

**PR OF CHINA: Ammonia Plant Dalian**

**Ex-post evaluation**

<b>OECD sector</b>	32614 – Chemical products	
<b>BMZ project number</b>	1989 66 244	
<b>Project-executing agency</b>	DAHUA Group Ltd., Dalian	
<b>Consultant</b>	Cremer & Warner Ltd., London (tender phase)	
<b>Year of evaluation</b>	<b>2002</b>	
	<b>Project appraisal</b>	<b>Ex-post evaluation</b>
<b>Start of implementation</b>	Q 2 1989	Q 2 1989
<b>Period of implementation</b>	44 months	48 months
<b>Investment costs</b>	EUR 181.3 million	EUR 211.6 million
<b>Counterpart contribution</b>	EUR 81.1 million	EUR 113.4 million
<b>Financing, of which FC funds</b>	Mixed financing: EUR 43.46 million (FC) EUR 56.75 million (progress review)	Mixed financing: EUR 43.46 million (FC) EUR 56.75 million (progress review)
<b>Other institutions/donors involved</b>	-	-
<b>Performance rating</b>	3	
<b>• Significance / relevance</b>	2	
<b>• Effectiveness</b>	3	
<b>• Efficiency</b>	4	

**Brief Description, Overall Objective and Project Purposes with Indicators**

In connection with the project the ammonia production plant of the current Dahua Group Ltd. (DHG) in the industrial zone of the urban center of Dalian, which had become too small and outdated, was replaced by a modern plant operating on the basis of heavy oil. The ammonia produced was to be increased from 170,000 t per year to 300,000 t; within the plant ammonia is used to produce fertilizers and intermediate chemical products (project purpose). This will contribute to improving the range of fertilizers available for agriculture and to supporting industrial development by supplying intermediate products while ensuring overall adequate macroeconomic feasibility (overall objective).

Indicators to measure Achievement of the Project Purpose

Indicator	TARGET (project)	ACTUAL 1998	ACTUAL 2000
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(t/year)	appraisal) (3 <sup>rd</sup> year of operation)	(3 <sup>rd</sup> year of operation)	(5 <sup>th</sup> year of operation)
• Ammonia production	300,000 (100%)	172,000 (57%)	282,000 (94%)

- Secondary purpose = adhering to chemical limits for sewage The chemical limits laid down in the project appraisal cover the pH value, COD, phenol, cyanide, oil, ammonia nitrogen and nickel. These limits were adhered to at the time of the ex-post evaluation.

Indicators to measure Achievement of the Overall Objective

Indicators (t/year)	TARGET (project appraisal) (3 <sup>rd</sup> year of operation)	ACTUAL 1998 (3 <sup>rd</sup> year of operation)	ACTUAL 2000 (5 <sup>th</sup> year of operation)
• Improved offer of fertilizers	762,000	544,000	769,200
• Supply of intermediate products to industry	621,800	757,300	865,300
• Total production	1,383,800 (100%)	1,301,300 (94%)	1,634,500 (118%)

- Overall economic profitability: expected profitability of 10% (TARGET)  
Actual profitability: 4.1% (ACTUAL)

**Major Deviations from the original Project Planning and their main Causes**

The ammonia plant in Dalian was, for the most part, constructed as originally planned. Due to the suspension of German FC with China in the beginning stage of the project and to subsequent delays in the contractual negotiations, production could not begin until 3 years later, in January 1996.

The start-up phase was more difficult than expected, and the plant did not attain a workload of 94% until its 5<sup>th</sup> year of operation. The reasons for this were technical difficulties and managerial problems which led to unscheduled shutdowns as well as to occasional supply bottlenecks with heavy oil. As a result of internal changes with respect to the further processing of ammonia the production goals for fertilizers and industrial intermediate products were already close to being achieved in the 3<sup>rd</sup> year of operation and, in the 5<sup>th</sup> year of operation, were exceeded by a wide margin.

At the time of the project appraisal the Chinese market was not expected to open up so quickly and become as progressively liberalized as it has. This process has intensified since the mid-1990s and been concluded for the time being by the country's accession to the WTO in early 2002 (which, however, provides for an entire string of transition clauses and areas of exception, including the fertilizer market).

**Key Results of the Impact Analysis and Performance Rating**

The production of ammonia in Dalian ensures the production of nitrogen and mixed fertilizers and of soda, which is used as an intermediate product in the production of glass and in the detergent industry. In view of a stagnating amount of land used for agricultural purposes and high population growth, at least in absolute terms, the project's contribution to fertilizer supply continues to be of great importance. Yet DHG's share of the entire domestic production of ammonium chloride (key nitrogen fertilizer for rice production) is a good 16% and, of the mixed fertilizer NPK, around 22%.

Its share of national soda production is approximately 10%. The macroeconomic effects are significant but cannot be quantified individually.

Added to this is the fact that soda can be produced at extremely low cost thanks to the carbon dioxide generated during the ammonia process (by-product). This would not be possible if ammonia were being imported. Owing to the costly and difficult transport of ammonia (in liquid form at  $-33^{\circ}\text{C}$  in a special tanker), China imports much less than Dalian needs. Thus, the importation of ammonia is rather a hypothetical alternative for Dalian.

The location of the urban center Dalian was opportune because of the proximity of the refinery, which was to supply an adequate amount of heavy oil at low cost – the key starting material for ammonia production. This did not turn out to be a correct assumption, however, since the refinery was able to tap better sales markets for its higher-quality oil products and, consequently, DHG was forced to buy lighter oils from an oilfield in the nearby Bohai Sea. This assured supplies. Production based on natural gas, which is used the most worldwide and is slightly more cost-efficient, is also not possible on a medium-term basis because Dalian does not have a connection to natural gas. The replacement of the old, polluting facility with a modern one with almost double the capacity was also an appropriate step towards improving the environmental situation.

The project did not directly create any new jobs since the personnel of the old plant was retained and no new personnel was hired. Overall, however, it had a stabilizing effect on DHG's staff at all production plants that process products further.

The development of the price of ammonia on global markets was problematic. After 1992/93 and again in 1998/99 it reached an all-time low and was 20-30% below the estimates in the project appraisal. The development of the price of heavy oil was even more extreme; in the year 2000 it even reached the price of ammonia and thereby exceeded the original projection by 75%. This double impact had a strong negative influence on the project's feasibility which DHG was not able to control.

Accordingly, its overall economic profitability remained considerably lower than the aspired minimum profitability of 10%: it is a good 4%, the cash value of the investment – with an interest rate of 8% - is negative (EUR –56 million, based on the prices of 2000). As this price development is reflected in the Chinese market with hardly any distortions, the project's internal rate of return of approx. 3% is insufficient (cash value at 8%: EUR –191 million).

When the effects described above are taken into account the project's effectiveness is evaluated as being altogether adequate (rating 3), while its efficiency – being an industrial project – no longer meets the requirements (overall inadequate effectiveness, rating 4). In contrast, the production goals on the level of the overall objective are exceeded in some cases; therefore, the effects on agriculture and industry are higher than expected. Thus, we rate the project's relevance and significance as satisfactory (rating 2).

No negative impacts worthy of mention arose, and no major sustainability risks can be identified. What is more, when the old ammonia plant was shut down the environmental problems were reduced to an acceptable level.

The insufficient profitability of the ammonia plant Dalian is to be criticized, but it is not far below the required minimum rate of return for FC projects of 6%. When the otherwise quite positive effects and the - in some cases - unquantifiable macroeconomic effects (spill-over effects) described

above are taken into consideration, we deem the evaluation of the ammonia plant Dalian as a project that still has adequate developmental effectiveness (rating 3) justified.

### General Conclusions applicable to all Projects

None

### Legend

Developmentally successful: Ratings 1 to 3

Rating 1 Very high or high degree of developmental effectiveness

Rating 2 Satisfactory degree of developmental effectiveness

Rating 3 Overall adequate degree of developmental effectiveness

Developmental failures: Ratings 4 to 6

Rating 4 Overall inadequate degree of developmental effectiveness

Rating 5 Clearly insufficient degree of developmental effectiveness

Rating 6 The project is a total failure

### Criteria for the Evaluation of Project Success

The evaluation of a project's "developmental effectiveness" and its classification during the final evaluation into one of the various levels of success described below in more detail concentrate on the following fundamental questions:

- **Are the project objectives reached to a sufficient degree (aspect of project effectiveness)?**
- Does the project generate sufficient **significant developmental effects** (project **relevance** and **significance** measured by the achievement of the overall development-policy objective defined beforehand and its effects in political, institutional, socio-economic and socio-cultural as well as ecological terms)?
- Are the **funds/expenses** that were and are being employed/incurred to reach the objectives **appropriate** and how can the project's microeconomic and macroeconomic impact be measured (aspect of **efficiency** of the project concept)?
- **To the extent that undesired (side) effects occur, are these tolerable?**

We do not treat **sustainability**, a key aspect to consider for project evaluation, as a separate category of evaluation but instead as a cross-cutting element of all four fundamental questions on project success. A project is sustainable if the project-executing agency and/or the target group is able to continue to use the project facilities that have been built for a period of time that is, overall, adequate in economic terms or to carry on with the project activities on its own and generate positive results after the financial, organizational and/or technical support has come to an end.