

IRAN

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Assisted by Morteza Ketabi, NICICo Sungun Copper Project

Iran is an exceptional country in its mineral diversity, ranking among the world's 15 major mineral-rich countries and producing 62 kinds of mineral. Based on the records released by the Ministry of Industry and Mines, total measured and indicated resources are estimated at about 53,000 Mt (including resources of metallic ores estimated at about 10,500 Mt, the remainder comprising non-metallic minerals, aggregates, dimensional and decorative stones). The share of the mining and mineral industry sector in GDP is just 1.1% and 140 Mt/y of minerals were extracted in 2003, which represents growth of 15% compared with the previous year.

In the solar year 1382 (March 2003 to March 2004), investment in the industry and mines sectors, as announced by Iran's central bank, amounted to IR66,666 billion (IR8,000 = US\$1.00), of which IR40,000 billion were spent on active projects and operating industry and mines under the umbrella of the Ministry of Industry and Mines. Some 20% of Iran's total investment is in the mining and mineral industries. In 2003, total foreign investment reached US\$2,061 million (2002: US\$616 million) and 95% was for some 30 mining-related and minerals industries projects.

Since the start of privatisation in 2002, until the present time, in excess of 80% of the privatisation contracts concluded have been with units affiliated to the Ministry of Industry and Mines. To date, over 80% of the country's economy remains under government control, and only 20% has been transferred to the private sector, and the government intends to accelerate the privatisation during the current year (to March 2005).

Recently, investment in the private sector has been liberalised for large-scale mines, and, based on a recent decision by the Expediency Council, if the private sector discovers a mineral large deposit, it will be allowed to own it. (In the past, the government decided on what scale a mine should be developed and who should own it.)

In 2003, there were 3,397 mineral operations in Iran, of which 2,575 were active, 644 were inactive, and 178 were at the development stage. Of these operations, 166 were owned and operated by the government, 684 by cooperatives and 2,547 by the private sector. In total, the mining sector provided employment for some 75,760 people.

In the period March to June 2004, a total of 493 exploration permits and 105 exploration licences were issued, representing mineral reserves of over 933 Mt. Also, 178 mining licences were issued for larger operations (>7,495 t/y) and 200 mining licences for operations exceeding 4,700 t/y. During the period, an additional 1,925 jobs were created.

Oil and gas

Oil and natural gas dominate Iran's economy and oil exports provide the principal source of income, contributing some 82% of foreign exchange earnings. Reserves, located mainly in southern Iran and offshore in the Persian Gulf, amount to some 130,000 Mbbl of oil and 26,700 billion m³ of natural gas, representing 11.4% and 15.2% respectively of the world's known reserves.

In 2003, Iran was the second-largest OPEC producer of crude oil, with a daily production of some 3.85 Mbbl. Natural gas production totalled 79 billion m³, equivalent to just 3% of world output. However, natural gas provided 43% of Iran's primary energy consumption.

The National Iranian Oil Co (NIOC) was opened to foreign investment and was swift to capitalise on the new mood of optimism amongst oil companies.

Iran expects to generate US\$100 billion in revenues over the coming decade from the South Pars natural gas field, and from the country's maritime frontier with Qatar in the Persian Gulf. The long-term, multi-phase offshore development project is based on 13,500 billion m³ of gas, equivalent to 7.7% of the world's total gas reserves. The project includes, as well, the transfer of the sour gas and the construction of refineries 105 km away at the port of Assalouyeh.

Iron and steel

One of the indicators of industrial growth in any country is the rate of production and/or consumption of steel. Iran, enjoying over 4,400 Mt of geological reserves of iron ore (over 2.1% of world's proven reserves according to the International Iron and Steel Institute) has much potential to raise its steel output. Based on statistics released by the IISI, world pig-iron production in 2003 reached 965 Mt but Iran, with an annual production of about 8 Mt, ranked 21st and its share of global steel production is less than 1%. Iran intends to increase its steel production to 54.6 Mt by 2020, and its share of world production should increase to 3.5%.

The country has proven reserves of iron ore amounting to 1,800 Mt and three main deposits are currently being exploited. Choghart near Yazd in central Iran supplies about 3.5 Mt/y of lumpy agglomerated, high-grade iron ore (magnetite) to the Isfahan steelworks, where a US\$115 million ore-processing plant constructed with assistance from Voest Alpine, ABB and Taim-Tfg, will come on stream shortly.

About 2.5 Mt/y of iron-ore concentrates are being railed from the Gol-e-Gohar iron-ore complex in Kerman Province in south-eastern Iran to the Mobarakeh direct reduction steel plant near Isfahan.

Elsewhere, the Chadormalou mine and beneficiation plant, 100 km northeast of Yazd, has a nominal capacity of 5.1 Mt/y and is the country's largest operation. Following the preparation of some ancillary facilities at the complex, iron in concentrate production is expected to rise to 3.4 Mt this year.

Chadormalou has reserves of 400 Mt, of which 320 Mt averaging 55% Fe can be mined.

Within the next few years, the National Iron and Steel Co (NISCo) plans to expand production capacity at Gol-e-Gohar from 2.7 Mt to 5.0 Mt/y, and to increase concentrate production at Chadormalou from 5.1 Mt/y to 8.5 Mt/y.

In the northeastern province of Khorassan near the border with Afghanistan, the Sangan iron-ore deposit is still under development and is expected to produce 3.4 Mt/y of concentrates within a few years. As well as using domestic funds, it is hoped to attract international investment for the project. The concentrate will feed the Neyshaboor mill, also in Khorassan, which is scheduled to produce 550,000 t/y of cast iron.

Currently, the price of steel in Iran is at least 17% below world prices, and the increase in the price of steel in world markets has killed the incentive to import steel.

Coal

The most important coal resources in Iran are in the provinces of Kerman and Khorassan, with lesser amounts in Semnan, Yazd, Mazandaran and Gilan. Of the country's total proved reserves of coal of some 484 Mt, 30% are in Kerman and 54% in Khorassan. Of the total probable reserves of 578 Mt, 85.5% are in Khorassan and 7% in Kerman.

A major goal is the mechanisation of Iran's coal mines and the modernisation of existing operations and washing plants. In southern Khorassan, pre-mining has begun at the Tabas coal project where there are estimated probable reserves of 500 Mt. A US\$153 million washing plant will come on stream shortly.

The total amount of coal washed in Iran is about 1.3 Mt/y and the Isfahan steelworks is obliged to augment its supply of coking coal by importing around 0.7 Mt/y.

Non-Ferrous metals

Substantial expansion is under way in the non-ferrous metals sector in the production of aluminium, copper, lead and zinc.

Aluminium

The aluminium smelter at Arak in central Iran produced 120,000 t of primary aluminium in 2003. Efforts are being made to complete the first phase expansion of the 110,000 t/y capacity Almahdi smelter at Bandar Abbas in the Straits of Hormuz, which is currently producing at the rate of 55,000 t/y. The future phase, as envisaged, will increase capacity to 220,000 t/y.

As aluminium production increases, Iran will require substantial additions of alumina to feed its smelters. At Jajarm in the northeast of the country there is a reserve of some 22 Mt of bauxite, which will provide feed for a 280,000 t/y

capacity alumina refinery. The first production line at the refinery has been completed and is producing at a rate of 50,000 t/y of alumina based on imported bauxite ore. Meanwhile, Iran expects to secure much of its future raw materials requirement through a government-to-government agreement committing it to invest in bauxite mining in Guinea, West Africa. A pre-feasibility study is also under way for the production of 80,000 t/y of alumina from a nepheline-syenite deposit in East Azarbaijan Province.

Copper

Iran possesses very large copper resources, and numerous copper porphyries occur in an arcuate belt extending from northwest Iran, southeast into Pakistan. These deposits are estimated to contain around 5% of the world's known copper inventory.

In 2003, there were 25 copper mines in Iran, of which 13 were active, six inactive and six others at the development stage. Of the 25 copper operations, 19 were operated by the private sector, three by co-operatives and three by the government. A total of 8,751 people were employed in the copper-mining sector. The total identified reserves at these 25 mines amounts to about 3,260 Mt. In 2003, a total of 15.1 Mt of copper ore was mined and copper products worth US\$121 million were exported.

The world-class Sarcheshmeh open-pit mine, concentrator, smelter, refinery and heap leach/SX-EW operation near Rafsanjan in Kerman Province are operated by state-owned National Iranian Copper Industries Co (NICICO). Last year, the total production of cathode copper was 178,000 t. Iran plans to double its copper production within a few years, and expansion at Sarcheshmeh includes boosting concentrate output to 700,000 t/y, increasing smelter capacity by 75% and refinery capacity to 200,000 t/y. Total annual copper production will reach 250,000 t in Iran's third Five-year Economic Development Plan and 350,000 t in the fourth.

A new 80,000 t/y flash smelter has been recently established by NFC of China at Khatoon-Abad, 40 km southeast of Sarcheshmeh.

To the west of Sarcheshmeh, at Miduk, adjacent the town of Shahr-e-Babak, a new mine and concentrator have been developed and the project is now in commissioning stage. The 150,000 t/y capacity plant has been budgeted at US\$285 million. It will be capable of treating 5 Mt/y of ore at a head grade of 1% Cu for the first five years of operation, and 0.8% Cu thereafter. Reserves are estimated at 145 Mt averaging 0.8% Cu and mineable ore is 86 Mt averaging 0.8% Cu. Miduk will provide concentrate feed for Sarcheshmeh and for the new flash smelter at Khatoon-Abad. Metso Minerals acquired the contract for this facility following its takeover of Svedala over three years ago.

Metso Minerals also has a contract to expand and modernise the Sarcheshmeh concentrator, and will provide equipment for the concentrator at the Sungun copper project in northwestern Iran near the town of Ahar. Sungun is based on a large porphyry copper with 388 Mt of mineable ore

averaging 0.63% Cu and 300 ppm Mo, and a US\$450 million mine will be developed producing initially, 150,000 t/y of copper concentrates in phase I, with an expansion to 300,000 t/y after six years. The Sungun copper-molybdenum deposit exhibits many characteristics of other porphyry deposits in the world and has the benefit of a moderately developed supergene enrichment blanket, containing high copper values. However, molybdenum grades are low and co-production with copper is unlikely to be economically feasible.

A bacterial leaching project adjacent to the Sungun copper mine at Varzaqan, and involving a IR1,315 billion investment by Azaran private company, 25% to be provided by the Italian JV partner, is planned to come into operation within 2.5 years. The project should yield 50,000 t/y of cathode copper. The plant will be fed by concentrate produced at Sungun.

Under the Iranian Government's investment protection guarantee system, the Canadian company, Zarcan International Resources Inc of Vancouver is in joint venture with NICICo to explore and, possibly, eventually exploit the Kuh-e-Lar copper and polymetallic resource locate about 15 km north of Zahedan in Baluchistan Province in southeastern Iran. Zarcan is also exploring for gold at Agh-Darreh in Azarbaijan Province, and a measured and indicated resource of 3.46 Mt averaging 3.9 ppm Au has been identified. The mineralisation is associated with silver and antimony in an epithermal system at the silicified contact of a limestone karst with sandstone and clay.

Lead and zinc

Iran possesses six lead and zinc mines and concentrators but there are three major operations: Angouran in Zanjan Province, Irankuh on the outskirts of Isfahan and Kushk-Bafgh east of Yazd. Last year, 1.2 Mt of ore were processed yielding concentrates containing 25,000 t of lead and 70,000 t of zinc. Angouran produced about 400,000 t of mainly oxide ore, which was processed in a local zinc calcining plant.

The 40,000 t/y capacity Zanjan lead smelter had insufficient feed material from Angouran but a number of small, local zinc-smelting operations in the vicinity of Angouran produced a total of 38,500 t of zinc ingots. At Kushk-Bafgh, a 27,000 t/y capacity smelter is still at the pre-production stage.

At the Mehdi-Abad zinc project south of Yazd, Union Resources Ltd (formerly Union Capital Ltd) has continued infill drilling, metallurgical testwork, design work and environmental studies. Proposals have been received from several engineering companies to prepare a bankable feasibility study (BFS) and a final BFS report is expected in mid-2005. A provisional open-pit mine design requires that the total ore to be extracted will need to be 249 Mt at 5.8% Zn, comprising 90 Mt of oxide (at 5.1% Zn) and 159 Mt of sulphide (6.2% Zn), and at a waste to ore ratio of 6:1. At present, a 160,000 t/y zinc metal capacity oxide plant is envisaged, to be complemented eventually, by a 340,000 t/y capacity sulphide concentrate leach plant.

Gold

Iran possesses a few active gold mines. Mouteh, north of Isfahan, produces about 200 kg of gold annually. Sarcheshmeh sells anode residues that yield about 500 kg/y of gold.

Rio Tinto Minerals Development Co has discovered a deposit containing 240 t of gold at Dashkasan, near Sariguni in Kurdistan Province. Currently, pre-feasibility studies are under way, and these are expected to be completed by the end of 2004.

Based on the latest statistics, the principal foreign investors in mineral exploration in Iran are Rio Tinto, Pars-Kani Kish and Zarcán, and their major focus of investment is on gold. Rio Tinto has made the largest investment commitment (US\$225 million) and has been permitted to participate not only in exploration, but also in the possible development of a new gold mine at Dashkasan under Iran's rules and regulations for foreign investment. The level of foreign investment demonstrates that gold extraction is economically feasible in Iran.

Other

Iran's other metal mines include three active chromite operations, at Faryab northeast of Bandar Abbas, at Esfandegh south of Kerman and at Foroumad-Gaft north of Sabzevar in Khorassan. Last year, total production was 97,000 t of chromite concentrates. Most of the production is exported but some is used to feed a ferroalloys plant near Roudan, 100 km northeast of Bandar Abbas. Two private Iranian companies, Buft Ferrochrome and Navid Ehya Sepahan, have reached agreement with a European consortium led by the engineering and construction group ABB and the Export bank of Switzerland, concerning the construction of two 25,000 t/y capacity ferrochrome plants at a cost of US\$47 million.

Iran has a population of over 65 million and demand for electricity is soaring. The government is seeking to conserve the country's oil and gas reserves, hence its stated rationale for developing nuclear energy. Uranium exploration was launched in the 1970s and has continued for the past two decades.

The US\$800 million, 1,000 MW nuclear power plant under construction at Bushehr on Iran's Gulf coast by Russian companies, is expected to become operational soon. The plant will most likely use fuel supplied by Russia, and the Russian authorities have apparently assured the US that all spent fuel from Bushehr will be sent to Russia and not diverted to a weapons programme.

Non-Metallic minerals

Iran produces 22 types of non-metallic mineral, and output in 2003 totalled 9.9 Mt, 2% higher than in 2002.

Cement

Due to lack of a comprehensive master plan and unsuitable distribution, cement has been one of the most controversial issues of Iran's economy over the past years. At present, cement prices in adjacent countries are some US\$60/t higher than in Iran and this has encouraged producers in Iran to export their product to the extent that this has caused a major complication for both the Ministry of Industry and Mines and the Ministry of Commerce. Currently, about 35% of the country's cement production is supplied by Iran Mines and Mineral Industries Development and Renovation Organisation (IMIDRO). In 2002, total production was 29 Mt and in 2003, it reached 31.5 Mt. The figure is expected to reach 33 Mt in 2004.

Gypsum

Iran's gypsum reserves exceed 1,000 Mt. This compares with estimated world reserves of 3,300 Mt. Currently, Iran is the world's second-largest producer of gypsum. The country's production of gypsum in 2002 has been reported at 13.54 Mt, whereas in 2003 it dipped slightly, to 13.50 Mt. Forecasts for 2004 are for an increase in output. Exports in 2002 reached 106,244 t and in 2003 they increased to 112,503.

Potash

A project to build a processing plant to produce potassium chloride using brines from the Koor and Biabanak regions has been concluded with Kahenerba Co in a contract worth US\$19 million. The project is 41% completed and production should begin during 2005. The operation should raise Iran's output by 50,000 t/y. At present, Iran imports between 150,000 and 300,000 t each year.

Tiles

Iran intends to become the world's fourth largest producer of ceramic tiles. Currently, it ranks eighth. It produced 120 million m² last year and expects to increase this to 170 million m² in 2004. By the end of 2005, capacity will reach 300 million m². In 2003, Iran exported 7.2 million m² and is predicted to export 7.8 million m² in 2004.

Gemstone

In the past year, Iran exported about US\$27.5 million worth of cut and uncut gems and this year they could reach US\$50 million.

Table following page.

Mineral Production ('000 t except where stated)

Commodities	2001	2002	2003
Crude oil	184,590	168,795	190,050
Natural gas (billion m ³)	66	75	79
Hard coal	2,002	2,020	1,902
Iron ore	12,208	13,950	18,287
Copper ore	14,415	16,100	15,084
Manganese ore	101	121	134
Chromites	161	166	97
Lead – Zinc ore	1,450	1,200	1,155
Barites	218	195	204
Bentonite	790	700	140
Kaolin	806	810	484
Bauxite	405	420	366
Refractory clays	485	490	389
Magnesite	143	130	92
Dolomite	303	310	522
Feldspar	168	200	243
Salt	1,985	1,970	2,023
Quartzite & silica	1,710	1,780	1,965
Sodium sulphate	387	580	430
Gypsum	10,890	13,535	13,500