International Institute for
Applied Systems Analysis
IIASA www.iiasa.ac.at

Siting and Approval Process for an LNG Terminal at Wilhelmshaven: A Case Study on Decision Making Concerning Risk-Prone Facilities in the Federal Republic of Germany

Atz, H.

IIASA Collaborative Paper
October 1982

SITING AND APPROVAL PROCESS FOR AN LNG TERMINAL AT WILHELMSHAVEN: A CASE STUDY ON DECISION MAKING CONCERNING RISK-PRONE FACILITIES IN THE FEDERAL REPUBLIC OF GERMANY

Hermann Atz

October 1982

CP-82-62

INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS
2361 Laxenburg, Austria

PREFACE

This case study was performed in the context of a larger research project at IIASA: the Study on Liquefied Energy Gas Terminal Siting (Kunreuther, Linnerooth, *et al.* 1982). A comparison of four concrete decision processes in four countries (namely the Federal Republic of Germany, the Netherlands, the United Kingdom, and the United States), is an intrinsic part of this project. All the studies are concerned with siting decisions on major energy gas import or export facilities that were made in the last decade. The comparative evaluation of these case studies seeks, in particular, a greater insight into the way technical studies succeed or fail to influence political decisions.

In the FRG the selected decision concerns the siting of an import terminal to unload, store, and regasify liquefied natural gas (LNG) shipped in special tankers from distant producing countries. This project was conceived around 1970 by German energy companies. Approximately ten years later, in July 1979, the plans for an LNG terminal at Wilhelmshaven had received all the necessary approvals, licenses, and permits for construction to be started. The description and analysis of the public decision-making process leading to this approval is the topic of the study presented here. Since the main goal of this research is a deeper understanding of the events leading up to such a decision, it does not matter that the project has yet to be realized.

ACKNOWLEDGEMENTS

It would have been impossible to carry out this study without the obliging support of representatives from most of the institutions involved in the decision process under consideration. I wish to express my thanks to all these individuals for giving us their time and providing us with important material and information on the siting process.

Furthermore, I am indebted to my colleagues from the Risk Task Group at IIASA, in particular to Joanne Linnerooth and Howard Kunreuther, who, through numerous discussions, suggestions, and comments contributed substantially to this case study. Among the various persons reviewing the first draft of this report, Volker Ronge played an outstanding role by the depth of his theoretical remarks and his familiarity with political decision making in the FRG. Moreover, he participated in a couple of key meetings with representatives from industry.

Special thanks also go to Eryl Ley and Derek Delves for smoothing my English, and to Noël Blackwell and Rhonda Starnes who patiently endured numerous revisions in producing this final manuscript.

Finally, I wish to acknowledge the continuous active interest in this case study of Werner Salz, of the Bundesministerium für Forschung und Technologie (Federal Ministry for Research and Technology), who was responsible for the entire Liquefied Energy Gas study. It is not necessary to mention that this project was made possible only through the Ministry's financial support.

Hermann Atz
June 1982

CONTENTS

SITING AND APPROVAL PROCESS FOR AN LNG TERMINAL AT WILHELMSHAVEN: A CASE STUDY ON DECISION MAKING CONCERNING RISK-PRONE FACILITIES IN THE FEDERAL REPUBLIC OF GERMANY

Hermann Atz

CHAPTER 1
INTRODUCTION

Siting decisions on large-scale technical installations have been a source of societal conflict for a number of years now. The sensitivity of health and safety issues, the possibility of catastrophic accidents, and uncertainty about the long-term consequences of certain industrial activities have resulted in technological risks frequently being at the center of public debate.

As a consequence, the development of methods to assess the effects of technical installations, in particular those relating to health and safety, has become a focus of scientific interest. For more than a decade risk assessment and, more generally, risk research has developed as an independent field of scientific activity (Conrad 1980, Kunreuther 1982). Yet most of this research has been normative in nature. Further research has been devoted to psychological aspects of risk perception, but the reality of societal decision making with regard to risk-prone activities is as yet only poorly understood (Kunreuther and Ley 1982). Clearly, this lack of knowledge limits the effectiveness of prescriptive risk research. The case study presented here attempts to reduce precisely that gap by accounting rather extensively for a concrete decision making process in the FRG.

Having stated the descriptive emphasis of this study, we can explain its goals by contrasting the idealized model of decision making that underlies prescriptive analysis with societal reality. Normative decision theory usually assumes a situation where a single decision maker has to make one particular decision on the basis of clear objectives, preferences and framing conditions. Actual public decision making involves a variety of actors with different interests. It is a sequence of partial decisions in a complex institutional setting whose final outcome may be influenced in an

unpredictable way by external information, unexpected events, or changes in the societal environment. The decision problem itself is not even well defined but may be changed during the process according to particular parties' interests. These and similar factors are likely to influence the actual use and impact of technical analysis in ways not considered in the idealized normative model of rational decision making. For our purposes it is very important to obtain a better understanding of precisely those relations in order to contribute to an explanation of why certain kinds of technical analysis are preferred to others, or why they do not have the effects promised by their promoters. In addition, the study should shed some light on the question of what functions technical studies and expert opinion really have in the societal process of risk management.

This case study does not start from an elaborate theoretical model or from fixed hypotheses on public decision making concerning risk to the population. Instead it draws a comprehensive and lively picture of the decision process under consideration. Such an approach seems to be appropriate for two reasons. Firstly, not much research has been done in the field, so it is reasonable to collect some empirical evidence before formulating theoretical models. Secondly, this case study is supposed to serve as a basis for international comparisons. Using a strict framework for the description would mean suppressing information that at the comparative stage of the project could possibly turn out to be of interest.

Our description starts with an overview of the main features and elements of the LNG terminal siting decision (Chapter 2). After a brief look at some relevant characteristics of the political and administrative system in the Federal Republic of Germany, the most important technical details of the project and the site at Wilhelmshaven are mentioned. A description of the nature of the major parties and the roles they played in the LNG decision follows. The summary of the main events in the siting process that concludes this chapter is supposed to serve as a guide to the more detailed discussions in the rest of the report.

While questions relating to health and safety risks are frequently considered in an isolated manner by analysts as well as by actors in the political process, we try to put risk into perspective with other important aspects of the siting decision. Therefore, Chapter 3 is devoted to a description of the policy context of the LNG terminal decision and the type of arguments related to it. For each of the main aspects identified, namely energy supply, regional development, health and safety, and environmental impact, the regulatory framework is also briefly referred to in order to give some background information on the politics of the respective field.

Chapter 4 attempts to account for the views the main actors in the decision held with respect to the LNG project and its different impacts. At the same time some consideration is also given to the interests each of the parties might have had in taking a certain attitude towards the project. This effort seems to be justified by the fact that risk studies are usually commissioned by and addressed to only one or a few parties in the decision. Against the background of these party interests and perspectives it is much easier to judge the impact technical expertise had on

the parties' positions. Conversely, the commissioning parties views might also explain some features of the expert studies used in the decision process. Finally, it seems to be worth investigating the relationship between risk concerns and other relevant aspects of the decision on the level of the individual parties also.

The dynamics of the decision process are dealt with in Chapter 5. In chronological order we will describe how the decision problem was viewed and who participated at subsequent stages of this process, and which factors seemingly determined its outcome. Apart from the concrete policy context and the distinct party interests, these events are determined by the different framing conditions, such as regulations and legally required procedures, and also by unwritten rules of the political culture. Illuminating the relationship between the proper decision problem and the structural factors will later be of importance for assessing the roles played by technical studies and expert views in the decision. On the one hand these roles may be regarded as a function of the framing conditions; on the other hand some of the actors might have used expert studies to influence the political and institutional framework.

Chapter 6 is a reflection on the decision making process as perceived by the different interested parties and legal actors. It points out some special aspects that would have confused the previous description of the decision process. Moreover, the parties' views on the final outcome should shed some light on the winners and losers in the siting decision for the LNG terminal at Wilhelmshaven.

Chapter 7 summarizes features and events considered by the author to be outstanding or noteworthy for various reasons. The interest in a particular aspect may be due to its central role in the dynamics of the process. It may also result from the observation that this aspect distinguishes the LNG terminal decision from comparable siting processes. By no means is it suggested that such deviations are related to any legal irregularities in the procedures. It seems to be important, though, to recognize that each political decision represents a new interpretation of established procedures and rules, and thus more or less influences later decisions as a precedent. The chapter ends with an independent evaluation of the decision process with regard to distribution of responsibilities, timing, participation, flow of information, and related aspects.

The last chapter (Chapter 8) exclusively focuses on the risk issue. A general review of the importance of risk questions in the LNG terminal decision is followed by a fairly extensive description of all expert studies dealing with population risk related to the project at Wilhelmshaven and their use in the siting process. In addition to stating when and by whom the studies were commissioned and introduced in the decision process and what explicit purposes they pursued, we also try to point out how the contents of these studies were interrelated. Particular attention is paid to the final risk assessment procedure which we consider as both crucial for the concrete decision and remarkable from a general perspective. Further interesting features of the risk evaluation process and a tentative analysis of the impact the different expert studies had on the decision conclude the report.

At the end of this introductory chapter I would like to make a few comments on sources of information and methods. The information underlying this case study stems from several sources, the most important being interviews with representatives of the main actors in the decision.* These essentially open interviews were made by several members of the IIASA research team, but mainly by the author of this report, between May 1980 and April 1981. Original documents, such as official reports or approval announcements, minutes of council meetings, public relations material, and expert studies were used wherever possible. Unfortunately, not many such documents exist, and moreover, not all of them were made available to us. In addition some information was drawn from articles in the local press, but we did not pursue a systematic media analysis.

Owing to the incompleteness of this information and to the unreliability of *ex post facto* interviews a second step of verification seemed to be important. Thus, a first draft of the case study report was sent for comments to all parties contacted in the first round. Although not all parties replied, we now feel that the important facts can be considered as reliable. Of course one cannot presume precision in every detail, but we have confirmed those aspects that are relevant in the context of this study. Because of this intricate data base, we decided not to support all factual statements with references, and we have cited the sources only in cases where this helps to clarify the text.

Obviously the picture of the actual events emerging from this procedure cannot be "objective." Instead it is an attempt to aggregate the distinct pieces of information in a logically consistent manner that is as unbiased as possible. The result, of course, still reflects the author's personal views in more subtle ways.

A final remark concerns the notions of public decision making and of parties or actors in the decision. The terms decision process, public decision making, and political process are used almost synonymously throughout this report. This contradicts the common use of the corresponding German terms, in which the predicate political is applied to legislative bodies, governments, political parties, and interest groups, but not the public administration. In the terms we use here we do not make this distinction, following a basic assumption of modern political science namely that the differences between these two types of public institutions are only gradual.

Parties and actors in the decision are not only considered to have interests but also to depend in their positions and actions very much on the type of resources available to them: financial resources, information, access to decision makers, public influence, etc. Of course their actions are also determined by the laws and regulations in force, in particular if they have a legal mandate. In general the decision making process is not viewed as a single and relatively independent phenomenon but rather as the expression of underlying political and socioeconomic structures. Nevertheless, each political process conversely shapes this structure. The special features and events of such a process, therefore, not only are indicators of the status quo, but also contribute to originate societal realities.

*See the Appendix for a list of organizations interviewed.

CHAPTER 2
OVERVIEW OF THE MAIN ELEMENTS OF THE DECISION

2.1. NATIONAL CHARACTERISTICS

The Basic Law (Grundgesetz) of 1949 established the FRG as a federation of what are currently ten autonomous *states*, called Länder (not including Berlin which has a special status). As a rule, the Federal Government establishes laws and regulations that are implemented by the Länder.* There are a few cases of direct Federal administration, including the regulation of the inland waterways, which according to German public law include coastal waterways. In these cases specific Federal authorities operate at the local and regional (intermediate) level.

For the major part of the legislation there are five administrative levels: Federal, state (Land), government district, county (Kreis) and municipality. At the two lowest levels an elected council appoints the head of administration. The latter acts in some matters as an agent of the Land but at the same time is also responsible for executing the autonomous legislation (Selbstverwaltung) of the local authorities. At the intermediate level of the government district no elected body exists. The district government (Bezirksregierung), which is responsible for a variety of different administrative duties, is the principle executive institution within the Land, and may act as an agency of the Land government in matters delegated to it. Some policy areas are not wholly assigned to either the Federal or Land governments but are defined as so-called concurrent matters. This means that, in principle, the Länder are responsible for legislation; however, the Federal government is able to override their laws in all matters that affect more than a particular region. Energy policies

*For a more detailed description see Southern (1979).

are a typical example of this category. Formally most environment legislation belongs to this category, though, in practice, Federal legislation dominates (Steiger and Kimminich 1976). In other areas, such as town and country planning at various levels or water management, the Federal government has only the power to issue framework laws which have to be regarded by the Land or local governments in their appropriate legislation.

Political decision making in the FRG cannot be understood adequately unless one takes into account the separation of powers between the legislature and the executive, as laid down in the constitution. Public administration is regarded as a branch of law rather than a part of what in the German tradition is considered to be the proper political system. Because administrative bodies are not directly controlled by the elected bodies, the administrative law and administrative law courts have a particularly important role. Every private individual or institution affected by an administrative act (Verwaltungsakt) may appeal to the courts against the decision. There is an intricate system of administrative law courts to deal with litigation of this kind.

Owing to these characteristics, namely the complicated distribution of responsibilities, the strict separation of powers, the important role of civil servants in policy making together with the relatively weak position of political parties, a tendency toward consensus prevails in German politics (see Scharpf, *et al.* 1976). It includes established interest groups which are either integrated through the political parties or co-opted in advisory bodies to ministries, parliament, etc. This cooperative climate against the background of a complicated but formally well defined and separate institutional structure determines also to a large extent the relations between public administration and private industry. In spite of the usually close contacts between public authorities and companies, a certain protection against corruption is secured by the different administrative levels involved in every decision and by judicial control. Direct public participation in decision making is severely hampered by this structure, however (see Hinz 1974; Kitschelt 1980).

Yet over the last years citizen action groups of all kinds have changed considerably the political landscape of the FRG. With regard to environmental issues, nuclear power being the outstanding example, a growing number of these groups has entered the political arena (Murphy, *et al.* 1979, Guggenberger 1980). In many cases siting decisions regarding large-scale technical installations were the focus of the protest. However, the climate of consensus between political parties and the main interest groups has hardly changed, at least in those policy areas which have attracted a lot of extraparliamentary opposition.

Therefore, despite the increased formal possibilities of public participation, the chances for nonestablished interest groups to influence particular decisions through political demands has remained rather small. Since litigation has proved to be more effective for stopping, or at least for delaying, technical projects or even whole technological policies, judicial expertise has become a major resource in political conflicts of this sort.

2.2. DESCRIPTION OF PROJECT AND POLICY CONTEXT

In September 1977, two German gas companies filed (through a joint subsidiary company) applications with the responsible regulatory authorities to construct an LNG importing terminal at Wilhelmshaven. The natural gas was to be shipped to Wilhelmshaven from a liquefaction facility in Algeria in special tankers each carrying 125,000m^3 of LNG. Each tanker would have five tanks to carry the liquid gas at a temperature of -160°C and normal pressure. From Wilhelmshaven the gas would be distributed either by pipeline (after regasification) or by smaller LNG tankers. The planned terminal consists of a berth to unload or load two large and one smaller LNG tanker at the same time, a closed transfer system to the land facilities, storage tanks for (originally four, later six) approximately 500,000 m^3 of LNG, and a system for regasification (see Figure 2.1). Depending on the season, seawater or fossil fuels could be used to provide the necessary heating in this system. The facilities are designed to transfer 12 x $10^9 m^3$ of natural gas (equivalent at normal temperature and pressure) a year; in a first stage approximately half of this capacity would be used (DGWE 1979; WSB 1979).* As this amount of gas corresponds to one fifth of the current level of natural gas use in the FRG, two thirds of which has to be imported, the project is not negligible with respect to national energy supply.

For several reasons that will be explained in the following chapters, the originally independent LNG terminal project became closely connected with another large-scale project, namely that of a petrochemical plant planned by Imperical Chemical Industries Ltd. of the UK (ICI). This facility, designed to produce chemical half-way products such as vinylchloride and polyvinlychloride, was going to be sited on a plot adjacent to the terminal site (see Figure 2.1). The real physical connection was effected through the harbor facilities which in their central part, the so-called transport bridge, should be used jointly by DFTG and ICI. The actual jetties for each of the plants branched off separately at the end of this common transfer system. At the ICI jetty various chemical liquids used as raw materials were to be handled, the most important among them being ethylene, vinylchloride and soda lye. To illustrate an order of magnitude, the ICI project is roughly twice as large as the planned LNG terminal by its scope, investment sum, and the number of jobs created.

Wilhelmshaven, founded as a Prussian naval harbor in the last century, is a city of about 100,000 inhabitants located on the German North Sea coast to the west of Bremen. In spite of its location on Jade Bay, with naturally good shipping conditions, Wilhelmshaven's industry has remained relatively weak and unimportant. The coastal zone near the city, which is still highly dependent on agriculture and which has a considerable rate of unemployment, is one of the least developed parts of Lower Saxony. To attract industry, the water channel was deepened and a large area appropriate for industrial installations was reclaimed from the sea. Now vessels with up to 250,000 tonnes of cargo, more than twice as much as in any other German harbor, can enter the Jade

*For the risks related to this technology, in particular distant vapor cloud ignition following a major LNG spill, see Mandl and Lathrop (1981).

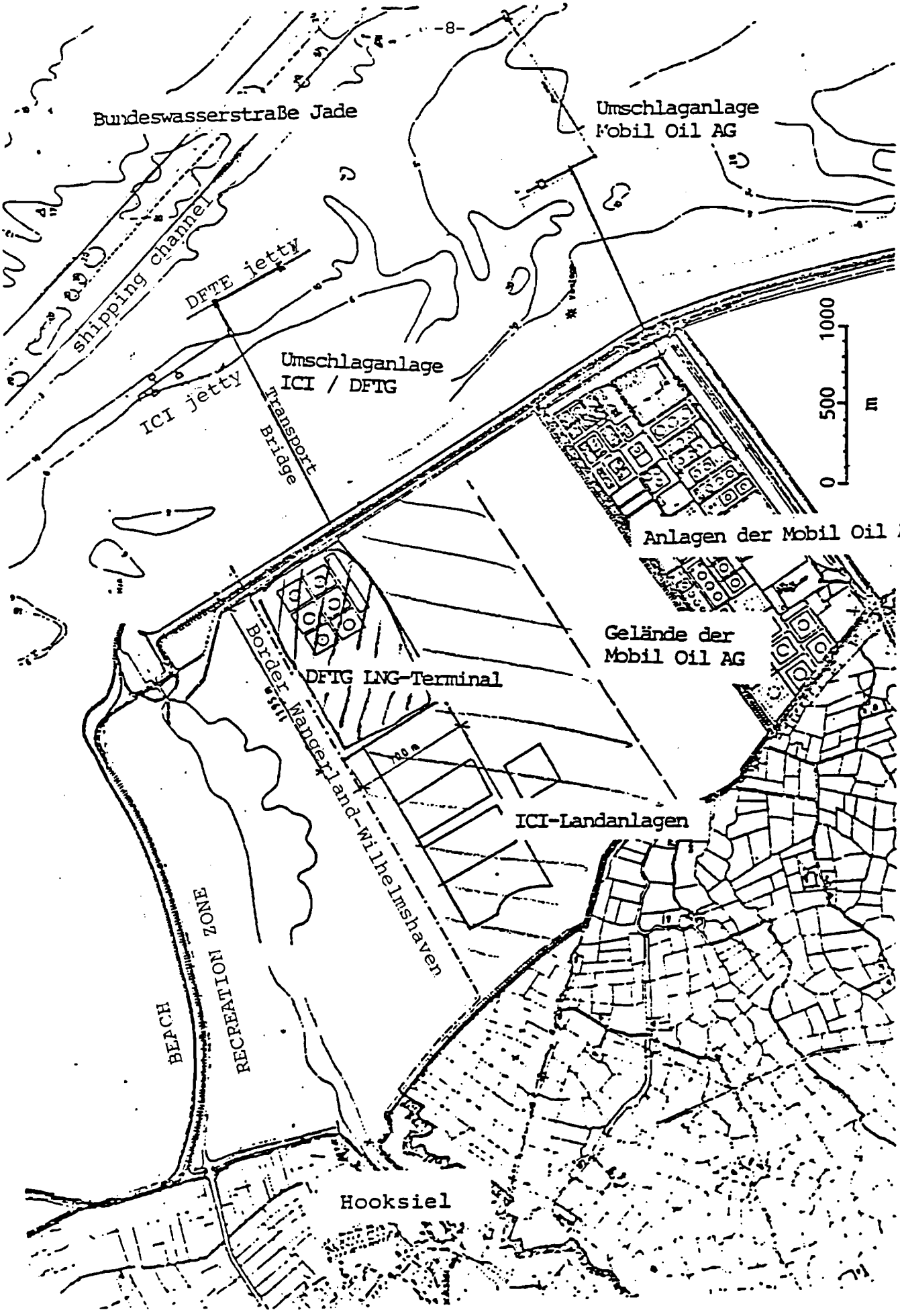


Figure 2.1. The LNG Terminal Site.

(Wilhelmshaven undated). This put Wilhelmshaven in a unique position with regard to the siting of the LNG terminal.

The site eventually selected is situated in the very north of this recently created industrial area at Wilhelmshaven, on the border of the adjacent municipality of Wangerland (see Figures 2.1 and 2.2), a land community of approximately 10,000 inhabitants. The village Hooksiel which belongs to this municipality is 2.6 km away from the nearest point of the terminal plot, its recreation area only several hundred meters away. This recreation zone, which is also situated on the land that has been reclaimed from the sea for industrial development purposes, was intended to be a compensation for Hooksiel's loss of its old harbor and the inconveniences resulting from the vicinity of industry. Nonetheless, the location of the LNG terminal became a source of conflict during the town and country planning procedures.

Because of sand banks on the Jade, the planned jetty would have to be built at a distance of more than 1.5 km from land and connected by a transport bridge with the facilities there. The shipping channel passes this jetty at a distance of about 500 meters. Thus the safety risk debated most in the decision process was the possibility of a ship deviating from its channeled course and colliding with an LNG tanker.

The technical features of the LNG project determined which approval procedures would be necessary. The most important are the following:

(1) The land-based facilities would be licensed, as for other major industrial projects, by an agency of the Land administration.

(2) Since the Jade is a part of the German coast within the three mile zone, it belongs to the inland waterways, which are under the jurisdiction of the Federal Waterways and Shipping Administration. A special licensing procedure is necessary for any construction in a Federal waterway.

(3) The plans for the land-based facilities can only be licensed if they are consistent with town and country planning. The adjustment of the relevant zoning plans, a responsibility of the autonomous administration of the municipalities, was therefore a precondition for the proposed terminal to be approved.

2.3. THE MAIN PARTIES TO THE DECISION

2.3.1. Definition

The distinction between main interested parties and others is more difficult to draw because there is no criterion to make the choice unique. However, the following three criteria define the selected set of actors reasonably precisely:

- legislative responsibilities
- assessment by participants in the decision process of who the main actors were

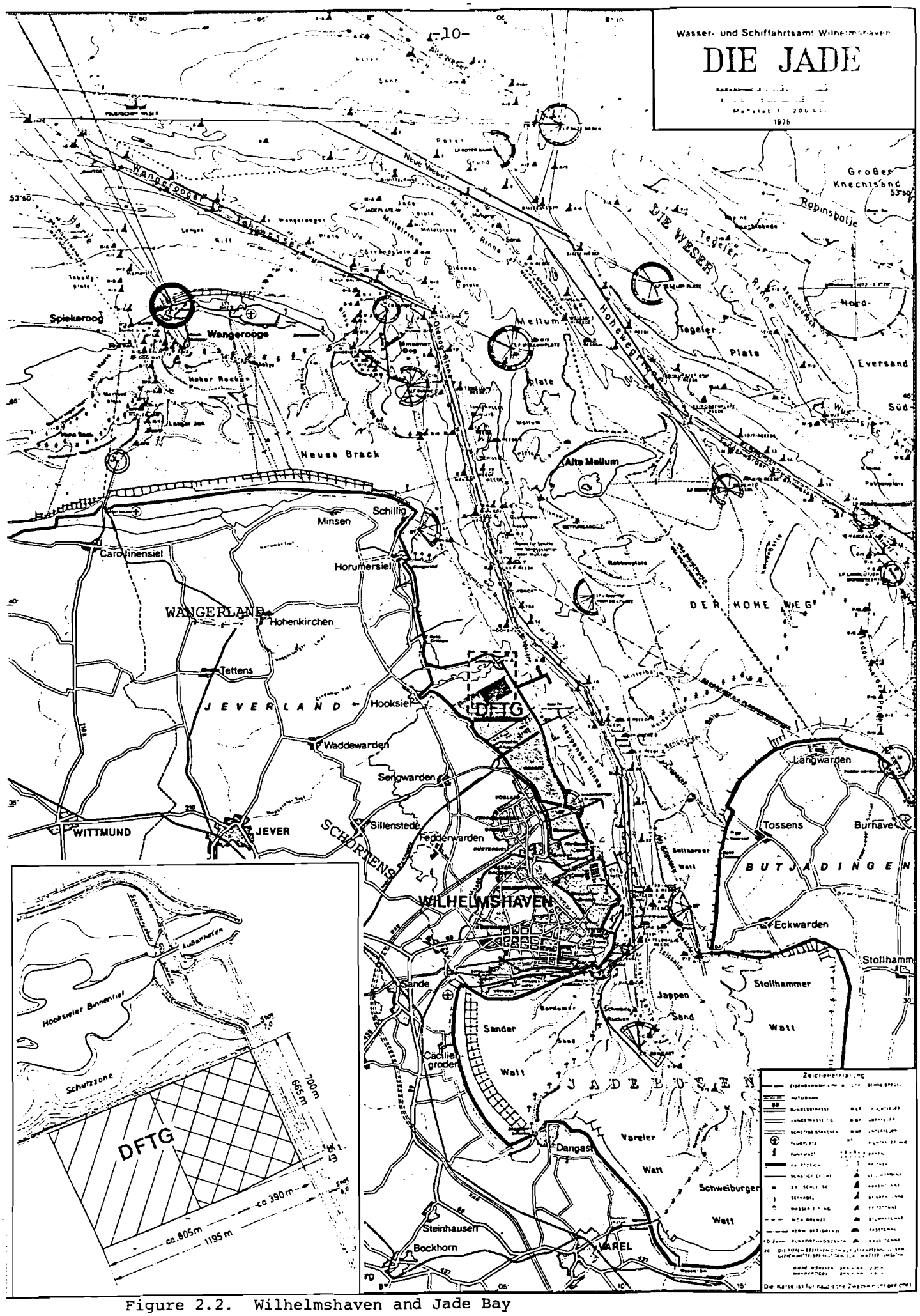


Figure 2.2. Wilhelmshaven and Jade Bay

- author's assessment of who influenced the decision in a sensitive way.

A couple of interested parties could perhaps have been added or omitted, but for the rest there is no arbitrariness according to these criteria.

2.3.2. Gas Companies and DFTG

The company assigned to plan, construct, and operate the LNG terminal in Wilhelmshaven, the DFTG (Deutsche Flüssigerdgas Terminal Ges.m.b.H/German LNG Terminal Inc. Ltd.) was founded as a subsidiary of Gelsenberg AG and Ruhrgas AG. To date it has only a few employees and a very small capital stock (0.25 million Deutschmarks/DM) (Brecht, *et al* 1980). Thus many of the planning and preparation activities remained with the management and the technical staff of Ruhrgas and Gelsenberg. Until 1978 DFTG was a fifty-fifty subsidiary company of these two companies. Since January 1, 1979, following an agreement between the shareholders of DFTG and Lower Saxony, the company tree of DFTG has been as shown in Figure 2.3:

Ruhrgas, a privately owned joint stock company with a complicated shareholding structure,* provides two thirds of all natural gas in the FRG (three-quarters of imported gas) and calls itself the biggest gas purchasing company in Europe (Ruhrgas 1980). With the vastly expanded gas market in the FRG, the share of natural gas in primary energy consumption increased from 4% to 16% within ten years (1969-1979), and Ruhrgas experienced a similar growth during that period. Simply because of this dominating position, Ruhrgas has to be considered as the driving force for the whole LNG project in the FRG.

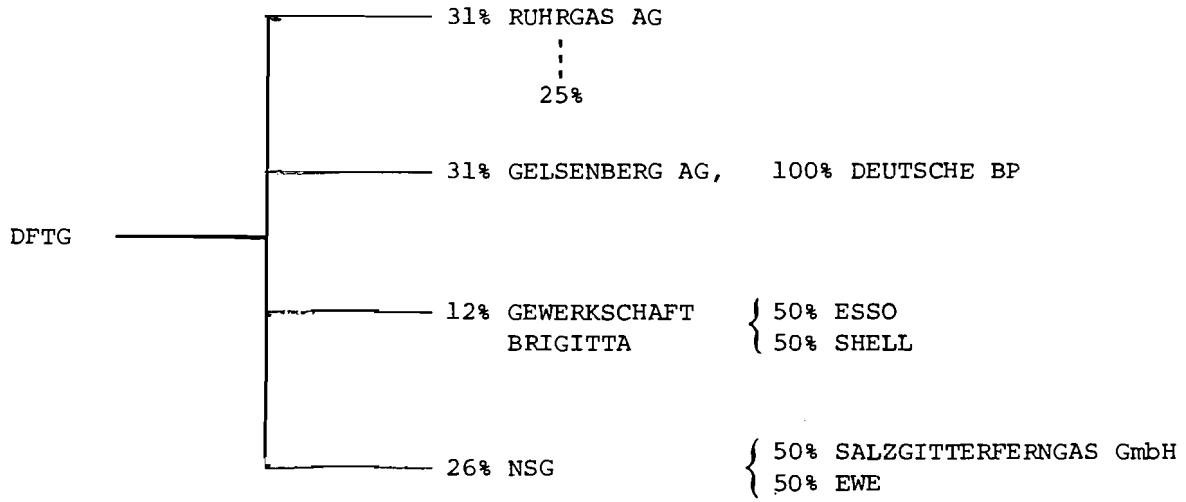
Whilst Ruhrgas specializes in the purchase, transportation, and distribution of gas, Gelsenberg is a company with a broad set of activities mainly in the field of energy production, such as oil and gas prospecting, coal mining, electricity production, and coal liquefaction and gasification. In 1978 Gelsenberg was taken over by the German BP Company; between 1974 and 1978 it had a minority state shareholding (Brecht, *et al.* 1980). The Gewerkschaft Brigitta owned by two multinational companies (Esso and Shell) has the specific goal of exploring, drilling, and piping natural gas, mainly within the FRG, where it accounts for two thirds of domestic production. Through BEB,** the management branch of the same company, it also acts as an important enterprise in the gas market of the FRG. Salzgitter Ferngas and EWE,† two essentially state-owned enterprises, have so far only been of regional importance in the gas supplying system of the FRG. Ruhrgas and Salzgitter Ferngas, which together with the Dutch company Gasunie formed a buyers consortium, were also engaged in the negotiations with Algeria for an LNG delivery contract.

---

*In fact Deutsche BP (directly and through Gelsenberg) and Gewerkschaft Brigitta each hold more than 25% stakes, but a special construction, the so-called Bergemann shareholding pool created on the request of the Federal Government, prevents oil and gas interests from taking a majority holding in Ruhrgas (Ruhrgas 1980).

**BEB--Gewerkschaften Brigitta und Elwerath Betriebsführungsges.m.b.H.

†EWE--Energieversorgung Weser-Ems AG



NSG: Niedersachsen-Gas-Ges.m.b.H.
EWE: Energieversorgung Weser-Ems AG

Figure 2.3. Company Tree of DFTG.

2.3.3. The Federal Minister of Transport (FMT)

The FMT is the highest authority of the Federal Waterways and Shipping Administration, responsible for maintaining and developing Federal sea and inland waterways and regulating shipping on them. In its capacity of policing shipping, the Administration has to ensure the ease and safety of shipping on the waterways. Most of the duties of the Waterways and Shipping Administration, such as licensing particular construction measures or other proposed activities, are delegated to subordinated authorities. The Minister himself is mainly in charge of issuing general guidelines and supervising the lower authorities. Individual decisions would only be taken by the FMT if considered to be of far-reaching importance.

The FMT was always informed about the main stages of the LNG siting decision through regular contacts with the Water and Shipping Board (WSB) and meetings with the applicant. The entire licensing of the harbor facilities was carried out with the FMT's compliance, but only at the last stage did the Minister assume a distinct responsibility within the approval process: he was the final decision maker on the acceptability of the public

safety involved in the transportation of LNG and other hazardous chemicals on the Jade.

2.3.4. Water and Shipping Board North-West (WSB)

The WSB, one of six intermediate authorities of the Federal Waterways and Shipping Administration, has the legal capacity of enacting specific duties of this administrative body in the area between the Dutch–German border and the mouth of the river Weser. In particular, it is responsible for approving any changes or construction measures in the waterways that might affect shipping. When acting as the licensing agency for the harbor facilities of the DFTG/ICI project, the Board was also the final decision maker in respect of impacts of the proposed project beyond the narrow responsibility of the Waterways and Shipping Administration, because the relevant license includes, with some exceptions, all other legally required permits and approvals.

By its twofold involvement in the LNG terminal siting decision, namely as regional shipping regulation authority and as licensing agency in respect of one of the main procedures, WSB played a particularly important role in the formal approval phase of the decision process. Internally these two duties were performed by different though closely cooperating departments: nautical and other technical questions were primarily dealt with by the shipping traffic department, whereas the judicial department was handling the licensing procedure.

2.3.5. The Lower Saxony Ministry for Economic Affairs and Transport (ME&T)

The Ministry executes regional development programs for the Land government, in particular it grants subsidies and advises companies in their siting decisions. One of the departments at the ME&T, Industrial Settlement Department, was specifically set up to serve as first contact for enterprises interested in engaging in industrial activity in Lower Saxony. On request the department is able to give assistance in site selection by use of a computerized data bank, as well as by mediating with local authorities. This department, together with two others, namely the Energy Department and the Department for Harbor Facilities, negotiated with representatives of DFTG, Ruhrgas, and Gelsenberg and with Wilhelmshaven about many detailed aspects of the project in the preparatory phase. As the industrial land reclaimed at Wilhelmshaven from the sea belongs to Lower Saxony, the ME&T represented the Land also in this regard. It is worth noting that although the Ministry has been headed by members of all three major political parties over the last ten years, there was no change in the policies relevant to the LNG terminal siting decision.

2.3.6. The District Government Weser-Ems (DGWE).

The name "government" should not mislead the reader into forgeting that this intermediate authority belonging to the Land administration has no legislative power (see Section 2.1). It performs a variety of administrative duties over a region in the North-West of Lower Saxony which embraces the Wilhelmshaven area.

With regard to the LNG terminal decision, the DGWE was involved in several functions: being in charge of granting the license according to the Federal Immission Control Law, it was a very important actor in the approval phase of the siting decision. At the same time the DGWE acted as agent of Lower Saxony in planning a part of the harbor facilities, namely the transport bridge assigned to be jointly used by DFTG and ICI (Imperial Chemical Industries Ltd of the UK). In this latter capacity DGWE also filed application with the Water and Shipping Board North-West (WSB) for a plan determination approval. The economic department of the agency, finally, collaborated with the ME&T in implementing the regional development program regarding the Wilhelmshaven area. In this respect it can be considered as the "extended arm" of the Land government.

2.3.7. The County of Friesland

The County of Friesland encompasses eight municipalities around Wilhelmshaven, exclusive of the city itself; that is, an area with nearly one hundred thousand inhabitants,* Friesland was involved in many talks during the first preparatory phase of the decision process. In the approval procedures Friesland had a limited duty regarding emergency planning in case of a major accident. Being one of the authorities affected in its jurisdiction by the proposed project, it was of course informed and heard in all licensing procedures.

The County Council of Friesland has, like the Wilhelmshaven City Council, a majority of Social Democrats, whereas the opposition includes a small minority of environmentalists. Socioeconomically the county area is partly agrarian/touristic, and partly industrial. The degree of industrialization exceeds that in the other areas of the coastal region near Wilhelmshaven. Yet, because of difficulties in the existing industry, the Friesland area has to be considered as depressed (WSB 1978). Therefore the different development programs of the Land and Federal government apply for the whole county as well (Niedersächsischer Minister des Inneren 1976).

2.3.8. The City of Wilhelmshaven

Wilhelmshaven is the host municipality for the proposed LNG terminal. In its capacity to carry out autonomous administration the city had to release appropriate zoning and construction plans for the project. Apart from these legally required formal procedures, the city authorities were involved in negotiations between the companies and Lower Saxony, as well as in the preliminary deliberations with regulatory authorities almost from the beginning.

The ruling majority in the city council is formed by a coalition of Christian Democrats and Social Democrats which in the 1976 election won 41 out of 47 seats (SPD, 25; CDU, 16). The remaining seats were shared by the Liberal Party (2) and a citizen group (4) which is to a large extent, but not exclusively, oriented towards environmental issues.** The local

*This is the situation as in 1981 and before 1979; in the two years between the County was united under the same name with a part of the neighboring county of Wittmund.

**_Die Bürgerschaft_, represented in the city council since 1972.

administration (municipality and county are identical in this case) is headed by an official appointed by the council for a twelve-year period. In a city like Wilhelmshaven with about one hundred thousand inhabitants, policy implementation, and to some degree also formulation, relies much more on the administration than on the elected council.

Economically Wilhelmshaven profits from being an important NATO marine base and a regional administration center. Industry plays a certain role too, but the labor-intensive enterprises belong to structurally weak industrial branches, and they got into considerable difficulties recently. Consequently, the unemployment rate is above the national average.

2.3.9. Neighboring Municipalities

Some municipalities in the vicinity of Wilhelmshaven, all belonging to the county of Friesland, intervened in the approval procedures for the LNG terminal. Wangerland, which has borders to the southeast directly on the terminal site, is an agrarian community of 10,500 inhabitants with considerable coastal tourism and with a relatively high proportion of inhabitants commuting to Wilhelmshaven or the industrial zone in Friesland. Wangerooge, situated on an island close to the Jade shipping channel, has 1,900 inhabitants and is mainly dependent on tourism. Schortens is a partially industrialized inland municipality to the southwest of the terminal site with a total of 20,000 inhabitants in its different dwelling areas.

All these municipalities had participated in the more general regional planning procedures. In the zoning and construction planning for the Wilhelmshaven area, they had only the status of affected parties. While Schortens and Wangerooge raised very specific problems at a certain stage of the decision, Wangerland was importantly affected and involved during the whole approval phase.

2.3.10. Public Interest Groups

The most effective public opposition to the proposed project developed in Hooksiel, the part of Wangerland situated next to the terminal site. In 1977, at about the same time as the formal approval process began, an action group called "Initiativausschuss Hooksieler Vereine" was founded in order to defeat the plans for the LNG terminal and a petrochemical plant in its vicinity. The Hooksiel Citizen Group (HCG) consisted of representatives of all associations and clubs based in Hooksiel (seventeen). It, therefore, claimed a higher degree of legitimacy than typical citizen action groups. Nevertheless, its financial resources were small and most of the group's activities relied on a few persons.

In Wilhelmshaven itself public resistance to the terminal project, except for a short period, was not very well organized. At the time when the approval process started at the local level, the opposition in the city council (Liberals and Ecologists), an environmentalist citizen group, some scientists, and the youth organization of the Social Democrats formed an action unit. It was mainly directed against the petrochemical plant, and did not have very much support from the population. Eventually internal difficulties broke the unit up and the different groups continued their fight individually.

2.3.11. Other Parties

Among the numerous other parties involved at one stage or another in the LNG siting and approval decision are several we should at least like to mention:

- The British company Imperial Chemical Industries Ltd. promoting the petrochemical plant in the proximity of the LNG terminal site
- The Mobil Oil Company, which operates an oil refinery to the south of the planned terminal, as an intervener in the plan determination procedure
- The Federal Ministry of Economic Affairs, which evaluated the economic benefits of the project after its acceptability had become an issue at the Federal level
- The Military District Administration II in Hanover, concerned with possible negative effects of LNG tanker accidents and traffic regulations on the NATO marine forces based at Wilhelmshaven
- A couple of Land ministries co-opted as responsible regulatory authorities, namely, the Lower Saxony Ministries for the Interior and Social Affairs
- Local regulatory agencies such as the Wilhelmshaven Water and Shipping Agency, the Wilhelmshaven Water Management Agency, and the Factory Inspection Agency in Oldenburg
- The Brotherhood of Harbor Pilots Weser II/Jade, a kind of trade union participating in some of the deliberations about shipping safety (regulations) and the most appropriate concept for jetties
- Aquatic sports clubs, nature conservation organizations, and a fishermen's trade union, which were officially informed about the planned development and, in part, objected to the project
- Several official technical boards
- Various consultants (institutes and individuals)

Political parties, labor unions, business interest groups, or environmental protection groups organized at a national or regional level were not involved in the decision process in any significant way. The local press in Wilhelmshaven and the Friesland area reported regularly on the planned LNG terminal and later also on the petrochemical plant. Regional and national media did not take up the issue of the LNG siting decision except for brief notices. The same pattern applies for public awareness in general, which did not extend beyond a relatively small area around Wilhelmshaven.

2.4. THE DECISION PROCESS

This section gives an overview of the main events in the decision process on the siting of a domestic LNG terminal in the FRG. It does not take into account internal decision making within interested parties, in particular within the companies. Therefore the starting point chosen for this case study is in 1972, at a time when public authorities became more directly involved in the site selection process (the precise date remains

slightly arbitrary). The main events leading up to the approval in principle in summer 1979 of an LNG import terminal at Wilhelmshaven are summarized in Figure 2.4 and will be explained below. The numbers shown in this figure are used to indicate the decision points in the diagram which is intended to clarify the structure of the decision process.

Several gas companies in the FRG began considering the possibility of constructing an LNG import terminal in the late 1960s or early 1970s. Algeria, at that time the most important LNG exporting country for consumers in Western Europe, played a predominant role in these plans. After completing an internal screening process, Ruhrgas and Gelsenberg, who had agreed on a joint project, decided that they would prefer a possibly more expensive domestic site to other potentially less costly sites in Belgium, France, or the Netherlands. In 1972 the two companies founded a subsidiary firm based in Wilhelmshaven with the purpose of constructing and operating an LNG terminal, the DFTG (1).*

Subsequent consultations with the Lower Saxony Ministry of Economic Affairs and Transport (ME&T)** and with local authorities confirmed industry's view that Wilhelmshaven was particularly appropriate for siting an LNG terminal on the German North Sea coast. In these talks the ME&T not only acted as the Land authority concerned with regional economic development in general but also represented Lower Saxony as the owner of the reclaimed terrain at Wilhelmshaven.

The decision in favor of Wilhelmshaven was agreed in principle and fixed in a preliminary contract between industry, Lower Saxony, and the City of Wilhelmshaven (2). These same parties then engaged in long and tough negotiations concerning the economic terms of the proposed project. The results of these talks were fixed in a "settlement contract" which was signed in July 1976 by DFTG, Gelsenberg, Ruhrgas, Lower Saxony, and Wilhelmshaven (4).†

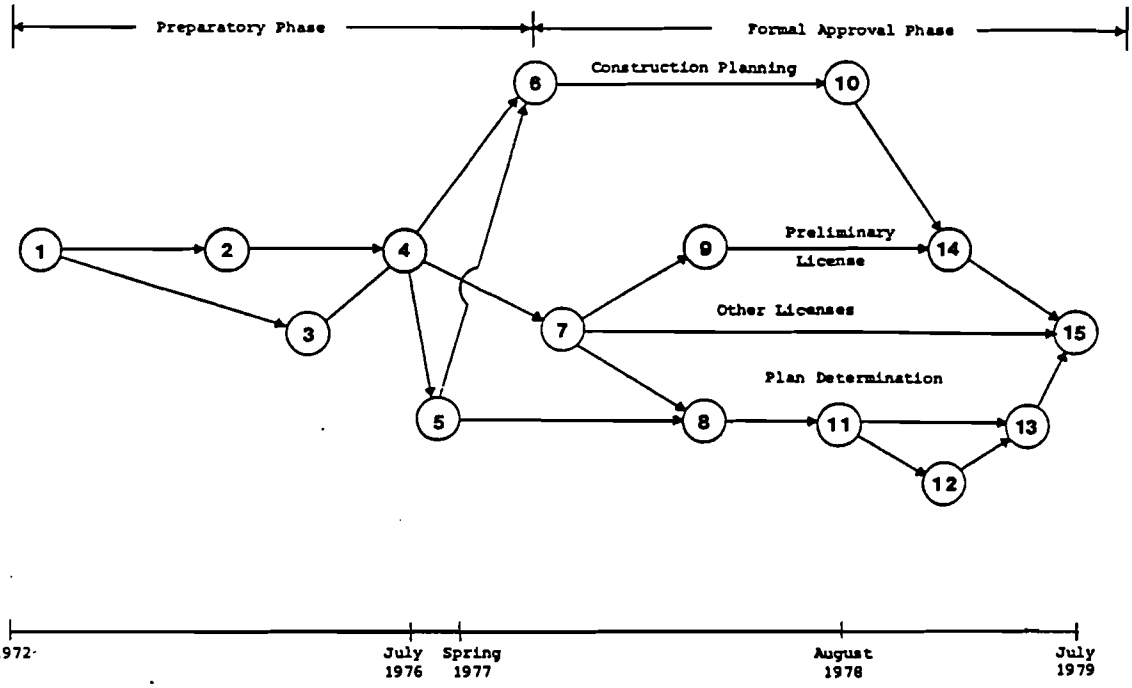
Simultaneously with these negotiations, and on the request of Lower Saxony and industry, the regulatory and local authorities affected by the proposed LNG terminal deliberated on the feasibility of the project from different perspectives, such as its impact on economic development, environmental effects, and occupational and public safety. They also considered suitable locations within the industrial zone at Wilhelmshaven and agreed on dimensions relevant in selecting the actual site. In 1974, DFTG decided in favor of one of the two building plots which it was offered by Lower Saxony, namely the one situated in the very north of the Wilhelmshaven area (3). Legally the sale of this piece of land was fixed in the settlement contract and later approved by the parliament of Lower Saxony.

---

*Numbers in parenthesis refers to the main events of Figure 2.4.

**"Niedersächsischer Minister für Wirtschaft und Verkehr", at that time called "Minister für Wirtschaft und öffentliche Arbeiten".

†The contract contains commitments from both sides on issues such as the provision of physical infrastructure, subsidies to be granted, support in approval procedures (public authorities), the types of investment to be made, environmental protection measures, and the possibility of smaller gas companies taking over a share in DFTG (industry). Such a settlement contract (Ansiedlungsvertrag) is legally binding by private law, and is frequently used in connection with industrial projects that are subsidized by public means.



MAIN EVENTS IN THE DECISION PROCESS

1. Ruhrgas and Gelsenberg decide in favor of a domestic site for the planned LNG terminal and found the subsidiary company DFTG (1972).
2. Gas companies, DFTG, and Lower Saxony sign a preliminary contract (November 1973).
3. DFTG, after consultations with public authorities, selects from possible sites in Wilhelmshaven (June 1974).
4. A settlement contract is agreed upon between DFTG, Ruhrgas, Gelsenberg, Lower Saxony, and Wilhelmshaven (July 1976).
5. DFTG, ICI, and Lower Saxony agree on the construction of joint harbor facilities for the ICI petrochemical plant and the LNG terminal (spring 1977).
6. Wilhelmshaven initiates the construction plan procedures for the terminal site (May 1977).
7. A delivery contract between a Dutch-German buyers consortium and Sonatrach, Algeria is signed (June 1977).
8. DFTG, followed by ICI and Lower Saxony, files applications for the harbor facilities with the Federal waterways agency, WSB (September 1977 to February 1978).
9. DFTG files application for the land-based facilities with the District Government Weser-Ems (September 1977).
10. The City Council of Wilhelmshaven approves the construction plan after dismissal of objections raised by several interest groups (July 1978).
11. The Federal Minister of Transportation becomes directly involved in the approval procedure concerning the harbor facilities (August 1978).
12. The FMT evaluates the risk related to the LNG terminal and tanker traffic on the Jade and finds them acceptable under certain conditions (March 1979).
13. WSB approves the joint harbor facilities (March 1979 to July 1979).
14. The DGWE announces its preliminary license for the land-based LNG facilities (July 1979).
15. Termination of approval procedure for construction of LNG terminal (July 1979).

Figure 2.4. LNG Decision Process: Structure and Main Events (PERT Diagram).

Following this contract, although some time before its actual signing, all interested parties intensified their efforts to initiate the required planning and approval procedures and various meetings took place between representatives of companies and regulatory authorities. In late 1976/early 1977 these activities were disturbed by an event unexpected by all parties in the decision process with the possible exception of Lower Saxony. The British company Imperial Chemical Industries Ltd. (ICI) became interested in Wilhelmshaven for siting a new petrochemical plant. Since the only suitable site was adjacent to the land reserved for the LNG terminal, in support of the ICI project Lower Saxony informed DFTG about a necessary change in the harbor conception for the LNG terminal. The revised plans, which were agreed between among DFTG, ICI, and Lower Saxony, provided for two separate jetties, one for each of the facilities, which were connected by a jointly used transport bridge (see Figure 2.1).*

Because ICI wanted to start construction of the plant as soon as possible, the ICI project had considerable impact on the continuing dynamics of the decision process. Hardly had the new concept for the jetties been settled when Wilhelmshaven initiated the construction plan (Bebauungsplan) procedures for both projects (DFTG and ICI), as required by the Federal Construction Law (Bundesbaugesetz) (6). Objections to the plans for the LNG terminal were raised by a rather small group of environmentalists in Wilhelmshaven and a citizen group in Hooksiel, as well as by the Municipality of Wangerland with a couple of other local authorities (for the location of Hooksiel and Wangerland see section 2.2). Having heard and responded to these objections, in July 1978 the City Council approved the construction plan as proposed (10).

A crucial precondition of the LNG project was fulfilled in June 1977 when the Dutch-German buyer's consortium signed a contract with the Algerian company Sonatrach for the sale of $8 \times 10^9 m^3$ LNG per year, half of which was reserved for the German companies (7). Delivery was planned for a period of twenty years starting in 1984. According to this contract, Sonatrach should have been notified of the exact location of the LNG importation site October 1978, a deadline which was later to cause some problems.

In September 1977 DFTG filed its application for two major licenses to be granted by public authorities (8,9). The District Government of Weser-Ems (DGWE) would grant approval for the land-based terminal facilities through a preliminary license (Genehmigungsvorbescheid) according to the Federal Immission Control Law (Bundes-Immissionschutzgesetz).** The harbor facilities were subject to another licensing procedure, the so-called plan determination (Planfeststellung) in accordance with the Federal Waterway Law. The Water and Shipping Board North-West (WSB),† which was in charge of this plan determination, considered the jetties for the LNG terminal and ICI plant and the transport bridge constructed by

*The bridge was going to be built by Lower Saxony, represented in this case by the District Government Weser-Ems.

**The term "immission" in contrast to "emission" focuses on the potential detriment to the environment instead of indicating the source of noise, pollution, etc.

†Wasser und Schiffahrtsdirektion Nord-West, one of the six Federal waterways authorities of the intermediate level.

Lower Saxony jointly in three similar procedures.*

For several months after submittal of the applications the two licensing procedures proceeded routinely. The licensing authorities began scrutinizing the plans, other authorities were involved, and the application was laid open to the public. However, toward the middle of 1978, the WSB department in charge of nautical questions revealed a growing reluctance to approve the project because of serious problems with respect to the safety of LNG shipping in the Jade Bay as perceived by the Board.

When the WSB informed the Federal Minister of Transport (FMT) about this development, stating that it did not wish to have sole responsibility for the decision regarding appropriate safety measures and the acceptability of the population risk, the Minister resolved to consider these questions himself. FMT's decision in principle was prepared by a working group at the WSB (which included the most relevant local and regulatory authorities and several technical boards) and a permanent advisory committee of experts from the Ministry.** After consultations with other Federal ministries FMT expressed the view that the population risk related to the project was acceptable under the condition that a number of injunctions on the applications were taken, the most important being a costly change in the shipping channel in the proximity of the terminal (12). This paved the way for WSB to approve the plan determination for all the harbor facilities (DFTG jetty, ICI jetty, transport bridge) between March and July 1979 (13).

When shortly afterwards the DGWE announced its preliminary license for the land-based facilities (14), the potential obstacles for the proposed LNG terminal were surmounted. This is equivalent to an approval in principle of the project allowing to start construction (15). As for the current state of the project (1981), the construction of the LNG terminal has not started because of an unanticipated shift in early 1980 of Algeria's export policy concerning LNG. It is expected that construction will be delayed until the gas companies are able to acquire a new LNG purchasing contract.

*In addition, a procedure concerning water management and protection was carried out by the DGWE. Though it became clear that this license would be granted, the procedure was never terminated because of the delay of the whole project.

**Beirat für die Beförderung gefährlicher Güter beim Bundesverkehrsministerium).

CHAPTER 3
DIMENSIONS AND POLICY CONTEXT OF THE DECISION

3.1. STATEMENT OF DIMENSIONS

Siting an LNG terminal is a complex decision problem with various aspects and consequences to be considered. Since different societal groups are affected differently by such a decision their perspectives on the problem will vary considerably. Owing to the nature of the political process, established policies and legal procedures play a crucial role in integrating the different views in an acceptable way. In this Chapter I attempt to achieve two goals:

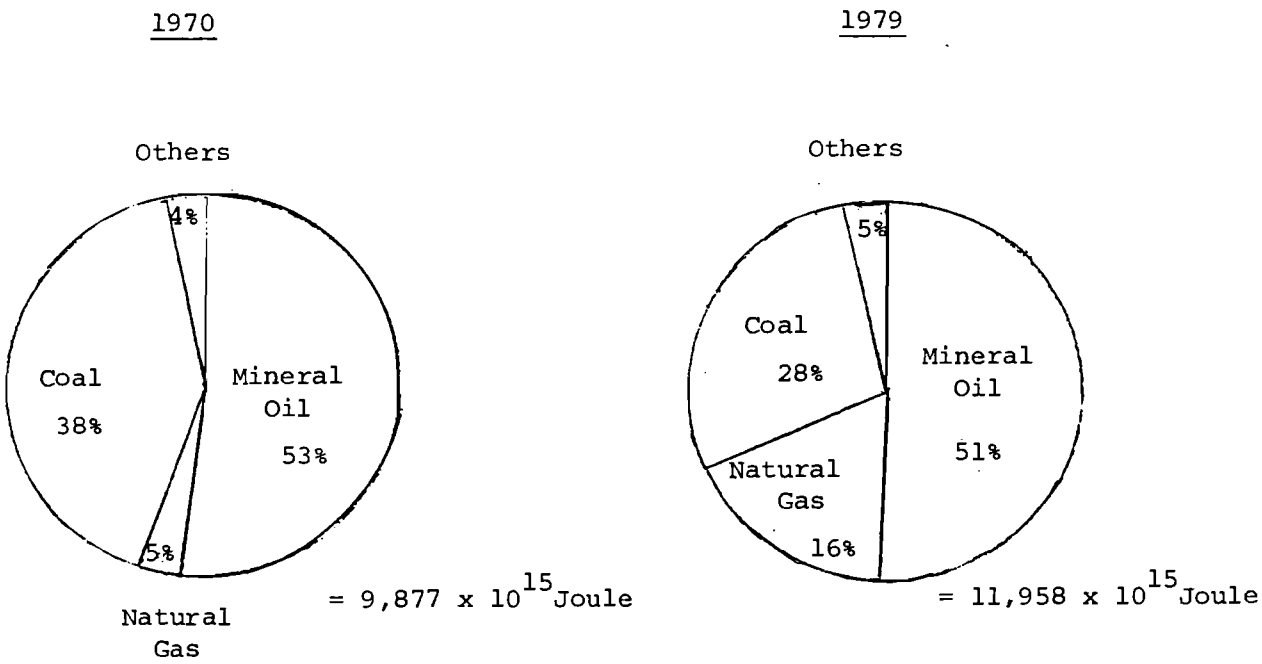
- to organize the numerous issues and concerns raised in the debate in a concise way by summarizing them under "dimensions"
- to give a draft view of the larger policy context in which the siting decision is embedded.

The following four dimensions are discussed here in general and will be used to describe in some detail the parties' perspectives on the different impacts of the siting decision in Chapter 4:

(1) Energy policy
(2) Regional socioeconomic effects
(3) Health and safety aspects
(4) Environmental impact

3.2. ENERGY POLICY

From a national perspective, the purpose and effect of the proposed LNG project were considered along one sole dimension: its contribution to the supply of a desirable form of energy. Natural gas was of minor importance in the FRG until the early 1970s. During the last decade its share in the primary energy mix increased enormously, from 5 to 16 percent or approximately 60 x $10^9 m^3$ of natural gas in 1979 (see Figure 3.1).



Source: Vereinigung Industrielle Kraftwirtschaft (VIK), 1980.

Figure 3.1. Primary Energy Mix in the FRG.

Currently, one third of the natural gas supply is produced domestically (1979). The other two thirds come from the Netherlands (38%), the Soviet Union (16%), and the Norwegian part of the North Sea (12%). The Netherlands is the oldest foreign supplier of natural gas--deliveries began in 1967. The first contract between the Soviet Union and Ruhrgas was signed in 1970 and the first Soviet gas arrived in 1973. Finally, the so-called Ekofisk pipeline from the Norwegian gas fields in the North Sea to the coast came into operation in 1977 (Ruhrgas 1980b). After the signing of the LNG delivery contract, Algeria became the fourth country on this list. The amount of LNG to be delivered by Algeria was fixed at 4 x $10^9 m^3$ in the first version of the contract and later increased to 5.6 x $10^9 m^3$ of natural gas equivalent per year. The terminal facilities themselves, however, were designed to transfer up to 12 x $10^9 m^3$ per year in the plans

submitted for approval, corresponding to one fifth of the current level of natural gas use in the FRG. From this perspective the project is not insignificant with regard to the national energy situation.

In contrast to many other European countries, the supply of energy in the FRG, including natural gas, is organized primarily by private companies. Public authorities have limited powers to regulate the activities of these companies and prefer to influence their policies, if at all, through negotiations and selected incentives. Governmental responsibility with respect to energy supply is shared by the Federal Government and the Länder since by constitution the matter is defined as one of concurrent legislation (see Section 2.1). In practice the Federal Government dominates in particular in relation to energy imports. The most important decision makers, though, are the companies. Within the limits of general market regulations they are quite free in making their principle decisions about production and trade engagements.

A comprehensive national energy policy hardly existed before the mid-1970s and has not developed very much since (Kitschelt 1980), but the rapid expansion of foreign natural gas supply was fully approved by the Federal Government in national energy policy statements. These forecast a share of 18% of the overall energy supply for by natural gas in 1980 and 1985 respectively (Bundesregierung 1974, 1977). In order to achieve this goal the Federal Government declared its support for all companies trying to acquire additional gas imports by such means as credit guarantees or bilateral agreements with countries at the government level.

The benefits of LNG with regard to future energy supply were never disputed in the decision process for the terminal in Wilhelmshaven. By some parties this dimension was used as a favorable argument, while others ignored it. Of course this does not imply that energy policy did not influence the decision, but it simply means that the related effects of the LNG terminal had not been assessed and debated in public.

3.3. REGIONAL SOCIOECONOMIC EFFECTS

Apart from Bremen and Hamburg, two cities with the status of independent Länder, the coastal region of Lower Saxony is one of the less developed parts of the FRG. It is still considerably dependent on agriculture and the few larger cities are mainly commercial and administrative centers. Therefore the income per head in the region lies significantly below the national average, whereas the unemployment rate exceeds the average. In Wilhelmshaven itself the situation is particularly difficult, because (as the most important base of the German marine forces) it was almost completely destroyed during World War Two. Even after the war the economy of the city remained highly dependent on the marine base, which is now used by NATO forces.

In the light of this situation a program to support the development of the coastal region of Lower Saxony was set up. The cost of such programs is usually borne jointly by Federal and Land governments. Though the Federal Government contributes considerably to the budget, the responsibility of deciding on special measures and individual projects remains

completely with the Land in accordance with the general division of power in the FRG. Support is given in two forms, either as direct subsidies to companies who invest in new facilities or as grants for the amelioration of the infrastructure for industrial activities.

Wilhelmshaven was designated to become a regional industrial center. The policy adopted for Wilhelmshaven, which had, of course, been agreed with the local authorities, was to take advantage of the naturally good shipping conditions in the Jade. The conditions have been further improved by deepening the water channel so that it can now be used by vessels with up to 250,000 tonnes of cargo. (This is far more than in any other harbor in the FRG: Cuxhaven, which comes closest to Wilhelmshaven in this respect, allows ships with up to 110,000 tonnes of cargo to enter the port). A great deal of land was reclaimed from the sea in several stages, the largest part which includes the later terminal site built between 1971 and 1976. This land offered good conditions for industrial plants dependent on such harbor facilities. In view of their generally growing importance, large energy plants or transfer facilities were considered to be particularly suitable. A policy goal was formulated to transform Wilhelmshaven into an "energy turntable" (Energiedrehscheibe) or even an "FRG Rotterdam". As a matter of fact, about eight facilities, including a coal power plant and an oil refinery, have been attracted so far (Wilhelmshaven 1979).

DFTG was one of the first enterprises to become interested in the specific advantages of the new industrial area at Wilhelmshaven. Although it was agreed that the direct socioeconomic effects of an LNG terminal were modest, public authorities decided to support the project. When the plans became more concrete the capital investment was estimated at 500 million DM (US$250 million). Some 140 jobs would be created directly for the operation of the terminal, without taking into account supply and maintenance activities as well as short-term employment in the construction phase. Thus local taxes, which are mainly paid on the invested capital, were seemingly more important than the number of jobs created. The increase in tax revenues for Wilhelmshaven from both the LNG terminal and the petrochemical plant planned in its vicinity has been estimated by a member of the city council to be 7 million DM (US$3 million) per year (Wilhelmshaven V).* It should be mentioned that only the host municipality of a facility benefits from these local taxes.

When opposition to the project grew, the lack of a significant positive impact on the regional economy was one of the criticisms raised. The argument went even further by claiming that industrial development destroyed jobs in other economic sectors, namely tourism and fishery in the municipalities of Wangerland and Wangerooge. Wangerland, for instance, records more than a million overnight tourist stays in a year in its whole area, which apart from Hooksiel encompasses essentially two other villages at the coast. One mussel fisherman in Hooksiel was going to lose (and actually lost) the major part of his submarine cultures.

*References of this type refer to interviews.

The different, partially conflicting perspectives on the socio-economic impact of the proposed project were debated in two contexts: environmental regulations which have to protect citizens against unacceptable disturbances and injurious effects, and Town and Country Development and Regional Planning. Every local development has to fit the larger and less specific regional and zoning plans agreed among local authorities affected. It depends on the specifications of these plans as to what level of detrimental effects has to be accepted by the neighborhood of a proposed facility.

3.4. HEALTH AND SAFETY ASPECTS

Legislation in the FRG does not distinguish neatly between health and safety and environmental impact considerations. Both matters are regulated jointly in a set of Federal and Land laws, the most important in this context being the Federal Immission Control Law (Bundes-Immissionsschutzgesetz) and related decrees.* The latter is applicable to almost all sorts of technical devices and installations with some remarkable exceptions, such as airports or nuclear facilities. For those considered to be particularly dangerous or damaging a formal licensing procedure is required. Similar approval procedures are provided for by other relevant laws like the Federal Waterway Law which regulates construction measures on inland waterways and on the coast. Historically, the current law evolved from factory inspection legislation. Therefore, as a prerequisite to being licensed in accordance with the Immission Control Law every planned industrial activity has to meet the relevant occupational health and safety regulations. The basic principles with regard to environmental protection that have to be followed for any installation submitted to licensing are as follows (Wohlleben and Vahrenholt 1979):

- to exclude dangers, considerable detriments, and disturbances to the public and the neighborhood of an installation
- to take precaution against harmful environmental effects by making use of the best available technology
- to provide for proper waste management.

Although specified to some extent in various ministerial decrees and administrative directives, these principles remain rather general and open to discretion with respect to the actual licensing practice. In some areas technical standards and guidelines (including measurement prescriptions) have been established, such as maximal emission rates for about 100 and incidence rates for some ten air polluting substances, in the so-called Technical Instructions Relating to Air, but they are not as rigorously handled as in the United States of America.** In other areas

*Law for the protection against injurious effects on the environment caused by impurities in the air, noises, vibrations, and similar disturbances. A comprehensive discussion of all regulations related to environmental protection can be found in Steiger and Kimminich (1976).

**Technical standards and regulations are essentially elaborated by official technical boards such as the Federal Institute of Material Control and the Federal Institute of Physics and Technology, or semi-official bodies constituted under private law such as the Association of German Engineers. In many cases they are not binding.

the requirements of authorities in charge of granting licenses are more oriented toward precedents; in particular, those which were confirmed in an administrative court suit. If neither of the two guiding principles applies, as in the case of novel technologies, the task of the licensing authorities becomes more difficult.

Any proposed project where licensing is legally required can only be approved if its safety and environmental acceptability are ensured. This seems to endow public authorities with important powers to decide upon such a project. While, in fact, nobody can prevent the licensing agency from refusing an application on these grounds, the decision has to be justified appropriately. Since the applicant is not obliged to prove that the proposed facility is harmless or at least acceptable with respect to health and safety and environmental impacts, the burden of proof lies in practice on the public authorities (Hinz 1974). The applicant's duty is to deliver sufficient evidence to allow a thorough scrutiny of the plans. If the applicant dislikes the requirements imposed by the licensing agency--in the extreme case refusal of the project--it may appeal to the courts against the decision as being unjustified.

In this situation expert studies of a particular form, the so-called Gutachten, play an important role. They are supposed to ensure the flexibility of the licensing procedures without diminishing their legitimacy. However, the merits of the Gutachten are not always unanimously accepted. Objectors in view of well-established cooperation between experts, public authorities, and applicants, frequently raise doubt about the objectivity of the studies, whereas project promoters point to the high cost and delay caused by a "flood of expert studies".

LNG is a good example of the difficulties just mentioned. Regulations concerning operations with explosive gases and liquids did, of course, exist in the FRG, but mainly for installations and devices of a much smaller scale. They did not cover some of the special features of LNG, such as the possibility of distant vapor cloud ignition. Therefore these points played a key role in the decision making process within the licensing authorities, as well as in the public debate about the project. Despite the fact that the critical questions with respect to the safety of LNG operations had been recognized from the beginning, they could not be resolved earlier than in the last stage of the decision process.

Distant vapor cloud ignition was a very important, but not the predominant, issue of the public dispute, as in some other LNG siting decisions (Kunreuther, Linnerooth, *et al.* 1982). Many people were likewise concerned about possible releases of chemicals from the ICI plant in the vicinity of the LNG terminal.* Such releases might not only be caused by internal failures in the petrochemical plant but also by an accident on the LNG terminal. Finally, much of the safety discussion was concentrated on vessel accidents involving LNG tankers. While the most serious potential consequences of such an accident would have to be expected in connection with the formation of non-ignited vapor clouds, it was also considered

*A risk analysis on potential vinylchloride releases performed in connection with the approval process of the ICI plant eventually led to the removal of some 100 inhabitants of a small adjacent village called Inhausersiel (Vahrenholt 1980).

to be a major danger if a large LNG spill ignited immediately.

The preoccupation with shipping safety can probably be explained by the high number of vessel accidents which have occurred in Jade Bay since it has been used by very large ships. Between 1965 and early 1978, thirty-one large vessels were involved in accidents, mainly groundings. Eight of them took place on a 5 km stretch of the shipping channel in the immediate vicinity of the LNG terminal. In four cases there was a high risk of a major oil spill which would have destroyed beaches and nature reserves around the Jade.*

One particular bend of the shipping channel was located in such a way that an incoming ship which for some reason did not change its direction appropriately at the bend would directly hit the jetty or the transport bridge (see Figure 2.2). Therefore several parties, including WSB, the licensing agency for the harbor facilities, required the removal of this bend by a change in the shipping channel.

There was little doubt that people using the recreation area of Hooksiel would be injured if a major accident (explosion, fire, distant vapor cloud ignition) took place. As mentioned in Chapter 2 this area is only about 1 km away from the LNG storage tanks and 2.5 km from the DFTG jetty, the shipping channel and the ICI jetty are within a distance of 2 km. Whether the village of Hooksiel at a distance of 3 km from the storage tanks and respectively more than 5 km from the jetties and shipping channel could also suffer from an accident was extensively debated, and finally excluded by the licensing authorities as impossible. Numbers relative to expected fatalities or injuries were usually not mentioned except by the Advisory Committee at the FMT which was talking about several hundred people potentially affected in ships on the Jade or at the beach (Risikoabschätzung 1979, p.11).

3.5. ENVIRONMENTAL IMPACT

As explained in the previous section, environmental protection is regulated by the same laws and monitored by essentially the same institutions as health and safety. Therefore at this point there is nothing to add about policy context or responsibilities. It could be argued that the distinction made between health and safety aspects and environmental impact would be artificial, but it seems justified for the author for reasons of comparison as well as for the purpose of clarifying the arguments used in the public discussions.

The concerns brought up by different parties in the decision process dealt with many different types of environmental damages. Air pollution was discussed with regard to the fuel used to regasify the natural gas. People argued that the noise produced by terminal operations would exceed acceptable limits in the neighboring dwelling areas. Others were more concerned about the damage to the coastal scenery caused by the high LNG storage tanks, or more generally, by the psychological effect of an industrial skyline near a recreation area. Possible water pollution

* According to private communication of Mr. Gottschalk from the City of Wilhelmshaven.

from chlorine was considered, and the effect on the marine environment of returning cooled water, as well as the danger of increased sand deposits in different parts of the harbor as a consequence of alterations in Jade Bay. Though none of these effects was severe enough to jeopardize the project, they attracted considerable attention. In many cases the parties bringing up these points were concerned not so much about the environmental impacts as such as about their consequences with respect to certain economic activities like tourism and fishery. Therefore the context of environmental legislation was not always appropriate to discuss them, but it was apparently easier to introduce the respective interests here than anywhere else.

CHAPTER 4:
PARTIES PERSPECTIVES ON THE MAIN DIMENSIONS OF THE DECISION

4.1. INTRODUCTION

This chapter focuses on consequences and features of the decision considered to be relevant by the main parties involved. It will essentially give the arguments raised by these parties in the decision process. There are a number of specific difficulties associated with this task:

- arguments made in public are not likely to be identical with the internal objectives and motivation of a party. They are essentially used as a strategic means to serve the parties' goals in a public debate, in negotiations, or at the courts (if necessary)
- arguments change over time according to the policy and institutional context of the current decision problem
- arguments are, in general, not complete in the sense that they do not look at all the aspects and dimensions relevant to the party.

The last statement is especially important with the decision under consideration. A proper analysis of the arguments made by a party at a certain stage of the decision process has to be based on written documents. In this case, though, only a few of them exist, and some of those that do exist are inaccessible. This has to do with the traditional secrecy of administrative processes in the FRG as well as with the fact that the LNG siting decision was hardly discussed in a larger political arena. To some extent the gaps could be filled with information from the interviews but these can never be as comprehensive as documents. Moreover, there is a considerable time lag between most of the main events in the decision

process and the time when the interviews were made.

These difficulties can be overcome in part by including information on legal or socioeconomic conditions and constraints of the different parties in the description. We cannot go into very great depth here yet because this would require an elaborate model of the political system under consideration, which goes far beyond the limits of this study. The interested parties dealt with in this chapter are the same as those presented in Chapter 2.

4.2. Gas Companies and DFTG

The gas companies, being private enterprises, have to act according to the principles of economic profitability. In an at least partially competitive energy market, this means that they are primarily concerned with safe gas supply at reasonably low prices. When the terminal project was developed, LNG promised to open up new sources of natural gas which allowed the share of gas in energy consumption to stabilize and expand further. It seems plausible that--as the companies stress--the concerns about safety of delivery weighed down simple price calculations, since the consumer price for natural gas always reflects an average of the purchasing prices (Ruhrgas I, II).* A diversification of sources not only reduces the risk of supply interruptions but also strengthens the position of the purchasing company with regard to possible requirements for extreme price increases.

While unrestricted in their principal decisions about production and trade engagements, the companies have to observe some constraints on the realization of their plans. These are, on the one hand, the general siting and licensing regulations. On the other hand, if the companies attempt to get financial or material subsidies from public authorities they will have to stress that their plans are in the best public interest, i.e. that they fit in one or several of the government policy programs regarding economic structure, energy supply, regional development, etc.

In their presentation of the LNG terminal project the companies primarily stress the context of *energy supply*. Natural gas should be considered as a particularly desirable energy source because of its efficient energy use and its low environmental impact (with regard to air pollution). The project would fit well into the energy program of the federal government, which aimed for an increased share of natural gas in the energy mix. As domestic resources were too small, the expected demand for natural gas had to be satisfied by imports (DFTG undated).

LNG is not only seen as a means of increasing overall gas import but also of diversifying the sources of delivery and thus of reducing the risk of supply interruptions. Because of the long-term contracts necessary in view of the high capital investment for an LNG transport system the safety of delivery would be further increased (Ruhrgas I, II). For the same reason Wilhelmshaven, as a domestic site, was preferred to possible locations of the terminal in other countries.

---

*References of this type refer to interviews.

The impact on the *regional economy* is of course addressed by the applicant but not stressed in particular. According to DFTG, Wilhelmshaven was primarily promoted as the technically and economically most suitable harbor on the German coast, in accordance with the findings of a harbor development study made by the FMT for all harbors in the FRG. This study found Wilhelmshaven to offer the best conditions for the transfer of mass goods; in particular, energy carriers delivered by large vessels. The number of long-term jobs created (between 100 and 140) was admitted to be modest, but not negligible. In the short term up to 800 people would be employed construction of the terminal (DFTG I). Other socioeconomic effects, such as the improvement of the regional infrastructure due to the project, were mentioned without going into further detail.

Coming to the *health and safety* aspects, LNG is described by the applicant as a well established technology which has proved to be safe. That there has been no significant accident in one and a half decades should convince everyone that the hazards of LNG operation are very low. Wilhelmshaven would offer the best conditions of all harbors in the FRG from a nautical point of view. Because of its low traffic density, few boats in the water channel, and good guidance devices, it was a safe harbor. LNG tankships submitted to the strict regulations of the IMCO code (Intergovernmental Maritime Consultative Organization) on gas tankships would have to be considered as safe (DFTG I, Ruhrgas I, II).

In the application itself DFTG attempts to prove that the LNG terminal project is in accordance with all relevant regulations and standards on materials and construction plans. Continuous control of materials, inspection of the construction and operation of the terminal, and special training of the staff ensured a maximum of safety. Moreover the best available technology would be used. Accidents were faced by an optimal combination of risk reduction and mitigating measures, risk prevention being especially important for the jetties and the vessels because LNG spills could not be confined on water as they could in the case of the land-based facilities (DFTG 1978). These statements were supported by several expert reports commissioned by DFTG (see Chapter 8).

Finally the companies also dealt with the *environmental impact* from two different directions. First natural gas was presented as a fuel with very desirable properties. In particular, LNG had to be considered as one of the cleanest energy sources with regard to air pollution because it had to be cleaned before liquefaction. Gas pipelines were built underground and therefore would not disturb the scenery (DFTG undated).

As in the case of danger to life and limb, experts were commissioned to show that noise and air pollution were below the limits required by environmental regulations and that water pollution was negligible (DFTG 1978).

On analyzing the companies objectives and concerns, one realizes that business policies and public energy policy were nearly identical. The impact on regional development was considered by industry as a favorable side-effect. There is no doubt that the applicant had an intrinsic interest in reducing health and safety risks as far as possible from a technical-economic perspective since a major accident could ruin DFTG

or the respective shipping company and could also damage the image of the gas companies. With regard to environmental effects the incentives were rather external to industry. Thus from the companies' perspective the siting decision was mainly a trade-off between safety and cost constrained by legislation.

4.3. THE FEDERAL MINISTER OF TRANSPORT (FMT)

In its capacity as supervisor of the Federal Waterways and Shipping Administration the FMT has not only the duty of controlling lower administrative levels with respect to the legality of their activities but also of ensuring an equal enforcement of the federal legislation. Therefore the FMT has a natural interest in all decisions that might serve as a precedent for similar ones. In the climate of growing societal concern about environmental issues and technological risks characterizing the FRG during the last decade the Federal Minister must have become particularly cautious in sensitive matters like the transportation of hazardous goods. Against this background it is not very surprising that the FMT participated in the LNG terminal siting decision; one might even have expected a more intensive involvement. Since the FMT also represented eventually in its decision the federal government as a whole (see Sections 5.7 and 8.3) he was not only concerned about maximal safety of the proposed LNG terminal but also considered other impacts of the project, in particular the economic benefits as perceived by the Federal Minister for Economic Affairs and the government of Lower Saxony.

The position of the FMT with respect to *health and safety effects* related to the LNG terminal is essentially based on the risk assessment performed by the Advisory Committee for the Transportation of Hazardous Goods (see Section 8.3). In its report the Committee deemed the population risk to be sufficiently small, if important safety measures were taken and appropriate traffic regulations formulated (most of these were already proposed in the WSB report to the minister). The Committee mentioned explicitly, though, that the final decision on the acceptability of this risk would have to be taken by public authorities in view of the political and economic benefits of the project (Risikoabschätzung 1979, p.3).

Obviously, after consultations with other Federal ministries in an interdepartmental committee, the FMT was willing to bear the respective responsibility. Thus the Minister's position toward the DFTG/ICI project can be interpreted as an implicit, though never pronounced, trade-off between safety and economic benefits which tries to maximize safety under the constraint that the costs must still be acceptable for the applicant and subsidizing public authorities (FMT I). Of course, there is a limit for the public safety risk beyond which the project would have been defeated. In his talks with the main parties the author got the impression that the decision under consideration was not too far away from this limit but that the perceived benefits with respect to energy policy and regional development outweighed concerns about safety and related public resistance.

4.4. THE WATER AND SHIPPING BOARD NORTH-WEST (WSB)

As explained in Section 2.3.4, WSB's main responsibility refers to shipping in federal waterways like the Jade. Therefore the Board was primarily concerned with questions of nautical safety and with morphological changes related to the construction of the harbor facilities for the LNG terminal. The latter are also of economic importance because of their potential impact on the maintenance costs of the shipping channel which have to be borne by the Federal Waterways and Shipping Administration.

However, in its capacity as licensing agency for the harbor facilities within the Jade the WSB had to take a much broader view on the different impacts of the proposed project. By law the WSB was obliged to exclude any possible negative effects on public welfare, in particular to ensure the health and safety of public and neighborhood, as well as to protect private rights that might be affected by the project (Federal Waterways Law, para. 18). While hazardous cargoes were not new to officials at the WSB--they have, for instance, to approve the transportation of such cargoes by sea--the agency does not employ professionals in this field. Therefore, on grounds of competence as well as justification the WSB had to rely quite strongly on outside experts, particularly since the Wilhelmshaven terminal was the first large-scale LNG facility applied for in the FRG.

From the beginning of its involvement in the LNG siting process the WSB stressed the importance of *safety questions* to be clarified before the LNG terminal could be approved. After a phase of collecting and processing information, including consultations with technical boards like the Federal Institutes for Material Control and for Physics and Technology, WSB deemed the open problems to be resolvable and expressed a favorable view on the feasibility of the project. Nevertheless for different reasons, not least the frequently changing plans for the LNG project, a comprehensive treatment of the safety question was only possible in relation with the formal approval procedure (WSB I, II).

Intensive deliberations on the problems of LNG tanker traffic and unloading activities took place between WSB and the applicant in the working group "Nautical Safety" during the preparatory stage of the plan determination (WSB 1978, p.2). As a result expert studies were commissioned by both parties on issues identified to be crucial for assessing the risk: dispersion and ignition properties of LNG vapor clouds, the safety of the LNG ship tanks in case of a vessel accident, and the likelihood of tanker accidents leading to a major LNG spill. Further studies on potential health and safety effects and possible risk-reducing measures were commissioned by WSB during the plan determination procedure (see Chapter 8).

When the WSB evaluated all these studies together with the information collected previously from the applicant, official technical boards, and comparable authorities in other countries (France, Japan, Netherlands, USA) it came to the conclusion that the population risk related to LNG operations at the harbor facilities of the terminal were not acceptable unless appropriate risk reducing measures were taken (WSB 1978, p.133). Among other requirements a change of the shipping channel in the proximity of the terminal was considered to be necessary in order to reduce

the probability of major vessel accidents at the jetty. Taking these measures into account the so-called residual risk (Restrisiko) would be low enough to exclude dangers to public and neighborhood (WSB 1978, p.188). By similar lines of reasoning the WSB concluded that the public safety risk related to potential accidents involving LNG tankers on the Jade shipping channel remained considerable even after the aforementioned safety measures had been taken (WSB 1978, p.188). WSB held that the harbor facilities could not be approved before the acceptability of this risk had also been settled.

The only other dimension considered by WSB besides health and safety effects was the *environmental impact* of the LNG project. During the preparatory phase WSB was seriously concerned about possible morphological effects of the jetty buildings and related construction measures. Expected sand deposits were an important criterion for the selection of the plot and the actual model for the harbor facilities. After an expert study commissioned by DFTG quite early in the decision process* had come up with satisfactory results, noise, air pollution, and similar environmental effects were no longer considered to be significant by WSB (potential water pollution was not the subject of the plan determination but of a specific licensing procedure for water management).

The WSB perspective on the impact of the proposed project was completely confined by the legal responsibilities of the Board in health and safety and environmental effects. Legally but also practically WSB could have refused the application if supported in this respect by the FMT. On the other hand there is no safety decision without implicit consideration of the other dimensions. WSB attempted to ensure the economic benefits of the project in as much as it looked for suitable requirements and regulations to make the safety risk to the population acceptable. These proposals were always deliberated with respect to their economic feasibility, i.e. whether the applicant or public authorities were able to finance them. Nevertheless, WSB's reluctance to approve the LNG tanker traffic and the risk-reducing measure it proposed suggest that WSB put a stronger emphasis on the safety dimension than most of the other parties in the decision.

4.5. THE LOWER SAXONY MINISTRY OF ECONOMIC AFFAIRS AND TRANSPORT (ME&T)

In order to ensure the implementation of regional development plans promoted by the Land government, the ME&T is concerned about all industrial projects in Lower Saxony. With respect to specific programs such as the one for Wilhelmshaven, it attempts actively to encourage or attract such projects. This requires a flexible policy responding as well as possible to the needs and wishes of interested companies, which on the other hand still serve the public policy goals. The ME&T itself defines its role therefore as a political broker mediating contacts between companies, local authorities, and licensing agencies (ME&T I). To regulatory

*Partenscky, 1974, Dec., "Gutachtliche Stellungnahme zur geplanten LNG-Umschlaganlage in der Innerjade und zu den Ergebnissen der Modellversuche des Franzius-Instituts," T.U. Hanover.

authorities or the local population this gives the impression that Lower Saxony is promoting certain industrial projects. The kind of support the ME&T granted to the ICI project is probably an even better example of the situation referred to than the proposed LNG terminal. The relation between companies and Lower Saxony can be characterized as a deal where both sides are interested in realizing a proposed project but at the best possible conditions from their perspective.

The importance of the LNG terminal project with respect to national *energy supply* was taken into account by the ME&T to some extent, though Lower Saxony itself did not need gas.* In addition the Ministry wanted to support gas supplying companies based in Lower Saxony and took the position toward Gelsenberg and Ruhrgas that the LNG terminal should be accessible to all companies that were able to acquire LNG delivery contracts. The justification for this was to support regional enterprises and to ensure a certain degree of competition in the highly monopolized gas market in the FRG (ME&T II).

It should be clear from the previous statements that the impact on *regional development* was the crucial aspect of the LNG project as viewed by Lower Saxony. Given the economic situation in and around Wilhelmshaven the LNG terminal was considered to be desirable for the following reasons: the number of jobs created was not expected to be very high, but certainly more than 140 (the number of people employed in the terminal itself). The jobs were safe even in times of economic depression. The trade taxes (Gewerbesteuer) paid to the municipality would strengthen its financial capacity considerably. Finally the LNG terminal could have the effect of an "initiative spark" for other projects in the newly created industrial area (ME&T I). *Safety and environmental aspects* were not considered by the ME&T, except for checking whether the project seemed to be feasible from this point of view.

In sum, the ME&T (Lower Saxony) viewed the proposed LNG terminal as favorable because of its impact on the industrial development of the Wilhelmshaven area. The original interest of the Land decreased somewhat, however, against the background of other projects considered to be more "important", such as the petrochemical plant promoted by ICI.

4.6. THE DISTRICT GOVERNMENT WESER-EMS (DGWE)

The different functions the DGWE assumed with respect to the decision process under consideration make it difficult to draw a consistent picture of interests and concerns underlying the agency's position. While economic and construction departments assumed an active role regarding the realization of the project, the factory inspection department had to scrutinize the plans and to decide upon objections from an independent position to some extent comparable to the courts'. On the one hand the law ascribes to every company the right to engage in industrial activities unless specific reasons forbid it; on the other hand the licensing

*Almost 100% of domestic national gas production comes from Lower Saxony.

agency has the duty to protect public and neighborhood against negative effects of a proposed project.

It is conceivable that such a situation would lead to internal conflicts between departments promoting the project and those in charge of carrying out the licensing procedures, possibly even to some pressure on the latter to decide in favor of the economic benefits. We do not have any evidence that this was the case in relation with the LNG project. Formally internal conflicts could not arise here because the licensing concerned only the land-based facilities, whereas DGWE's planning dealt with the transport bridge between the jetty and the land-based facilities. However, it should be clear that such a situation is liable to cause doubts with interveners about the independence of the licensing agency. Therefore it has to be considered as a structural deficiency with regard to the credibility of public authorities in the eyes of the public.

The position the DGWE took with respect to the expected socio-economic impact of the proposed project--the dimension of energy supply was not addressed--is very similar to that of the ME&T. Referring to this close connection, we sometimes talk about both as Lower Saxony's perspective. An assessment of the economic benefits of the LNG project performed by DGWE had been summarized in Section 3.3. During the licensing procedure the agency also had to check whether the terminal plans were consistent with regional development and zoning plans in force, which had been questioned in some of the objections. These concerns were not shared by DGWE (DGWE 1979, p.61).

As already mentioned, *safety and environmental effects* of the LNG terminal were addressed by DGWE in the context of the Immission Control Law. The agency was used to licensing large-scale industrial facilities, and one of the officials in charge of carrying out the licensing procedure, had a background in chemical engineering. DGWE did not approve the terminal plans as they were, but suggested various changes and imposed a number of more or less serious conditions on the applicant. In assessing the population risk, the agency considered a probabilistic risk assessment to be inappropriate because of the uncertainty of its results, and commissioned instead an analysis of the maximum credible accident (DGWE I, also see Pilz 1980). Based on previous deliberations and on the findings of this study (Brötz 1979), DGWE considered the revised terminal plans to exclude danger for public and neighborhood as required by the law (DGWE 1979, see also Chapter 8).

Air pollution and noise were the potential environmental effects primarily considered in the aforementioned licensing procedure. After DFTG had agreed not to use oil for regasifying the LNG, the emission of air pollutants was assessed in an expert study to be very small. With respect to noise disturbance to the neighborhood, DGWE required the applicant to meet the strongest standard, namely the one applicable for purely dwelling areas. Complaints about visual detriment due to high storage tanks were not upheld (DGWE 1979). Water pollution dealt with in another licensing procedure which also was performed by DGWE (license in accordance with the Federal Water Management Law and respective Land legislation) was considered to be insignificant (DFTG II).

In general the decision about the acceptability of the environmental impact was easier to take than that related to risk because regulations are more precise and easier to handle in the former case; moreover, LNG is quite harmless in this respect. The risk dimension was taken seriously by DGWE and played the predominant role in the licensing procedure, but apparently DGWE did not perceive any unresolvable conflict between economic benefits and safety. Therefore it is hard to say whether one of the two dimensions outweighed the other.

4.7. THE CITY OF WILHELMSHAVEN

Confronted with a difficult situation in the local economy, (unilateral structural dependency and a high rate of unemployment), Wilhelmshaven authorities committed themselves to a policy of industrialization, but not "at any price" (Gottschalk 1980). The benefits of such a policy besides the creation of jobs are mainly related to an increase in local tax revenues. While most of Wilhelmshaven's citizens are willing to accept this policy, the authorities have to take into account environmental concerns raised by a critical minority group (but which certainly affect the majority as well). Since 1972, 8% of the votes in local elections have gone to an ecologically oriented citizens' group.* Thus, despite a clear majority of the ruling coalition in the council, the authorities have to stress their attempts to reduce negative effects on environmental quality as much as possible.

The limits of the environmental protection measures are quite obvious, as companies will look for another site if they deem the cost to be too high. As mentioned before, on the local level the justification for any industrialization project has to stem from positive *socio-economic effects*. Nevertheless, arguments in favor of the LNG terminal made by officials and council members in Wilhelmshaven are on a rather broad level. Usually they stress the quality and safety of jobs created (for instance, by referring to the importance, nationally, of natural gas supply). The increase in tax revenues is acknowledged to be essential for further improvement of public facilities in Wilhelmshaven, such as sport and recreation areas or traffic routes. Finally, there is a general feeling that Wilhelmshaven's becoming an important harbor city, where energy carriers of all sorts are handled and major industries concerned with primary production are set up (Wilhelmshaven I-VI).

The municipality was neither responsible nor had sufficient resources to investigate the *health and safety* aspects of the proposed terminal in detail. Nevertheless, in the face of public concerns, the local authorities felt an obligation to look at these problems as carefully as possible. The city government considered the selected site to be optimal because it maximized the distance between the terminal facilities and the nearest residential areas (within the given constraints) (Gottschalk 1980). To deal with more specific technical questions the authorities invited some of the experts involved in the licensing procedures for discussions

*In recent local elections (September 1981) this group was able to improve its position further, now holding six instead of four seats on the council.

with the council and to a public hearing.* In general Wilhelmshaven followed the view of these experts that LNG was a developed technology which could be made safe by appropriate measures. In some questions like the tank conception the city expressed itself in favor of additional measures (*Jeverländisches Wochenblatt /JW* 6 December 1978).

Because of its particular industrial development policy, the city has acquired more expertise with regard to *environmental impact* control than to questions of safety risk. The symbol of its environmental policy is an urban network of air pollution control stations. This network, being financed to a great extent by local industry (the respective obligation is usually laid down in the settlement contract), is unique in the FRG. It is intended to ensure a reasonably clean environment despite ongoing industrialization (Stenzel 1977).

The LNG terminal seems very benign in this respect, especially after the DFTG had agreed to use clean natural gas instead of sulfurous oil to regasify the LNG. Thus, the city government underlined that the terminal would not significantly increase air pollution. Noise was said to remain below acceptable limits in all residential areas and the impact on water quality to be negligible as well. With regard to the most critical issue, namely potential detrimental effects on the recreation zone in Hooksiel, Wilhelmshaven authorities hold in their response to objections raised during the construction plan procedure that the distance of several hundred meters, a green emission protection zone, and a dam with bushes and trees, together with requirements for the operation of the terminal, would sufficiently alleviate the negative effects. (Most of these measures were originally planned to mitigate the effects of the ICI petrochemical plant.) The remaining effects would have to be accepted because the whole area had been reclaimed from the sea to promote industrialization - and because the creation of jobs has priority (Wilhelmshaven 1978).

Economic benefits and the safety and environmental impacts of the proposed project were both very important to Wilhelmshaven. On the one hand the city had a direct political and economic interest in attracting a facility which it perceived to be beneficial; on the other hand, it did not want to be accused by its citizens of lacking responsibility. Furthermore, there was a strong incentive for Wilhelmshaven to maintain a cooperative atmosphere with Lower Saxony in order to get support from the Land also in future industrial projects. Therefore it seems justified to assume a slight bias of Wilhelmshaven toward the economic aspects.

4.8. THE COUNTY OF FRIESLAND

The County of Friesland represented mainly the interests of the municipalities in the vicinity of Wilhelmshaven or the Jade shipping channel and of their populations in the decision. It requested maximal protection measures against the effects of the proposed project with respect to tourism, agriculture, coastal fishery, and general amenity and quality of life. All conceivable measures to reduce the risk to life and limb and to exclude negative environmental effects would have to be taken in order to

*Federal Institute of Material Control, Engler-Bunte Institute.

preserve the coastal zone as a viable living and recreation area (Friesland I). For the detailed argumentation we refer to the description of Wangerland's perspective in the next section.

The county's strict position, which almost neglects the economic benefits of the proposed project, seems to be inconsistent with Friesland's need to rely on industry for its economic development as well. However, in contrast to Wilhelmshaven, Friesland can count on tourism as a second economic branch in the future, and naturally it does not want to have this jeopardized.

4.9. THE MUNICIPALITY OF WANGERLAND

Wangerland's concerns are closely related to the geographical situation at the terminal, namely the proximity of the village Hooksiel to that site (See Section 2.2). Thus some of Wangerlands citizens were more directly affected by the planned development than the major part of the population in Wilhelmshaven. This entailed the odd situation that the people who had to bear most of the costs of the proposed project did not belong to the municipality politically responsible for the decision. Moreover, the only benefits Wangerland perceived in the DFTG/ICI project was an indirect form of compensation in terms of Land subsidies for the development of the recreation zone. Consequently Wangerland, and in particular, Hooksiel, felt threatened in their viable interests (tourism, fishery, and general living conditions), and objected to the project with a variety of arguments.

Their initial concerns developed around the dimension of *socio-economic effects*. Industrialization was expected to have negative effects on tourism in Hooksiel in several ways, by:

- a threatening, ugly scenery
- noise
- air pollution
- fire and explosion hazards

This could jeopardize a major goal of all regional development programs, namely to encourage tourism at the coast. The distance between the terminal and the residential and recreation areas in Hooksiel was deemed to be too small to assure Hooksiel's function as a coastal resort. Moreover the selected site would contradict the existing zoning and development plans, which had provided for a gentler transition from recreation to industrial area (Wangerland I, II; Wilhelmshaven 1978).

The site was not considered to be appropriate in view of the potential *health and safety* effects. It was selected at--according to Wangerland--a very dangerous point in the shipping channel. Therefore the vessels going into the new terminal would increase the risks to shipping in the Jade. Potential explosions during unloading operations at the terminal could injure people at the recreation and residential areas. The proximity of the LNG terminal, ICI's petrochemical plant and the Mobil Oil refinery was seen as a particularly serious problem. In the view of Wangerland and Friesland all of these questions should not only be treated by privately commissioned experts but by an independent expert looking at the whole

problem (*Wilhelmshaven Zeitung/WZ* 27 July 1978).

A decrease in the height of the storage tanks was strongly demanded from the *environmental impact* point of view. Air and water pollution should also be minimized by additional measures and finally the level of noise was expected to be too high. Wangerland's argumentation follows the typical pattern of an opposing group in making no trade-offs in its impact evaluation but rather listing all potential negative effects of the project with regard to the different dimensions. In view of the particular role the community had to play in this case such an attitude seems to be perfectly understandable and also rational in that it supported Wangerland's struggle for better protection or more compensation.

4.10. THE HOOKSIEL CITIZEN GROUP

As already mentioned in Section 2.3.10, the Hooksiel Citizen's Group (HCG) attempted to gather all local interests in a sort of village community. This rather unusual organizational structure must be seen against the historical background of relations between the village Hooksiel and the municipality it belongs to. Until 1972 Hooksiel was a municipality in itself. Only in the course of an administrative reform did it become part of Wangerland. Consequently there was still a kind of mistrust that the municipality would not fight for Hooksiel's interests as strongly as possible, or at least a general feeling that Hooksiel itself should take care about things affecting the village community almost exclusively. Despite the representative character of HCG, the group's activities relied on a few individuals only. Being laymen, these had to overcome considerable difficulties in order to familiarize themselves with all the technical information. The more detailed the objections were, the better their chances became of influencing the decision substantially. HCG would not have been taken seriously unless it was able to argue at the same technical level as experts from the licensing agencies. Many of the arguments, of course, were identical to those made by Wangerland and Friesland. While this does not necessarily mean that they were simply taken up by the Citizen's Group, we will not repeat them here.

Socio-economic aspects and regional development were in focus again. HCG took a slightly broader perspective and argued that the benefits of the whole industrial development were not obvious. On the one hand a few jobs were created with enormous public subsidies; on the other hand, the new installations destroyed or threatened other economic sectors, namely tourism and fishing in Jade Bay. In the long term, the NATO marine forces might also leave Wilhelmshaven because of the concentration of ships with hazardous cargoes in Jade Bay. HCG did not consider all industrialization to be negative, but the type of industry that had been attracted to Wilhelmshaven was not appropriate for improving the employment situation to any noticeable degree (HCG I, II; Wilhelmshaven 1978).

One of the main points of criticism concerning *health and safety* aspects was again the location of the terminal close to a particularly dangerous point of the shipping channel. Since the risk of vessel accidents would be greater as a result of traffic to the new jetties,

construction measures were required to prevent collisions with tankers moored at the jetty. The proximity of the LNG terminal and the petrochemical plant, in particular the two jetties, was considered to cause an unique accumulation of hazards. These hazards would result from the fact that neither detonation of natural gas spills nor the formation and propagation of vapor clouds could be excluded on the basis of existing expert studies. Thus the distance between the terminal and the village as well as the recreation area ought to be greater. An objective senior expert report was required in order to prove that the project was harmless (Wilhelmshaven 1978; *WZ* 14 September 1978; *JW* 15 September 1978).

A greater distance would also reduce negative *environmental effects*: noise and air pollution (mainly from the ICI plant) would exceed acceptable limits if the current plans were realized. The size of the tanks was attacked as a psychological threat affecting in particular tourism. The construction of the jetties and a potential change of the shipping channel would affect the morphological situation in Jade Bay. This would result in increased silt deposits in other parts of the harbor and would disturb the ecological equilibrium of the bay. As one of the consequences the natural base of shell-fishery would be further damaged (Wilhelmshaven 1978; *WZ* 27 November 1978).

In sum, HCG's perspective, similarly to those of Wangerland and Friesland, was one of an opposition group fighting for its case. Competing objectives were therefore not considered and weighed.

4.11. THE IMPORTANCE OF THE SAFETY DIMENSION

Concluding this chapter, we will summarize the importance the safety dimension had in the different parties' perspectives on the LNG siting decision. As a matter of fact, all parties but Lower Saxony's government paid attention to questions of health and safety in their evaluation of the decision problem, but the relationship between this dimension and other important concerns differed substantially between the various parties. Table 4.1 gives an overview of the main dimensions of concern and the relationship between them for all parties considered.

The companies and Wilhelmshaven, in view of their competing interests with regard to the LNG project, had to make real trade-offs between political or economic benefits and safety (environmental protection). Licensing authorities, on the other hand, were required by law to look exclusively at health and safety and environmental effects. Practically, public authorities also paid attention to the economic feasibility of injunctions they intended to impose on the applicant. Nonetheless, the exclusion of dangers and detriments for the public was the ultimate criterion for their decisions. The FMT, which falls into the category of the licensing authorities as well, deviated to some extent from this pattern. Although population safety had to be ensured in any case, the FMT's decision reflected political concerns, i.e. primarily expected economic benefits, much more than the position of lower agencies.

Table 4.1. Dimensional Analysis of Party Perspectives.

PARTY	MAIN POLICY QUESTION	DOMINANT DIMENSIONS
Companies	What is the optimal site and design for the project?	Energy policy and profit/safety*
FMT	Is LNG shipping acceptable?	Safety/energy policy and regional development
WSB	Are LNG shipping and harbor facilities acceptable?	Safety
ME&T	Is project desirable?	Regional development
DWGE	Are land-based facilities acceptable?	Safety and environmental protection
Wilhelmshaven	Under what conditions is project desirable?	Economic benefits/safety and environmental protection
Friesland Wangerland HCG	What impacts has the projects? Can they be made acceptable?	Economic costs, safety, and environmental protection

*Denotes a trade-off between dimensions.

Objectors to the proposed project, finally, viewed the safety aspect as one factor among others to explain their opposition to the plans. This does not diminish the sincerity of their concerns about risk. Given that they perceived no benefits from the project, it would be irrational from their part not to introduce all possible arguments to put the project in an unfavorable light.

CHAPTER 5
THE DECISION PROCESS

5.1. INTRODUCTION

This chapter deals with the chronological development of the decision process leading to the approval in principle of the LNG terminal at Wilhelmshaven. Particular attention is paid to the question of how the main events in the siting decision and the behavior of the different parties involved were influenced by the legally required approval procedures as well as by the policy context of the LNG project (see Chapter 3).

The chapter starts with a description of the formal approval and licensing procedures carried out in relation to the LNG terminal decision. While these procedures were the central part of decision making with respect to the acceptability of the population risk, most of the more general political decisions framing the approval procedures were taken before this stage in a less formal manner. All contacts, negotiations, and agreements made under this preparatory phase have only the status of private trade connections or of information and informal advice. Yet in terms of substance and real decision making, the involvement of public authorities at an early stage of the decision, in particular the commitments they made toward the later applicant, influenced the whole decision process considerably. Therefore our consideration begins much earlier than the formal applications for the different legally required licenses.

5.2. DESCRIPTION OF APPROVAL PROCEDURES IN GENERAL

The approval process on the LNG terminal involved three main procedures:

(1) town and country planning in Wilhelmshaven (Bauleitplanung).

(2) Licensing for the construction of the jetty and transport bridge in Jade Bay called "plan determination" (Planfeststellung).

(3) Licensing for the construction of the land-based terminal facilities, called "licensing according to the Federal Immission Control Law" (Genehmigung nach dem Bundes-Immissionsschutzgesetz).

Other procedures concerning regional planning, water management and pollution control, the duration of the delivery contract with Algeria, and the operation of an energy facility at Wilhelmshaven in general will not be described in detail, since they played only a minor role in the LNG terminal decision.

5.2.1. Town and Country Planning

town and country planning is part of the autonomous administration of the municipalities regulated by federal framework legislation (see Figure 5.1). According to the Federal Construction Law (Bundesbaugesetz) there are two steps involved:

- zoning (Flächennutzungsplan)
- construction planning (Bebauungsplan)

Zoning is the general procedure of selecting certain areas for residential, recreational, agricultural, and industrial use and of determining traffic routes and other public facilities. Zoning plans have to fit the more general regional development plans released by the Land authorities. They cover the whole area of a municipality, and are closely related to the overall planned development of a city, town or parish. Construction plans are more concrete. They are released only for those areas to which buildings are assigned. They regulate the type of buildings (purpose, size, arrangements), the portion of area to be built upon, and measures to preserve the characteristics of the area. Moreover, they allow for prescriptions with regard to environmental effects emerging from or affecting the area under consideration. Certain areas may be designated as protection zones; in others the use of certain damaging technologies may be prevented or regulated. Yet the prescriptions must not be too specific in order to preserve the general character of building plans (Dreyhaupt 1977).

The formal procedures for zoning and construction plans are very similar. They start with the decision by the council or the administration to release a zoning or construction plan. In the next stage the municipality has to announce its intention to the citizens and to explain the main features and consequences of the plan in an appropriate form.* The plan is redrafted after a public hearing, where people have the chance to give their views and to ask questions about the plan. This draft plan is then laid open for public scrutiny again, and comments and objections can be made by everyone who feels affected in his legally ensured rights. They have to be answered in writing, this time by the administration. Public authorities whose responsibilities might be affected, participate in a similar way in the decision process. Thereafter the council releases the plan

*This is usually referred to as "early citizen participation". Its main purpose is to inform the planning authorities comprehensively about potential effects of the draft plan and the views of their constituency.

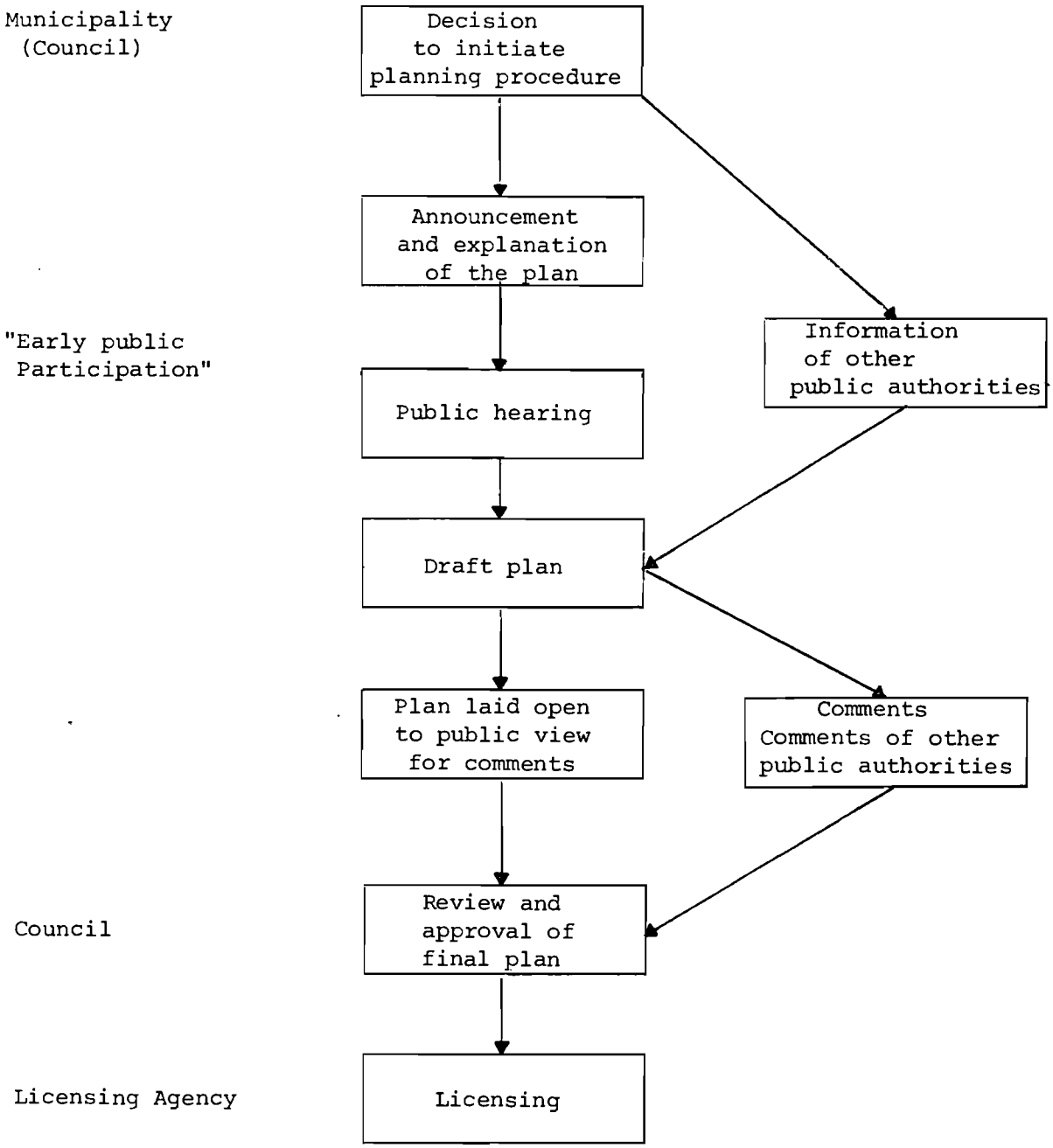


Figure 5.1. Town and Country Planning Procedures according to Federal Construction Law.

after considering suggestions and objections made by the public and by other public agencies. Finally the plan is reviewed by a licensing agency of the Land administration. This agency scrutinizes the plan to see if it is consistent with framework legislation on town and country planning and whether the procedure was carried out correctly. It has no active right to make changes. Thus the plan is either refused or licensed, in which case it becomes valid a few days later.

5.2.2. Plan Determination

According to the Federal Waterways Law (Bundeswasserstrassengesetz) every building or installation in a federal waterway which might affect ease and safety of shipping has to be licensed by the Federal Waterways and Shipping Administration. This can either be done by a simple license (in which case the license is not equivalent to a construction permit but the project has to obtain a number of other approvals and technical permissions) or by a "plan determination" procedure (see Figure 5.2). This plan determination gives final approval, including all other licenses and permissions required. Therefore all aspects relating to the public interest have to be considered and all regulatory authorities whose responsibilities are affected have to be involved in the procedure. In contrast to the first possibility (single permissions), plan determination provides for formal public participation. For the applicant it has the advantage of judicial safety.

Any company or other judicial person intending to construct a building within a federal waterway must inform the responsible Water and Shipping Board. The agency (sometimes the Federal Ministry of Transport) then decides which procedures apply. The company is then able to apply formally. The licensing agency has to check whether the plans filed as an application are detailed enough for it to examine all aspects of the technical installations which are submitted to regulation and to impose appropriate requirements. (In many cases there have been consultations between company and agency about the application before the latter was officially filed). In some cases the applicant may be asked to complete the plans, for instance, by expert reports assessing safety or environmental impact.

After the application has been accepted the licensing agency starts to scrutinize the plans, and other authorities have to be co-opted or simply informed, depending on whether their responsibilities are directly affected or not. The set of participating public authorities usually includes municipalities, counties, and district governments whose area of jurisdiction borders the site of the proposed project, and regulatory agencies such as the local harbor authority, professional and other interest groups. Natural preservation and sport associations and similar organizations are also informed about the plans. Furthermore, the plans are laid open to public scrutiny for at least one month. Suggestions or objections have to be made within two weeks. This part of the procedure is intended to inform the licensing agency in time about possible violations of legally ensured citizens' rights entailed by the proposed project. All interveners are then invited to a public hearing where the statements have to be dealt with by officials belonging to the licensing agencies or by external experts.

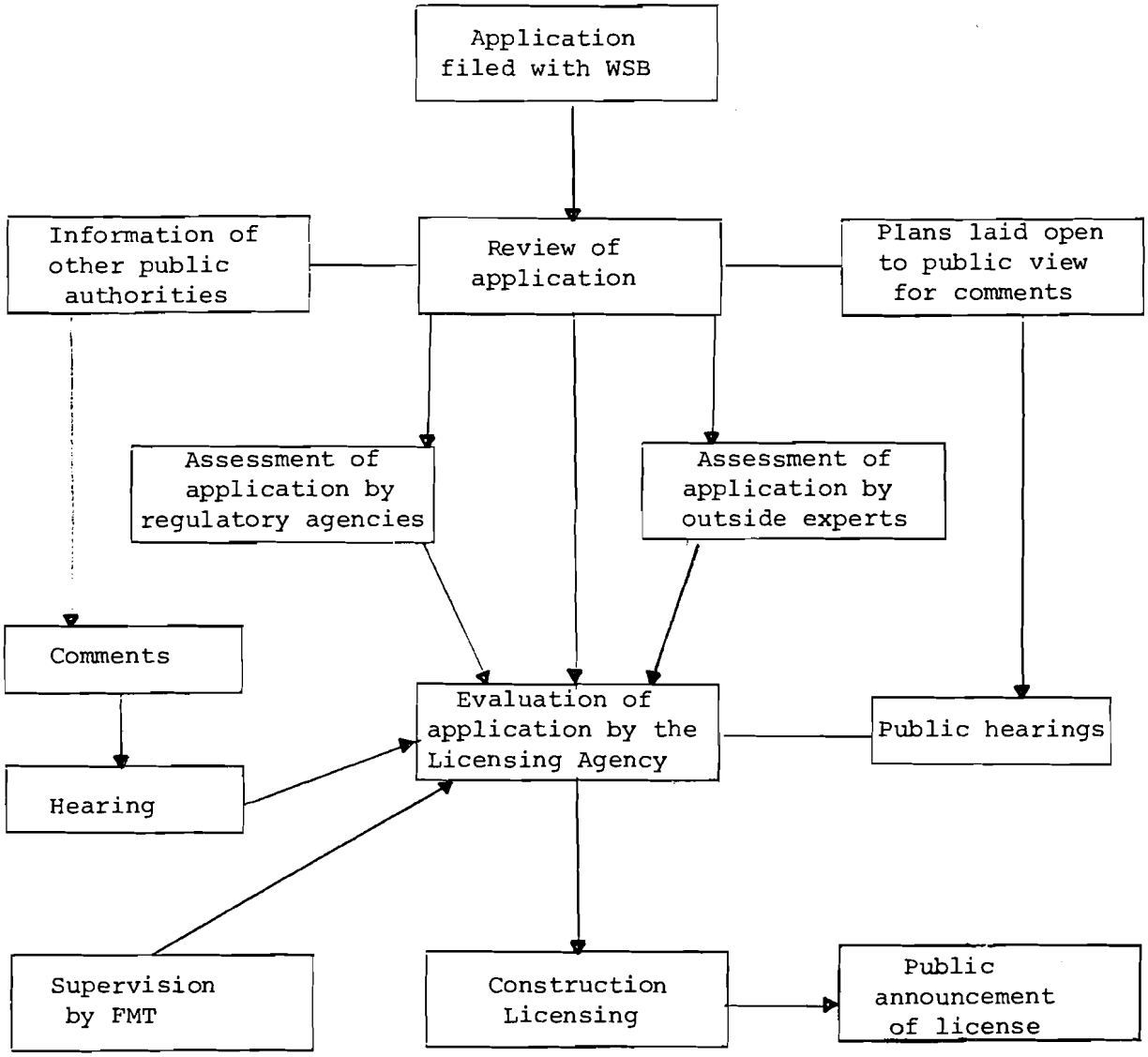


Figure 5.2. Plan Determination according to Federal Waterways Law.

The final decision, based on the views of other regulatory agencies, on independent expert studies, and on the licensing agency's own expertise is recorded in writing and sent out to the applicant and to all objectors. It not only approves or disapproves the application but includes a (sometimes very long) list of requirements and injunctions on the applicant concerning the construction and operation of the planned installations. The licensing procedure is described and the requirements, as well as the approval as such, are explained in this document. The only way to enforce a review of the decision is to apply to the administrative courts.

The application has to be refused, if the proposed construction measures would be detrimental to the public welfare and if potential detrimental effects cannot be excluded by appropriate requirements. The same applies for private law titles that would be affected in an unjustifiable way. The notion of public welfare includes the protection of citizens from dangers and harmful health effects as regulated in the Federal Immission Control Law. If no negative effects can be found, approval, according to German laws, is obligatory and the company is entitled to enforce this right by appealing to the courts. This is the main difference of approval between town and country planning and the proper licensing procedures. In the former the local authorities are free to refuse a project on political grounds without explanation, while in the latter, the licensing agencies have to justify their decisions in detail with technical and/or procedural regulations.

5.2.3. License According to Federal Immission Control Law

The Federal Immission Control Law regulates health and safety as well as environmental protection aspects of technical installations and devices in a very broad sense (see Chapter 3). A specific licensing procedure is only required for some types of large-scale technical installations (considered to be particularly hazardous or damaging). Energy facilities are among the installations listed in the law.* The structure of the licensing procedure is almost identical to the plan determination procedure. We will therefore not describe it here in full detail. One difference is that the license may be split into a preliminary license (Vorbescheid), mainly approving the site, and a series of partial licenses (Teilgenehmigungen) for different steps of the construction process. Public participation in the way described for plan determination is then limited to the preliminary license. This split was introduced in order to avoid extreme delays in connection with very large projects.

The authority in charge of the license is always a Land agency. In Lower Saxony responsibility usually lies with the district governments, for smaller projects also with the local governments. The list of participating public authorities is also similar to that described in relation with the plan determination. Some Land Ministries and the responsible factory inspection agency are typically among the regulatory agencies involved.

*For a more detailed discussion of licensing procedures concerning energy facilities see Dreyhaupt (1977).

5.3. THE SELECTION OF THE SITE AT WILHELMSHAVEN

In the late 1960s gas companies in the FRG, encouraged by recent experiences in other European countries, also began to contemplate becoming involved in the LNG trade. Preliminary contacts with Algeria on gas delivery were made and they eventually began looking for a site suitable as an LNG import terminal. Ruhrgas and Gelsenberg, who had agreed on a joint project, performed an internal screening process on possible sites in four European countries, namely France, Belgium, the Netherlands, and the FRG. Technical and economic factors, such as shipping conditions, population density, physical infrastructure, and subsidies provided by public authorities at the different sites and the access to the existing gas distribution network (proximity to consumers) seemed to have been major criteria for the selection of the terminal site (DFTG II). As a further influencing factor political safety was mentioned, although it reached its full importance only after the oil crisis in 1973–1974, when not only many oil-producing countries cut down supplies but also the Netherlands reduced their natural gas deliveries (Ruhrgas I). Around 1972 the two companies decided that they would prefer a domestic site, although this was not necessarily the cheapest solution, and that Wilhelmshaven ranked highest among possible locations in Germany. Potential sites in other countries were not completely dismissed by industry but considered as possible second choices throughout the decision process, in case major difficulties arose in connection with Wilhelmshaven (Ruhrgas I; DFTG I,II; ME&T I).

Then Ruhrgas and Gelsenberg announced their intentions to the Lower Saxony Ministry of Economic Affairs and Transport in Hanover (ME&T). Together they went through another quick screening process and confirmed the companies preselection of Wilhelmshaven. The Baltic Coast was ruled out by the fact that it would increase the length of the voyage considerably; therefore appropriate sites for the terminal had to be found on the FRG part of the North Sea Coast. Despite the fact that it was a short stretch, the latter still offered in principle at least four different places where an LNG terminal could be sited (apart from the possibility of an artificial island). These were at the mouths of the rivers Elbe (Cuxhaven-Hamburg), Weser (Bremerhaven-Bremen), Ems (Emden), and Jade Bay (Wilhelmshaven). Apart from Wilhelmshaven, some of the other places, namely Cuxhaven, Nordenham on the opposite side of Bremerhaven, and a place near Emden were considered for a very short time, but according to the comparison criteria, these alternatives soon turned out to be less appropriate. Therefore, according to the gas companies and the ME&T, considerations were focused on Wilhelmshaven without a great deal of analysis.

Since the preliminary siting decision was made almost ten years ago and written documents about it are not available, the information on this subject drawn from different interviews is not very reliable. This makes it very difficult to reconstruct exactly what these criteria were. Official and industry representatives agree that Wilhelmshaven's main advantages were the following (ME&T I; DFTG I,II; Ruhrgas I):

- the deep water channel (in all other harbors shipping channels are not deep enough to allow for 125,000 tonnes tankers at the moment)
- the low density of vessel traffic in Jade Bay
- the large industrial area available in Wilhelmshaven
- the favorable access to the German gas pipeline network

In 1972 Ruhrgas and Gelsenberg founded their joint subsidiary firm DFTG based in Wilhelmshaven with the registered purpose of constructing and operating an LNG terminal. A large part of the aforementioned industrial area would come into existence by reclaiming more land from the sea north of Wilhelmshaven. As described in connection with the regional development policy promoted by state and local authorities (Section 3.3.) this project played a central role in the attempt to attract industry to Wilhelmshaven. The plan to site an LNG terminal at Wilhelmshaven was thus welcomed by both gas companies and public authorities. Whilst the former willingly made use of the advantages of the site, the latter were pleased at getting confirmation in their industrial development policy.

In the following the local authorities in Wilhelmshaven as well as the public agencies whose responsibility included the proposed terminal were informed and included in the talks. The City of Wilhelmshaven began to consider the desirability of the project from its own perspective, and the regulatory authorities were to give a preliminary view on the feasibility of the project with respect to their legal mandates. They attempted to familiarize themselves with the new technology and to identify the main problems which would have to be clarified before or during the licensing procedures from their own point of view.

As a next step the companies, Lower Saxony, and Wilhelmshaven began to look for an optimal location for the terminal within Wilhelmshaven's industrial area. The licensing agencies--namely, the Water and Shipping Board North-West (WSB) and the District Government Weser-Ems (DGWE)--and some other regulatory and local authorities* were asked by the ME&T to collaborate on criteria for the selection of an appropriate "microsite". With the notion of representing public interests these criteria served as inputs for a technical–economic siting analysis. A consortium of two private consulting firms (Linde AG, Munich and Engelbrecht Engineering Association, Hamburg) was commissioned by DFTG to do the study, in order to compare three possible sites; later this was narrowed down to two on grounds that were not related to the LNG siting problems. The following dimensions were considered.**

- safety and ease of shipping
- hydrological conditions and effects on the morphology of Jade Bay

*Such as the County of Friesland, the Oldenburg Factory Inspection Agency, the Wilhelmshaven Water Management Agency and others

**The siting analysis was not available to us, all statements about it are based on interviews with DFTG (DFTG I, II), WSB (WSB II, III) and on private communication of Dr. Gottschalk from the City of Wilhelmshaven.

- population safety: distance of LNG facility from inhabited areas and other industrial installations
- potential environmental effects: noise, air, and water pollution
- technical and operational aspects
- availability of sea water for the vaporizing system
- costs

Priority was given to the area in the very north of Wilhelmshaven but the difference between the two plots was not very large. According to the study, the main advantages of the preferred site were:

- less disturbance for shipping
- more safety from a nautical point of view
- fewer negative effects on existing residential and recreation areas (the one in Hooksiel was just being developed, and another one near the second site had been used for many years)
- smaller distance between the jetty and land-based facilities (LNG pipelines are not only dangerous but also very expensive)
- lower costs

In the meantime negotiations among the gas companies, DFTG, Lower Saxony and Wilhelmshaven on the conditions the terminal had to fulfill in order to be acceptable for all parties had shown some results. In late 1973 the companies and Lower Saxony signed a preliminary contract whereby they expressed their interest in the project and laid down some general features. The Land, after consultations with local authorities, offered the two areas mentioned above as possible constitution plots for the terminal to DFTG. Further negotiations sought to clarify points on which the parties had not come to an agreement fairly rapidly, since the target for terminal operation was 1979 or 1980. Based on the siting analysis, in mid-1974, DFTG announced to Lower Saxony and Wilhelmshaven that they preferred the site in the very north of the industrial area for constructing the terminal.

Almost simultaneously (July 1974) a first delivery contract was signed between Ruhrgas, Salzgitter Ferngas, and the Algerian state-owned gas company Sonatrach. The contract period for 20 years was to begin around 1979 with 6 billion m^3 of natural gas per year, but was not executed because the two parties could not come to an agreement on certain points concerning future prices.

5.4. SETTLEMENT CONTRACT

Despite the fact that the gas companies and Lower Saxony had in principle already agreed on the construction of the LNG terminal in Wilhelmshaven in the preliminary contract, it still took further tough negotiations before they reached a definite agreement in 1976. The main point of contention was that the Land wanted to reserve part of the capacity of the LNG terminal for gas companies operating in Lower Saxony in order to break the quasi-monopoly on imports and prices of the big com-

they achieved was to change the constitution of DFTG (by then 50% Ruhrgas and 50% Gelsenberg) and to reserve a 26% share for smaller companies to be nominated by the government of Lower Saxony (this was carried out in 1978).

The conditions of how these changes in DFTG were to be executed was one of the points laid down in the so-called "settlement contract" (Ansiedlungsvertrag). Such a settlement contract is signed in all such industrial development projects. In the form of a private trade agreement, it embraces all commitments made by private companies and public authorities with regard to planning, construction, and operation of the projected facilities. In accordance with this contract the State of Lower Saxony sold 80 hectares of the artificial industrial area to DFTG at a price of 9.3 million DM (approximately US$4.5. million).* Furthermore, Lower Saxony and Wilhelmshaven committed themselves to providing the necessary physical infrastructure as well as to giving the company all possible help for getting approval for the terminal. The companies, on the other hand, agreed on the scope of the project, on deadlines for construction and start of operation, and on specific measures to protect the environment which were more than they were obliged to do under standard regulations.

These final requirements--as well as the fact that Wilhelmshaven was even included in the contract--are quite unusual because, as a rule, such agreements are made between companies and state authorities only (Wilhelmshaven II). As Wilhelmshaven tries to limit the negative effects of industrial development by a specific environmental protection policy (mainly concerning air pollution) the only way to impose stronger conditions on the industry was to enter into a contract with them (see Section 4.7). This is due to the aforementioned fact that, according to German laws, approval of industrial installations is obligatory if all relevant standards and regulations are met. With regard to environmental pollution, this means that a company has the right to obtain approval for a plant where certain imission and emission rates are not exceeded and where the emissions are controlled by the "best available technology".

In June 1976 the City Council of Wilhelmshaven voted by an overwhelming majority (including ecologists) for the contract. A few weeks later it was officially signed by representatives of DFTG, Ruhrgas, Lower Saxony and Wilhelmshaven. Lower Saxony's parliament did not have to agree directly on the contract, but only on the sale of the area. Approval for the latter was given in November 1977 without any public debate (Niedersächsischer Landtag 1978b).

5.5. THE PREPARATION OF THE APPLICATIONS

At that time (late 1976), the Lower Saxony ME&T, continually looking around for new industrial projects, was successful in interesting a British Company, Imperial Chemical Industries Ltd. (ICI), in Wilhelmshaven. The

*According to Niedersächsischer Landtag (1978a), since the settlement contract was not available to us all further information is drawn from interviews (Wilhelmshaven I, II, III; ME&T I, III).

company intended to construct a petrochemical plant in the FRG or another West European country (with a capital investment of US$500 million in the first stage, to be increased in subsequent stages). The company had specific requirements for the site--in particular:

- an area of about 300 hectares close to a good harbor
- a separate jetty
- accessible salt deposits near the site.

Moreover production should start as early as possible.

In view of the high investment involved and the number of jobs which would be created (the authorities were talking about 2000 at the beginning; later it became clear that only 450 people would be employed in the plant), Lower Saxony and Wilhelmshaven made every effort to attract the company. As salt mines of good quality exist in the region of Wilhelmshaven, the main condition to be fulfilled was to find an appropriate location. The only way to make available an area of the quality and size required was to locate the plant in the proximity of the LNG terminal site. Thus the next difficulty arose with regard to the necessary jetty. For morphological and nautical reasons it was not possible to construct a fifth jetty within the Jade between the three already existing and the one planned by DFTG. To solve this problem the idea of building a common transport bridge from which two separate jetties should diverge was developed in the ME&T. Thus the ICI project had two important effects on the decision process related to the LNG terminal: the plans for the terminal, but particularly for the jetty, had to be changed, and as a result new problems associated with the operation of two hazardous installations near one another arose. In addition, the approval procedures for both projects had to be carried out under considerable time pressure since ICI wanted to start production as early as possible. From then on the two projects were closely related.

When DFTG was informed by ME&T about these developments early in 1977 it was not very pleased (DFTG I, WSB III). Under the condition that it would not have to bear any supplementary costs the company finally accepted the proposed changes and agreed to redo all plans for the jetty. During the following months different concepts for the construction of the jetties and the transport bridge were discussed between DFTG, ME&T, licensing agencies and the consulting firms assigned to draw up the construction plans. At the same time DFTG drew up plans for the land-based facilities to be submitted as applications to the licensing agencies. All this was essentially finished in the middle of 1977.

The last precondition for DFTG to file its applications was fulfilled in June 1977 when Sonatrach and a European buyers' consortium, including Ruhrgas, Salzgitter Ferngas, and the Dutch Gasunie, signed a new delivery contract for 8 billion m^3 natural gas per year, half of which would go to the FRG. Delivery was to begin in late 1983 and would continue for over 20 years (*Erdöl und Kohle* September 1977). As a supplementary condition the contract included a deadline for the buyers' consortium to announce on which site the terminal would be constructed. This deadline--originally October 1978--caused some troubles in the licensing procedures and eventually had to be postponed because the decision

could not be made in time.

5.6. TOWN AND COUNTRY PLANNING IN WILHELMSHAVEN

In May 1977, Wilhelmshaven authorities initiated the construction plan procedures for the petrochemical plant and the LNG terminal. This requires some explanation since, in keeping with the idea of town and country planning, the plans should already have been fixed when the companies arrived. A rough concept of how the area, which had been reclaimed for purposes of industrial development, was going to be used did, of course, exist. This was laid down in a first zoning plan which had been agreed among interested parties, in particular between the municipalities of Wilhelmshaven and Wangerland. However, this plan was not detailed enough owing to the fact that facilities such as roads, railway tracks, and electric cables differ very much depending on the type of installation they have to serve. Therefore the plans had to be adjusted and worked out in detail for the two projects considered here. In this respect the whole planning procedure does not fit very well into the constraints for siting a large-scale facility. From this point of view there is nothing exceptional about the construction plan procedures under consideration. Yet it was in the course of these procedures that a number of conflicts among public authorities and between citizens and public authorities arose.

The construction plan proposed for the ICI area was presented to the public, as well as to neighboring municipalities, early in summer 1977. The reaction on both sides can best be described as "planning shock". By this term we mean that people suddenly became aware of what was going to be constructed in front of their homes (see Hartje and Dierkes 1978). Particularly in Wangerland, citizens felt that the current plans were not in accordance with former development and zoning plans and suspected they had been deliberately excluded from the information given. In their view, the original zoning plans which had been agreed among municipalities and publicly announced provided for a "soft transition" between Hooksiels' recreation zone and the Wilhelmshaven industrial area. (In this context, "soft transition" means that only trade and smaller, clean and safe industrial facilities would be located there.) While the plans to build an LNG terminal were generally known, a large petrochemical plant with potential hazards and harmful environmental effects was not expected. The Hooksiel Citizens' Group and an action group in Wilhelmshaven were formed for the purposes of defeating the plans in their existing form.

The first opportunity for a confrontation with Wilhelmshaven authorities was the public hearing of the ICI project after the announcement of the construction plan procedure. The outcome of this hearing was not satisfactory for the interested parties concerned with the project. Moreover the rest of the procedure was carried out in an extremely short time--only 4 months (usually it takes at least a year for comparable plans). The speed at which the hearing was carried out and the way comments and objections were treated promoted a feeling of distrust among citizen groups and neighboring municipalities.

As a result of this experience the opponents to the project prepared themselves very carefully for the discussion on the DFTG construction plan in fall 1977. The official hearing was preceded by a couple of meetings in Hooksiel. One was organized by Hooksiel Citizens' Group with Mr. Johannsohn, a technical expert in the field of chemical plants, from Bremen. He expressed very critical opinions on the location of the LNG terminal and the petrochemical plant of ICI. In particular he stressed the hazards resulting from the proximity of these two installations and the fact that LNG tankers and vessels would essentially have to use the same harbor facilities. A short time later, at the invitation of the municipality of Wangerland, DFTG gave the first public presentation of the planned LNG terminal in Hooksiel (*JW* 15 October 1977). In the following discussion on safety issues company representatives denied the existence of significant risks related to the LNG terminal. Some people in the audience on the other hand raised important concerns and demanded an expert inquiry into all industrial projects at Jade Bay.

The official presentation of the DFTG project during the construction plan procedure took place in Wilhelmshaven. When the objectors from the public raised the same concerns about the LNG terminal as in the previous meeting, this time the company's view was not only presented by their own representatives but supported by two experts from the University of Karlsruhe and two members of the Federal Institute for Material Control. Moreover, the top civil servants of the City Administration also put the project in a favorable light. Attendance at the three meetings was quite good (up to two hundred people). Despite the heated debates the contributions remained on an "objective" (sachlich) level as formulated in one of the newspaper reports (*WZ* 7 November 1977).

It is interesting that nearly all of the arguments against the LNG terminal that were subsequently used by objectors in the decision process arose at this first step of public involvement. The main factors of concern were (for more details see Chapter IV):

- the safety of the population living in the nearest village (Hooksiel) and the people using the recreation area next to the terminal storage and vaporization facilities
- protection of the same areas from noise and air pollution
- conservation of the natural coastal landscape, especially in the areas of tourism at Hooksiel
- water quality and living conditions for the sea fauna in the Jade Bay area it being a natural preservation zone and economic base for fishermen
- safety of shipping and aquatic sports in the Jade
- fighting efficiency of the NATO marine forces stationed in Wilhelmshaven
- morphological alterations in Jade Bay that would result in silt deposits in other parts of the harbor.

In the period following this first public hearing the City of Wilhelmshaven had to elaborate the details of the construction plan which was to be released. After a couple of additional hearings with DFTG representatives and experts of the University of Karlsruhe the plans were approved by the city council in early spring 1978 and made available for public scrutiny thereafter. Citizen groups in Wilhelmshaven and Hooksiel and a couple of neighboring municipalities made objections partly against the project itself, partly against the decision procedure. For instance, criticism was made that public involvement occurred too late, at a time when substantial changes in the project could no longer be made (Wilhelmshaven 1978). All these concerns were turned down in the final vote of the city council in July 1978 on the grounds that the planning procedure was correct, whereas detailed technical aspects of the project, especially those with regard to public safety, were not related to the current decision but had to be considered by the relevant licensing agencies. In contrast, for the ICI construction plan, where Wangerland, strongly supported by the County of Friesland, and the Hooksiel Citizen Group had applied to the courts, the decision concerning the LNG terminal was not challenged further.

Wangerland's suit against the ICI project seems to have disturbed the Lower Saxony and Wilhelmshaven authorities considerably. Apparently they were anxious to settle the conflict outside the courts by a mixture of political pressure and willingness to compromise. On the one hand Lower Saxony made it clear that the Land could reconsider the support it had given so far to the touristic development of Wangerland; on the other hand, it seemed to be prepared to follow Wangerland's requirements as much as possible without jeopardizing the project. Wilhelmshaven, although the decision being contended had been taken by the city council, tried to play a mediating role in this conflict (Wangerland I,II; HCG I,II). After several talks during summer 1978 an agreement between Wangerland and Lower Saxony was reached and laid down in a contract in late September 1978. The main points of this contract, which to some extent also took into account concerns about the LNG terminal, were:

- The industrial zone in the north of Wilhelmshaven may not be extended northwards beyond its actual limits at the border between Wilhelmshaven and Wangerland.
- Lower Saxony would continue to promote tourism in Hooksiel. In particular, the Land committed itself to subsidizing a planned recreation center near Hooksiel.*
- A dam with a maximum height of 15 m would be built and a certain stretch of land offered in order to improve the protection of Hooksiel and its recreation area against industrial emissions.

*The costs for this recreation center consisting of a roofed seawater swimming pool with artificial waves and various communication facilities, are estimated at 12.5 million DM (approximately US$6 million), 80% of which will be covered by different state subsidies. This is significantly more than the usual rate of 50% state subsidies for economic development projects. Moreover it was not clear that without this contract this particular project would have been recognized at all as desirable by the responsible Land authorities.

- Lower Saxony ensured the right of citizens to acquire private property for construction purposes in the recreation area.
- Wangerland on the other side promised to withdraw its claim against the construction plans concerning the ICI project.

Whether satisfactory or not this compromise apparently took the edge off Wangerland's and Friesland's protest against the petrochemical plant and the LNG terminal. While these parties raised serious concerns in the main licensing procedures before and after the agreement with Lower Saxony had been reached, they renounced to express their opposition in another law suit. HCG's claim about the construction plan was not affected by the agreement. Later the courts dismissed it because the citizens in Hooksiel were not recognized as being affected in their legally ensured rights by the outline plans of the ICI plant.

5.7. THE PLAN DETERMINATION PROCEDURE

As mentioned in Section 5.2, the plan determination procedure was not the only possibility for licensing the projected harbor facilities according to the Federal Waterways Law. This licensing procedure was chosen in view of expected objections and in order to avoid confusion and time delays caused by a great number of individual permissions. This suggestion was made by Lower Saxony to the FMT.

Consultations between DFTG and WSB about the application and the problems to be clarified by expert studies were intensified in May 1977 when representatives from both parties formed a working group called "Nautical Safety" which existed until spring 1978 (WSB 1978, p.2). In regular meetings the issues of these studies were coordinated between company and public authorities. Most of them were later commissioned by DFTG, others like the Krappinger Gutachten by WSB (see Chapter 8). The intention was to cover all potential points of concern and to help facilitate the role of the licensing agency. When DFTG's application was officially filed with WSB in September 1977 many of the expert reports commissioned by the company were not yet completed. Thus it was possible to take into account objections made in the public hearings at Wilhelmshaven (DFTG I).

Because of the joint planning of the DFTG and the ICI jetties the licensing agency decided to treat them jointly too. Therefore it had to consider three applications at the same time, namely for:

- the DFTG jetty (applied for by DFTG in September 1977)
- the unloading and transportation facilities on the ICI jetty (applied for by ICI in January 1978)
- the ICI jetty and the joint transport bridge (applied for by Lower Saxony, represented by the DGWE, in February 1978)

In May 1978 the complete applications (including expert reports commissioned by the applicants) for plan determination were available for public scrutiny and objections could be raised. Advantage of this opportunity was taken by a number of individuals and organizations, e.g. local citizen groups (although the latter are treated as individuals),

several sports clubs, a fishermen's union and a few companies which handle facilities in the neighborhood of the LNG terminal. Public authorities possibly affected were involved in a similar way (apart from those who had to assess the application anyway with respect to their particular responsibilities).

In the course of evaluating the application, WSB commissioned more expert reports. Their stated purpose was partly to revise the expert opinions and to support the agencies' decisions independently of the applicants' consultants, and partly to study problems which had not been considered in the application (see Chapter 8). Most of the reports were deliberately not finalized before the hearings in order to take into consideration all comments and objections made there. Three hearings were organized by the WSB in September 1978 with the different groups of interested parties (companies, public bodies, individuals). The experts, on which the authorities' decision relied, took part in these hearings. The hearings again revealed great differences of opinion between objectors and experts on the major safety and environmental impact issues, but it never turned into sheer polemics, as some of the organizers had suspected. By contrast the eleven hours of discussion at the hearing with individual interveners was characterized as "always objective" (sachlich) and "sometimes a lesson for the audience" in the local press (*WZ* 14 September 1978).

To date nothing really unusual had happened in the decision process concerning the LNG terminal. The main economically interested parties (applicant, Land, City) had come to an agreement laid down in the settlement contract, the town and country planning procedures were terminated, and the licensing procedures seemed to be well under way. Unexpectedly to most other parties in the decision, the approval procedure at the waterways and shipping authority, WSB, resulted in an important shift in the level of decision making in late 1978.

Already during the summer of that year WSB had informed the Federal Minister of Transport in Bonn, expressing that it still considered the safety problems related to the planned DFTG/ICI project, and in particular the tanker traffic with hazardous goods it would entail on the Jade, as very serious. Therefore the Board did not wish to have sole responsibility for the decision regarding appropriate safety measures and the acceptability of the population risk. Of course the FMT had known about the project and the plan determination right from the beginning. Yet it was only then that he became more actively involved in the decision and began to worry about the project and the possible consequences of its approval or refusal.

Seemingly, the involvement of the FMT in the licensing of an individual project is unusual. As a matter of fact the FMT is mandated to supervise but not to grant a plan determination approval. In this case his participation was legitimized by the fact that the approval of the plan determination was dependent on the possibility of appropriate ship traffic regulations. Because such regulations would affect all users of the Jade shipping channel, they were not to be issued in the course of a plan determination procedure which as an administrative act deals with the application of one particular client only. Formally the FMT was therefore not

involved in the proper plan determination procedure but in a more general decision problem which could be treated at any level of the Federal Waterways and Shipping Administration.

However, in fact, this meant a shift of the decision concerning the acceptability of the LNG project from WSB to the FMT. Since the acceptability of the population risk related to LNG tanker traffic on the Jade was considered by WSB as a necessary pre-condition for the licensing of the LNG harbor facilities, a negative decision of the FMT would have entailed refusal of the plan determination application. A positive decision of the FMT with regard to appropriate ship traffic regulations and the acceptability of the remaining risk on the other side included also the acceptability of the population risk related to the proper harbor facilities, because the latter was of the same nature but considered to be significantly lower. Consequently, at least the advisory committee at the Ministry (see later) did not distinguish between the two questions.

While concerns about the acceptability of the population risk at the WSB were apparently the main reason for the involvement of the FMT, a couple of other factors which could have contributed to this shift in the level of decision making should be taken into consideration: one of them is related to possible time delay, the other to more general policy implications. By the middle of the year 1978 it must have become clear to all parties that the deadline of 31 October 1978 to name the LNG import facility site to Algeria could not be met. Therefore the gas companies, as well as the public authorities which were interested in the aspects of energy supply and the socioeconomic benefits of the LNG terminal, would have become concerned about the time delay. Moreover, Lower Saxony was anxious to avoid any time delay for the ICI project. In view of threats from this company to look for another site and penalties to be paid by the Land in case of a time delay (this was laid down in the respective settlement contract), Lower Saxony did not want to take any risk in this regard. Thus the gas companies and ICI very likely attempted to influence the licensing authorities in favor of a speedy positive decision by stressing the importance of the project. In such a situation it is very sensible for the higher authority to take over the responsibility for the decision.

Moreover the decision on vessels carrying LNG and hazardous chemicals on the Jade could have been considered a precedent for the enforcement of regulations on the transportation of hazardous cargoes in shipping channels. In this case the FMT was concerned about an individual decision in WSB which did not sufficiently take into account the consequences of such a decision on similar ones to be made in the future. Whatever the actual significance of these three reasons, the important facts to state here are that :

- WSB was not able or willing to approve the project as a whole within the expected period of time
- FMT's involvement in the decision corresponds to distinct external interests (companies, Lower Saxony, other federal ministries) to influence and accelerate the decision process.

In contrast the Waterways and Shipping Authorities were anxious to stress that there was nothing unusual in FMT's involvement in the approval process. As a consequence of regular contacts between WSB and FMT about every major decision the FMT would always have his say in matters that turned out to be important. The time delay in the plan determination had to be explained by the fact that a crucial Gutachten (Brötz, 1978) was not completed before December 1978. While this interpretation is obviously correct for the proper licensing procedure, in our view it does not apply for the overall approval of the LNG project, which was, as described earlier, dependent on a decision concerning the acceptability of the tanker traffic. Both questions were originally to be dealt with by WSB although in different departments.

5.8. THE DECISION CONCERNING THE ACCEPTABILITY OF LNG SHIPPING

One of the first measures of the FMT was to establish a working group at WSB with the purpose of intensifying the procedure and elaborating a decision aid for the Board (WSB 1978; p.2). This working group included, apart from representatives of the WSB and the FMT, the DGWE, the County of Friesland, the City of Wilhelmshaven and four technical boards.* It had to complete its task (mainly the comparison of the different expert's reports) within less than two months, and WSB lodged a complaint about the short time span in its two-hundred page report to the Ministry (WSB 1978: p.3). Therefore this report, which was finished at the end of October 1978, mainly reflected the views of the Board. It tried to assess the population risk of vessel traffic with LNG and hazardous chemical cargoes in the Jade without evaluating it. Nevertheless, the terms used in the conclusion, which stated a "significant" (nicht unerheblich) risk to life and limb in the residential and recreation areas of Hooksiel, suggested that the risk was hardly acceptable.

The "Advisory Committee for the Transport of Hazardous Goods", which is a standing committee at he FMT's disposal, was then asked by the minister to perform a final risk assessment based on the WSB report and on all other expert studies. Four of the five members of the working group actually concerned with this duty belonged to institutions which had already been involved or consulted during the approval procedure (Germanischer Lloyd, BAM, PTB, and FMT); the fifth was the Federal Health Bureau.

After ten meetings between October 1978 and January 1979 they came to the conclusion (Risikoabschäzung 1979) that:

(1) A number of special safety measures (most of them identical to those proposed by the WSB) had to be taken in order to reduce the risk to shipping from tankers carrying LNG and hazardous chemicals.

*Namely the Federal Institutes for Material Control (BAM), and for Physics and Technology (PTB), the Federal Bureau for the Environment (UBA), and the Society for Nuclear Power Utilization in Vessel Construction and Shipping (GKSS).

(2) There still remained a nonoccupational risk, although very small, for people using the recreation area near the LNG terminal and for various water sports. The risk to life and limb for the population in the nearest inhabited areas was considered to be negligibly small.

(3) As a policy recommendation the experts stated that the residual risk was acceptable on the condition that the political and economic gains of the project were deemed to be sufficiently high by the responsible political authorities (which had literally "to take over the residual risk").

At the same time an interdepartmental committee with representatives from six or seven federal ministries dealt with the DFTG/ICI project. They had agreed on the risk evaluation procedure and the questions to be answered by the Advisory Committee. Later on each of the ministers expressed an opinion on the costs and benefits of the project, as seen from their various responsibilities. These activities in the Federal Government, were, at least in general, agreed upon by the Government of Lower Saxony. The Federal Minister of Transport and Lower Saxony's Minister of Economic Affairs and Transport had consultations in autumn 1978 on the measures to be taken by the Federal Government. Moreover, some other Federal Ministries, such as the Ministry of Economic Affairs (energy department), contacted their counterparts in the State Government in order to obtain support in their assessment of the LNG project.

Despite all these horizontal and vertical consultations which seemingly were sought to spread responsibility the final decision on LNG shipping was taken by the Federal Minister of Transport alone. He approved the project in early 1979 on the condition that all safety measures and regulations proposed by the Advisory Committee would be realized. This paved the way for the WSB approval given between March 1979 (transport bridge) and July 1979 (DFTG jetty, ICI jetty) to all three applications. In the official document the decision to approve the terminal is justified by the expert reports commissioned by the licensing agency (WSB 1979). These would prove that no risks according to relevant regulations existed for the public and the neighborhood of the jetty if all requirements (more than 300) imposed by the licensing agency were followed. Among these the injunction to change the shipping channel over a length of 7 km in the proximity of the terminal plays a major role. (The same requirement is a condition for the approval of the ICI plant and the transport bridge applied for by Lower Saxony too.) It is explained by the fact that it would reduce to a negligible limit the otherwise significant risk of a major vessel accident on the jetty. As there was a causal relationship between the operation of the jetty and this risk, it would be justified to impose the injunction in relation to the plan determination. This means that DFTG, ICI, and Lower Saxony would have to bear the costs, which were estimated to be at least 100 million DM (about US$50 million). This would increase the costs of the LNG terminal by about 20% if they had to be borne by the DFTG alone.

In the last phase of the licensing procedure the applying companies, being aware of the likelihood of this injunction, had tried to pass these expenses on to the public authorities. Negotiations between state and federal authorities, including a meeting between the Federal Chancellor and Lower Saxony's Prime Minister, took place but did not lead to a positive result. Thus DFTG applied to the courts against the WSB decision, arguing that it was not justified to charge only the applicant since all users of the shipping channel would profit equally from the improvement, and that the injunction concerning the shipping channel was not sufficiently supported by the expert reports. The case has still not been decided (DFTG I,II). Another, also still pending, suit against the WSB decision was filed by Mobil Oil on grounds of possible damages to the oil refinery and the related jetty operated by this company in the proximity of the LNG terminal. After the plan determination approval for the transport bridge in March 1978, two Hooksiel citizens representing HCG made a claim to the courts for prohibiting the beginning of the construction until all necessary licenses were legally valid. They were dismissed on formal grounds and a following complaint against this decision was refused by the responsible administrative law courts. Because after these failures the chances for winning their case were deemed to be very low by the Hooksiel citizens, they desisted from applying against the approval of the DFTG jetty (HCG 1).

5.9. PRELIMINARY LICENSE ACCORDING TO FEDERAL IMMISSION CONTROL LAW

The licensing procedure at the District Government Weser-Ems was initiated and terminated almost at the same time as the plan determination. In contrast to the latter, normal channels were always followed, so it will be described only very briefly. DFTG, having the option to apply for the final construction license at once or to divide the procedure into preliminary license and subsequent partial licenses, chose the latter, although the DGWE had suggested to them the other possibility. *Ex post facto* they were quite happy about their choice because public concerns were revealed to be more important than expected (DFTG 1).

The application was laid open for public scrutiny between June and September 1978; comments and objections were considered in a public hearing in November 1978. The arguments of the objectors will not be repeated here since they were very similar to those raised in the two previous approval procedures (see also Chapter 4). Perhaps it is interesting to note that in the last of the three hearings on the same topic the citizen groups opposing the project were represented by a few of their members only, who had become technically expert in the meantime (*WZ* 27 November 1978). The experts commissioned by the District Government were partly identical with WSB experts. In particular the essential study on health and safety risks for the population was carried out by the same expert (Brötz 1979).

The document by which the preliminary license was pronounced in July 1979 contains, similar to the plan determination approval issued by WSB, a long list of specific requirements on risk reducing and mitigating measures, environmental impact control, emergency plans and related

issues. Approval based on expert studies is given on the condition that all the requirements are met (DGWE 1979).

The most important change from the original plan emerged as a voluntary commitment by DFTG as a result of negotiations between the Company, the licensing agency, and Wilhelmshaven, although it was eventually included as a requirement in the licensing notification. Instead of four large tanks (130,000 m^3) protected by a double steel hull, six smaller ones (80,000 m^3) would serve to store the LNG. The outer tank would be in ferroconcrete, considered by all the experts to be safer than pure steel. Thus one important claim raised by both the Municipality of Wangerland and the Hooksiel Citizen Group had been satisfied. This change did not only affect risk perception but also allowed for a reduction in the height of the tanks--an eyesore for landscape protectors and people relying on tourism--from 48 to 41 meters. Although already considered at the time of the public hearings, it was not definitely announced before spring 1979.

When the preliminary license of the DGWE was pronounced all main approvals required for the terminal had been given. The construction of the LNG terminal could have begun in late summer 1979, but for reasons external to the decision system under consideration, it has not done so yet (end of 1981).

5.10. POST DECISION EVENTS

In March 1979 the contract between Sonatrach, the Algerian State Company, and the Dutch–German buyers' consortium was modified again. The amount of gas was slightly increased and the designated starting date for LNG delivery changed from late 1984 to early 1983. Although strictly speaking this change took place before the final decision was announced, it should be considered as a post decision event because it had no effect on the approval procedure whatsoever.

In November 1979 Ruhrgas announced that the construction of the LNG terminal would start in the near future but nothing happened until spring 1980. At the Kyoto Conference on LNG (April 1980) the director of Sonatrach disclosed in public that Algeria wanted to change its gas export policy, e.g., to increase LNG prices quite dramatically (*Erdöl und Kohle* August, 1980). With respect to the aforementioned contract, Algeria informed the gas companies that it was at the moment not able to afford the high investment costs for the necessary liquefication facilities. It is therefore doubtful whether the LNG project will be realized at all even though a preliminary delivery contract with Nigeria has been signed in the meantime. The gas companies assert that they are still interested. In any event there will be a major time delay until the terminal actually starts working (perhaps in the late 1980's).

By contrast the construction of the ICI plant and the respective harbor facilities, including the transport bridge, began immediately after the required licenses had been granted. Now, in fall 1981, the plant is completed and already operating at its full capacity. The change in the shipping channel has not been effected so far. Unless the LNG terminal will be constructed despite all difficulties it is unlikely that this injunction will ever be enforced (WSB III).

CHAPTER 6
PARTY PERSPECTIVES ON THE DECISION PROCESS

6.1. PARTY PERSPECTIVES ON THE ROLES OF KEY ACTORS IN THE DECISION

This section summarizes comments made by parties involved in the LNG siting decision on other interested parties and the relations between them.* None of the interested parties had any doubts about the capacity of the gas companies planning the LNG terminal or their subsidiary DFTG. Public authorities consider DFTG's behavior generally as cooperative and flexible. The company would have been particularly willing to accept safety measures and other requirements. Most of the criticism was concerned with certain aspects of the technology rather than with the role of the applicant in the decision.

The companies, despite apparent tensions between them and the Board, do not view the Water and Shipping Board North-West as being an opponent. Rather they put the blame on the fact that WSB had to act in a field where it had little competence (namely operations with hazardous chemicals). With regard to its main responsibilities the WSB's expertise is considered to be excellent. The FMT looks at WSB as having been reasonably cautious and sceptical about information on safety questions coming from the applicant until they were confirmed by independent experts. The district government is of the opinion that WSB put too much weight on the question of safety and behaved too cautiously. Together with Wilhelmshaven officials, DGWE considers the WSB report to FMT from the content and formulation point of view as "beyond acceptable limits," i.e.,

*Nearly all information incorporated in this chapter originates from the interviews between representatives of the respective parties and members of the IIASA research team. Since there should be *no* doubts as to what statements come from which party, we do *not* explicitly refer to these sources.

as overstating the population risk. Objectors, on the other hand, talk about greater accountability of WSB compared to the other licensing agency, DGWE.

Lower Saxony's (i.e., the state government's) leading role in promoting industrial development is unquestioned by all parties in the decision process. It is effected by the Ministry of Economic Affairs and Transport. This ministry--according to licensing agencies as well as local authorities--mainly cares about economic aspects. To ensure safety or environmental impact control the ME&T would consider existing regulations and their implementation by the responsible authorities as being sufficient. This is consistent with the picture given by the ministry itself.

The District Government of Weser-Ems is appreciated by the applicant as being experienced, and in all respects a competent partner, who has clear objectives and does not hesitate in making decisions. Wilhelmshaven's opinion is that the DGWE limits its control to the well-defined standards and explicit requirements of existing regulations without interpreting them in the spirit of a future-oriented environmental policy. The WSB sees the district government, in many respects, as the long arm of Lower Saxony's government, yet without questioning therefore its accountability as a licensing agency. Representatives of the citizen groups finally express unanimously very unfavorable opinions on the DGWE. They reproach it for supporting industry at the costs of the interests of the local population. Officials in the DGWE are, according to them, not willing to take any action that might restrict the plans of the Land government. The way experts are selected to give their opinion on the plans, and the way the questions to be answered by these experts are formulated, is considered to be manipulative. The district government, in contrast, stresses its independence with regard to ministries in Hanover as well as to private companies.

The local opposition considers the City of Wilhelmshaven, that is the administration and, in particular, the ruling majority of the Council (see Section 2.3), to be insufficiently critical about industrial development projects. These would only look at the size of the projects proposed without carefully scrutinizing the impact on the regional economy and living conditions. The Hooksiel Citizens' Group argues that Wilhelmshaven has lost control over the industrial development which, once initiated, followed its own rationale. Under the conditions given, this would mean a concentration of hazardous operations that nobody had originally intended. The city's environmental policy is viewed by the same opponents as being essentially cosmetic in nature. Because of the lack of a general scheme for industrial development, and the limitation of environmental impact control to only a few pollutants and monitoring measures, it would not be able to prohibit negative effects in the future. The Land government and licensing agencies also have some reservations about this policy and interpret it as interference in their responsibilities and as an expression of distrust.

Wilhelmshaven authorities feel that Wangerland's strong reaction to the terminal plans (and its support by the county of Friesland) was not justified. Since people knew about the industrial development and had accepted the general plans for it, they should not be surprised. Thus the

behavior of Wangerland's officials is considered as being "very human": one does not believe what is going to happen until it actually happened.

To some extent this interpretation is supported by representatives of Wangerland. At the time the decision had to be taken by the council of Hooksiel, the latter was going to be dissolved in a regional administrative reform. Under these circumstances and in consideration of the limited resources of a parochial council, one could not expect representatives to be fully aware of the consequences of a planned development.

Public opposition to the projected terminal was heard by a relatively small number of individuals, but applicant and licensing authorities recognized that the arguments the citizen groups put forward were sound and based on a good understanding of technological problems. The applicant admitted that all critical questions discussed in the literature were raised in the objections. Nevertheless the motivation of local opponents was considered to be mostly selfish by the authorities that had to cope with the objections. WSB held that their licensing procedure was attacked by the local opposition not because of real concerns but because it had failed in the previous town and country planning procedures. Wilhelmshaven officials pointed out that the objectors did not present any alternative solution. Their only goal would be to avoid any risk related to industrial activities in Wilhelmshaven.

A civil servant in the federal bureaucracy described the siting decision as primarily a "deal between Land government (Lower Saxony) and industry (gas companies)." This view of the relationships between these two parties was confirmed by many participants in the decision. With regard to the DFTG project it does not mean that the interests of the Land and the companies were completely in line. In contrast there had been long and tough negotiations about certain points, especially about other users of the LNG terminal (see Section 5.4), but this rather confirms the picture of a deal where the importance of the relationship was not questioned. Nevertheless, when the ICI petrochemical plant project came into the discussions, there obviously was a change in the relationship between Lower Saxony and DFTG. WSB, for instance, had the impression that Lower Saxony's interest in the DFTG project became very weak after the appearance of ICI. ICI's full support by the Land was acknowledged by all parties. The Hooksiel Citizen's Group felt that, from the beginning, this support was so strong that it predetermined formal approval and licensing procedures, thereby undermining the democratic nature or legality of these procedures.

The cooperation between Federal and Land authorities was generally viewed as good. WSB and the district government both describe their collaboration as close and correct though their views on risk assessment and safety measures differed in some points. The only conflict between Lower Saxony and the Federal government was related to the financing for the change in the shipping channel. Whilst Lower Saxony argued that this had to be borne by the federal government since the waterway is under federal administration, the latter stressed that the change was only necessary because of industrial development projects which were the responsibility of the State.

The conflict between Wilhelmshaven and Wangerland has been touched upon several times already. Thus we will not repeat the arguments described in Chapter 4 and in the previous Chapter. Representatives in Wangerland have always stressed that they were not opposed to industrial development in general. Even if they were, they did not see any chance of being successful since there was no other possibility left open to Wilhelmshaven. Wangerland complained about the reluctance of Wilhelmshaven authorities to listen to their arguments. Some people, also from Wilhelmshaven, thought that the way officials in Wilhelmshaven had treated neighboring municipalities deliberately destroyed the climate of trust and cooperation that had been built up over the years.

Finally, we wish to summarize some remarks about the relationship between licensing authorities and private objectors, in particular the action groups. Direct confrontation between these two parties was described by the participants as "hard but within acceptable limits." Many of the objectors wanted to collaborate with the authorities, at least at the beginning, but during the procedure they felt that their offer had been refused and they became disaffected. All public authorities were quite pleased that resistance was not stronger, despite the fact that they had originally not expected it at all. They interpreted this as compliance on the part of most of the people living in Wilhelmshaven. The citizens' groups, on the other hand, think it rather demonstrates resignation, and manipulation by local authorities and by the local newspaper which would give only official views.

6.2. PARTY EVALUATION OF DECISION OUTCOME

The gas companies are, of course, pleased with the approval of the terminal site, since it was their choice. On the other hand, they have to cope with a number of requirements, some of them quite bothersome. With the exception of the change in the shipping channel, DFTG considers the requirements eventually to be acceptable. The obligation to keep the overall noise level below a certain limit and the modified tank concept, which the company agreed upon voluntarily, seem to be the most difficult and expensive additional measures. Yet the company views them as being justified in some way. "Unjustified requirements" raised by objectors had been turned down by the licensing authorities. DFTG's position towards the change in the shipping channel has been described in earlier chapters (in particular, Section 5.8). The company does not think that the change as such is unimportant, although with regard to potential accidents of oil tankers it is seen as having more importance.

The licensing agencies (WSB, DGWE) which clearly had to justify their own decision, considered their requirements as necessary not only in the public interest, but also to ensure a balanced outcome. These would regard both the interest of the local population from the point of view of a reasonably preserved environment and the interests of the applicant. In particular, the change in the water channel would contribute to this balancing of different interests by excluding the risk to life and limb for the population.

Wilhelmshaven authorities still think that the selected site is the best possible choice in the FRG. Despite the revelation that it has been necessary to make additional and rather expensive changes in Jade Bay, no other harbor would offer similar conditions for the transportation of hazardous cargoes.

Wangerland is not satisfied with the outcome of the decision but feels that a law suit would not have been successful. The compromise actually agreed upon had at least contributed to some important improvements compared to the original plans. The future existence of the recreation zone with its touristic installations granted by Lower Saxony and additional protection and safety measures would reduce the negative impact of the terminal on Wangerland. Taking into account the existing power structure, Wangerland did not expect to achieve much more, though neither the question of safety nor that of local economic development had been solved in a completely satisfactory way. The benefits of industrial development were estimated as rather unimportant because the jobs created are too specialized for the workers living in Wangerland and because the municipality would not profit from tax revenues. The only positive effect could be expected from people employed at the terminal who settled in Wangerland.

The Hooksiel Citizens' Group shares most of Wangerland's views on the outcome of the decision. It considers all improvements to have resulted from the joint efforts of the citizen group, the local council, and the county of Friesland. In any event, they consider themselves the losers. If they could decide on their strategy once again, they would organize more public resistance and have less trust in the willingness of licensing authorities and officials in Wilhelmshaven and Lower Saxony to cooperate with representatives of the local population.

6.3. PARTY EVALUATION OF DECISION PROCEDURES IN GENERAL

The most striking aspect of parties views on the decision process is the high degree of satisfaction about existing regulations and procedures. All public authorities are pleased with their current state: the procedures work and they see no reason to argue about their legitimacy. The system of responsibilities, though quite intricate, has evolved historically and is familiar to everyone. Thus under the condition of appropriate coordination it would not cause any problems. Industry's needs and interests were met by a close cooperation between public agencies and companies. Informal talks before the beginning of the formal procedures prevented unjustified time delays and economic losses. Those directly affected by a project had standing at the licensing procedures. In sum, the conditions for a fair balance of the different interests were as good as possible. If somebody felt at a disadvantage he could apply to the courts. This view is shared almost completely by industry people. They think that the cost and some minor disadvantages related to the licensing procedures are outweighed by the advantage of clear decision.

Some general complaints which related to the general political-economic situation were made by civil servants in Land and federal ministries. One was that sudden unexpected changes in economic circumstances made it very difficult to carry through the licensing procedures for large-scale projects in a straightforward manner. In the case of the LNG terminal there was, for instance, a strong time pressure for the provision of a certain license, later it turned out that the realization of the project was not very likely at all. The other point of concern is the effect of international competition on environmental protection regulations. If these were too strict or too strictly enforced, private companies threatened to remove their activities to other countries.

The attitudes towards public participation were ambivalent. On the other hand, most parties, including public authorities, considered a comprehensive public debate with regard to policy decisions of all kinds as necessary and useful. On the other hand public authorities and companies unanimously complained about certain types of objectors who were politically motivated and made use of any arguments they could find in order to defeat a project. The possibility of participating in licensing procedures should be confined to people whose private rights are directly affected. Unfortunately this could not be ensured if participation was reduced below the current level--a level which should therefore be maintained. Under no circumstances should public participation be further enlarged, which would mean a substantial contribution in the decision process. Decisions had to be made exclusively by political representatives legitimized through public elections.

All difficulties encountered in the decision process were considered to be caused by special circumstances, external events, personal biases and mistakes, etc., but never by failure of the decision procedures as such. Therefore proposals to change these procedures remained very modest. A Wilhelmshaven official suggested that the active involvement of the municipality be formally built into the decision process. Representatives of other public agencies felt that the courts sometimes acted too clumsily and went into too much technical details.

Interestingly enough, the speakers of the local population did not differ that much from public authorities and private companies in their evaluation of the decision. They also considered regulations and procedures in the FRG to be very good, if only they could be enforced correctly. In the decision process on the LNG terminal the law had been disregarded in many respects. Neighboring municipalities should have been included in the decision to modify the zoning plans. When Wangerland applied on this ground the courts had taken a political decision in favor of Wilhelmshaven. Public participation had only been formally effected without giving people a fair chance to scrutinize the plans and without listening to their argument. The information on the project was strongly biased and thus geared to manipulate people's opinions. Nobody really listened to the concerns and propositions of the objectors. Licensing agencies did not care about a comprehensive objective risk assessment but instead selected experts and the topics of their studies in a way which justified approval in the easiest way. They blamed Lower Saxony's early commitment in favor of the ICI project as the main source for all these deficiencies. This decision had predetermined the whole approval and licensing process in a most unfavorable way.

CHAPTER 7
ANALYSIS OF SELECTED ASPECTS OF THE LNG SITING DECISION

7.1. SPECIAL FEATURES AND NOTEWORTHY EVENTS IN THE DECISION

The main features and events of the LNG siting decision have been described at some length in Chapters 2 and 5 of this report. In this section we will summarize some specific aspects of the decision process which have to be considered as unusual or at least noteworthy compared to similar industrial facility siting decisions. Possible explanations and the impact of these conditions and events are briefly discussed.

With regard to the focus of this study the following points seem to be most relevant.

- The preparatory phase of the approval procedures, which stretched over more than 5 years from the first involvement of public authorities until the formal application, was exceptionally long compared to a typical industrial siting decision.
- The planning process, public discussions and formal procedures concerning the LNG terminal were significantly affected by the close connection between this project and ICI's proposed petrochemical plant.
- An important part of the approval procedures, in particular the construction planning, had to take place under considerable time pressure.
- WSB's refusal to take the sole responsibility for a decision about the acceptability of LNG tanker traffic led to the unusual, though legally correct, involvement of a federal ministry in the approval process concerning a specific project.

- The plan determination procedure for the LNG facilities exceeded previous experiences at the WSB in the scope of the questions at stake, the number of experts involved, and the type of requirements connected with the final approval (in particular, the injunction to change the shipping channel).
- The DFGT/ICI project provoked serious tensions eventually leading to open conflict between local authorities, particularly between the municipalities Wilhelmshaven and Wangerland.
- Public opposition to the proposed project was limited to a relatively small set of people. It came from a coalition of environmentalist groups in Wilhelmshaven and an unusual citizens group intending to be a kind of representative community body for the village of Hooksiel.
- Despite the fact that the main licenses for the LNG terminal were granted by summer 1979, the construction has not begun so far.

Owing to the informal character of talks among industry, local authorities, and the Land agency in charge of industrial development, there is no rule for their duration; the same applies to the preparatory phase of approval procedures. With regard to the LNG terminal, several factors contributed to the relatively long duration of the preparatory phase: Lower Saxony's requirement that the corporation in charge of operating the LNG facilities be open to smaller gas companies was a serious point of contention in the negotiations with Ruhrgas and Gelsenberg leading repeatedly to a time delay of the settlement contract (ME&T III). Furthermore, the negotiations between gas companies and Sonatrach in Algeria were very tough with regard to price conditions.* Another important reason for this delay was the lack of experience on the part of public authorities in the FRG with LNG facilities of this scope. Thus, numerous doubts about the acceptability of the LNG technology with respect to safety and environmental impact questions had to be dealt with during the preparatory phase. Nevertheless, the most important of these questions were not settled before the initiation of the formal approval procedures.

Some of the consequences on the decision procedures resulting from ICI's plan to construct a petrochemical plant in the proximity of the LNG terminal site have been mentioned earlier (see Chapter 5). One of the immediate consequences--apart from the necessary revisions of the harbor facilities for the LNG terminal--was that Lower Saxony took a more active role since it became one of the applicants itself. Some citizens of Wilhelmshaven, as well as the neighboring municipalities, became alarmed by the new plans, although they had known about the LNG terminal before this time. The regulatory authorities, in particular WSB, had then to cope with a more complex technical situation, although the licensing agencies hold that the main questions about the LNG terminal would have arisen even without its affiliation with the ICI project. In sum, most of the parties were influenced in their concerns and positions by the

*A pre-contract signed in 1974 was never executed because of differences on that point.

appearance of ICI.

One, perhaps the most important, impact, of the ICI project on the LNG terminal decision was the increased momentum resulting from the imposed time pressure. ICI, which was fully supported by Lower Saxony, was pushing for an early decision. Consequently, a number of decisions, such as the construction plan approval for ICI, were taken in a precipitous way entailing legal difficulties* and provoking conflicts at the local level. Towards the middle of 1978, the gas companies apparently also became worried about delays in the approval procedures, since they had to meet a deadline for notifying Algeria about the site of the LNG import terminal. There is a good deal of evidence, however, that their concerns did not strongly influence the timing of the decisions. Eventually, the deadline was postponed for three months, yet the licensing procedures were not terminated at the time the notification was made (December 1978). Nonetheless, time pressure was felt in the construction plan and plan determination procedures whether exerted by an applicant intermediated by Lower Saxony, or self-imposed by those who had to carry them out (WSB 1978; p.3; FMT I). It is likely that the LNG terminal decision would have been more difficult or at least delayed without the driving force exerted by the ICI project.

This leads us to a key event in the approval process, the reluctance of the WSB to decide upon the safety of LNG shipping and the related shift in the decision making level. With respect to the main theme of this case study, the most interesting question concerns the contribution of the risk dimension to WSB's attitude, that is, to what extent it can be explained by the type of technical information WSB had to deal with and by the manner in which this information was perceived and interpreted. Since this question will be elaborated in the following chapter, here we will try to put the risk considerations into perspective by taking into account all possible influencing factors:

- As the agency does not employ professionals in the field of hazardous chemicals, WSB officials had to rely to a large extent on experts from outside.
- Difficulties resulting from this situation must have been aggravated by the time pressure explained above.
- There are indications that the "human factor" played a certain role. Representatives of other interested parties mentioned several times in reference to WSB the influence a single person could have on the behavior of an agency. If such an influence existed, it was in the direction of risk avoidance.
- The WSB would have an interest in involving the FMT in a decision where the possibility for a catastrophic accident was involved in order to spread the responsibility for this decision. In addition, the WSB might have needed support for several measures it was going to require from the applicants that were unusually far reaching and expensive.

*This procedure had to be repeated twice due to concerns raised about its legal correctness (Wilhelmshaven III).

Quite likely all of these factors contributed to the decision or, better, "non-decision" at WSB concerning the LNG project as a whole. Once the Board had taken this position the question of LNG shipping and the related population risk was actually critical for the approval of the terminal. The involvement of the FMT indicates that the application was on the verge of being refused. Therefore the last part of the decision process, taking place at the level of the federal government, was really the one where the question of acceptability was settled.

Local opposition to the proposed project was shaped to a large extent by the specific sociogeographical situation of the terminal site. Those having to bear the main part of the safety and environmental costs were inhabitants not of Wilhelmshaven but of the neighboring municipality of Wangerland. On the other hand only the host municipality of Wilhelmshaven expected to benefit from the project. Owing to these opposed interests tensions between local authorities were likely to occur. Given the long preparatory phase and the fact that the area to the north of Wilhelmshaven had already been designated to industrial development projects the form and intensity of the actual conflict was surprising. Therefore there must be some further reasons to account for this development. Misinformation and different expectations about the planned use of the industrial area on Wangerland's side played a certain role; the urgency of the ICI project apparently also contributed to sharpen the situation. Finally, the personality of Wilhelmshaven's head of administration, who was referred to as "positively scintillating" and sometimes a little rude, was blamed for the worsened atmosphere between Wilhelmshaven and other local authorities (Wilhelmshaven VI; DFTG II; Wangerland II). The resulting opposition from Wangerland and the Friesland County possibly would have complicated the approval of the project if the case had been treated at the courts. Because of the actual compromise laid down in a contract between Lower Saxony and Wangerland, it had no impact on the final decision except for the special protection and mitigating measures fixed by this contract.

The most interesting aspects of the public opposition to the proposed LNG terminal were the organizational structure of the Hooksiel Citizens' Group and the fact that it did not embrace more of the local population or political and environmental groups organized at a national or regional level. While for the further aspect we refer to Section 4.10, a few factors for the latter will be mentioned here: the local citizen groups opposing the project did not make a serious attempt to enlarge their case to regional or national issues. Moreover, the nuclear power debate in the FRG reached its climax just at the time when the LNG terminal decision was at stake. Thus more forces of the ecological movement were already bound. The sociological situation in the Wilhelmshaven area was not favorable for citizen activities either. Given that this area belongs to a depressed region and that industrial development was already planned before the LNG terminal came into discussion, a large part of the local population accepted the project as unavoidable. There is some evidence that the gas companies and Lower Saxony took this specific situation into account as a factor in favor of the site at Wilhelmshaven.

To look at the effort and money* the applicant put into the promotion of the planned LNG terminal until it was definitely approved, it is astonishing to see the project postponed for years. Obviously Algeria's unwillingness to fulfill the delivery contract agreed upon in 1977 was the main factor for DFTG's construction moratorium. For increasing the sunk costs wold worsen the gas companies' position in further negotiations about a purchasing contract (Ruhrgas II). However, the companies might have looked harder for another source of LNG if the overall growth rate in energy and gas consumption had not declined against all expectations during the last few years. Moreover, Ruhrgas has just reached another agreement with the Soviet Union for extending pipeline delivery considerably until the end of the decade (*Neue Zürcher Zeitung/NZ* 22/23 November 1981). Nonetheless, the projected LNG terminal might already have brought some benefits to the gas companies: the sole possibility of new sources of delivery should have strengthened their position in negotiations with the traditional delivery countries. From an energy policy perspective the realization of the LNG project would be still desirable because it contributed to reducing the strong dependence on a few export countries. As a matter of fact, there has been a heated political debate upon this last point within the FRG and at the international level in relation to the aforementioned purchasing contract between Ruhrgas and the Soviet Union. If the opposition to this project eventually prevailed the LNG terminal at Wilhelmshaven would be a realistic alternative option and thus very actual again.

7.2. EVALUATION OF THE DECISION STRUCTURE

The first decision of importance, after the two German companies, Ruhrgas and Gelsenberg, had agreed to promote an LNG terminal, was the selection of an appropriate site. It was essentially taken by industry, public authorities mainly providing information about the properties of the different sites. However, an important influencing factor for the companies' choice was former public policy decisions, namely regional development plans and the physical infrastructure already created at Wilhelmshaven. It was then necessary for the companies to interest the state and municipality authorities holding jurisdiction over the preferred terminal locations for the project in order to get their compliance. The ensuing negotiations and internal deliberations of these three actors settled the question of desirability from the different parties' perspectives, as well as the concrete conditions for the realization of the proposed project. While the public authorities tried to get concessions concerning the technical concept or the business structure of the LNG terminal from the companies, the latter were anxious to get appropriate support and make use of public subsidies if possible. By referring to alternative locations for the facilities in other countries, they were able to keep the authorities requirements below certain limits. This distribution of roles not only reflects the economic interests and power of companies and public authorities, but in the FRG it also corresponds to the dominating view on

*As a very rough estimate of these costs DFGT was talking about several tens of million DM (around 30 million DM) which would be lost if the project failed (DFTG II).

desirable forms of cooperation between private industry and state agencies, saying that state interventions should be limited to the creation of framework conditions.

The public, the people directly affected, and the regulatory agencies in charge of ensuring the public welfare, in particular population safety and environmental protection, were only marginally involved at this stage of the decisions process. While the public was only represented by Wilhelmshaven and Lower Saxony, the regulatory agencies could directly express their (preliminary) views on the acceptability of the project in consultations with applicant and authorities. However, these views were neither based on a very thorough analysis nor binding on any of the parties. Thus the main actors of this phase incorporated the information about requirements and conditions likely to be imposed by other public authorities as a sort of framing conditions to their decision in principle on the LNG project. This means the consideration of the respective dimensions did not necessarily evolve from intrinsic concerns of the parties taking this decision.

By contrast during the formal approval procedures all possibly affected parties were informed and had some say concerning the decision at stake. The main decision power was then with the regulatory authorities, in particular the agencies in charge of carrying out the licensing procedures. These procedures, which are regulated by laws and interpreted by the current jurisdiction of administrative courts, allow only for considering a restricted set of questions. Important pre- decisions, such as the site, could not be questioned, although this phase was the first time that side-effects and impacts of the project were treated carefully by the regulatory authorities.

To assess the influence of these authorities on the decision an important difference concerning the character of the formal procedures between town and country planning and the proper licensing procedures has to be recalled. Since the municipality is free to release or draw back a certain zoning or construction plan without further justification, the respective decision is open to political arguments and to pressure exerted by different interested parties on the city council. A negative decision would have required very strong reasons though, because Wilhelmshaven had already made commitments in the settlement contract. The licensing procedures are considerably more restrictive. Refusal of an application has to be justified by the licensing agencies with serious concerns concerning the construction or operation of the proposed facilities (see Section 5.2). Apart from a limited margin inherent in every decision, the outcome of the procedure is therefore determined by general policy decisions in the past, and is not open to political or other considerations related only to the specific application. It depends on the type of project, namely on how established and well-understood a technology and its impacts is, and whether this margin in the approval decision is large or narrow. Given the lack of experience in the FRG and the differences in the scientific literature it seems to have been rather on the large side in the case of the LNG terminal.

From a political perspective the main problem related to this decision structure concerns the question of democratic control and participation. Citizens objecting to the project as well as opposing local authorities complained about their involvement in the decision being too late. They considered their chances to influence the decision substantially as very small owing to the precommitment of the most important actors (see Chapter 6). Clearly the described structure for a siting procedure is not consistent with a strongly participatory societal model. Respective requirements are not unique though, but rather an aspect of the continuous struggle about the democratic norms of the political system intrinsic to all our societies.

The second question to be asked in this context is whether such a siting procedure is able to ensure an optimal decision in a more material sense, namely whether it is suitable to reduce the physical and economic costs and risks as much as possible. Since the answer to this question is very complex and depends on a lot of detailed information, we can only illuminate a few aspects. The crucial point from a procedural perspective seems to be the entanglement of the preparatory and the formal approval phase of the decision process. If it was not possible for the predominant actors of the preparatory phase to anticipate the later requirements of regulatory agencies and the main points of concern in the public debate, serious difficulties could arise. Refusal or even requirements for major changes of the project might entail high financial costs or losses. The licensing agencies, on the other hand, could be quite embarrassed to take such a decision, so that in cases of doubt they might be tempted to grant approval in spite of certain concerns about the acceptability of the project. It has to be mentioned, though, that German administrators are usually relatively insensitive to the economic consequences of their decisions.

Some of these problems apparently played a role in the LNG terminal decision. Although the applicant knew that the population risk related to shipping was considered a serious problem by public authorities, it had not completely foreseen the difficulties at the WSB and was surprised by the injunction to change the shipping channel. Most of the difficulties could be overcome by the involvement of the federal government. As discussed in Sections 5.7, and 7.1, this certainly means deviation from standard siting procedures, indicating that the licensing procedures were not completely appropriate to deal with the LNG terminal decision. A possible explanation for this deficiency of the formal licensing procedures, if this assumption is right, would be that they defined the decision problem too narrowly. Looking at shipping safety alone might not be sufficient to judge the acceptability of the LNG project. The involvement of federal ministries, though it did not change the administrative character of the approval decision, allowed for a broader set of dimensions to be taken into account. Nevertheless, it should not be overlooked that only the experts concerned in the FMT advisory committee paved the way for the final approval of the LNG project.

CHAPTER 8
SAFETY QUESTIONS AND THE ROLE OF RISK ANALYSIS

8.1. THE IMPORTANCE OF THE RISK ISSUE

Safety questions were an important aspect of the siting and approval decision about the LNG terminal at Wilhelmshaven. They were considered at all stages of the decision process but under changing assumptions and constraints and at different depth. In this chapter we will focus on the influence of considerations about population risk, including technical expertise, on the LNG decision. Beginning with an overview on the general importance of the risk dimensions we will concentrate on the use of expert studies, and conclude the chapter with an evaluation of the risk assessment procedure from different perspectives.

Industrial siting decisions usually give rise to various concerns about safety and environmental effects. While industry considered the latter to be of minor importance in the case of the LNG terminal, it was well aware of the importance of the safety question. According to the companies promoting the project, this fact has been realized from the beginning, and population density was a major factor in the preliminary site choice (see Section 5.3).

As discussed in Section 7.2, population risk was not the predominant issue during the phase of negotiations among industry, Land, and local authorities. Nevertheless, it played an important role because the acceptability of the risks was a necessary condition for the desirability of the project. In particular, the city of Wilhelmshaven needed confirmation on this point since its constituency would be directly affected by the hazards of the proposed project.

Consequently, the safety question was discussed by industry and the public authorities at some length. When the regulatory agencies whose jurisdiction was affected by the project were asked to give their views on the feasibility of the LNG project the acceptability of the population risk was one of the crucial points to be clarified. After a preliminary deliberation the responsible authorities deemed the safety problems related to the LNG terminal to be resolvable, with the reservation, however, that more detailed considerations during the licensing procedures would not reveal unexpected difficulties. Thus the main weight of the risk assessment process shifted to the later formal procedures.

At the beginning of the approval phase the public debate evolved around issues of town and country planning in the Wilhelmshaven area, mainly the consistency of the submitted plans with the original zoning. Very soon health and safety, and environmental impact aspects were also raised by those going to oppose the proposed project. Owing to the geographical and sociopolitical situation in the proximity of the terminal site, the coincidence, sometimes also entanglement, of concerns about economic impact, environmental effects and population risk related to the project was almost unavoidable. Therefore, it would be very difficult to assess to what extent arguments concerning public safety risk corresponded to real concerns of the different parties or whether they were only used for strategic reasons. Research on individual risk perceptions suggests that such an attempt is even inappropriate, since people usually do not base their judgments about the acceptability of a technology on a narrow consideration of the risk dimension (Otway and von Winterfeldt 1982). Although in general the local population seems to have been more concerned about environmental effects emerging from the ICI plant, there is no doubt that people also worried seriously about possible accidents. Additional safety measures were not by chance an intrinsic part of the attempts to pacify the local opposition.

During the formal licensing procedures the regulatory authorities had the legal mandate to scrutinize the plans, among others, with respect to the acceptability of the population risk. In the plan determining procedure this question was the dominant issue, but it also played a role for the licensing of the land-based facilities. Public concerns raised by interveners had a limited impact on the questions considered by the licensing agencies or by outside experts. However, as the latter stressed, the procedures would not have occurred much differently without these interventions.

The last part of the decision process, where the Waterways and Shipping Administration dealt with LNG shipping regulations, was exclusively devoted to the question of health and safety. As stated in the previous chapter, this point was critical for the LNG project as a whole. Thus one could say that the risk dimension was of increasing importance during the decision process. To some extent this has to be attributed to the decision structure, precisely the time at which the different aspects of the decision were considered. As more and more of the other questions had been settled, risk was the remaining one to be treated. However, the public authorities' perception of public safety risks related to LNG transport and handling also seems to have changed during the decision process. At least they had underestimated the difficulties to resolve the open problems. The influence of technical information and expert views on this development will be considered in the following section.

8.2. EXPERT STUDIES DEALING WITH POPULATION RISK

The companies promoting the project familiarized themselves, of course, with the main safety problems related to the LNG technology before they performed their internal selection process. Likewise the responsible regulatory authorities when asked to give their preliminary views on the project, began to collect information from comparable authorities in other countries, official technical boards, and the company experts. However, no comprehensive risk analysis was done specifically for Wilhelmshaven during the proper site selection and preparatory phase of the approval process. Expert studies concerning the risk to the population were only introduced later in the legally required formal procedures. These studies, or Gutachten, usually carried out by certified experts were commissioned by three groups of actors, namely the applicant, interveners, and the licensing agencies (DGWE, WSB). DFTG's main purpose was to support its applications for the two main licenses by independent expertise. Interveners used a couple of reports to put forward their objections to the proposed project. The set of expert studies commissioned by the licensing agencies was directly related to the final approval and therefore played the most important role in the decision process.

Most of the studies did not address the problem of population risk as such, but more piecemeal issues like technical safety, safety of shipping, or prevention and mitigating measures against fire and explosions, dealing with risk to life and limb only implicitly. The focus on safety instead of risk has to be seen in the background of the relevant legislation in the FRG, according to which public authorities are responsible for protecting the citizen against "harmful environmental effects and other dangers, considerable detriments, and considerable disturbances" (Federal Immission Control Law, para. 5), whereas the notion of risk is not used. Table 8.1 gives an overview of all expert studies dealing with population risk, which is supposed to be self-explanatory.

8.2.1. Expert Studies Commissioned by the Applicant

The first expert studies related to population risk were commissioned by DFTG. Together with several reports on other questions they were submitted to the licensing agencies as supplements to the application for both main licenses (a few months after the application itself had been filed). The stated task of these reports was to prove that the plans submitted as application were consistent with relevant technical regulations and standards and that the proposed safety measures were appropriate and sufficient. None of them was strictly required but in the consultation that preceded and followed the formal applications the licensing agencies made suggestions about topics that should be covered by expert reports. In particular, studies were done by the following institutions and experts:*

*Since we did not have direct access to the expert reports (No. 1 to 5) commissioned by the applicant, all information about the first three studies had to be drawn from other sources (DFTG 1978; WSB 1978; BAM 1979; WSB 1979; DGWE 1979).

Table 8.1. Expert Studies Dealing with Public Safety Risk.

No.	Author	Date of Completion[1]	Commissioned By	Type of Author[2]	Topic	Results	Methods Used to Assess Risk
1	ICT-Fraunhofer Ass.	1977, Dec.	DFTG Applicant	publicly subsidized institute for applied research	ignition and dispersion properties of natural gas/air mixtures	safety for neighborhood	no information[3]
2	Engler-Bunte Institute I	1978, Jan.	DFTG	university institute	safety questions regarding gas and fire control technology of land-based facilities	safety ensured; prevention measures appropriate	-"-
3	Engler-Bunte Institute II	1978, April	DFTG	-"-	safety questions regarding gas and fire control technology for harbor facilities	-"-	-"-
4	Böttcher/ Rother I	1978, Feb.	DFTG	certified experts	scrutiny of terminal plans (land-based facilities) with respect to proposed fire safeguard measures	measures sufficient	-"-
5	Böttcher/ Rother II	1978, April	DFTG	-"-	-"-	-"-	-"-
6	Germanischer Lloyd	1978, March	DFTG	semi-official insurance company	safety of LNG tankers	high safety standard insured; LNG spills on Jade not to be expected	deliberation of potential accidents (qualitative)
7	Energy Analysts Inc.	1978, June	Mobil Oil AG	consulting firm	scrutiny of application regarding the quantification of potential hazards	risk analysis should be completed and	no independent analysis performed
8	Johannsohn	without date	citizen group (HCG)	certified expert	hazards of LNG and liquid chemical spills related to tanker accidents	selected survey of literature	-"-
9	Krappinger	1978, June	WSB	university prof./ research institute	estimated frequency of tanker accidents on the Jade (A) and at the jetties (B)	probabilities of tanker accidents leading to an LNG spill up to the order of 10^{-3} per year	probabilistic calculations of critical events based on historical data and shipping simulations
10	Karlsch/ Spohn	1978, July	Wilhelmshaven (as agency of DWGE)	certified experts	prevention measures for local population related to fire hazards and catastrophes harbor facilities	measures essentially sufficient	no information[3]
11	Karlsch	1978, Nov.	-"-	-"-	prevention measures for local population related to fire hazards and catastrophes land-based fac.	-"-	-"-
12	Brötz I	1978, Dec.	WSB	university prof./ certified expert	scrutiny of application regarding safety technology; analysis of selected potential accidents: harbor facilities	no dangers in the sense of the relevant laws, if additional safety requirements are regarded	quantitative/ deterministic with respect to physical consequences of accident; qualitative estimation of probability of failure events
13	Brötz II	1979, July	DGWE	-"-	scrutiny of application regarding safety technology; analysis of selected potential accidents: land-based facilities	no dangers in the sense of relevant laws, if additional safety requirements are regarded; new storage tank construction	-"-
14	TÜV[4]	1979, March	WSB	body constituted under public law	scrutiny of application with respect to detailed technical safety regulations (mainly concerning occupational safety)	essentially consistent with relevant regulations	qualitative discussion of technical details
15	BAM[5]	1979, March	WSB	federal technical institute	review of plans and requirements with respect to appropriateness, state of the art, comment on WSB-report	safety measures sufficient, residual risk acceptable	qualitative discussion of probability and consequences of major accidents
16	WSB	1978, Oct.	FMT	licensing agency	risk assessment and discussion of safety measures relating to tanker traffic with hazardous chemicals to the DFTG/ICI jetties	additional safety measures have to be taken; even then the residual risk to the population remains considerable	qualitative evaluation of other expert studies
17	Advisory Committee at FMT	1979, Jan.	FMT	permanent advisory committee at FMT	risk assessments relating to shipping and transfer of LNG and hazardous chemicals on the Jade	given the proposed safety measures are taken the residual risk is acceptable	qualitative evaluation of other expert studies including WSB report

[1] First version [2] all authors apart from state agencies were either certified experts or they had a comparable semi-official status [3] These reports were not available to us, information on them was mainly drawn from: DFTG 1978; WSB 1978; BAM 1979; WSB 1979; and DGWE 1979 [4] see reference TÜV 1979 [5] see reference BAM 1979

(1) *Institute for Chemistry of Fuels and Explosive Materials of the Fraunhofer Association (ICT).** As indicated in the title of the study, ICT looks at the ignition properties of mixtures of natural gas and air. One of the findings is that detonation of such mixtures cannot occur. Conceivable LNG spills and other gas releases are described and used to calculate potential blast effects on the neighborhood of the LNG terminal. According to ICT blast risks for the population as well as for adjacent industrial installations can be excluded (WSB, 1978).

(2,3) *Engler- Bunte Institute at the University of Karlsruhe (EBI).* This study consists of two parts, one for the land-based facilities, the other for the jetty. The EBI considered conceivable accidents resulting in fire or explosions, the consequences of such accidents, and how appropriate the "safety concept" of the proposed terminal was to cope with these hazards (DFTG 1978). The study comes to the conclusion that the safety of workers and of the population is assured. Even a "catastrophic accident" would not cause any detriment outside the LNG terminal (WSB 1978).

(4,5) *R. Böttcher / H. Rother*** These two certified experts based their expert opinion on the EBI study. They scrutinized the plans of the proposed LNG facility in order to check whether the accidents considered by EBI could be faced with the fire safeguard measures assigned in the application plans. According to Böttcher/Rother this is ensured and technical precaution against fire are in general sufficient (DFTG 1978).

(6) *The Germanischer Lloyd (GL)* has a semi-official status as recognized experts of the Federal Government on the safety of shipping and marine technology. The company was asked by DFTG to give its view on the safety of LNG-tankers. In its report GL states that all LNG tankers have to meet the very strong requirements of the IMCO code which provides for their safety (Germanischer Lloyd, 1978).

On request of the licensing agencies certain supplements were added to these expert studies during the approval procedure. These considered, for instance, further types of potential hazards, or took into account more precise information about the project. None of these supplements seems to have caused an important change in the conclusions of the original reports. In sum all the expert studies commissioned by DFTG asserted that the safety measures described in the application were sufficient and that any dangers to the neighborhood from the LNG terminal, including the petrochemical plant proposed by ICI, could be excluded. This way of presenting the results of the studies does not make use of the notion of risk. As far as can be said from second-hand information about the studies, quantified measures or a comparable concept of risk did not play a role for deriving these results either. Apparently the decision on

*Institut für Chemie der Treib- und Explosivstoffe der Fraunhofer-Gesellschaft (ICT), Pfinztal.
**Dipl.-Ing. Rudolf Böttcher, Dipl.-Ing. Horst Rother, "Ueberprüfung des brandschutztechnischen Teils des eingereichten Antrags," Düsseldorf, February 1978 and "Brandschutz für die Errichtung und Betrieb des seeseitigen Bauteiles eines LNG-Terminals in Wilhelmshaven", Düsseldorf, April 1978.

what accidents to consider as conceivable and what likelihood to assign to their occurrence was based on some sort of best engineering judgment. Calculations were used but only for determining the consequences of such accidents.

8.2.2. Expert Studies Commissioned by Intervenors in the Licensing Procedures

The expert reports done for the applicant were laid open to public view and sent out to directly affected organizations and companies together with the plans for the LNG terminal. A number of the objections to the application reacted to or referred to these reports. Mobil Oil AG, the German branch of the international company which operates an oil refinery in the vicinity of the proposed terminal also commissioned an expert to scrutinize the plans. This study was carried out by a US consultancy firm.

(7) *Energy Analysts*. As stated in the introduction to its report Energy Analysts intended to give a survey of analytical methods currently used by the LNG industry to quantify potential hazards of proposed LNG facilities (Energy Analysts 1978). The cited literature is exclusively from the US. Based on dates on Wilhelmshaven given in the EBI report and on assumptions about LNG vapor cloud dispersion and ignition that were deemed to be conservative, Energy Analysts calculated that a major LNG spill at the jetty (25,000m^3) would have serious consequences in the vicinity of the terminal (including the Mobil Oil refinery and the recreation area). Its main point of criticism was that the probability for such a spill had not been assessed by the applicant and that the data basis was not sufficient to carry out an assessment. Thus Energy Analysts suggested a careful analysis of potential collisions at the jetty and a deliberation on suitable safety measures.

(8) *G. Johannsohn*. Mr. Johannsohn is an expert on hazardous chemicals who used to work for public authorities before invited by the Hooksiel Citizen Group to comment on the proposed terminal.* In his report, which is rather an outline and collection of material from the literature than an independent study, Johannsohn mainly refers to research for the US Coast Guard (Johannsohn undated). He discusses a model to estimate the potential hazards of LNG and ammonia spills onto water without applying it to the specific conditions of the Wilhelmshaven site.

Neither of the two last expert studies can be considered as an independent risk assessment of the LNG terminal. They both commented on the way such an assessment should be done without themselves undertaking for this task. Under these circumstances, statements about the actual risks of the LNG terminal in Wilhelmshaven could not be expected and the results had the form of recommendations on the approval procedure.

*Dipl.-Ing. Johannsohn has the status of a certified expert in this field.

8.2.3. Expert Studies Commissioned by Licensing Agencies

These studies were requested for two purposes: one, to advise the licensing agencies in their decision, and, two, to justify these decisions against potential claims from those directly affected. By justification we mean in this context scientifically based evidence furnished by independent experts showing that the project meets all relevant regulations, and, in particular, that it does not impose any dangers on the public and the neighborhood of the facilities. Studies commissioned by public authorities from outside experts are usually well defined and limited to a particular set of questions. They mainly deal with these points where the responsible authority, after having studied and structured the problem, feel insufficiently experienced or not legitimate to give a decisive answer. The balance between these two purposes, advice and justification, is changing from case to case. While, for instance, Professor Brötz's study (see later) seems to have only marginally influenced the authorities' internal decision-making process, Professor Krappinger's report had apparently a significant impact on the position of the WSB (DGWE II; WSB 1978).

(9) *O. Krappinger.* In their deliberations with the applicant WSB* had come to the conclusion that ship collisions and grounding of LNG tankers could result in disastrous accidents. Therefore an estimation of the expected frequency of such events was deemed to be necessary. Professor Krappinger, the head of a shipping construction research institute,** was asked to perform this study since the WSB had already cooperated with him on a computer simulator of shipping operations in the Jade. He established a mathematical model based on the historical record of vessel accidents in the Jade and on the aforementioned shipping simulators to calculate expected probabilities of different types of accidents involving LNG tankers. By combining these results with estimated rates for a rupture of one of the LNG tanks in the event of an accident, the calculated probabilities of the order of 10^{-3} per year, for a major spill, depending on the type of accident. The higher probabilities concerned accidents of LNG tankers on their way to the jetty, whereas the results for accidents at the jetty were considerably lower (Krappinger 1978a,b). This last step in the analysis provoked a lot of criticism because the rupture probabilities were deemed to be unjustifiably high, and the estimated spill rates had to be lowered in the final version of the study report (Krappinger 1978c).

(10,11) *D.D. Karlsch / H.D. Spohn.*† These two certified experts dealt with very similar issues as the Bötcher/Rother study, namely to scrutinize whether appropriate fire protection measures were provided for in the terminal plans. It is interesting to note that this was the only report commissioned not directly by one of the licensing agencies but by Wilhelmshaven, which acted in this case as as agent of the

*Intensive deliberations on nautical problems went on between WSB and the applicant from May 1977 until Spring 1978 in the working group "nautical safety" (WSB 1978).

**Hamburgische Schiffsbauversuchsanstalt GmbH

† Dipl.-Ing. D. Karlsch, Köln, Dipl.-Ing. H.D. Spohn, Münster, Gutachten zu Fragen des Vorbeugenden Brand-und Katastrophen-Schutzes, July and November 1978.

DGWE.

(12,13) *W. Brötz.* Brötz's study (1978, 1979) was commissioned in the summer of 1978 by DGWE and WSB at approximately the time when the first version of the Krappinger report had been submitted. Professor Brötz, an expert frequently working for public authorities, had to scrutinize the applications for both licensing procedures with respect to the technical safety (Sicherheitstechnik) of the proposed project. The WSB specified this task by requesting the investigation of three major types of potential accidents and of the so-called domino effect, i.e., the interaction between LNG facilities, industrial plants in the proximity of the LNG terminal, and vessels in case of an accident; moreover, it was requested that external failure sources like aircraft crashes be considered. With respect to the land-based facilities, Professor Brötz was to assess the likelihood and potential consequences of the maximum credible accidents and to give his opinion on the safety of the revised conception for the storage tanks.*

Important parts of his two reports deal with numerous technical devices, design requirements, and operational prescriptions to prevent failures and confine accidents. After this traditional engineering approach, deemed by Professor Brötz to ensure sufficiently the safety of the terminal, he considers, following the wishes of the licensing agencies, the potential danger to public and neighborhood relating to the aforementioned accidents (Brötz 1978, pp.180-183). By partly using his own models, partly methods developed in connection with nuclear safety regulations, the calculates the physical consequences of these accidents. While dangers for the population, particularly at the recreation zone near Hooksiel, cannot be completely excluded by these calculations, Professor Brötz considers them in view of the very low probability of these accidents to be small enough to fulfill the requirements of law.**

(14) *Technical Inspection Association.* The report of the Technical Inspection Association (TUV 1979) is a standard expertise in comparable procedures since the Association would later be prominently involved in operation licensing. It scrutinizes the application with respect to consistency with numerous safety regulations for technical details, the focus lying on operational safety. The study requires or suggests several rather minor technical changes, but in general considers the LNG terminal plans to fulfill the legal requirements.

(15) *Federal Board for Material Control.* The study commissioned by WSB from the Federal Institute of Material Control, as the official expert board in this field, was quite similar in type to the previous ones. It probably would not have been necessary in a less delicate decision. Its purpose was to review the application and safety measures proposed by other experts to determine whether they reflected the state of the art, to judge whether the safety requirements of the plan

*This conception provides for an outer tank made of reinforced concrete instead of steel.

**Some quantitative probability estimates are taken from other studies (Krappinger, TUV), the likelihood of other events is assessed in qualitative terms. For more details see Mandl and Lathrop (1981).

determination were sufficient, and to comment on the WSB report to the FMT discussed in the following. The first two questions were affirmed by the BAM with a few additional suggestions and WSB's concerns about population risks were considered to be unjustified (BAM 1979).

In a standard approval process regarding a large industrial facility, the expert studies described so far, together with those dealing with purely environmental issues which were not considered here, would be sufficient to prepare and support the final decision of the licensing authorities. In fact, the preliminary license was terminated at this stage. Although the number of studies related to the LNG terminal was quite high, none of them significantly exceeded the usual frame with respect to scope or methodology. Only Professor Krappinger's analysis deviated by its quantitative approach from the other reports, but this can be explained with the specific kind of question be considered.

As described earlier, the situation was complicated and difficult with respect to the plan determination procedure. Therefore, another round of risk assessments were to be performed before the final approval.

8.3. FINAL ASSESSMENT OF THE POPULATION RISK RELATED TO LNG TANKERS

By summer 1978, it was clear to the WSB from Professor Krappinger's study that vessel accidents involving LNG tankers (and those transporting hazardous chemicals to and from the ICI jetty), identified as the largest potential source of population risk, had to be expected along the shipping channel as well as the jetty with a certain probability. The consequences of such accidents, in respect of their scope and likelihood, had not been assessed in a way that satisfied the WSB. Moreover, shipping regulations and other safety measures appropriate to reducing the related population risk were unusually far-reaching and expensive. When the FMT was informed about this situation it decided to consider the open questions.

In order to get a concise picture of the problems and the different perspectives on them the FMT suggested establishing a working group at WSB formed by representatives of important parties in the licensing process, and of four technical boards (see Section 5.7). Based on discussions within this group WSB produced in October 1978 a report to the FMT which, owing to time pressure, reflected mainly the views of the Board (WSB 1978, p.4). In this report the agency explained why the information collected on the question of population risk by the date of the report was not considered to be sufficient and reassuring enough to approve the proposed terminal:

> By the expert studies numerous problems which are still being investigated at the international level were introduced. The studies deviate therefore partly even in fundamental questions substantially from each other. Regarding the question of how to evaluate the risks there was disagreement, for instance, also

> among the experts of the working group. The expert studies revealed partly also to be incomplete in as much as essential and for this case decisive questions, which are known from the international literature, were no considered at all. (WSB 1978, p.5)

Nevertheless, after proposing and deliberating various risk-reducing measures, WSB tried to evaluate the residual risk of LNG tanker traffic by reviewing and comparing the different expert studies. Despite the fact that the probability of a major accident was deemed to be very low, WSB came to the conclusion that the population risk remained considerable because of the serious consequences of such an accident (WSB 1978; pp.185-189). Since later the expert studies criticized in his report were used to justify the approval of the terminal facilities, it has to be mentioned that the final version of the Brötz study was only submitted after the completion of the WSB report.

The FMT handed this report together with all the expert studies over to the Advisory Committee for the Transportation of Hazardous Goods, a permanent board of experts at the Ministry. The committee formed a sub-group which prepared in ten meetings a final risk assessment. Four of the five members of this group belonged to institutions that had already been involved in the decision process, namely Germanischer Lloyd, BAM, PTB, and FMT, the fifth to the Federal Health Bureau. Whether intended or not, this composition played an essential role in establishing some consensus between experts who had not agreed so far on crucial points.

The report states that probability estimates would be desirable to assess the acceptability of the risk if they could be based on statistical data. Otherwise a quantification of the residual risk would involve too much uncertainty to be of any help to decision makers (Risikoabschätzung 1979; p.8). Therefore the risk assessment of the Committee was confined to qualitative statements. After deliberation on several major hazards, the Committee concluded that there was a residual risk related to shipping with LNG and other hazardous chemicals, smaller by is probability but larger by the potential consequences than comparable risks already accepted. This residual risk would be acceptable if public authorities took the responsibility for it taking into account political and economic benefits of the proposed project (Risikoabschäzung 1979; p.12). This view was adopted by the FMT and paved the way for the plan determination approval including its injunctions and requirements for the applicant.

8.4. SUMMARY REMARKS ON THE USE AND IMPACT OF TECHNICAL ANALYSIS

Technical analysis and expert studies dealing with risk to life and limb were broadly used in the decision process about the LNG terminal at Wilhelmshaven. All of them were performed and introduced in the context of the formal approval procedures, while the proper site selection

decision was taken without a comprehensive risk analysis accessible to more than one of the interested parties.* The type and shape of these studies was in many respects related to their use in connection with the licensing procedures. Usually of a narrow scope, the studies treated well-defined problems and questions and came up with clear answers. Their authors were of course selected with respect to their professional qualifications, but past cooperation, reputation, and official or semi-official status also had some influence on the choice.

In most cases the presentation of the results was oriented towards the general mandate of the regulatory authorities to exclude dangers for public and neighborhood or more specifically to ensure consistency with particular safety regulations. Many of the Gutachten concluded with the statement that subject to certain additional measures the proposed facilities were safe. To some extent this context also explains why quantitative measures were hardly used to assess the population risk: the administrative, semijudicial framework of the licensing procedures is not very appropriate for dealing with the probability statements, but rather expects definite answers. Therefore, the main risk assessment studies took a less formalized approach which tried to combine basically qualitative estimates on conceivable accidents with quantitative calculations of their physical consequences. The acceptability of the risks was established by showing that serious damages had not to be expected for maximum credible accidents. Other studies of minor importance followed a conventional engineering approach which is mainly based on past experience with similar technologies and generally recognized technical standards. The only author using frequentistic data and probabilistic methods was not supposed to perform a comprehensive risk analysis but to deliver a particular piece of information for the evaluation of the population risk.

This leads to the purposes the expert studies had to fulfill, which were essentially two: advice and justification. In general the purpose of justification dominated over the purpose of advising the commissioners of the risk studies. The timing of important studies illustrates this point. For example, the Brötz Gutachten were completed only briefly before the announcements of the two main licenses but after the objections raised during the respective procedures had been dealt with in public hearings. Therefore, it would be surprising if the findings of the different expert reports had influenced the decision making process considerably. For particular aspects such as the probability of vessel accidents with potentially serious consequences, it appears, though, that there was a significant impact on the main parties' views and positions. Moreover, a large part of the numerous proposals regarding the improvement of technical details, additional safety measures and devices, or even more important construction and design features put forward and debated in the expert reports were taken into account in the plans actually approved, the modified concept for the storage tanks being the most prominent example of this sort.

*We do not know what kind of analysis the companies used internally, but for the political process this is irrelevant.

The main burden of the risk assessment and evaluation process remained thus with the regulatory agencies. They had to conceptualize the problem and to formulate the questions they wanted to have answered by outside experts. Given the intricate nature of the safety problems related to the LNG terminal, the officials responsible for the licensing procedures performed their task very well. However, contradictory expert views on certain points seem to have caused difficulties that could not be resolved within the respective agencies. Eventually they were overcome when the FMT asked dissenting experts to reconsider the contended questions in a working group, thereby forcing them to agree upon joint conclusions.

While the procedure chosen by the FMT was quite effective in dealing with disagreement among experts consulted by the licensing agencies, this situation should not be mixed up with an adversarial process where the differing expert views correspond to different party interests. Counter-expertise was not impossible, but was by no means encouraged within the licensing procedures. When the plans were laid open for public scrutiny interveners had only two months or even one month to raise their concerns. They would have to bear alone the costs of any study they wanted to commission. Moreover, as mentioned above, the most important expert studies were not even completed at the time when objections were to be made. The only way to challenge these expert studies would have been to apply to the courts against the approval decision. The experts commissioned by the licensing agencies, like the agencies themselves, did not play the role of party to the decision but rather of a final authority. This follows from the timing of their studies and is underlined by the fact that the studies were not submitted to any proper review process except for the overall evaluation performed by the Advisory Committee of the FMT. Consequently, the authors of the Gut- achten did not try to convince the public, the intervenors, or other critics of the proposed project. Since their main duty was to support and legitimate the approval decision there was no incentive to present the results of the studies in an easily understandable format.

Finally, we turn to the question of how typical the risk evaluation process was. The last stage of this process together with the relatively high number of studies commissioned on issues related to health and safety indicates that the risks of the LNG terminal were perceived as very serious by public authorities. Yet, authorities and applicant repeatedly stressed that they refused any association of the LNG risks with those of nuclear power, and in the authors' view they are right. On the other side it is quite obvious that the concerns about safety exceeded what one would have expected in a standard approval process concerning the siting of a large-scale industrial facility. While the DGWE viewed the licensing procedure for the land-based facilities as not too unusual, the Waterways and Shipping Authorities considered their approval procedure as unprecedented with respect to the scope and depth of the risk assessment process. Whether it really becomes a model for other decisions is not clear, although a similar procedure is currently used by the WSB to evaluate the planned LNG terminal at Eemshaven close to the Dutch–German border. In any case, the experiences gained in connection with the LNG terminal at Wilhelmshaven are sure to have some impact on future regulations concerning the transportation of hazardous liquids and gases.

REFERENCES

General

Conrad, J. (ed.) 1980. *Society, Technology, and Risk Assessment*. London: Academic Press.

Dreyhaupt, F.J. 1977. *Standortbereitstellung für Energieanlagen in der Bundesrepublik Deutschland unter besonderer Berücksichtigung des Landes Nordrhein-* Westfalen. Essen: Vulkan-Verlag.

Ewringmann, D., and Zimmermann, K. 1978. "Umweltpolitische Interessenanalyse der Unternehmen, Gewerkschaften and Gemeinden," in M. Jänicke (ed.), *Umweltpolitik*. Opladen: Leske und Budrich.

Gottschalk, H.-J. 1980. *Wilhelmshaven, Umweltschutzmodell* (Wilhelmshaven) March.

Guggenberger, B. 1980. *Bürgerinitiativen in der Parteiendemokratie*, Stuttgart: Kohlhammer.

Hartje, V.J., and M. Dierkes. 1976. "Impact Assessment and Participation: Case Studies on Nuclear Power Siting in West Germany," in D.F. Burkhardt, ed., *Environmental Assessment of Socioeconomic Systems*. New York/London: Plenum Press, 1978.

Hinz, O.M. 1974. "Von der Gewerbeordnung zum Atomgesetz: Zur Kritik des Umweltrechts, in Ch.F. Doran, *et al.* (eds.). *Umweltschutz-Politik des peripheren Eingriffs*. Darmstadt: Luchterhand.

Kitschelt, H. 1980. *Kernenergiepolitik: Arena eines gesellschaftlichen Konfliktes*. Frankfurt a.M./New York: Campus Verlag.

Kunreuther, H. (ed.) 1982. *Risk: A Seminar Series*. CP-82-S2,

Laxenburg, Austria: IIASA.

Kunreuther, H., and E. Ley (eds.) 1982. *Decision Processes and Institutional Aspects of Risk*. Proceedings of a Summer Study held at the International Institute for Applied Systems Analysis, Laxenburg, Austria, June 1981, Berlin: Springer Verlag.

Kunreuther, H., J. Linnerooth, and R. Starnes (eds.) 1982. *Liquefied Energy Gases Facility Siting: International Comparisons*, Proceedings of a Task Force Meeting, 23-26 September 1980, CP-82-S6, Laxenburg, Austria: IIASA.

Kunreuther, H., J. Linnerooth, *et al.* 1982. "Risk Analysis and Decision Processes: The Siting of LEG Facilities in Four Countries," Preliminary Draft, March. (Forthcoming publication from Springer-Verlag).

Mandl, C., and J. Lathrop. 1981. "Assessment and Comparison of Liquefied Energy Gas Terminal Risk," WP-81-098, Laxenburg, Austria: IIASA.

Murphy, D., *et al.* 1979. *Protest: Grüne und Steuerrebellen. Ursachen und Perspektiven.* Reinbeck bei Hamburg: Rowohlt.

Otway, H.J., and D. von Winterfeldt. 1982. "Beyond Acceptable Risk: On the Social Acceptability of Technologies," *Policy Sciences*, 14(3):247-56.

Partenscky. 1974. "Gutachtliche Stellungnahme zur geplanten LNG-Umschlaganlage in der Innerjade und zu den Ergebnissen der Modellversuche des Franzius-Instituts," T.U. Hanover. December.

Pilz, V. 1980. Risikoermittlung und Sicherheitsanalysen in der chemischen Technik, *Chem.- Ing.- Tech.* 52(9):703-11.

Reichel, P. 1981. *Politische Kultur der Bundesrepublik*, Opladen: Leske und Budrich.

Scharpf, F.W., B. Reissert, and F. Schnabel. 1976. *Politikverflechtung: Theorie und Empirie des kooperativen Federalismus in der BDR.* Kronberg: Scriptor.

Southern, D. 1979. "Germany," in F.F. Ridley (ed.) *Government and Administration in Western Europe.* London: Martin Robertson.

Steiger, H., and O. Kimminich. 1976. *The Law and Practice Relating to Pollution Control in the Federal Republic of Germany.* London: Graham and Trotman.

Stenzel, W. 1977. "Immissions-Messnetz Wilhelmshaven," *Umwelt*, 7(1):32-7.

Vahrenholt, F. 1980. "Chemieanlagen sind keine Schokoladefabriken!" in E.R. Koch and F. Vahrenholt (eds.) *Im Ernstfall hilflos. Katastrophenschutz bei Atom- und Chemianlange.* Köln: Kiepenhauer and Witsch.

Wohlleben, W., and F. Vahrenholt. 1979. "Störfälle in der chemischen Industrie: eine neue Problemstellung für den Immissionsschutz," in *Technische Überwachung* 20 (1979) nr. 5 Mai and nr. 6 Juni.

Statistics and Official Programs or Reports

Brecht, C., et al, (eds.). 1980. *Jahrbuch für Bergbau, Energie, Mineröl und Chemie 1980/81*. Essen: Verlag Glückauf

Bundesregierung. 1974. "Erste Fortschreibung des Energieprogramms der Bundesregierung," BT-Drucksache 7/2713.

Bundesregierung. 1977. "Zweite Fortschreibung des Energieprogramms der Bundesregierung," BT-Drucksache 8/1357.

Niedersächsischer Landtag 1978a. *Vorlage der Landesregierung Nr. 2892*, NL-Drucksache 8/2892.

Niedersächsischer Landtag 1978b. *Achte Wahlperiode 1974, Stenographische Berichte (Band 4)*, 7634-7635. Hannover: Niedersächsischer Landtag.

Niederächsischer Minister des Inneren (ed.). 1976. "Regionales Raumordnungsprogramm für den Verwaltungsbezirk Oldenburg, in Amtsblatt für den Niedersächsischen Verwaltungsbezirk Oldenburg, Nr. 52A, 1976 (Sonderausgabe).

Ruhrgas. 1980a. *Annual Report 1979* (54th financial year). Essen: Ruhrgas Aktiengesellschaft.

Ruhrgas 1980b. "Erdgas im Europäischen Verbund: ein Eckpfeiler der Energieversorgung Westeuropas," Essen: Ruhrgas AG.

VIK--Vereinigung Industrielle Kraftwirtschaft (ed.). 1980. *Statistik der Energiewirtschaft 1979/80*. Essen: Energieberatung GmbH.

Wilhelmshaven (undated). *Neuland am Tiefwasser*. Stadt Wilhelmshaven.

Wilhelmshaven 1979. *Wilhelmshaven: Tiefwasserhafen mit Top-Chancen*. Stadt Wilhelmshaven.

Reports Related to the LNG Decision Process

Brötz, W. 1978. "Sicherheitstechnisches Gutachten zum Planfeststellungsverfahren eines Schiffsanlegers vor dem nördlichen Teil des Voslapper Grodens im Norden von Wilhelmshaven." Instituts für Technische Chemie der Universität Stuttgart, Stuttgart, December.

Brötz, W. 1979. "Sicherheitstechnisches Gutachten zum Antrag auf Vorbescheid zur Errichtung und zum Betrieb eines LNG-Terminals in Wilhelmshaven der Deutschen Flüssigerdgas Terminal Gesellschaft mbH, Wilhelmshaven," Stuttgart, July.

BAM (Bundesanstalt für Materialprüfung). 1979. "Sicherheitstechnische Beurteilung einer Transport- und Umschlagbrücke vor dem nördlichen Teil des Voslapper Grodens in Wilhelmshaven," Berlin, March.

DFTG (undated). *Auf ein gutes Miteinander*. Wilhelmshaven: Deutsche Flüssigerdgas Terminal Gesellschaft mbH.

DFTG. 1978. LNG Terminal Wilhelmshaven. Kurze Projekt-Beschreibung des LNG-Terminal in Wilhelmshaven nach § 9 des Bundes-Immissionschutzgesetzes, Wilhelmshaven, May.

DGWE. 1979. *Genehmigungsvorbescheid. (§4ff Bundes-Immissionschutzgesetz): Errichtung eines Erdgas--Terminals in Wilhelmshaven der Deutschen Flüssigerdgas Terminal Gesellschaft mbH-DFTG*, Oldenburg: Bezirksregierung Weser-Ems, July.

Energy Analysts. 1978. "Eine kritische Betrachtung der geplanten Übergabe- und Transportbrückeneinrichtungen für den DFTG-LNG-Terminal in Wilhelmshaven Deutschland." ausgearbeitet für Mobil OilAG in Dutschland von Energy Analysts, Inc. June.

Germanischer Lloyd 1978. "Gutachten: Zur Sicherheit von LNG-Tanken." Hamburg, March.

Johannsohn, G. (undated). "Gefährdung der Umwelt durch gefährliche Stoffe bei Kollisionsfällen von Gas- und Chemikalientankern," Bremen.

Krappinger, O. 1978a. "Abschätzung des Risikos, dass Tanker mit gefährlicher Ladung im Jadefahrwasser mit anderen Schiffen kollidieren oder auf Grund laufen." Hamburg: Hamburgische Schiffbauversuchsanstalt GmbH, June.

Krappinger, O. 1978b. *Risikoanalyse: Über die Gefährdung der an den Umschlagsbrücken der DFTG und ICI liegenden Schiffe durch den die Anlage passierenden Verkehr auf dem Fahrwasser der Jade.* Hamburg: Hamburgische Schiffbau-Versuchsanstalt GmbH, June.

Krappinger, O. 1978c. *Ergänzung der Risikoanalyse: Über die Gefährdung der an den Umschlagsbrücken der DFTG und ICI liegenden Schiffe durch den die Anlage passierenden Verkehr auf dem Fahrwasser der Jade.* Hamburg: Hamburgische Schiffbau-Versuchsanstalt GmbH.

Risikoabschätzung 1979. *Risikoabschätzung für den Transport und Umschlag von tiefkalt verflüssigtem Erdgas (LNG) und Chemikalien auf der Jade.* Bonn: Arbeitsgruppe des Beirates für die Beförderung gefährlicher Güter beim Bundesverkehrsministerium, January.

TUV (Technischer Überwachungsverein Norddeutschland e.V.) 1979. "Sicherheitstechnisches Gutachten im Rahmen des Planfeststellungsverfahrens nach dem Wasserstrassengesetz für die Errichtung und den Betrieb einer Transport- und Umschlagbrücke vor dem nördlichen Teil des Voslapper Grodens in Wilhelmshaven," Hamburg, March.

Wilhelmshaven 1978. "Bebauungsplan 130 B-Voslapper Groden Nordost--Behandlung der Bedenken und Anregungen Privater". Stadt Wilhelmshaven.

WSB. 1978. "Transport gefährlicher Güter zu den geplanten DFTG/ICI-Umschlagsbrücken." Aurich: Wasser- und Schiffahrtsdirektion Nordwest, October.

WSB. 1979. "Planfeststellungsbeschluss für den Ausbau der Bundeswasserstrasse Jade durch die Errichtung und den Betrieb einer Umschlaganlage für Flüssigerdgas der Firma Deutsche Flüssigerdgas

Terminal Gesellschaft mbH-DFTG-Essen, vor dem nördlichen Voslapper Groden in Wilhelmshaven," Aurich: Wasser- und Schiffahrtsdirektion Nordwest, July.

Newspaper Articles

"Algerisches Erdgas für Ruhrgas und Salzgitter." (September 1974). *Erdöl und Kohle*, 27(9):548.

"Algerisches Erdgas für Ruhrgas, Salzgitter und Gasunie." (September 1977). *Erdöl und Kohle*, 30(9):436-7.

"Sonatrach legt die Leitlinien für seine Gaspreispolitik dar," (August 1980). *Erdöl und Kohle*, 33(8):391-3.

"Berechtigte Sorgen der Wangerländer nach dem Expertenbesuch noch verdichtet," *Jeverländisches Wochenblatt (JW)* 15 Oktober 1977.

"Höhere Gefahr durch die neue Unschlagbrücke?" *JW* 15 September 1978.

"Auch Wilhelmshaven möchte bei DFTG fremdenverhehrsfreundliche Lösung," *JW* 6 December 1978.

"Erdgas-Röhren-Geschäft Bonns mit Moskau unter Dach," (22/23 November 1981), *Neue Zürcher Zeitung* .

"Erdgas-Basis für die Bundesrepublik." 1 September 1977. *Wilhelmshavener Zeitung (WZ)*.

"Nähe der Industrie ze Hooksiel ist ein grosses Problem." *WZ* 15 Oktober 1977.

"Flüssigerdgas-Terminal unterschiedlich beurteilt." *WZ* 31 Oktober 1977.

"Hooksieler wollen ein Gesamtgutachten." *JW* 31 Oktober 1977.

"Luft, Wasser und Umwelt bleiben Heilige Güter," *WZ* 7 November 1977.

"Neue Brücke: Friesland will Einsatz von Obergutachtern." *WZ* 27 July 1978.

"Eine Lehrstunde sachlicher Diskussion." *WZ* 14 September 1978.

"Voslapper Groden: Flüssiggas soll ab Herbst 1984 kommen." *WZ* 15 September 1978.

"Kreis: Bedenken gegen Ansiedlung der DFTG." *WZ* 20 September 1978.

"Forderung bleibt: höchstmögliche Sicherheit." *WZ* 27 November 1978.

Interviews

Bundesminister für Wirtschaft I, Bonn, December 1980.

DFTG I (Deutsche Flüssigerdgas Terminal Ges.m.b.H.), Essen, January 1981.

DFTG II, Essen, September 1981.

DGWE I (Bezirksregierung Weser-Ems), Oldenburg, November 1981.

FMT I (Bundesminister für Wirtschaft), Bonn, December 1980.

Friesland I (Landkreid Friesland), Jeves, November 1980 (Letter).

HCG I (Initiativeauschuss Hooksieler Vereine), Wangerland, December 1980.

HCG II, Wilhelmshaven, April 1981.

ME&T I (Niedersächsischer Minister für Wirtschaft und Verkehr), Hannover, November 1980.

ME&T II, Hanover, January 1981.

ME&T III, Hanover, January 1981.

Niedersächsischer Sozial Minister I, Hanover, November 1980.

Ruhrgas I (Ruhrgas LNG Flüssigerdgas Service Ges.m.b.H.), Essen, May 1980.

Ruhrgas II (Ruhrgas AG), Essen, January 1981.

Ruhrgas III (Ruhrgas AG), Essen, September 1981.

Wangerland I (Gemeinde Wangerland), Wangerland, November 1980.

Wangerland II, Wangerland, April 1981.

Wilhelmshaven I (Stadtverwaltung Wilhelmshaven), Wilhelmshaven, May 1980.

Wilhelmshaven II (Stadtverwaltung Wilhelmshaven), Wilhelmshaven, November 1980.

Wilhelmshaven III (Stadtverwaltung Wilhelmshaven), Wilhelmshaven, April 1981.

Wilhelmshaven IV (Stadtrat Wilhelmshaven), Wilhelmshaven, April 1981.

Wilhelmshaven V (Stadtrat Wilhelmshaven), Wilhelmshaven April 1981.

Wilhelmshaven VI (Stadtrat Wilhelmshaven), Wilhelmshaven April 1981.

WSB I (Wasser- und Schiffahrtsdirektion Nordwest), Aurich, May 1980.

WSB II, Aurich, November 1980.

WSB III, Aurich, April 1981.

APPENDIX A
LIST OF INSTITUTIONS CONTACTED

Bezirksregierung Weser-Ems, Oldenburg

Bundesminister für Verkehr, Bonn

Bundesminister für Wirtschaft, Bonn

Deutsche Flüssigerdgas Terminal Ges.m.b.H., Wilhelmshaven

Gemeinde Wangerland, Wangerland

Initiativausschuss Hooksieler Vereine, Wangerland

Landkreis Friesland, Jever

Niedersächsischer Minister für Wirtschaft und Verkehr, Hannover

Niedersächsischer Sozialminister, Hannover

Ruhrgas AG, Essen

Ruhrgas LNG Flüssigerdgas Service Ges.m.b.H., Essen

Stadt Wilhelsmhaven: Stadtverwaltung, Wilhelmshaven

Stadt Wilhelmshaven: Stadtrat, Wilhelmshaven

Wasser- und Schiffahrtsdirektion Nordwest, Aurich

APPENDIX B
ABBREVIATIONS

AG	Aktiengesellschaft
BAM	Bundesanstalt für Materialprüfung
BEB	Gewerkschaften Brigitta und Elwerath Betriebsführungsges.m.b.H.
BP	British Petroleum
DFTG	Deutsche Flüssigerdgas Terminal Ges.m.b.H.
DGWE	District Government Weser-Ems
DM	Deutschmarks
EBI	Engler-Bunte-Institue der Universität Karlsruhe
EWE	Energieversorgung Weser-Ems AG
FMT	Federal Minister of Transport
FRG	Federal Republic of Germany
GKSS	Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt
GL	Germanischer Lloyd
HCG	Hooksiel Citizen Group
ICI	Imperial Chemical Industries Ltd.
ICT	Institut für Chemie der Trieb- und Explosivstoffe der Fraunhofer Gesellschaft
IIASA	International Institute for Applied Systems Analysis
IMCO	Intergovernmental Maritime Consultative Organization
JW	Jeverländisches Wochenblatt
LNG	Liquefied natural gas
ME&T	Lower Saxony Ministry for Economic Affairs and Transport
NATO	North Atlantic Treaty Organization
PTB	Physikalisch-Technische Bundesanstalt
TUV	Technischer Überwachungsverein
UBA	Umweltbundesamt
UK	United Kingdom
US	United States
US$	United States Dollars
WSB	Water and Shipping Board North-West
WZ	Wilhelmshavener Zeitung