio Emilia and (2.) turbogas power station for Sessa Aurunca.

[23] The Ministry of the Environment claims that **only** those Acts already revised are accessible to the public; it excludes those norms that are yet to be defined. Hence the public can challenge only existing laws.

[24] The United States Environmental Protection Agency has developed the Integrated Risk Information System (IRIS) to provide risk information on chemicals likely to affect environmental and public health concern (Canter, 1993, p. 7).

CASE STUDY I

PROJECT RETE 2 FOR REGGIO EMILIA

OBJECTIVES OF THE PROJECT:

Project Rete 2, initiated in the mid-1970's under AGAC (Azienda Gas Acqua Consorziale), was an effort to promote renewable energy at competitive prices in an environmentally friendly way. The power station was supposed to recuperate heat from an urban incinerator of solid wastes handled by the Local Municipal Enterprise (City of Reggio Emilia) as well as from coal-burning, using fluidized-bed combustion.

Project Rete 2 heats the water of a series of complex buildings *via* a remote control system. None of the buildings are equipped with a separate water heater in their basement, rather controls of the heaters is done *via* a tele-system.

STRATEGIES CONDUCTED FOR THE PROJECT:

- A techno-economic study as well as a preventive analysis on health and safety impacts, a socio-economic assessment, and an Environmental Impact Assessment (EIS), commissioned by CISE (Milan), were conducted.
- A Regional commission composed of the Comune, technical experts of the USL, the Province, and AGAC, informed the population on health and other impacts associated with technology, on a *weekly* basis.
- A Communal Administration was established to respond to the social needs of different *target* and interest groups.

• Finally, *public hearings* were organized by AGAC and CISE to clarify technical issues. Typical strategies for public participation included: public polls, public hearings, environmental negotiation sessions, dissemination of flyers, and mass-media coverage.

PROBLEMS ENCOUNTERED:

A great deal of public dissent accompanied **Project Rete 2**. In particular, the following points were contested:

(i.) The choice of the site installation for the power station.

(ii.) The choice for the primary source of heat -- *i.e*. coal.

(iii.) The environmental risks associated with the use of coal -- especially atmospheric pollution.

(iv.) Inadequate consultation with the public regarding the selection of the site and choice of technology.

(v.) Inadequate information by AGAC on the operation and management of the plant.

(vi.) The use of "blowing techniques" without informing the public.

CONCLUSIONS & RECOMMENDATIONS:

Project Rete 2 is a prime example of a case whereby consensus for an innovative energy technology was attempted after (*ex-post*) the installation of the plant. A *mitigatory* versus *precautionary* approach was attempted. Measures to inform the public on the technology were taken **after** the project had already initiated, hence, there was a great deal of mistrust and resentment surrounding the existing technology.

A flyer called *Il Contatore* was distributed to the public. It included information on **Project Rete 2** in laymen terms, however, the public information was unidirectional. No open debates **nor** other feedback mechanisms were adopted. This maintained centralization of the project. In addition, the benefits of the entire community (population surrounding the plant and the city in general) were addressed only marginally. Public participation in the decision-making process was a mere formality and played **no** concrete role.

Criticisms of ENEL:

(i.) Low credibility and confidence in the entity (*i.e.* ENEL)

(ii.) Appropriate (unbiased) information would have been more effective in allowing the local population to form autonomous and cognitive opinions about ENEL. This would have most probably resulted in greater confidence and trust in the entity.

Criticisms Concerning the Public Hearing:

(i.) The pre-existence of the nuclear power plant generated feelings of distrust in virtually all initiatives and suggestions proposed by ENEL.

(ii.) The new installation did not fit in well with the program and plan of actions conducted.

(iii.) The Cost-Benefit Analysis (CBA) was seen as unequitable by the public.

CASE STUDY II

TURBOGAS POWER STATION FOR SESSA AURUNCA, GARIGLIANO

OBJECTIVES OF THE PROJECT:

ENEL proposed to install a combined-cycle turbogas power station in Garigliano, which now hosts a disactivated nuclear-power plant.

STRATEGIES CONDUCTED FOR THE PROJECT:

- A technical, socio-economic, and Environmental Impact Assessment were conducted *ex-ante* (prior) to the installation of the plant.
- A *public hearing* was also conducted (legislated under **Article 6, 1** and **Article 7** of Annex IV of **DPCM (December 12, 1988)**

PROBLEMS ENCOUNTERED:

Public hearings are instrumental tools which assist in learning about public attitudes and feelings towards new technologies and risks. During the public hearing at Sesso Aurunca the citizens expressed their opinions about the proposed technology, about ENEL, and about the way the public hearing was conducted. Below is a synthesized resumé of the points addressed.

Criticisms About the Project:

(i.) Need for better environmental risk assessment as well as better health and safety protection.

(ii.) Inappropriate site selection. The public opposed the reinstallation of a new plant on a former nuclear site.

(iii.) Social compatibility studies were not adequately conducted.

(iv.) The economic and environmental benefits of the project were not clearly defined.

From these two case-studies , it is evident that **NO** systematic approach was adopted to communicate information on the technologies and their associated risks to the public. Moreover, the role of public participation in policy and decision-making was virtually nonexistent! No *feedback* was given to the public, rather communication was

uni-directional. The entire *"public hearing"* process became a mere formality, and hence exacerbated public animosity towards the project even further.

5. 3. Economic Barriers

An important issue which governments are often faced with is, how much to spend to avoid particular environmental consequences. **Cost** is a determining factor. The challenge of societal risk management is to minimize the probabilities of *negative impacts* without incurring excessive costs (Rayner and Cantor, 1987). To date, the choice of high-risk technologies has been based foremost on economic and political considerations, safety components have played a negligible role. Due to the lack of risk data, opponents of a technology have had to rely on uncertainty and have generally had to "dramatize" their fears regarding high-risk technologies. *W.C. Clark*, in fact argues that one of the major problems is not so much to dominate risk, as to mitigate the uncertainty surrounding risk.

One option is to increase our capacity to live with the uncertainties of risk (Sartori, 1991). Following this line of thinking, it is imperative that if risks are to be incurred, there should be some kind of compensatory measure for bearing those risks. Compensation for environmental damage is a well-known tool, especially in the United States, however, it has only now gained attention in Italy. The main prevailing criticism of environmental compensation is that it "monetizes" environmental impacts and allows the continuation of those risks; it does not halt them. Paying for adverse impacts absolves the "producer" of those impacts from any responsibility (Bossi, 1991). It legitimizes the behavior of the "polluter" and makes him/her feel an *acquired "right"* to pollute.

One of the major problems with placing an economic value on risk is the incommensurability of risks. *Cost-Benefit Analysis* (CBA) is the conventional tool that

has been used to put a *price-tag* on environmental risks. However, there are several shortcomings associated with CBA. Ideally, the goal is to reduce risks by making it cheaper to invest in *risk reduction* rather than paying for the damages of the injuries incurred.

Taking a more decentralized approach and opening the market of *environmentally friendly technologies* can contribute significantly towards risk reduction and a cleaner environment. To date, the *bureaucratic/authoritative system* in Italy has severely limited innovation and the diversification of technology choices to minimize environmental risks. If risk minimization is made obligatory, there will be a greater incentive to innovate and invest in *environmentally friendly technologies.*

The **DPR No. 175 (17 May, 1988)** for accidental risks in the industrial sector attempted to integrate this *polluter pays principle*. It stated that the promoters of an activity should provide "indicators on ***if*** and ***which*** insurance measures or guarantees that entity had or should adopt to safeguard risks on people, objects, and the environment" (Greco, 1992 p. 83), however, it did not place any kind of impositions or punishment for noncompliance.

5.4. Social Barriers

One of the most notorious social barriers affecting risk evaluation is individual interpretation of risk. The way people perceive a technology will be greatly influenced by individual and social preferences. Below are some interesting observations.

- Risk interacts with daily events and situations.
- Specific technologies are placed in a large socio-technological context; they are not seen in isolation.

- Technology choice depends on institutional and decisional processes.
- Technology perception does not occur in a *vacuum*; it includes risk assessment as well as learning from past and present events.
- Risk perception is influenced by world-views (*i.e.* cosmologies).

In light of these five points, the difficulties of harmonizing individual risks can be appreciated. Technological risks are **not** limited to physical, social, and mental factors, rather all social processes surrounding technology options play an important role.

Public opposition is a valuable means of controlling environmental risks. This was clearly the case in the 1987 referendum which outlawed nuclear energy in Italy. However, to date, there are various factors in Italy which have quenched this driving public force. Consensus-making and the dissemination of technical/scientific information to the public has been negligible, as have *public hearings*. One solution is to focus on *anticipatory strategies* as a means to increase the social acceptability of those technologies having inherent risks.

The United States is the first country that has introduced a mechanism by which individuals can contest collective levels of *risk acceptability*. In the United States, victims of accidental risk events can rely on liability. This gives social actors not only the possibility to challenge "expert" knowledge, but also to claim compensation for those unwanted risks imposed on them.

VI. RECOMMENDATIONS TO IMPROVE ENVIRONMENTAL RISK EVALUATION IN ITALY

6.1. Establishment of an Environmental Agency-vs- Ministerial Approach

In June 1990, the EEC instituted a European Agency for the Environment and mandated that all member states establish a national environmental Agency. Each national Agency consists of a technical (*i.e.* scientific) board and has autonomous control over its administration and finances. The Agency is peripheral to the Ministry of the Environment and is composed of a President and four staff members. Its duties constitute: monitoring and technical support; assistance to regions/the countryside, training of personnel; scientific and social research; as well as the administration of compensation.

On August 4, 1993, **Law No. 274** officially called for a re-organization of environmental projects under a structured Agency. The Ministry of the Environment recently organized such an Agency. It is known as **ANPA** (Associazione Nazionale per la Protezione dell' Ambiente). The Agency has jurisdictional and administrative autonomy, financial accountability, and carries out technical/scientific activities in collaboration with other entities. The prospectives of ANPA are to merge the administrative responsibilities of the Ministry of the Environment, Ministry of Public Works, and the Ministry of Cultural and Environmental "Goods" under one Agency. In addition to duties of data collection, research, and training, ANPA will be delegated the following duties:

- Process and decision-making for Environmental Impact Assessment of national programs.
- Compensation for environmental damage, as well as the creation of incentives and disincentives to safeguard the environment.

- Setting of standards and environmental indicators.
- Grant exemption standards for case specific events.
- Control and monitoring of standards.
- Management of funds to mitigate environmental damage (Caravita, 1992).

In addition to legitimizing ANPA, it will be necessary to extend legal authority onto other parties. These include: (i.) the State and interested public utilities; (ii.) all national and local organizations/associations that are dedicated to protection and preservation of the environment; and (iii.) private individuals interested in the well-being of the environment (Taruffo, 1991).

6.2. What Are the Consequences of ANPA for the Ministry of the Environment?

ANPA is ideally supposed to be similar to the renown USEPA, but in reality it comes closest to the German Federal Agency for the Environment, *Umweltbundesant*, which offers environmental services to German government programs. There are several reasons why the establishment of an Agency such as ANPA has been approved. First of all, the Ministry of the Environment does not feel threatened by the decisional powers of the Agency. The decisionary powers of the Agency will remain rather limited. ANPA will function under the Ministry of the Environment and Court of Finances, and will be legally governed by the State. Secondly, the Ministry of the Environment will benefit from ANPAs research, monitoring, and information services. This is a significant asset for the Ministry of the Environment which in the past relied on dispersed and haphazard information from various research centers and institutions (Rapisarda Sassoon, 1993a).

In unison, the Ministry of the Environment and ANPA have great potential, hence, it is unfair to be over-critical of these entities. **Law No. 221 (July 13, 1993)** proposed

concrete measures to ensure the proper functioning of the Ministry of the Environment and hopefully ANPA will be able to complement its services positively.

6.3. Pressure from the EEC

Italy's environmental risk regulation is still based in great part upon EEC Directives. The **1985 Galasso Decree** (Galasso Order of Council) which calls for the protection of natural ecosystems and the environment, is based on those EEC guidelines which have over the past decades dealt with chemical and air pollution, public information, hazardous waste management, pollution prevention, and protection of flora and fauna. Our national environmental policy has in fact, depended almost exclusively on EEC legislation. There has been little initiative to find innovative approaches or to go beyond! As a matter of fact, there is an urgent need to reform those environmental policies which have proven to be most ineffective.

Despite Italy's dependency on EEC regulations, many Directives have not been observed. This is mainly due to the weak and disorganized institutional and legislative infrastructures currently in place. It is also due to the fact that promulgating, enforcing, and implementing EEC Directives is complex and time-consuming in nature. National Parliaments and other regulatory bodies share enough *discretionary power* to translate Directives into national regulations. Hence, the extent to which the Directives are enacted is purely arbitrary. It is imperative that the EEC direct its efforts to empower and aid its member states to develop adequate and *sound* national environmental policies. By this, I do not intend to promote an *interventionist approach*, rather, furthering research and development in this area, learning from other member states, as well as enforcing compliance, is fundamental.

One example is the **Law No. 1836 (29 June 1993)** instituted by the EEC Council. This Law appeals for the voluntary integration of the Italian industrial sector within the EECs system of *eco-audit* and *eco-management*. The objective is to ameliorate environmental and efficiency standards and to inform the public of these activities (**Article 1**). The law defines environmental audits as management tools which systematically evaluate, document, and increase the efficiency of industrial activities in an *environmentally friendly* manner (**Article 2**). It also promotes participatory activities (**Article 3**) and defines how audits should be carried out (**Article 4**). Furthermore, it outlines what information the eco-audits should contain (**Article 5**). The Law requests member states to establish managing units to ensure the effective functioning of this system at a national level (**Article 18**) (*Impresa Ambiente*, 09/93).

VII. CONCLUSIONS: WHERE DO WE GO FROM HERE?

> "If we are irrational in our judgments about risk, the policies we enact will reflect a similar bias" (Teuber, 1993, p. 253)

Risk evaluation is a subject to intricate social constructs. It is a multi-dimensional phenomenon which affects all areas of choice. There is still a great deal to learn about risk such as: (1.) those social objectives, values and motivations which make us fear certain risks as opposed to others; (2.) understand the way people (especially decision-makers) analyze risk as well as the cognitive and logical patterns they use to set acceptability standards; and (3.) identify cognitive and motivational biases which guide risk choices. Granted, risk policy and decision-making cannot wait until *science* provides a response to all unanswered questions; on the contrary, *consent* is necessary to act upon those risks which remain uncertain. Decision-making issues need to be defined as a means to decide whether a decision is necessary and, if so, which alternatives need to be considered.

One option is incremental decision-making or *bootstrapping*. Setting safety levels from previous risks is an intelligent approach for responding to new risks. It is a flexible approach which is self-correcting over time. Attempting to regulate risks on a *case-by cas*e basis is unreasonable. It neglects the benefits which can be accrued from the *learning approach* and ensures that serious hazards be neglected, whilst trivial ones be regulated. It is not a cost-effective choice, since resources will be spread thinly over a large area.

Risk evaluation has a great deal to offer in this era of rapid modernization and technological innovation. One of the most important contributions of risk evaluation is the possibility to compare the risks of various alternatives. Risks are *technology forcing*

in that they encourage technical innovations to *reduce* or *mitigate* risks. Through innovation, they can move competitive markets and drive the *invisible hand*. Risk regulation can in fact enhance economic development. Moreover, risks are *society forcing* in that they "push" society to make a choice among alternatives (Fischoff *et. al.*, 1981). However, before this can occur, it is essential that the government place concrete priorities on risk issues.

What can be done? The first step towards ameliorating risk policy/ regulation is to establish a theoretical framework to guide policy decisions. Acknowledging the presence of risks as well as the uncertainties surrounding it, is a critical step. Secondly, it is necessary to establish a risk infrastructure. Resources for risk research are critical because it is only *via* research that valuable information can be used to assist decision-makers in making risk decisions [25] (Døderlein, 1987). There are several means by which governments can deal with risks. These include:

- Appropriate legislation
- Inspection and fining
- Training, education, and risk research
- Public information and campaigning
- Coordination of safety programs with voluntary organizations
- Subsidy schemes with industry and other entities, as well as collaboration on emergency-preparedness programs, etc. (Hovden, 1987)
- Monitoring and evaluation

Providing the public with appropriate information is a critical point which needs to be over-emphasized. *Jasanoff* quotes, "The provision of expert information to the lay

[25] Risk decisions consist of quantifiable and non-quantifiable losses. Some of these include: loss of human lives, reduction in life-expectancy, loss of human health, material losses, environmental damage, and social disturbances.

public on a widening scale may be the most significant contribution that risk makes to the politics of liberal societies over the next decade" (Jasanoff, 1993, p.77). It is necessary to gain the consent of the public. In fact, one of the major dilemmas surrounding risks is the lack of trust in the institutions that manage them.

From the Italian experiences encountered thus far in the area of risk evaluation, it is clear that risk events (*i.e.* especially environmental risks) are gaining greater attention. The very recent SNaM disaster near Turin, the AGIP event in Trecate, as well as the Mont-Alto di Castro installation, are prime examples which have captured the attention of the Italian people. In addition to public interest, government has also demonstrated a serious interest in risk. Influenced by the pressures of the EEC, national plans are slowly reflecting "safety" and "risk" aspects in their programs. Insurance companies, the judiciary system, and others are also showing greater interest in risk. As the arena of risk expands to incorporate new disciplines, there is much hope in a concerted effort for risk evaluation.

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LIST OF ACRONYMS

AEAM	Adaptive Environmental Assessment and Management
ALARA	As Low As Reasonable Achievable
ANPA	Agenzia Nazionale per la Protezione dell'Ambiente
CA	Concordance Analysis
CBA	Cost-Benefit Analysis
CNR	Centro Nazionale di Ricerche
DPCM	Decreto del Presidente del Consiglio dei Ministri
DSS	Decision Support System
DPR	Decreto del Presidente della Repubblica
EEC	European Economic Community
EES	Environmental Evaluation System
EHIA	Environmental Health Impact Assessment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ENEA	Ente per le Nuove Technologie, l'Energia e l'Ambiente
ENEL	Ente Nazionale per Energia Elettrica
EPA	Environmental Protection Agency
ERA	Environmental Risk Assessment
ISPE(SL)	Istituto per la Programmazione Economica
MAA	Multiple-Attribute Analysis
NRDC	National Resource Defense Council
RA	Risk Assessment
RE	Risk Evaluation
RM	Risk Management
SMART	Simple Multi-Attribute Rating Technique
SNaM	Società Nazionale Metanodotti