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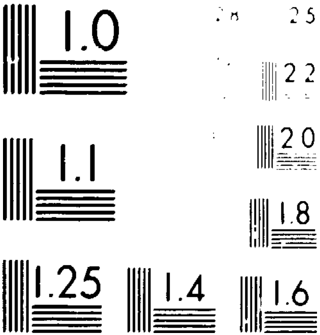

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PRESENT SITUATION AND PROSPECTS OF AMMONIA TECHNOLOGY AND FERTILIZERS IN ROMANIA - SUGGESTIONS ON CO-OPERATION*

by

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C O N T E N T S

PRESENT SITUATION AND PROSPECTS OF AMMONIA TECHNOLOGY AND FERTILIZERS IN ROMANIA - SUGGESTIONS ON COOPERATION

1. Present Stage of Romanian Economy

Romania is a country with a developed agriculture; farmers constitute approximately 51.4 percent of its 22 million inhabitants.

Being an economy-planned socialist country, the major social political objective aimed at during the period following World War II was the rapid economy development so that the country could go beyond the developing stage before long.

In the next years Romania will rank among the average developed countries.

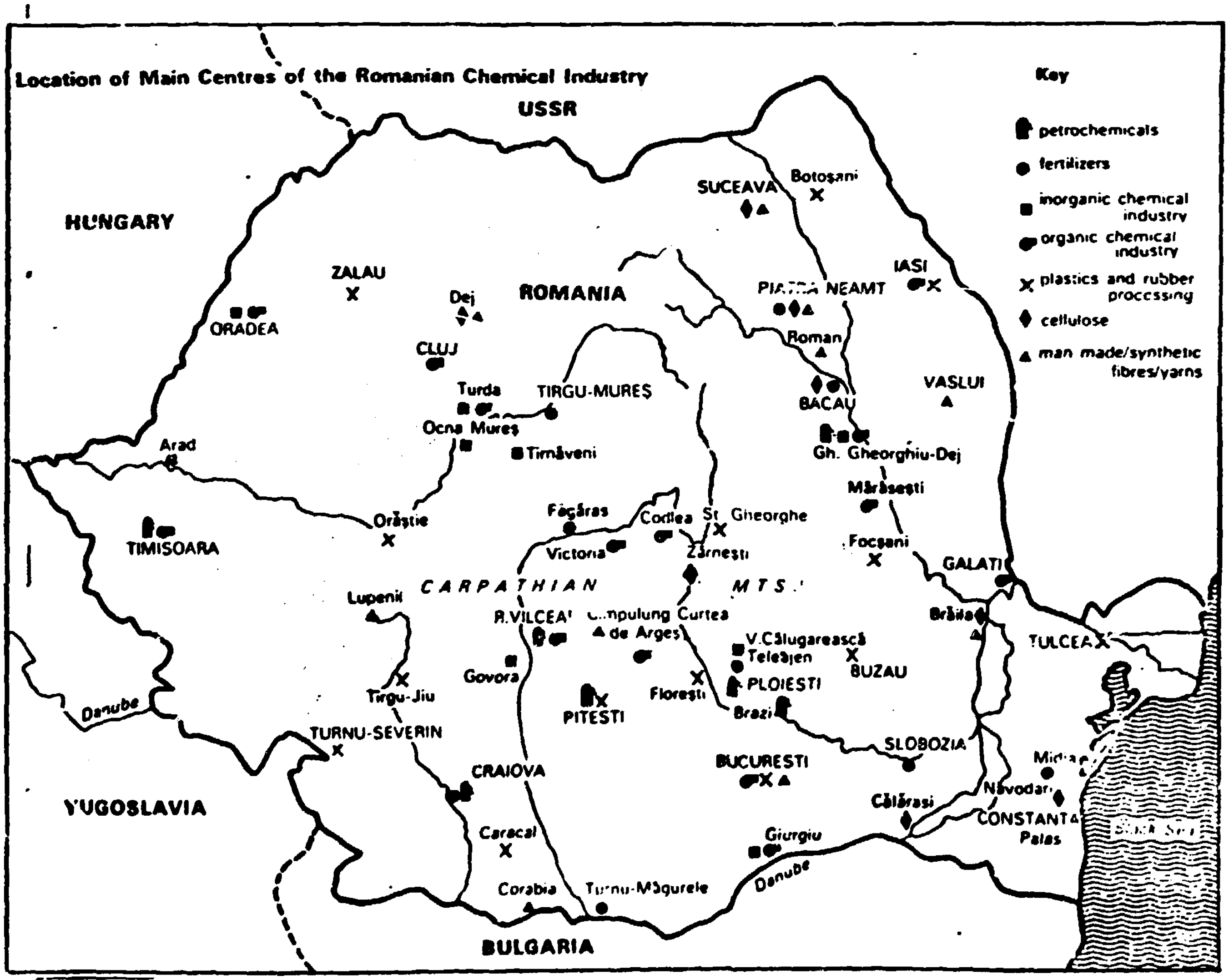
2. Development of Romania Ammonia Industry

The ever growing significance of chemical fertilizers which enjoy favourable conditions i.e. natural resource availability (methane) has imposed the development of the chemical industry generally and especially of the ammonia industry.

The main concern in the years 1946-1950 was to rebuild and up-date the existing ammonia and fertilizer plants, followed by a rapid development stage which made most of up-to-date technologies.

At the same time, attention was paid to the development and enlargement of polytechnical education to get technicians able to build, operate and maintain new chemical plants.

In 1950 a research development program was established to back up the technological development. National engineering companies were set up, which initially cooperated with foreign companies, suppliers of processes and equipment to Romania. Construction and erection services were organized as well.



Location of Main Centres of the Romanian Chemical Industry

Based on indigenous skill and on the knowledge and experience gained by cooperation with foreign partners, the Romanian industry is capable today to build modern chemical plants on original or licensed up-to-date processes and to deliver turn-key units.

To get an idea of the distribution of chemical centres, including ammonia and fertilizer units, refer to the Figure below.

In 1981-1985 the Romanian fertilizer industry will grow at a fast rate, as illustrated by the figure below.

Planned Growth of Romanian Chemical Industry

(five-year plan 1981 - 1985)

Sector	Growth index
Synthetic fibres	1.6 - 1.8
Synthetic rubber	1.4 - 1.6
Fertilizers	1.8 - 2.0
Pesticides	1.4 - 1.6
Inorganic products	1.7
Organic dyestuffs	1.6 - 1.8
Drugs	2.0 - 2.2
Detergents	1.8 - 2.0
Cosmetics, perfumes	2.4 - 2.6

Compared to 1978

3. Present and Future Strategy in Romanian Fertilizer Industry

A major task over the coming period is to improve by inovations the efficiency of raw materials and reducing of energy consumption.

The automation of chemical plants enjoys great priority ; comprehensive studies are being undertaken on the use of microprocessors in the existing plants, in order to increase the energy efficiency, to improve the processes and to raise labour productivity.

The development of the chemical fertilizer industry in huge complexes raises difficulties related to environmental pollution.

Environmental pollution control is known to cause additional expenses, which requires particular care about reducing pollution and consequently the costs.

First of all losses should be diminished together with the investment and pollution control expenses. Some ideas as for instance utilization of waste water from fertilizer plants to irrigate land (as this water still contains nutrient value) and of phosphogypsum and calcium carbonate from nitrophosphate manufacture for the conditioning of acid and salty soils should be launched and put into practice.

4. Technology Transfer in Ammonia Industry - Assistance Granted to Developing Countries

One of the major problems of the world is the dramatical discrepancy between the developed and developing countries which has become obvious mostly in the field of technology. Being familiar with the nourishment problems in non-developed countries, this discrepancy is even more keen in the field of ammonia and fertilizers technologies.

The technology transfer to non-developed countries mostly in case of advanced technologies such as ammonia industry proves to be, is a very complex problem and can be successfully solved out only for each individual case. In case a key factor is left out and the transfer is incomplete, the economic effects are not those expected. This is one of the causes why the use of fertilizers plant capacities is of only 60-70% in case of developing countries.

Due to the great development of fertilizers industry, Romania has acquired a wide experience in the field of technology transfer.

This experience allows for granting a good assistance to developing countries on their way of satisfying by themselves their techno-economic needs. For 10 years Romania has offered technologied and has built chemical plants in other country, such as :

Turkey and Syria : fertilizer plants

Turkey and Agypt : sulphuric acid plants

For the same purpose of technology transfer, Romania also supplies engineering services and assistance in working out the pre-feasibility studies for various chemical fertilizers complexes, studies prepared in accordance with UNIDO methodology and used by the customers for the selection of the best alternative from techno-economical viewpoint.

Romania's capabilities are also shown in the field of school training, a great number of foreign students attend the courses of Romanian universities. Romania also organizes specialization /training courses for the personnel from developing countries both within economic contracts and as an activity of the international UNIDO Centre-Bucharest.

These services granted by Romanian specialists and experts show that the technology transfer to developing countries is a must for their economic development-

5. Critical View on Ammonia Manufacture Technology in Romania

Ammonia manufacture has developed a lot in the last 15 years due to the fact that ammonia is the basic raw material for complex and nitrogen fertilizers manufacture. As a matter of fact Romania has started ammonia production before the Second World War.

Today, in Romania there are 18 ammonia plants with a capacity of 4.12 mil. tons/y and 2 more plants with a capacity of 0.6 mil.tons/y are being built (see the table below).

All the ammonia plants in Romania are based on the natural gas as raw material.

List of Ammonia Plants in Romania

Ref. no.	Platform	Ref. no.	Plant type	Year of start-up	Capacity tnous.t/y	
					In operation	Under construction
1	2	3	4	5	6	7
1.	Făgăraş	1	IPROCHIM	1964-66	100	
		2	KELLOGG	1980	300	
2.	Piatra Neamţ	3	GIAP	1962	130	
		4	FWF + ACSA	1973	300	
3.	Craiova	5	GIAP	1965	200	
		6	H and G + ICI	1970	300	
		7	KELLOGG	1977	300	
4.	Tîrgu Mureş	8	MONTECATINI	1966	90	
		9	UHDE	1968	100	
		10	KELLOGG	1974	300	
		11	KELLOGG	1978	300	
5.	Turnu Măgurele	12	UHDE	1967	100	
		13	UHDE	1968	100	

1	2	3	4	5	6	7
		14	H and C + ICI	1971	300	
		15	KELLOGG	1971	300	
6.	Slobozia	16	H and G + ICI	1973	300	
		17	KELLOGG	1981		300
7.	Arad	18	KELLOGG	1977	300	
		19	KELLOGG	1981		300
8.	Bacău	20	KELLOGG	1979	300	
	TOTAL				4,120	0,600

The implementation of these plants was at the high level of world technical progress concerning both technology and equipment used. As a result, technical and economical performances were continuously rising and they are significantly illustrated by the following table, where the plant types fall in four representative "generation" groups.

The development of technico-economical indices for ammonia plants

Ammonia plants classification Erection year	Capacity (tNH_3/y)	Equipment weight for 1 ton NH_3	Surface (m^2)	Labour profitability (%)	Power consumption total	Production cost %
I^st Generation (1960-1965)	65,000 / 200,000	10,000	60,000	100	100	100
II^nd Generation (1967-1968)	100,000 / 200,000	4,000	40,000	114	68	64
III^rd Generation (1969-1972)	300,000 / 300,000	4,200	13,500	286	64	50
IV^th Generation (1974-1980)	300,000 / 300,000	3,500	10,000	500	64	40

After examining the situation of the IV^th Generation units power consumption, we shall notice that the procedures power efficiency is not satisfactory under the conditions of the present power crisis. The comparison of these consumptions is given below.

Item No	Plant type	Capacity t/day	Power consumption Gcal/t NH_3	Power efficiency %
1.	Kellogg	9o7	11.462	36.7
2.	Foster Wheeler	1ooo	1o.745	39.1
3.	Uhde	3oo	1o.521	39.1
4.	Humphreys and Glasgow	925	9.49	44.3

Note:

1) Power consumption was calculated both for natural gas and for the remaining utilities required (cooling water, demineralized water, electric power etc) using unitary transformation coefficients.

2) Power efficiency is defined as the ratio between liquid ammonia thermodynamic power (abt. 4.2 Gcal/t NH_3) and the equivalent power consumption.

During the last years when power crisis had already started, all companies owing technologies tried hard for their technology up-dating with a view to rising their power efficiency.

Nowadays, the plants offered are up-dated both by the power improvements of the well-known processes and by using new processes, therefore their power efficiency is of abt. 5o%, consuming within the range of 7 - 7.7 Gcal/t NH_3

It is well-known that to up-date a plant which was already implemented, based on previous technical and economical philosophies, is more difficult that to implement new plants based on new philosophies.

All the same we decided to update our plants, especially the Kellogg type (which have the greatest share in the Romanian Ammonia Production). We have the following in view:

1) to use a new procedure for carbon dioxide scrubbing at the same time with ammonia scrubbing from the catalyzed gas by water absorption and stripping.

2) hydrogen recovery from purge gases in order to rise hydrogen utilization efficiency up to 98-99%.

3) heat recovery from burnt gases coming from primary reformer.

4) replacement of classic synthesis catalyst with a a new type of active catalyst (FeCo or FeCe).

By applying the above a decrease in the power of the synthesis and recirculation gas compressor is obtained in the main as well as elimination of the cooling compressor, decrease in the process methane gas and in the combustion methane gas consumptions, decrease in the cooling water consumption at the turbine condensers. On the basis of the preliminary calculations the power consumption is estimated to reduce to about 9.1Gcal/t NH_3.

6. CONSIDERATIONS ON FERTILIZER PRODUCTION CAPACITIES IN DEVELOPING COUNTRIES. COOPERATION SUGGESTIONS

As an effect of the world economic shortage in the eighties a fast increase in the raw material costs for the fertilizer industry (gas, naphta, phosphate rock, sulphur, potassium salts) occurred. which brought about an increase in the production costs. This process was not accompanied by the due increase in the costs of agricultural products, so that the larger crops got by using fertilizers should make up for the expenses meant to get such extra crops, especially in the areas where the agricultural techniques used were not at a high efficiency level.

So, it stands to reason that a decrease in the production cost is needed and it can be obtained by increasing the production capacities. Nevertheless it cannot be true all over since the economic size of a production capacity greatly depends on the conditions specific to each separate country.

The size can be only determined on the basis of a comprehensive techno-economic study, considering the following factors:

1. investment value under the local conditions.

It is known that for the same capacity, a developing country should invest about 4o-5o% more than a developed country.

2. utilization factor of the annual operating time.

Statistically speaking, a plant operates for about 33o days/year in Europe, for 34o days/year in the USA and 310 days/year in Africa.

3. technical local conditions for the investment implementation.

For very large plants, some special facilities are necessary related to very heavy equipment transportation and erection. We can mention that a large urea plant of 17o t/day originally designed with one single manufacturing train had to be modified to two manufacturing trains when under construction, for lack of suitable roads to transport such heavy equipment. For instance the urea synthesis reactors have diameters of 37oo mm for a plant of 2ooo t/day and of 27oo mm for a plant of 13oo t/day the weights of equipment being of 4oo t and 26o t respectively.

4. possibilities of selling the production locally and abroad.

The developing countries have usually to face difficulties in selling large amounts of fertilizers due to the scarce development of the transport means, of the infrastructure as well as organizations required and capabilities of domestic market to take them over.

Thus, in the first years of production, part of it was meant to the export in areas neighbouring this country, predicting the diminishing of export in the course of time.

Obviously, in this situation, risks connected to the market stability and competition between traditional exporters, should be accepted.

Following the same idea, it also should be mentioned the training of personnel and the services required for plants maintenance and repairing in order to increase the yearly operating time of plants.

All these elements partly contradict the idea that a high capacity is more profitable (under certain circumstances) than a small production capacity, which as we have already said, should be determined for each case.

We can show that from our studies worked-out for a developing country between:

alternative I : ammonia 9o7 t/day
urea 125o t/day

and

alternative II ammonia 15oo t/day
urea 25oo t/day,

the first alternative proved to be abt. 2o% more pro[illegible].

Thus the problem of adopting adequate tecnnologies is essential for maintaining the production costs below the profitability level.

Therefore, the use of the experience gained in this field by some developing countries is highly profitable for the countries which aim at the development of the fertilizer industry.

There are various cooperation ways for developing such an experience, Romania making use of:

a) Mutual working out of feasibility studies, basic and detail engineering designs (possibly, prefeasibility studies within UNIDO, in compliance with methodologies worked-out by UNIDO).

b) Supervision of final designs worked out by the partner, both for the local works and for equipment supplied by the partner's own industry;

c) To organize a thorough training of the operators in similar plants in Romania, before commissioning the plant to be implemented by the partner.

The practice of training the personnel "on the fly" can be sometimes expensive.

As a matter of fact, these suggestions aim at the development of the fertilizer industry in the developing countries through some prompt and flexible cooperation ways, by involving more and more the local capabilities.