



International Fertiliser Society

MA'ADEN PHOSPHATE COMPANY: A DREAM REALISED

by

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1. INTRODUCTION.

The Kingdom of Saudi Arabia is one of the largest producers of oil and gas in the world. In 1933, the Government established a leading oil company (Saudi ARAMCO) which helped in the rapid transformation of Saudi Arabia from a desert kingdom to a modern state. Since then, the Kingdom has undergone a transformation which continues to this day. In order to grow in various fields, the Kingdom strategically went ahead with extensive exploration work. This has resulted in collection of scientific knowledge about the geology and mining potential of the region, which is immense, and has become the basis for expanding the industrial activities of the Kingdom.

With all the identified potential, it is not out of place to say that in the coming years, mining and mineral wealth will become the third pillar of Saudi industry.

With this vision, Ma'aden was formed by Royal decree in 1997 to facilitate the development of Saudi Arabia's mineral resources and to be a world class minerals enterprise in terms of size, capabilities, competitiveness and global reach.

Downstream industries will be considered if they strengthen Ma'aden's position in commodities. As an enterprise Ma'aden will develop best-in-class capabilities supported by internal knowledge, an expanded talent base through joint venture partnerships wherever necessary. Ma'aden aspires to be a leader in Corporate Social Responsibility through environment friendly sustainable operations, education and Saudisation.

2. MA'ADEN BUSINESS PROFILE.

Initially Ma'aden's activities focused on expanding its active gold business which now includes five mines and over 11 million ounces of JORC compliant gold resources at operational and exploration sites.

Ma'aden has also developed its activities beyond gold with the development of Ma'aden Phosphate Company. In the line with Kingdom's strategy to spread the industrial growth across the country for decongestion of industries, economic uplifting of the society and creation of job opportunities, it was decided to implement this world scale complex in Ras Al Khair (RAK), an under-developed area, 120 km away from Jubail Industrial City. This strategic decision had its own challenges in terms of need to develop all the infrastructural facilities including development of port facilities, roads etc. The aluminium project under construction is 10.8 billion USD joint venture with Alcoa. When completed, it will be the largest vertically integrated aluminium complex in the world. Ma'aden's exploration teams are working to expand available resources in existing business areas as well as to broaden the company's mineral portfolio. Ma'aden business structure is shown in Figure 1.

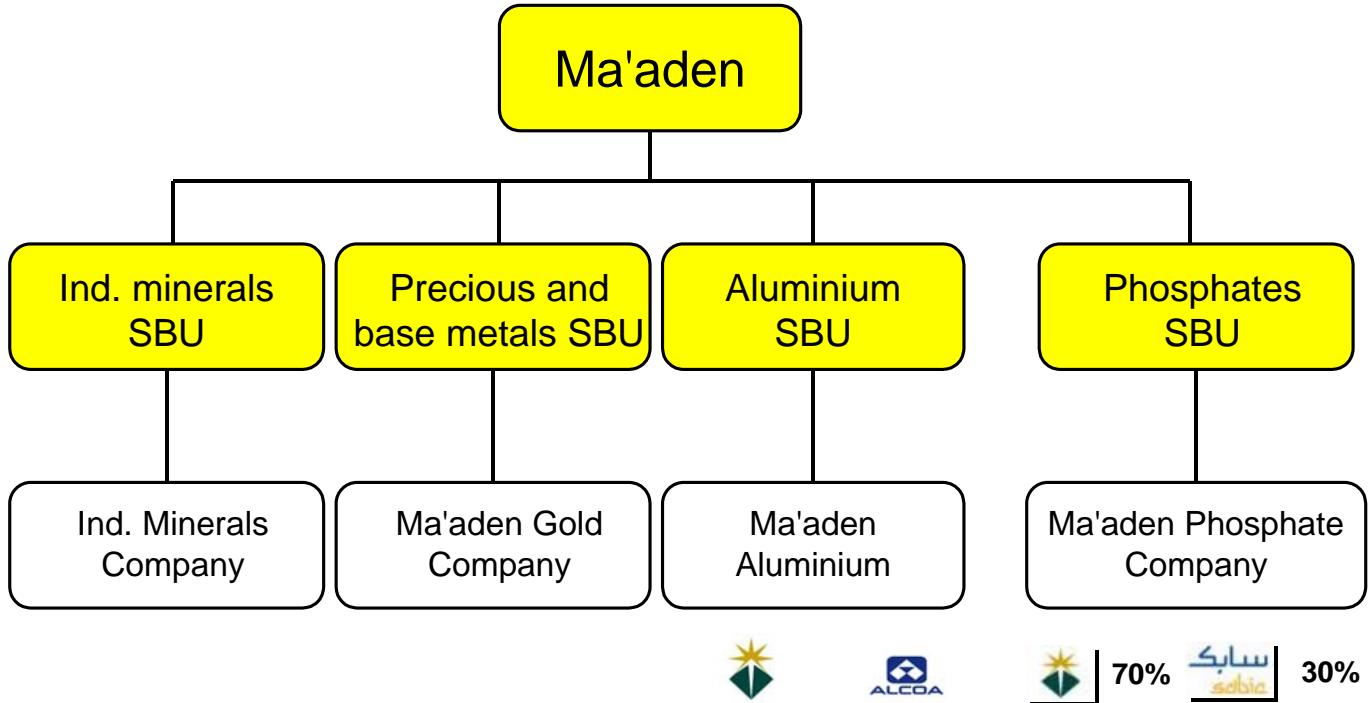


Figure 1: The Ma'aden business structure.

2.1. Ma'aden Phosphate Company (MPC).

MPC is a joint venture with SABIC in which Ma'aden owns 70% of equity and SABIC holds 30% of the equity. It commenced initial production of ammonia on 11th of February 2011 and DAP on 17th of June 2011 and has been exporting di-ammonium (DAP) phosphate and ammonia since 2011. MPC exploits the phosphate deposit at Al Jalamid in the north of Saudi Arabia and utilises local natural gas and sulphur resources to manufacture DAP at integrated fertiliser facility at Ras Al Khair on the Arabian Gulf coast. These facilities have the flexibility to produce mono ammonium phosphate (MAP) also.

3. PROJECT CHALLENGES AND MILESTONES.

MPC succeeded in this achievement after passing successfully through many challenges and difficulties. In addition to development of the infrastructural facilities, other challenges were logistics related such as movements of rock phosphate from the Jalamid mining and beneficiation plant over a distance of 1,400 km, the movement of molten sulphur by road from ARAMCO and the laying of a cross-country pipeline for natural gas.

3.1. Rock phosphate train.

The project main milestones are as below:

- Preparation of detailed project report: Q1, 2005.
- Nomination of PMC: Q4, 2005.
- Agreements with EPC contractors: Q2, 2006.

- Environmental Impact Study: Q4, 2006.
- Commencement of site preparation: Q4, 2007.
- Identification of technology: Q1, 2007.
- Business Risk Assessment Study: Q1, 2008.
- Mechanical completion of Sulphuric Acid Plant: May, 2010.
- Mechanical completion of Power and Utility Plant: June, 2010.
- Mechanical completion of Ammonia plant: August, 2010.
- Commencement of Beneficiation Production: November, 2010.
- Commencement of Ammonia Production: February, 2011.
- First shipment of Ammonia: March, 2011.
- Mechanical completion of Di Ammonium Plant (DAP): May, 2011.
- Mechanical completion of Phosphoric Acid Plant : June, 2011.
- Commissioning of Power Generator: November, 2011.
- Commencement of Sulphuric Acid production: June, 2011.
- Commencement of Phosphoric Acid production: June, 2011.
- Commencement of DAP production: June, 2011.
- First shipment of DAP: August, 2011.
- Commencement of commercial production of RAK site: February, 2012.

MPC converted the concept of the project to reality within four years from awarding the main contracts in 2007 to exporting the first shipment of DAP in 2011 as shown in Figure 2.

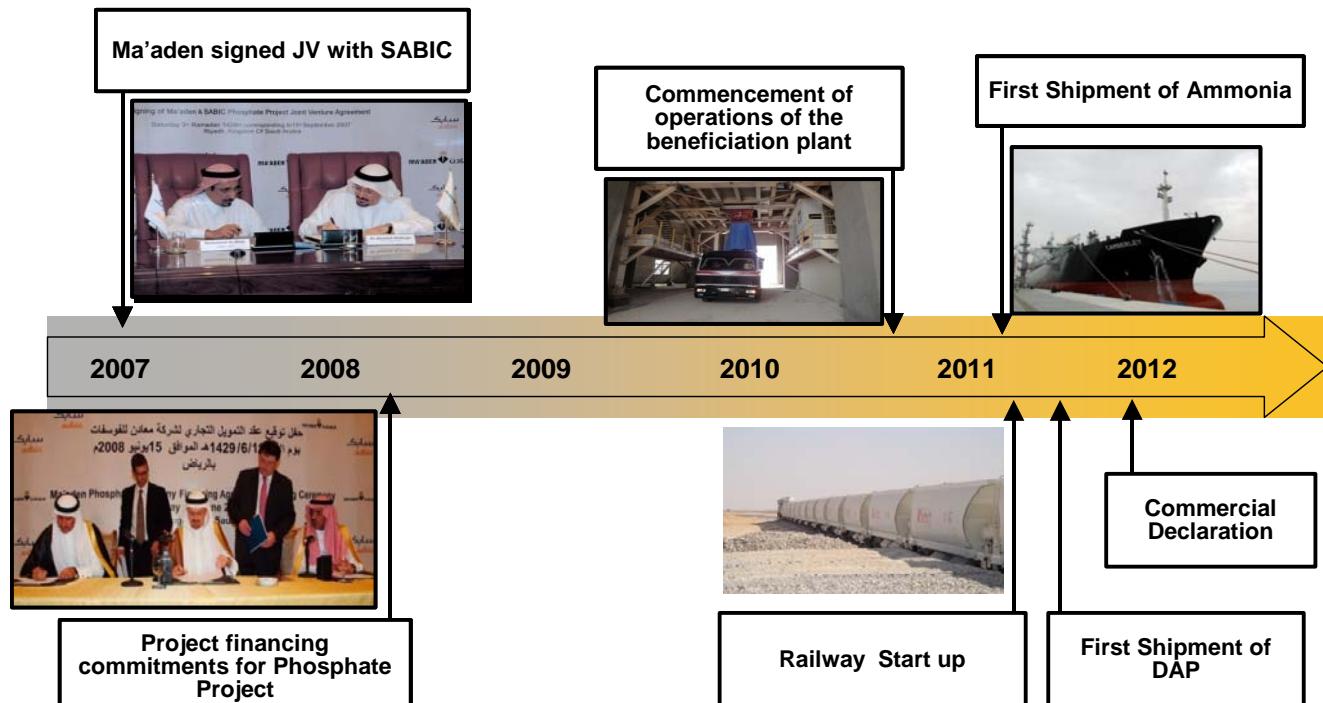


Figure 2: The company milestones.



Plate 1: *Transport of beneficiated phosphate rock by rail.*



Plate 2: *Ammonia plant.*



Plate 3: *Sulphuric acid plant.*



Plate 4:
Phosphoric acid plant.



Plate 5: *DAP plant.*



Plate 6:
Power and utility plant.

4. INTEGRATION PHILOSOPHY OF PLANTS.

In order to be among the top decisive players in the global phosphate industry by the year 2020 (MPC vision), selection of its plant's capacities and technologies was implemented in a strategic and flexible way. MPC chose proven technologies that will easily support future expansions in order to meet the planned increasing of the rock production from 199.7 million tonnes in 2005 to 258.3 million tonnes by 2030. Capacities of plants and details of the technology selected are shown in Table 1.

Table 1: *Plant details.*

Plant	Licensor	Capacity (MTD)
Ammonia	Uhde	3,300
Sulphuric acid	Ouotec	4,500 x 3
Phosphoric acid	Yara	1,460 x 3
Diammonium phosphate	Incro	2,250 x 4
Power and utility generators	Siemens	75 x 2 MW
Desanation units	Entropi	40,000

These mega plants have been integrated to supply each other in many operational scenarios and philosophies. In normal operation, the plant integration is shown in Figure 3.

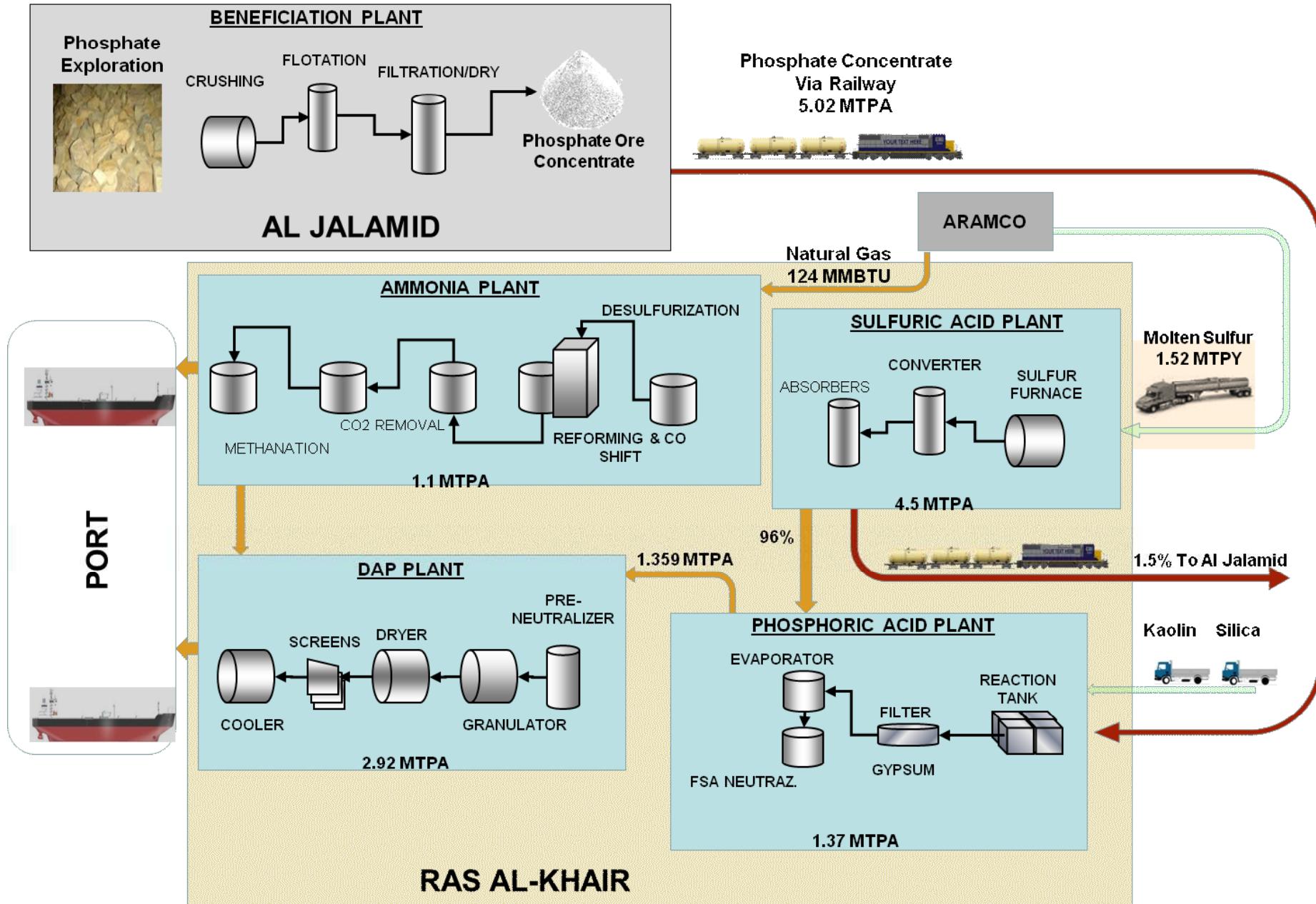


Figure 3: Integration of the plants.

Figure 3 also shows how the plants in the chemical complex at Ras Al Khair are integrated with the mines at Al Jalamid. One of the challenges, that of transporting phosphate rock for more than 1,400 km, has been solved by constructing the Minerals Railway. This railway line has made the exploitation of the world scale phosphate deposits feasible.

Supplying other feed-stocks, i.e. natural gas and molten sulphur from ARAMCO, was one more logistical issue which was also treated with high priority.

MPC is fully aware of the skills required in commissioning and running of these units. Accordingly, extensive training programs were conducted for all the technical personal for proper orientation and smooth running of the plants.

Since the economic development needs to be linked with creating job opportunities for the citizens of the home country, industry – institute interactions are active using the local institutions. The selected personnel are going through a rigorous training programme.



Plate 7: First batch of MPC graduates.

Safety and environmental protection are of the greatest importance in any chemical complex. The utmost care has been taken right from technology selection through detailed engineering, construction and commissioning of the facilities.

Robust systems are in place for regular monitoring of plants, management of changes etc.

All the plants have been commissioned safely and successfully with acceptance of the performance test of each plant. Moreover, the ammonia plant has been tested at 105% of the nameplate capacity, which was achieved on 11th of October 2011.

Currently, all the plants are running normally and MPC is contributing to the world of fertilisers through the export of DAP and ammonia.



Plate 8: *Ma'aden village.*

5. MPC AND MARKET DEMANDS.

With growth in global population the demand for crop production is expected to grow which in turn will sustain the growth in demand for phosphate fertiliser. This strong growth for fertiliser over the medium and long term, would not only be influenced by the growth in population but change in dietary pattern in emerging economies like China and India, owing to the overall growing economic health of these countries. At the same time, there is likely to be a significant shortage of phosphate rock capacity.

For many years the U.S.A. has been a major producer, but largely due to depletion of Florida reserves and environmental restrictions, production has fallen. It is an opportunity for other competitive suppliers.

6. CURRENT STATUS.

All the plants in the complex have been successfully commissioned and performance test runs have been conducted for all plants except the PAP and beneficiation units. The capacity of ammonia plant has been taken up to 105%.

Overcoming the initial problems, the beneficiation unit is achieving its capacity and also the required parameters in the rock concentrate.

Although there were problems in the phosphoric acid plant, due mainly to the corrosive nature of the plant and engineering and material of construction-related issues, the solutions are being implemented for taking up the capacity of the phosphoric acid plant.

7. CONCLUSION.

When the world-scale phosphatic fertiliser complex was visualised years back, it appeared to be distant dream, in view of the challenges in implementing this project and especially as the phosphatics business was new to the Kingdom.

Now MPC is proud of its successful implementation and operation of the world-scale phosphatic complex.

It is worthwhile to mention that this is the only fully integrated phosphatic complex with availability of all the raw materials and proximity to the market.

Having successfully implemented this project, MPC is embarking upon further expanding the capacity at Ras Al Khair itself and also implementing of another grass root complex with different product profile in Al Khabra.

RELATED PROCEEDINGS OF THE SOCIETY.

154, (1976). *Planning and establishment of a major fertiliser complex*,
C Gowran.

433, (1999). *Fertiliser projects: planning, financing and engineering from conception to birth*,
J A Hallsworth and C Fawcett.



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