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Eco-check for submarine pipelines in the Baltic Sea

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Table of contents

Summary

Even though submarine pipelines constitute tested and mature technologies their construction and operation can cause substantial impacts to the marine environment. The recent Northern European Gas Pipeline Project NEGP from Russia to Germany, which will cross the territories of 5 Baltic Sea states, was the motivation for WWF to contract BioConsult Schuchardt & Scholle GbR to conduct a brief study on the requirements to be met by a project for laying and operating a gas pipeline in the Baltic Sea from the point of view of environmental protection and nature conservation.

Whereas in German territorial waters several laws and procedures exist that require an Environmental Impact Assessment (EIA), regulations in the Exclusive Economic Zone (EEZ) are not very stringent. At the international level the Helsinki Convention (HELCOM) is one of the conventions requiring a procedures for notification and information. However, an explicit recommendation on pipeline constructions and detailed EIA regulations does not exist so far.

The study identifies aspects of special concern during pipeline planning: e.g. the process of route selection, the pipe laying process, and also the aspect of possible cumulative and transborder impact. The study proposes elements of how "best environmental practice" for submarine pipelines can be defined including route selection, information and monitoring, use of best available technology, compensatory measures, early stakeholder involvement, and the implementation of an environmental management programme.

A proposal is made on standard requirements concerning the necessary environmental data collection and monitoring during a pipeline approval procedure. Such a standard should be coordinated and agreed on a transnational basis for individual seas or marine regions. Some of the recommendations given in the study are:

- Formal requirements, approval procedures and environmental standards for transnational or transregional pipeline assessment should be harmonised in the territiories and EEZs of the different countries concerned according to the highest standards of one concerned state.

- Route selection should be carried out within a formal approval procedure (or several if necessary) by comparing different alternatives on the basis of sound and comparable data (avoiding sensitive areas, etc) with integrated environmental impact assessment and early transnational stakeholder participation.

- HELCOM (and OSPAR) should decide on standard requirements regarding the scope of the investigations necessary for the approval procedures for cables and pipelines.

- Ecological impacts must be compensated for. Compensation should be standardised on a transnational basis and also be binding for the Exclusive Economic Zone.

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1. Introduction

Natural gas is one of the most significant sources of energy for the future. The importance of gas has increased steadily over the last decade, compared to other fossil energy resources such as coal and oil. One of the reasons for this increase is that the use of natural gas results in comparatively less harmful emissions, and thereby higher environmental acceptability. Thus the construction of onshore and offshore pipelines is increasing at the European as well as at the global level, as is the case with other line structures as well, especially for the transport of electrical energy (GOODLAND 2005). Many such installations have been laid during the last decades, also in the Baltic Sea (www.bsh.de).

Most recently a trans-Baltic gas pipeline project, the North European Gas Pipeline (NEGP) was announced. The leading company, GASPROM in Russia, communicated the project outline to the Baltic Sea states in December 2005.

WWF, a major environmental NGO, has been involved as a relevant organisation to be informed about the project. WWF will seek to define the degree of necessary and sound research to be conducted in order to determine the most sustainable way of transporting gas from Russia to Germany and assess whether the construction and operation of such a gas pipeline through the Baltic Sea can be sustainable at all and if so, how and where it should be built and how the impacts on the environment must be monitored.

Against this background WWF contracted BioConsult Schuchardt & Scholle GbR in April 2006 to conduct a brief study on the requirements to be met by a project for laying and operating a gas pipeline in the Baltic Sea from the point of view of environmental protection and nature conservation.

The study outlines in a first step the view of the Northern European Gas Pipeline (NEGP) consortium on the environmental implication of this large pipeline project.

In a second step, generally critical aspects to be taken care of in marine pipeline projects are highlighted and a short overview is given on the legal implications for such a project based on the experience in a national context of German law.

In a third step an attempt will be made to specifically define the HELCOM demand for “best environmental practice” for a pipeline project. HELCOM has specified this in particular with respect to reduction of inputs of hazardous substances, but in the NEGP case this could affect also many HELCOM Contracting parties.

In a fourth step a possible Environmental Management Programme will be outlined for the construction and operation of a pipeline and in the fifth step a proposal will be made to define standards and requirements for an Environmental Impact Assessment (EIA) of submarine pipelines that should be further developed by the Baltic Sea states.

2. The North European Gas Pipeline project (NEGP) in the view of the applicant – "no problem" for the environment?

The following project description is quoted (slightly abridged by us) from the technical description of the NEGP project presented at the pipeline consortium at the end of 2005 (Gazprom, Wintershall, eon ruhrgas NORTH EUROPEAN GAS PIPELINE (OFFSHORE SECTION) THE TECHNICAL DESCRIPTION. Moscow 2005). It is not reflecting the position of the author of this study.

"In accordance with EC 85/337/EC Directive, Convention on the Environmental Impact Assessment in a Transboundary Context (Helsinki, 1992), national legislation of the Russian Federation, Finland, Sweden, Denmark and Germany the development of the North European Gas Pipeline requires full-scale Environmental Impact Assessment (EIA).

The current document comprehends project description, as well as a short preliminary review of the potential environmental impacts of the proposed activity. These data are necessary to estimate EIA scope and elaborate the EIA program.

2.1 *Project objectives*

In the near future the existing export gas pipeline from Russia to Europe will not be able to cover the increasing demand for gas: by 2010 analysts forecast an increase of natural gas consumption beyond long-term contracts in force with estimated volume about 100 billion m³. To solve this problem as well as to improve reliability of Russian natural gas export process, there was begun elaboration of the North-European Gas Pipeline project (NEGP).

The European Council Energy and Transport Commission has defined the NEGP construction as a priority project in the field of gas transportation and extraction. Taking into consideration that the European Union is interested in creating a unique European energy market and an integrated electric power system, where Russia will play a leading part in the field of creating new gas transport itinerary to Western Europe, by the decision of the European Commission the NEGP project received "TEN" (Trans-European Networks) status.

In the frame of the project realization "Gazprom" JSC and the German concerns BASF AG and E.ON AG signed an agreement upon the gas pipeline and construction and exploitation on September 08, 2005. On December 05, 2005 in Switzerland there was established a German-Russian joint venture North European Gas Pipeline Company (NEGPC).

On the first stage raw materials base for NEGP will be the gas fields of Nadym-Pur-Tar Region (Yamalo-Nenetskiy autonomous area), later on – the gas fields of Yamal, Ob-Taz Bay and Stockman offshore gas field (Barents Sea). NEGP offshore section begins in the area of Portovaya Bay, situated near Vyborg (Leningrad region), will go along the Baltic Sea bottom within the territorial waters and exclusive economic zone (EEZ) of Russia, EEZ of Finland, EEZ of Sweden, EEZ of Denmark, territorial waters and EEZ of Germany. The end point of NEGP is the receiving terminal in Greifswald Bay (Germany). The branch gas pipeline to Sweden, Nyköping City area, is under consideration.

The productivity of two pipelines will achieve 55 billion m³/year.

The NEGP construction will begin in 2008 and will take, admittedly, 2 years. The project operation time of the pipeline is 25 years. Delivery commencement is planned in 2010, running at full capacity in 2013.

2.2 *Project description*

The length of the marine pipeline sector from Portovaya Bay to Greifswald Bay is 1,198 kilometers. The length within the Exclusive Economic Zone of Denmark is ca. 150 km. Landfall site coordinates in the Portovaya Bay (Russia) are N 60o31'30" E 28o04'24". Landfall site coordinates in the Greifswald Bay (Germany) are N 54o08'48" E 13o38'23".

During project conceptual designing and technology selection there were taken into consideration the results of the pipeline strength and stability calculation, clear span length, interaction between the pipeline and the trawling gear, as well as the environmental conditions along the pipeline route mainly according to the existing technical standards from DNV (De Norske Veritas) and GL (Germanischer Lloyd).

Three main alternatives are considered:

1. *Two runs by 48" of diameter under operationpressure 220 bar*
2. *Two runs by 42" of diameter under operation pressure 220-250 bar with intermediate pumping station (within EEZ of Sweden)*
3. *Three runs by 42" of diameter under operation pressure 210 bar.*

2.2.1 *Pipeline construction review*

Coastal line intersection

a) In Portovaya Bay: *The length of the coastal line intersection area is about 575 meters, up to 5 kilometers of sea depth. It is intended to lay the pipeline in a trench at a depth not less than 3 meters from the lower generatrix of the concrete coating. The trench smoothes the pipeline contour and ensures its stability and mechanical protection in tidal and shallow water zones, where the pipeline is the most exposed to disturbance, provoked, among other things, by ice gouge.*

Trenching is effected by bucket excavators from a previously seaward dumped dam and by dredgers of shallow draught. The trench width is not less than 5 meters.

The pipeline string will be mounted on a pipe-laying vessel of shallow draught and stretched towards the shore by a winch, installed on a pipe-laying vessel.

b) In Greifswald Bay (Germany): *Approximate intersection area length is 800 meters. The pipeline is supposed to be laid in a trench, excavated by cofferdam (if not possible – from the dam). The pipeline string will be mounted on a pipe-laying vessel and stretched towards the shore by a winch, installed on a pipe-laying vessel or on the shore. The pipeline pontoons will decrease resistance during stretching.*

Near shore sections

The stretch of coastal water zones with depths under 20 meter isobath along the Russian coast is about 4.7 kilometers, along the German coast – 68.2 kilometers. To ensure the pipeline stability and to protect the pipeline from wave action and encounter with ice features, the trench will be filled back. The distance between two pipelines will be 50-100 meters.

Trench width: 5 m at trench bottom, while it is to be taken in account that trench's slopes must be more or less gentle (to improve a trench stability until the pipe laying), so the total width will be up to 15 meters. Trench depth will be 3 meter (minimum) and trench length up to the water depth 20 meters, ca. 68 km or less depending on the final pipeline route.

Trenching at a depth of less than 12 meters will be effected by a cutterhead hydraulic dredge and/or a hopper dredge with a sunction drum. At a depth more than 12 meters it is a good practice to bury the pipeline with a pipe-burying barge. Barges length and width are specific and depends on type of vessels possessed by potential subcontractors. Explosive works are not intended.

Backfilling and dumping of the excavated ground: backfilling nor dumping is not needed in case of post-laying trenching (at the depth more than 12 meters). In case of pre-trenching excavated grounds may be used for backfilling, dumped along both sides of the trench or dumped in special areas. The final decision depends on the result of geological and environmental investigations regarding bottom sediments grain-size, contamination, etc. Coarse rock debris are used at the last stage of backfilling.

The pipe-laying will be effected by a pipe-laying vessel of shallow draught up to the deep areas, where the main pipe-laying vessel sets to work. In certain areas additional dredging may be required.

Offshore section

Pipe-laying in marine areas will be effected by generation III/IV pipe-laying vessels. The pipes will be supplied by powered crafts or barges from intermediate storage sites or directly from plants. The pipeline will be laid directly to the seabed. In certain areas ground work (sea bed rectification) may be needed to shorten clear spans.

a) Trenching: *Pipe-laying in a trench is applied mainly in shallow waters. Depending on the area depth and seabed lithology: trenching may be effected by different methods – by dredgers with mechanical ripper or with sunction drum. The extracted ground may be deposited in a dredger hold, on a hopper for its further transportation to the dump site.*

b) Clear span elimination: *Clear span elimination is necessary in sites with complex seabed relief, where the pipes "hang" over the seabed on separate crests or other heights, which causes too large clear spans. Along the NEGP route such areas are the most common in its eastern part – within the limits of the Finnish exclusive economic zone.*

Underwater crests are cut off by dredgers, which is aimed at reducing altitude difference along the pipeline route. Another method is a riprap before and after pipe-laying. It is effected from a hopper (barge with self-opening floor) or with a special fault pipe. The last method presupposes the use of more expensive equipment, but ensures work accuracy and materials saving. In cases, when seabed shaping is impossible, concrete and steel footings are used.

The volume of the excavated ground and of the backfilling material (sand, gravel, rock detritus) will be specified later after the final definition of the NEGP route in the course of surveying work.

c) Crossing the existing engineering service lines: *The NEGP route will cross at least 16 communication and power cables. During pipeline construction security measures will be taken. There are a number of safe intersection point variants such as rubble mound, steel supporting floor, flexible concrete mats, concrete footings or preliminary cable dismantling and its restoration after pipeline laying. Intersection type variant depends on environmental conditions in the intersection site, as well as on the owner of the intersected area.*

2.2.2 *Testing and pre-commissioning*

Before putting in operation include pigging, hydrotesting, drying and pipeline filling are carried out. During hydrotesting chemicals will not be used. Testing will be carried out using processed seawater; water intake will be effected in Portovaya Bay area, water discharge – in Greifswald Bay.

2.3 *Preliminary assessment of the potential environmental impact*

To develop a detailed EIA and discover priority objectives and important problems that should be solved at scoping stage, preliminary EIA has been carried out. It has been based on scientific and technical documentation data, library material, similar project experience (BBL, Baltic Gas Interconnector, "Blue Stream").

Environmental impact will take place during design and exploration work, construction (marine section of pipeline mounting), testing and pre-commissioning work (water discharge after hydrotesting), NEGP exploitation and decommissioning.

Investigations for planning are associated with noise nuisance from hydrographic and other survey vessels, seabed habitat and benthic bio-community disruption and extraction of a moderate volume of biological resources (fish, benthic organisms) during sampling. The intended activity may affect birds' and marine mammals' habitats, as well as benthic flora and fauna. The zone of possible impact varies from the surface to 500 meters deep, depending on survey activity and equipment used.

In certain areas dumped chemicals and munitions may be discovered. These sites will be recorded, then, recovered and liquidated by specialists to avoid contact with explosive and toxic matters during pipeline construction.

Main impact will occur during construction stage. The pipeline mounting process within the water column or on the seabed supposes isolation of a certain space of the seabed. Seabed leveling works (drilling and local heights and depressions elimination), trenching, seabed deepening and backfilling will provoke destruction of benthic communities in the area from 5 to 50 meters on both sides of each pipe line. Ground works will provoke detachment of sediment, containing considerable volume of technogenic matters and their transport by currents and re-deposition. Trench backfilling with sand, gravel, macrofragmental material) will produce physical impact on benthic communities, but other kinds of impact is unlikely.

The pipe-laying and other vessels will generate noise and disturb ichthyofauna, marine mammals and birds. The activity will require temporary isolation of the territory, which will provoke difficulties for navigation and fishery. The affected area is estimated to be about 1000 meters around the vessel. Beside that, certain general impact will be produced on air, as a result of fuel combustion during construction activity (thermal emission, NO_x, CO_2, CO, SO_2).

During construction activity in the sea vessel accidents may occur, which may be dangerous for people and environment (in case of fuel spill).

Pipeline landfall construction activities may impact environment to the same extent as during pipe-laying in the open sea. Environmental impact magnitude during trenching is higher than during pipe-laying activity in the open sea. Depending on the pipeline landfall site (open seashore, bay coast etc.), bathymetry, hydrographic conditions and bottom sediment lithology the environmental impact zone varies from < 1000 to < 2500 meters.

During testing and pre-commissioning work water discharge will be effected after hydrotesting. That cause noise nuisance and physical impact for birds, zones of recreation (beaches) and tourism. It is estimated that the impact zone will be about 500 meters. Depending on water composition and properties (salinity, oxygen level, temperature etc.), water discharge during hydrotesting will impact water quality, flora and fauna, ichthyofauna and fishery, marine mammals. Little amount of pollutants (calces) may be discharged into the sea with water.

At pipeline exploitation stage the impact seems to be the longest, but the least intensive. The mounted pipeline may lead to certain changes in the benthic communities. The level of these changes depends on pipeline burial depth. The mounted pipeline impact zone, as well as the zone of pipeline intersections or other pipeline constructions is estimated to be <100 meters, nevertheless safety zone around the pipeline (100 meters to each side) has been established. Within this zone fishery (bottom trawling), shipping (anchoring) are limited.

During gas transport through the pipeline insignificant noise is observed, which may have certain impact on ichthyofauna. Thermal (emission of matters from the concrete protective coating of the pipes) and chemical impact should be studied. At pipeline landfall sites the main impact is connected with land reclamation.

Special attention will be paid to possible environmental impact from pipeline accidents, including the most negative – a cross-section fault. In case of an accident on a marine section of pipeline a large amount of gas and gas-fluid mixture is blown out. It has lower density than water, and may be dangerous for vessels in the region. Natural gas components may dissolve in water to some extent, impacting hydrobionts. Greenhouse gas – methane – may be discharged into the air. Shockwave, provoked by gas blowout, may also influence hydrobionts. Short thermal impact (temperature drop to negative value caused by gas expansion) may occur. In case of similar accident in the pipeline landfall sites, inflammation and explosion are probable, which will be dangerous for people (maintenance engineers), and will lead to combustion gases emission.

Impacts, connected with the pipeline decommissioning and dismantling are similar to those during construction."

3. Identification of environmentally critical issues of a submarine pipeline project

The tentative brief assessment submitted above in section 2.3 by the project applicant specifies in our opinion major adverse effects on the environment resulting from a pipeline project. In the following special focus shall be placed on several aspects on the basis of our experience with the pipeline projects Europipe I, Europipe II and NORFRA as well as various cable projects in the North and Baltic Sea.

The aspect of possible fundamental alternatives to the transport of gas through a pipeline will not be examined in detail in this brief study. This would relate mainly to the use of tankers for transporting liquid natural gas (LNG).

3.1 Critical issues

Route selection process

Selection of the route is decisive for the impacts resulting from construction and later operation on the environment. It is important to identify the least sensitive corridor in ecological terms on the basis of sensible data by comparing different alternative routes. This may also result in advantages for the operator of the pipeline (ELDÖY 1999). At the same time, however, it should be taken into account that the "ecological sensitivity" of a region with respect to the laying and operation of a pipeline is different from that in connection with construction and operation of a wind farm since the construction-related (temporary) impacts predominate in comparison to the operation-related (long-term) effects. These impacts must be appropriately considered together with the aspects of resource efficiency and "environmental policy sensitivity" of certain routes. In most cases the area of the landfall to the mainland will also be of special significance. The "correct" selection of the landfall point is particularly important in this context.

Crossing nature reserves and protected zones as "no-go areas" should be avoided as far as possible.

Especially in the Baltic Sea, the risks connected with possible hazardous wastes (munitions, poison gas, etc.) must be appropriately taken into consideration in the planning process.

Pipe laying

In offshore areas pipelines are usually simply laid on the seafloor. In coastal regions locally defined laying depths have to be observed in connection with the landfall of a cable so as to rule out exposure and damage, e.g. due to casting anchor. In addition to such aspects as safety, this must also be examined with regard to ecological factors (VAN BERNEM 1999). Coverage with sediment (various methods are possible for this purpose) leads to greater construction-related impacts, but to less significant operation-related effects (cooling of the gas also has to be taken into account here) and vice versa.

If coverage is necessary, this should be done with the naturally available materials as far as possible and placement of foreign materials should be avoided.

Horizontal drilling and other methods that may be used, particularly in crossing dikes or sensitive areas, lead to negligible quantities of shifted material, but may result in greater impairment of other environmental compartments, such as avifauna, so that advantages and disadvantages must be weighed up against each other in each individual case. This discussion was conducted extensively in connection with the laying of the Europipe gas line in the Wadden Sea in Lower Saxony between Langeoog and Baltrum in 1995 (SCHUCHARDT 2001).

Among other things, disturbances of avifauna and marine mammals may occur during the laying work due to the presence of construction equipment and ships, depending on the marine region, season, scope and type of activities (VOGEL 1994). The impacts can be reduced or entirely avoided by giving consideration to extremely sensitive time windows, such as construction work near breeding grounds prior to the beginning of the breeding period or establishment of colonies (SCHUCHARDT & GRANN 1999).

Commissioning

Various measures that negatively alter the chemical composition of the water in the line must be carried out on the pipeline for commissioning (the line is flooded for this purpose). Prior to commissioning the water is discharged into the sea at one of the end points. These aspects should be the subject of discussion even during the approval procedure. The methods applied as well as the place and time of the discharge are important (SCHUCHARDT et al. 2002).

Operation

In normal operation impacts relevant for the environment, apart from the temperature anomaly (see below), occur due to necessary checks and possibly restoration of eroded cover. Therefore, the selection of a morphologically stable corridor is important.

The gas cools down in the pipeline to a very substantial degree over long transport distances. Negative temperatures with corresponding ice formation in the area surrounding the pipeline may also be reached. This must be examined in detail in connection with the operation-related impacts.

Because of the high potential for damage, reduction of the probability of sudden gas leakage due to damage to the pipeline is of special significance. This may occur due to material defects or improper production, deficient maintenance or outside influence, e.g. the effects of ships. However, a comprehensive set of technical standards has been established by Den Norske Veritas and Germanischer Lloyd, among others, whose objective is to minimise this risk. Nevertheless, special importance should be attached to this aspect, such as by already establishing risk management during the planning stage.

Decommissioning

Up to now pipelines and cables have usually been left in the sea after termination of use. After the end of operation of a pipeline, the latter does not have any direct adverse impacts on the environment. Nevertheless, decommissioning should be stipulated and ensured on a binding basis in the official approval, as is now already provided for in the current approvals for cables of offshore wind farms in Germany. This appears meaningful so as to be able to use the steel again, on the one hand, and to prevent accumulation of anthropogenic structures in the sea, on the other hand.

Cumulative impact

Cumulative adverse environmental impacts, i.e. impairment resulting from the interaction with other projects, may occur due to pipelines, especially during the laying phase, and must be given appropriate consideration in the planning process. During operation cumulative impacts are conceivable via temperature anomalies, for example. Also cumulate affects have to be regarded with respect to the whole pipeline route through the Baltic Sea.

3.2 Consequences

- Routing represents a very major step towards mitigation of adverse environmental impacts in a pipeline project. Key aspects that must be given special consideration when comparing various possible routes include risks due to hazardous wastes, resource efficiency, a morphologically stable corridor and avoidance of crossing ecologically sensitive areas.

- Although the impacts that occur during laying and commissioning are of a small scale and temporary in most cases, they can be further reduced by appropriate routing, selection of a suitable laying method, definition of time windows and environmentally compatible processes during commissioning (pressure test).

- Normal operation of the pipeline may have an adverse impact on the environment due to temperature anomalies. Though risks due to accidents are already greatly reduced by applying existing standards, special consideration should be given to such risks in the planning phase by establishing a risk management system.

4. Submarine pipelines: formal environmental requirements based on the German case

In the following the current legal situation in Germany and in Mecklenburg-Vorpommern is described with respect to the requirements for an approval procedure for laying a gas pipeline in the German EEZ, on the continental shelf and in the coastal sea as well as supplementary requirements regarding an environmental impact assessment based on international and European law.

4.1 Approval in the EEZ

In the Exclusive Economic Zone (EEZ) or on the continental shelf all countries are fundamentally granted the freedom to lay pipelines. However, they must give consideration to the rights and obligations of the coastal state and comply with the laws and regulations enacted by the UN Convention on the Law of the Sea (UNCLOS), see Art. 58 of UNCLOS[1]. Art. 79 of UNCLOS contains detailed regulations for the laying of pipelines that grant the coastal state various powers vis-à-vis the laying state[2].
In Germany transposition into national law shall primarily take place through the German Federal Mining Act (Bundesberggesetz, or BBergG[3]), and the Marine Facilities Ordinance (Seeanlagenverordnung, or SeeAnlV[4]).

Requirements for approval from the point of view of mining law

The German Federal Mining Act (BBergG) applies to the laying of transit pipelines[5] in the continental shelf area in accordance with Section 2, subsection 3 BBergG.

In accordance with Section 133 BBergG, mining approval by the responsible state mining authority is initially required for construction and operation of a transit pipeline. In addition, the approval of the German Maritime and Hydrographic Agency (BSH) is required with regard to regulation of use and utilisation of the waters above the continental shelf and the air space above these waters. However, the BSH may grant such approval only if mining approval has been given, see Section 133 BBergG. The general provisions of the Administrative Procedures Act (VwVfG[6]) apply to the approval procedure.

Impairment of predominantly public interests exists in particular in the case of impairment of flora and fauna in an unwarrantable manner as well as in the event of concern regarding pollution of the sea, see Section 133 subsection 2 BBergG. The latter question must be negated if the pollution of the water is only minor or temporary. On the basis of the formulation "in particular", however, it is conceivable that further concerns regarding protection of the natural bases of life might apply as public interests justifying refusal[7]. If neither the safety of persons or physical assets are jeopardised nor predominantly public concerns are impaired, the approvals must be granted. Currently there is no obligation to carry out an environmental impact assessment (EIA) for transit pipelines.

Construction and operation are approved in accordance with DIN EN 1461 and a directive of the mining authority for the construction and operation of pipelines in marine regions. The directive is being revised at present.

[1] United Nations Convention on the Law of the Sea, adopted in New York on 30.04.1982; opened for signature in Montego Bay (Jamaica) on 10.12.1982; entered into force on 16.11.1994; BGBl. (Federal Law Gazette) 1994 II p. 1799

[2] In accordance with Art. 79 subsection 3 of the Convention on the Law of the Sea, the approval of the coastal state is required for route determination for pipelines.

[3] German Federal Mining Act of 13.08.1980, BGBl. (Federal Law Gazette) I p. 1310, last amended by Art. 37 of the law of 21.06.2005, BGBl. I p. 1818.

[4] Marine Facilities Ordinance of 23.01.1997, BGBl. (Federal Law Gazette) I p. 57, last amended by Art. 122 of the law of 21.06.2005, BGBl. I p. 1818.

[5] A transit pipeline is a pipeline that goes from the continental shelf or from the territory of another state to the continental shelf of the Federal Republic of Germany or crosses the latter, see Section 4 subsection 10 BBergG. The Baltic pipeline is such a transit pipeline.

[6] Administrative Procedures Act of 25.05.1976 BGBl. I p. 1253, last amended by Art. 4 subsection 8 of the law of 05.05.2004 BGBl. I p. 718.

[7] Also according to R. Wolf, final report on the research and development project: "AWZ-Vorhaben: Rechtliche und naturschutzfachliche Aspekte beim Bau und Betrieb von Stromkabeln" (EEZ Project: Legal and conservation-related aspects in connection with construction and operation of power cables) (FKZ 803 85 200), February 2004, p. 22.

4.2 Approval for coastal sea

Withhin the 12 nautical mile borders, the legal regime for approval and thus also the requirements for approval for laying of the pipeline changes. For the coastal sea[8] as part of the territory of the Federal Republic of Germany the following applies: when a pipeline is laid, all federal and state laws of Germany that apply to the mainland and on the basis of which specific legal environmental protection and nature conservation requirements result for the planned project must be fundamentally observed.

Regional planning law

For a planned transit pipeline one could stipulate a regional planning procedure in the framework of which it is examined whether a project of regional relevance conforms with the regional planning requirements and how it can be coordinated with other planning work and measures of regional relevance and implemented, see Section 15 of the Regional Planning Act (ROG[9]), Section 15 of the law concerning regional and state planning of the German federal state of Mecklenburg-Vorpommern (LPlG M-V[10]).

One of the prerequisites is that the laying of the pipeline is a measure of regional relevance, see Section 3 No. 6 ROG, among others. Regional relevance can be assumed in the case of a transit pipeline that runs through the entire width of the coastal sea.

The procedure is initiated officially or at the request of the project applicant. The regional planning procedure includes a regional planning environmental impact assessment and must take place with the involvement of other planning institutions and recognised nature conservation organisations, to the extent they are affected, as well as of the public.

Federal Immission Control Act

Although noise emissions that may cause significant nuisance for the general public, depending on the route chosen, may occur during the laying of a pipeline, pipelines are not facilities requiring approval in accordance with Section 4 of the Federal Immission Control Act (BimSchG) in connection with the 4th Federal Immission Control Regulation (BImSchV[11]). However, they have to meet the requirements of Section 22 of the Federal Immission Control Act.

Building law

On the basis of the law on building project planning, it may be necessary to examine the permissibility of the pipeline according to Section 35 of the building code (BauGB[12]). The laying of the pipeline is undeniably a project in accordance with the building code that is only permissible (with regard to city planning) if public concerns do not stand in the way and it is a so-called privileged project in accordance with Nos. 1-7. Conflicting public concerns here may be, in particular, conservation concerns, especially protected areas that restrict or preclude the use of pipelines, as well as regional planning goals. Approval in accordance with the state building regulations of Mecklenburg-Vorpommern (LBauO M-V[13]) is not necessary.

Water law

According to the Water Resources Management Act (WHG[14]), which is also applicable in the coastal sea, Section 19a of the latter requires planning permission or planning approval for the construction, operation and significant modification of a pipeline facility for conveying substances hazardous to water[15] in accordance with Sections 20-23 of the Environmental Impact Assessment Act (UVPG[16]). Since natural gas is not a substance hazardous to water in accordance

[8] See Art. 2 of the Convention on the Law of the Sea.

[9] Regional Planning Act of 18.08.1997 BGBl. I p. 2081, last amended by Art. 2b of the law of 25.06.2005 BGBl. I p. 1746.

[10] Law concerning regional and state planning of the German federal state of Mecklenburg-Vorpommern in the version of 05.05.1998 GVOBl. M-V 1998 p. 503.

[11] Regulation on facilities requiring approval in the version of 14.03.1997 BGBl. I p. 405, last amended by Art. 1 of the regulation of 20.06.2005 BGBl. I p. 1687.

[12] Building code in the version of 23.09.2004 BGBl. I p. 2414; last amended by Art. 21 of the law of 21.06.2005 BGBl. I p. 1818.

[13] State building regulations of Mecklenburg-Vorpommern in the version of 06.05.1998 GVOBl. M-V 1998, p. 468.

[14] Water Resources Management Act in the new version of 19.08.2002 BGBl. I p. 3245; last amended by Art. 2 of the law of 25.06.2005 BGBl. I p. 1746.

[15] According to Section 19a subsection 2 of the Water Resources Management Act (WHG), substances hazardous to water are crude oil, petrol, diesel fuel and heating oil as well as other liquid or gaseous substances that may pollute waters or otherwise change them in terms of their properties in a detrimental manner.

[16] Environmental Impact Assessment Act in the version of 25.06.2005 BGBl. I p. 1757, 2797; amended by Art. 2 of the law of 24.06.2005 BGBl. I p. 1794.

with Section 19a of the Water Resources Management Act, planning permission or planning approval is not required according to Section 20 subsection 1 UVPG in connection with Annex 1 No. 19.3.

However, approval based on water law is required for the construction, significant modification or elimination of pipelines in Section 86 of the water law of the federal state of Mecklenburg-Vorpommern (LWaG M-V[17]). Such approval may be refused only if impairment of the well-being of the general public, especially impairment of the concerns of coastal protection or public safety, is expected that cannot be prevented or compensated for by means of requirements.

Federal Waterway Act

In addition, it may be necessary to obtain approval in accordance with Section 31 of the Federal Waterway Act (WaStrG[18]). According to the latter, use of a federal waterway requires approval of the water and shipping authority in accordance with Section 3 of the Water Resources Management Act if impairment of the condition of the federal waterway necessary for shipping or impairment of the safety and smooth flow of traffic is expected due to the planned measure. The laying of pipelines does not represent use of the federal waterway in accordance with Section 3 of the Water Resources Management Act. However, the pipeline can be subsumed under the construction of facilities and thus requires approval if the above mentioned impairment is expected. This can be assumed to apply at least to the operation of laying. Approval may be refused only if the impairment cannot be prevented or compensated for, see Section 31 subsection 5 of the Waterway Act (WaStrG). The approval cannot be refused on the basis of environmental and conservation concerns.

Conservation law

A requirement of approval may also result from the State Nature Conservation Act of the federal state of Mecklenburg-Vorpommern (LNatG M-V[19]). In accordance with Section 15 subsection 2 LNatG M-V, interventions in nature and the landscape according to Section 14 subsections 1 and 2 LNatG M-V require approval.

The laying of a pipeline generally represents an intervention in accordance with Section 14 subsection 1 since the impairments are usually not only temporary or insignificant. Therefore, the question of significant or lasting impairment of the ecosystem's ecological ability to function must be answered in the affirmative. According to Section 14 subsection 2 No. 13, too, particularly the laying of above-ground and underground lines outdoors outside the road structure represents an intervention. It does not matter whether the pipeline is laid on the seafloor since above-ground lines are also covered. This means there is a requirement for approval according to these provisions. Such approval must be refused in the case of avoidable or unavoidable and non-compensatable impairments if the nature conservation concerns have priority. If adequate compensation is not possible, compensatory measures must be taken in accordance with Section 15 subsection 5 LNatG M-V. If these are not successful either, the party responsible for the impairment has to make compensatory payment for the remaining impairments, see Section 15 subsection 6 LNatG M-V. The approval procedure conforms with Section 16 LNatG. When applying for approval, the project applicant must submit all necessary documents for evaluating the intervention, including those relating to the compensatory measures. If the laying of the pipeline affects a Natura 2000 region, an environmental impact assessment in accordance with Section 34 of the Federal Nature Conservation Act (BNatSchG) and examination of the permissibility or impermissibility of the intervention in accordance with Section 18 LNatG M-V must be additionally carried out. By virtue of the fact that this project requires an environmental impact assessment according to No. 19.5.1 Annex I of the Environmental Impact Assessment Act, an environmental impact assessment procedure must be conducted in Natura 2000 regions, Section 18 subsection 5 LNatG M-V. If laying of the pipeline affects other protected areas, the legal regulations enacted in this regard must be enforced with respect to permissibility of the pipeline.

[17] Water law of the federal state of Mecklenburg-Vorpommern of 30.11.1992 GVOBl. M-V 1992, p. 669; last amended by the law of 06.06.2005 GVOBl. M-V p. 246.

[18] Federal Waterway Act in the version of 04.11.1998 BGBl. I p. 3294; last amended by Section 2 of the regulation of 25.05.2005 BGBl. I p. 1537.

[19] Law on the protection of nature and landscape in the federal state of Mecklenburg-Vorpommern in the version of 22.10.2002, GVOBl. M-V 2003, p. 1; last amended by the law of 11.07.2005, GVOBl. M-V 2005, p. 326.

Energy Management Act

If transit pipelines are regarded as gas supply lines that have a diameter of more than 300 mm, planning permission granted by the authority responsible according to state law is required in accordance with Section 43 subsection 1 of the Energy Management Act of 2005 (EnWG 2005[20]) if an environmental impact assessment has to be carried out according to the Environmental Impact Assessment Act. The requirement of an environmental impact assessment (EIA) results from No. 19.2.1 of Annex 1 to the Environmental Impact Assessment Act. The public and private concerns affected by the project must be considered in the planning approval procedure to be conducted.

EIA

In accordance with Section 20 subsection 1 of the Environmental Impact Assessment Act, projects that are listed in Annex 1 under numbers 19.3 to 19.9 require planning permission granted by the responsible authority if there is an obligation to conduct an environmental impact assessment according to Sections 3b to 3f. In accordance with No. 19.5.1 of Annex 1 to the Environmental Impact Assessment Act, the construction and operation of a pipeline facility for conveying non-liquefied gases with a length of more than 40 km and a pipeline diameter of more than 800 mm fundamentally require an environmental impact assessment (unless the pipeline falls under No. 19.3 or No. 19.2), see Section 3b subsection 1 of the Environmental Impact Assessment Act. According to Section 22 of the Environmental Impact Assessment Act, the procedure conforms with Sections 72-78 of the Administrative Procedures Act. At the beginning a hearing takes place in accordance with Section 73 of the Administrative Procedures Act. After that the project applicant must submit application documents (plan). The authorities whose sphere of responsibility is affected can present their statement within a stipulated deadline[21]. The plan must be placed open for public view. Everyone concerned can raise objections to the plan within 2 weeks after expiration of the period of public view. These objections are then discussed together with the statements after expiration of the deadline for submission of objections. The hearing authority presents a statement on the result of the hearing that is then transmitted, together with the plan, the official statements and objections, to the planning approval authority, which grants official approval of the plan. Because of the concentration effect of a planning approval, no further official approvals are necessary, see Section 75 subsection 1 of the Administrative Procedures Act.

4.3 Supplementary requirements from the point of view of international or Community law

Supplementary requirements result from the ESPOO Convention on environmental impact assessments in a transboundary framework that also applies to the Federal Republic of Germany[22]. The ESPOO (EIA) Convention sets out the obligations of parties to assess the environmental impact of certain activities at an early stage of planning. It also lays down the general obligation of states to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across borders. It requires the contracting parties to create the basis for an environmental impact assessment procedure that enables public involvement as well as preparation of the documentation on the EIA described in Annex II. For transit pipelines it can be assumed that the requirements of Art. 2 subsection 3 have been met so that an EIA has to be conducted.

According to Art. 2 subsection 4, other contracting parties concerned must be notified when such activities are planned. This notification must include, in particular, information on the planned activity as well as all available information on its possible transboundary impact, on the type of possible decision and indication of a reasonable deadline within which a reply should be made. If the contracting parties concerned want to be involved in the EIA procedure, an exchange of pertinent information on the planned activity and its impacts shall take place. Furthermore, the participation of the public must be ensured and the latter shall be given the opportunity of submitting statements and objections.

[20] Law on power and gas supply of 07.07.2005 BGBl. I p. 1970 (3621).

[21] According to Sections 64, 65 LNatG M-V, recognised organisations shall be given the opportunity to make a statement, e.g. in project approval procedures or related decisions regarding waiver according to federal or state law as well as in the case of exemptions in accordance with the State Conservation Act.

[22] Law on the convention of 25.02.1991 concerning environmental impact assessments in a transboundary framework as well as on the amendment of the convention (ESPOO Convention Act) of 07.07.2002 (BGBl. II p. 1406 ff.) decided at the 2nd conference of the parties in Sofia on 27.2.2001, and the law on the Second Amendment of the convention of 25.02.1991 concerning environmental impact assessments in a transboundary framework (Second ESPOO Convention Act of 17.03.2006 (BGBl. II p. 224 ff.).

Documentation concerning the EIA must be submitted to the responsible authority for the decision on the approval or implementation of the planned activity. According to Annex II to the convention, the former must at least contain a description of the planned activity and its purpose, possibly a description of acceptable alternatives to the planned activity as well as the option of refraining from carrying out the activity. In addition, a description of the presumably significantly affected environment and the possible impacts of the activity and its alternatives on the environment as well as an assessment of their scope and a description of the mitigation measures have to be provided. The responsible authority then makes this information available to the contracting parties concerned, on the basis of which consultations subsequently take place.

The Kiev (SEA Strategic Environmental Assessment) Protocol, once in force, will require its parties to evaluate the environmental consequences of their official draft plans and programmes. SEA is undertaken much earlier in the decision-making process than EIA - it is therefore seen as a key tool for sustainable development. The Protocol also provides for extensive public participation in government decision-making in numerous development sectors.

The Helsinki Commission, or HELCOM, works to protect the marine environment of the Baltic Sea from all sources of pollution through intergovernmental cooperation between Denmark, Estonia, the European Community, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. The Commission unanimously adopts recommendations for the protection of the marine environment, which the governments of the Contracting Parties must act on in their respective national programmes and legislation.

Article 7 of the Helsinki Convention covers the following main aspects of international cooperation in the case of planned activities with possible transboundary impact:

- Notification
- Consultations
- Cooperation with EIA
- Joint measures to prevent and eliminate pollution.

The requirements concerning the EIA process are specified in Helcom Recommendation 17/3. From an Ad Hoc Working Group on Environmental Impact Assessment in a Transboundary Context in 2004 recommendations dealing with the requirements regarding EIA have been submitted to the Commission.

A HELCOM recommendation on the laying of gas pipelines does not exist. However, it would appear useful to submit a recommendation, such as HELCOM recommendation 19/1 on marine sediment sampling. The latter recommends that an EIA be carried out prior to approval. This would be important particularly for the EEZ or continental shelf area, for which there has been no EIA obligation according to national law to date. In our view a requirement for a comprehensive examination of alternatives would be especially important here.

In addition, it is not possible to derive any specific standards for the laying of pipelines from the European strategy for the protection and preservation of the marine environment. This strategy is designed more on a comprehensive basis. The objective is to achieve a marine environment in Europe that is in good condition by the year 2021. Merely common goals and principles at the EU level are specified in this marine strategy directive that is based on this strategy, but not yet in force.

5. What might "best environmental practice" mean for a submarine pipeline project

The definition of best environmental practice indicated in the HELCOM recommendation 13/6 of 1992 focuses in particular on reduction of the input of substances from land and also from the sea. One of the objectives proposed by HELCOM in the Baltic Sea Action Plan (objective: "Maritime activities in the Baltic Sea carried out in an environmentally friendly way") also includes the maritime activities in the target system. To maintain consistency, therefore, the above mentioned HELCOM recommendation for best environmental practice should, as provided for there, be adapted and appropriately extended.

Without any claim to completeness, some proposals shall be made in the following regarding consideration given to submarine pipelines as a maritime activity. Some of them have already been taken into account in various pipeline projects, but are not necessarily part of the standard procedures.

These aspects should be taken into account both within the framework of the further HELCOM process, such as in updating recommendation 13/6, and within the scope of a voluntary commitment on the part of the companies involved.

5.1 Route selection process: taking environmental issues into account

- Selecting the route (including landfall) with the lowest environmental impact and highest resource efficiency by comparing different alternatives on the basis of sound and comparable data (avoiding sensitive areas, etc) is a very important step towards realising best environmental practice of a pipeline project.
- Route selection should be carried out within a formal approval procedure (or several if necessary) with integrated environmental impact assessment and early stakeholder participation.
- This must be supported by the authorities through
    - binding transnational regional planning at sea,
    - early stakeholder participation,
    - comprehensive data documentation,
    - clear requirements concerning the approval procedures,
    - harmonisation of the procedures within the individual states as well as between the countries involved and
    - formulation of minimum standards.

5.2 Sound data basis and monitoring necessary

- Both the route selection process and further planning steps must take place on the basis of data appropriate for the respective task since a number of environmental risks can be reduced or avoided by examining the alternative routes and subsequently examining in detail the selected route. This includes an investigation of hazardous wastes (munitions, poison gas, dumping sites, etc.), of the geological subsoil and its dynamics (extent to which sediment conditions allow the jetting method for burrowing the pipeline; free span, etc.) and of the ecological conditions (benthos, etc.). Existing data should be used and, to the extent necessary, project-related data should be generated for this purpose. Standards for environmental impact assessment should be formulated (see also section 7) for certain frequently occurring uses (e.g. sand and gravel extraction, pipelines and cables, gas and oil exploration and production), as has been done for offshore wind energy converters in Germany by the Federal Maritime and Hydrographic Agency (BSH). These standards should be coordinated on a transnational basis for individual seas or marine regions (e.g. Baltic Sea).

- It is useful in this context to create freely accessible databases for the various marine regions or expand existing ones. They could be set up and updated by the approval authorities, international organisations like HELCOM or institutions established especially for this purpose, for example. Not only the data collected with public funds within the framework of monitoring programmes or research projects should be inputted into these databases, but also the data obtained by scope of approval procedures. An appropriate legal basis should be provided for.

These databases should be freely available so the companies as well as the other stakeholders gain a long-term advantage from them.

- Monitoring of possible impacts identified in the environmental impact study should always be carried out whenever there is a high forecasting uncertainty regarding certain relationships of cause and effect (e.g. new methods for the pressure test or the subsequent draining of the pipeline) or particularly sensitive areas are affected (e.g. in connection with possible impacts in NATURA 2000 regions).

- In any case collected data should be accessible to the public so as to enable extensive participation.

- After commissioning of the pipeline, an ecological audit should be carried out in which project effects assumed during project planning are compared to those that actually occurred. At the same time the planned project procedure, resource consumption and further measures provided for, such as compensation, shall be compared to the measures actually implemented and the reasons and consequences of deviations shall be discussed. If ecological monitoring has been carried out, the results must be compared to the impacts forecast during project planning (see SCHUCHARDT & GRANN 1999).

5.3 Reducing environmental impacts and risks

The key aspect for reduction of environmental impacts and risks must be the route selection (see section 5.1). Furthermore, a number of additional aspects are also important.

Best Available Technology

The greatest possible reduction of environmental risks requires application of the best available technology in each case with respect to potential environmental impacts. This applies to a large number of aspects, such as mitigation of disturbances during pipeline laying, the impacts of the pressure test prior to commissioning, avoidance of temperature anomalies, activities for maintenance, risk of disturbances and accidents, etc. (these may also be inconsistent with each other; this must be specified in each case in the approval procedure).

Best Available Techniques (BAT) shall generally be applied and projects shall document their specific choice of BAT. Guidelines for selection of BAT may be found in NORSOK S-003, World Bank guidelines (onshore and offshore) and EU IPPC BREF documents.

During the construction phase of Europipe I and II in the national park of Lower Saxony (North Sea) Statoil as the operator had developed and implemented a “zero dumping concept” to avoid any contamination of the sea, including rainwater runoff from the decks. It should be examined whether this is adequate for each section of a pipeline.

Decommissioning after termination of use should be stipulated in the approval, as has already been implemented for cables in the German exclusive economic zone (EEZ).

Mitigation measures

Measures for reducing adverse impacts on the environment (mitigation measures) should be developed in the planning process. This requires early and close cooperation between technical experts and environmental experts, which must be appropriately ensured in an environmental management programme. This may entail, for instance, laying the pipeline in certain time windows that are ecologically less sensitive, the use of less environmentally harmful hydraulic oils and much more. Here again, however, the selection of the route represents a decisive step towards avoidance of environmental impairment.

Risk management

Risk management is based on an interaction between personnel, organisation and technology during planning, construction and operation of a pipeline that is aimed at reducing risks to the health of humanity and the environment. All installations must be designed to prevent accidents and hazardous incidents. Their technical standard and the way they are operated must also ensure the same. Among other things, this should include condition monitoring of technical safety and also sound emergency planning.

Quantitative risk analyses on the probability of occurrence of certain environmentally hazardous events may improve the decision-making bases for planning and approval (e.g. with respect to the risk of damage due to casting anchor in navigation channels). This should be examined in each individual case during the approval procedure.

Resource efficiency

Enhancing resource efficiency is an important task of sustainable development and should also be targeted and documented for pipeline projects. However, it is quite possible that conflicts result with other environmental goals, such as the avoidance of extremely ecologically sensitive areas. Such potential conflicts must therefore be examined in each individual case during the approval procedure.

5.4 Implementation of ecological compensation measures

In the German coastal seas substantial adverse impacts on nature and landscape must be compensated for by means of appropriate measures according to the respective Länder laws (laws of the German federal states) or, if this is not possible, financial compensation must be provided. In principle, the intervention regulation has proven effective as a tool for the settlement of conflicts in terms of use. Corresponding regulations apply in some other European countries. These regulations do not apply to the German exclusive economic zone, though possible extension of the intervention regulation to the EEZ is to be examined in Germany (BMU 2006). If NATURA 2000 regions are significantly impaired, coherence measures must be carried out.

Against this background it appears reasonable to implement this tool for the mitigation of conflicts in use within the scope of application of HELCOM (and, of course, OSPAR) in a coordinated manner. It would be desirable if this long-term process were anticipated on a voluntary basis through appropriate consideration in project planning on the part of individual project applicants, such as the NEGP consortium.

In view of the difficulties involved in establishing functional compensation measures on the high seas, we propose the option that compensation alternatively be carried out in financial form and this money be used to fund application-based conservation and environmental protection research and monitoring in marine regions, e.g. within the framework of a foundation (model: German Wadden Sea Foundation).

5.5 Early and extensive stakeholder involvement (public participation) and open access to all information

Broad, early, comprehensive participation based on equality of all relevant political sectors, economic actors, social groups and administration levels in the various processes involved in the development of coastal and marine regions is fundamentally provided for in Germany and the other EU states through the existing set of legal tools and established practice, which goes beyond the former in some cases. HELCOM also clearly formulates this demand.

At present further important changes in the legal framework are being or have been implemented in the EU states through specifications of the Commission (Aarhus Convention, among others). They are aimed at broad-based and open participation while more extensive approaches are being discussed in connection with governance or participatory governance. The 3rd basic principle of the national ICZM strategy of the German government (BMU 2006) (download: www.ikzm-strategie.de) is also aimed at broadening these processes and states:

> *(3) ICZM incorporates all relevant political sectors, economic and scientific actors, social groups and levels of administration into the process in order to identify development potential at an early stage, find solutions for which there is a consensus and improve conflict management.*

This requires
(3.1) early and comprehensive communication based on equality between all respectively relevant actors;

(3.2) the presence and use of different participation procedures that are appropriate in each respective case;

(3.3) the presence and accessibility of all respectively relevant information and research results.

Planning procedures for pipelines should also conform to these basic principles.

5.6 Increasing ecological awareness

The mitigation of adverse environmental impacts should be a major goal of project management in all project phases. To achieve this, it is necessary to set up an appropriate management structure and a system should be established within the organisation of each project applicant as well as in all companies involved with the aim of supporting ecological awareness at all levels by means of suitable further training programmes and at the same time ensuring compliance with environmental standards through checks.

5.7 Implementation of an Environmental Management Programme

To implement best environmental practice, it appears meaningful to develop an Environmental Management Programme for a pipeline project that integrates the various aspects addressed here as well as additional points into a systematic approach (SCHUCHARDT & GRANN 1999). Section 6 outlines such a programme.

6. Environmental Management Programme

Against the above described background we recommend the development and implementation of a detailed and systematic environmental management approach. To ensure a high level of environmental performance, the pipeline operator should implement an Environmental Management Programme (EMP) for the planning, construction and operation phases in order to introduce environmental management in the project, ensure best environmental practice and place key focus on environmental expertise within the management team.

6.1 Environmental Management Plan for the planning phase

The Environmental Management Plan for the planning phase might cover:

- ecological sensitivity studies for the route selection process including an environmental impact assessment (EIA)
- environmental studies (baseline studies) as a basis for the EIA for the proposed route
- environmental impact assessment
- intensive communication between technical and environmental experts
- relations with authorities
- participation of the public

In the planning phase the plan must, above all, meet the legal requirements as well as any more extensive obligations of the project applicant with respect to best environmental practice. However, it should also guarantee that environmental protection is integrated into the technical planning of the project and is part of the internal decision-making basis. In addition, it should create a systematic basis on which environmental protection is incorporated into the construction and operation phase.

The importance of environmental impact assessments should be underlined. The EIA is both a basis for selecting alternative solutions in the planning and official approval phase and a basis for identifying and designing mitigation measures. It should be the central instrument for the project's Environmental Protection Plan in the planning as well as in the construction phase.

6.2 Environmental Management Plan for the construction phase

The Environmental Management Plan for the **construction phase** might cover:

- Ecological Monitoring Programme (if necessary)
- environmental management of construction activities
    - Environmental Management Manual
    - Environmental Protection Programme for construction activities
    - information and training of staff of construction companies
    - operational control sheets
- emergency plans
- intensive communication between technical and environmental experts
- relations with authorities
- participation of the public
- ecological compensation measures

One of these items should be outlined in some detail: environmental management of construction activities. To ensure a minimum of adverse environmental effects of the physical construction activities, not only was a detailed and systematic approach required, but also a methodology enabling identification of environmentally critical work operations, development of effective protection measures and, in particular, development of simple work instructions which „translate" the sometimes vague environmental issues into concrete action.
For this purpose the British Standard BS 7750 „Specification for Environmental Management Systems" or other guidelines shall be a useful basis for the development of the required systematic planning approach. Such a management approach may consist of the following three levels of documentation:

1. Environmental Management Manual
In this document the contractor states his commitment to a high level of environmental performance and describes how he intends to carry out environmental management. The manual addresses such items as environmental policy and objectives, organisation of environmental activities, personnel qualifications, permits, regulations, etc., as well as environmental audits, reviews, etc.

2. Environmental Protection Programme
This document provides a considerable amount of detail based on the principles and statements given in the environmental management manual. This programme includes identification and description of environmentally critical operations, description of adverse effects of environmentally critical operations, description of protective measures, programme implementation, control and verification as well as emergency planning.

3. Operational Control Sheets
These one-page sheets provide simple, specific work instructions for the execution, inspection and control of each of the specific environmental protection measures. These sheets are for the use of the first line supervisors, the inspectors and the various craftsmen actually doing the job. The sheets cover definition and description of the activity, plan for work instruction, instruction for job execution, responsibility/authority, control and verification, handling of deviations.

6.3 Environmental Management Plan for the operation phase

The Environmental Management Plan for the operation phase might cover:

- Ecological Monitoring Programme (if necessary)
- information and training
- Environmental Management Manual
- emergency plans
- relations with authorities
- participation of the public
- environmental audits
- Environmental Management Reviews

The programme for the operation phase should, above all, provide for an environmentally compatible inspection of the functional reliability and safety of the pipeline and an audit programme in which forecast and documented adverse environmental impacts are compared and the causes of deviations are analysed.

7. Proposal for a Standard Monitoring Programme "Pipelines and Cables"

In section 5.2. we proposed standardised collection of the necessary data also for the planning of pipelines (and cables), i.e. of linear submarine structures, as has been done for offshore wind energy converters in Germany by BSH (STUK, i.e. standards for environmental impact assessment, download: www.bsh.de). If possible, this should take place on a transnational basis, i.e. within the framework of HELCOM, for example. In the following a proposal in this regard will be made, based on the above mentioned standards for environmental impact assessment (STUK – impacts of offshore wind farms on the marine environment [BSH 2003]).

First of all, however, it must be emphasised that the standards for environmental impact assessment (BSH 2003) shall support the introduction of new large-scale technology, for which no practical experience was available for formulation of the standards for environmental impact assessment. Therefore, the standards for environmental impact assessment focus not only on the database necessary for planning, but also include an approach for monitoring possible adverse impacts on the environment during construction and operation. On the one hand, significantly different impacts are expected than those during the laying and operation of pipelines (and cables). On the other hand, the technology involved in the construction and operation of pipelines is a tried and tested technique for which numerous studies on the related environmental impacts are available. However, this applies only to a restricted degree to cable connections, for which there is a lack of experience, particularly with possible temperature anomalies and the formation of electromagnetic fields (KNUST et al. 2003).

In view of this background, it does not appear to make sense to base the concept for standards for environmental impact assessment of pipelines/cables too closely on the existing standards for environmental impact assessment of wind energy.

7.1 Route selection phase

Route selection should be carried out within a formal approval procedure (or several if necessary) with integrated environmental impact assessment and early stakeholder participation (see section 5.1.).

This can essentially take place on the basis of existing data. Collection of data may be necessary for special areas, such as the landfall site, and must thus be defined for the specific project.

7.2 Basic survey phase

At least the following data should be collected for the route selected in step 1, taking into account ecological aspects (this data collection belongs in part to the study programme which is also necessary anyway from a technical point of view).

Extensive investigations on hazardous wastes (munitions, etc.) are also necessary, especially in the Baltic Sea. This will not be described in further detail here.

If not otherwise indicated, the following proposal conforms to the specifications of the existing standards for environmental impact assessment of wind energy in connection with the methodological data (towing time, towing speeds, mesh sizes, etc.). It must be detailed further within the framework of coordination.

1. Benthos

Investigations on benthos shall encompass

- Investigations on sediment and habitat structure by means of side scan sonar and sediment sampling
  - single mapping of a strip at least 500 m wide along the route
  - checking the results by means of grab samples ("ground truthing" by means of benthos grabs see below)
- Investigations on infauna by means of grab sampling
  - removal of 3 samples in each case (0.1 m2 van Veen grab) on a transect 500 m wide at least every 5 sm (EEZ) or 2 sm (coastal seas) and determination of grain size distribution, organic content and infauna (taxonomy and abundance)
- Investigations on habitat structure (macrophyte benthos and hard substrate) by means of video
  - areas in which macrophyte benthos and hard substrate have been found using side looking sonar or benthos grabs are mapped along these route sections by means of underwater video

- Investigations on epibenthos by means of beam trawl
    - Removal of one catch in each case on the route with a 2-metre beam trawl every 5 sm (EEZ) or 2 sm (coastal seas) (taxonomy of epifauna and semi-quantitative indication of abundance)

2. Fish fauna

Investigations on fish fauna shall encompass

- Investigations on sediment and habitat structure by means of side looking sonar and sediment sampling (see benthos)
- Investigations on habitat structure (particularly macrophyte benthos) by means of video (see benthos)
- Investigations on small fish fauna by means of beam trawl (see benthos)

3. Avifauna

Investigations on avifauna shall encompass

- Mapping of breeding and resting birds in the landfall areas (insofar as significant in terms of avifauna)
- Mapping of marine birds in the area around planned permanent structures above the water surface (marine compressor station)
- Mapping at sea along the entire route is not necessary as a standard if data from official or other monitoring programmes are available because the disturbances due to laying work are generally only small-scale and short-term. However, a financial contribution of the applicant to the implementation of such programmes should be provided for.

4. Marine mammals

Investigations on marine mammals shall encompass

- Mapping of marine mammals in the landfall areas (insofar as significant in terms of fauna)
- Mapping of marine mammals in the area around planned permanent structures above the water surface (marine compressor station)
- Mapping at sea along the entire route is not necessary as a standard if data from official or other monitoring programmes are available because the disturbances due to laying work are generally only small-scale and short-term. However, a financial contribution of the applicant to the implementation of such programmes should be provided for.

7.3 Monitoring phase

Standardised monitoring of environmental impacts of construction and/or operation of pipelines and cables is in our view not necessary in view of the known impacts. However, further investigations are necessary, particularly with respect to the impacts related to cables. This should take place in the form of targeted individual investigations (see below). It appears meaningful to require applicants to participate in such individual investigations.

7.4 Individual investigations

There is still need of further investigation and/or research regarding individual aspects for a comprehensive evaluation of the impacts of pipelines and cables and for derivation of mitigation measures. This includes (without any claim to completeness):

- distribution and effects of temperature anomalies in connection with pipelines (cold) and cables (heat)
- distribution and effects of electromagnetic fields

7.5 Data storage

As already proposed in section 5.2., the data collected in connection with the project should be inputted into a database which is accessible to the public and in which all data relevant to the environment for individual marine regions are compiled and updated.

8. Recommendations

The following recommendations are directed both at authorities and at applicants:

- Formal requirements, approval procedures and environmental standards for transnational or transregional pipeline assessment should be harmonised in the territiories and EEZs of the different countries concerned according to the highest standards of one concerned state.

- Route selection should be carried out within a formal approval procedure (or several if necessary) by comparing different alternatives on the basis of sound and comparable data (avoiding sensitive areas, etc) with integrated environmental impact assessment and early transnational stakeholder participation.

- HELCOM (and OSPAR) should decide on standard requirements regarding the scope of the investigations necessary for the approval procedures for cables and pipelines.

- Ecological impacts must be compensated for. Compensation should be standardised on a transnational basis and also be binding for the Exclusive Economic Zone.

- The use of Best Available Technology should be required by the approval authorities and also provided for on a voluntary basis by the project applicants.

- Environmental quality objectives should be formulated.

- Broad, early, comprehensive, transnational participation based on equality of all relevant political sectors, economic actors, social groups and administration levels in the planning and approval processes should be targeted.

- Data relevant to the environment in individual marine regions (also project-specific data of individual project applicants) should be compiled and updated in a database accessible to the public.

- Compensation for adverse ecological impacts through compensation measures should be standardised on a transnational basis and also be binding for the EEZ. At the same time the option of financial compensation should also be provided for.
- All environmental issues should be systematically integrated into an Environmental Management Programme for each project.

- A risk management plan should be developed and implemented for each project.

- From our experience there is a strong need for an improved understanding of the interrelationships between technology, business, politics and environment and this understanding has to be introduced in project planning and management. This means that concepts of integrated assessment should be further developed and implemented.

9. Literature

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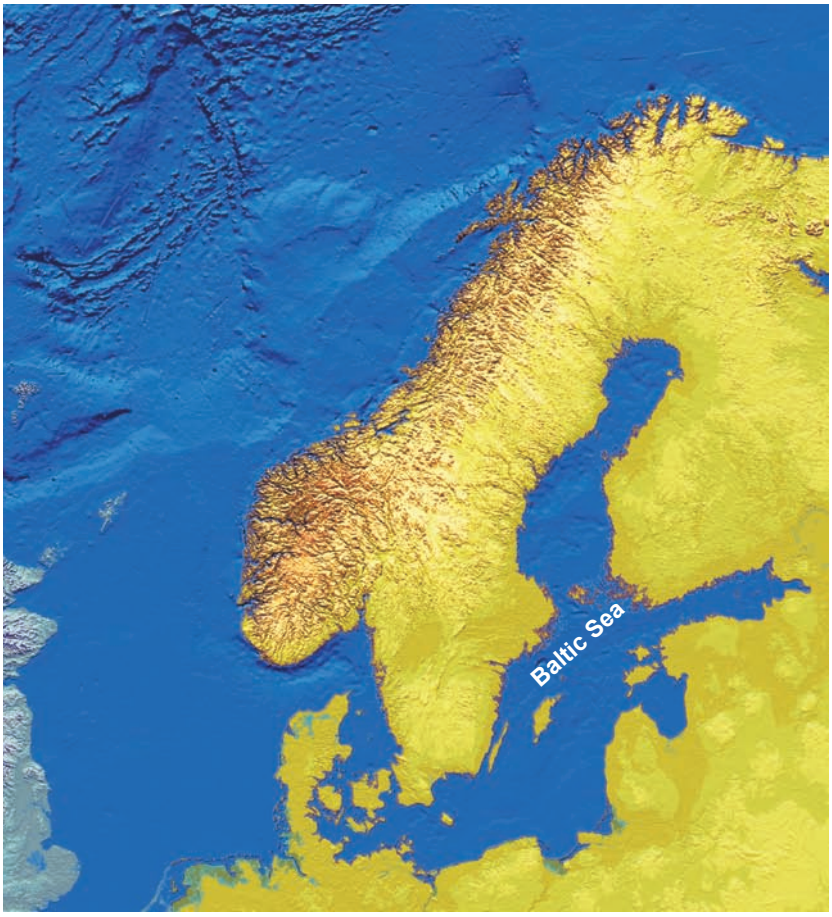

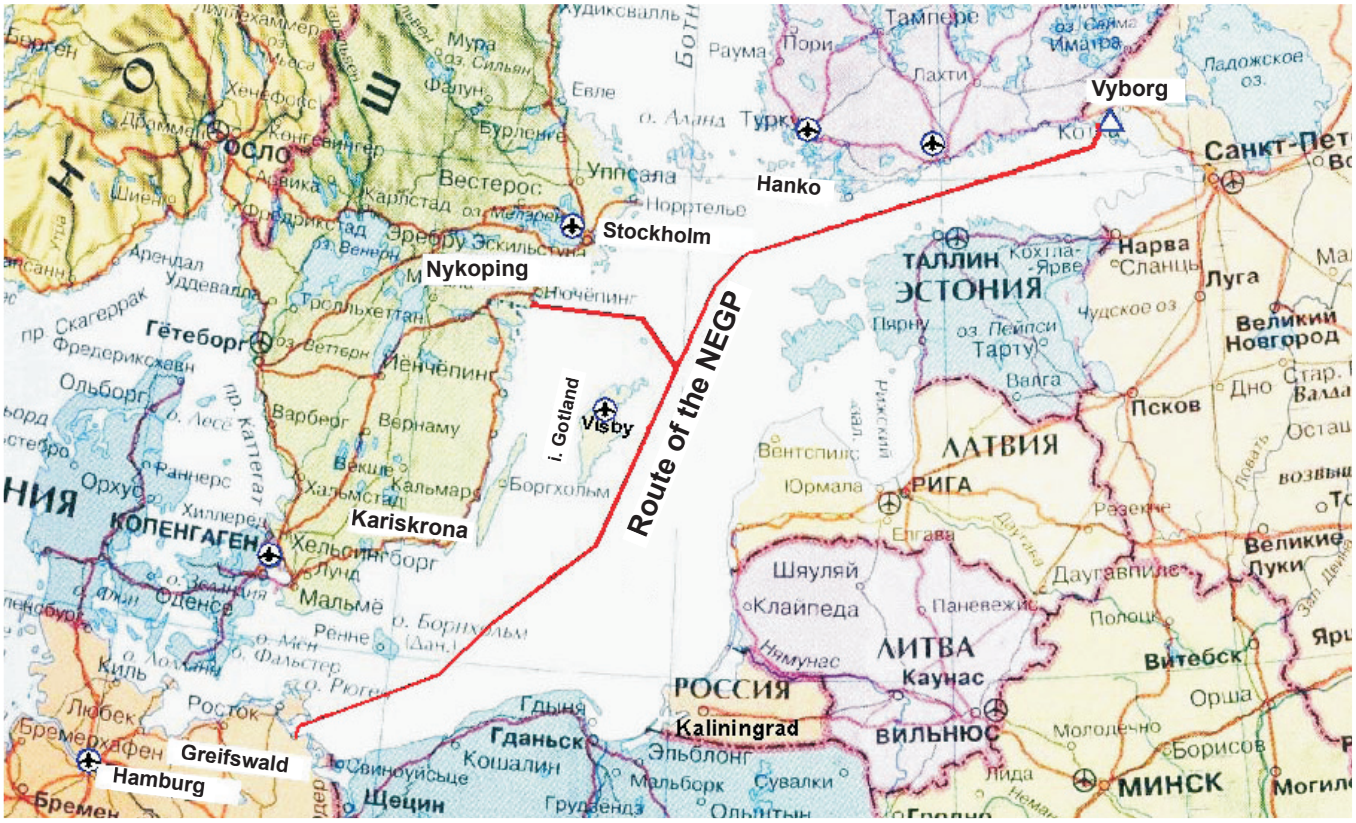

Map: The Route of the North European Gas Pipeline (NEGP), Notification Document

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- promoting the reduction of pollution and wasteful consumption.