

IRAN

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Assisted by Morteza Ketabi, NICICo. Sungun Copper Project

Following the Islamic Revolution in 1979 and the eight-year war with Iraq in the 1980s, Iran underwent a decade of chaotic social change. During this 'Era of Reconstruction', the government did ensure that a generous sprinkling of individuals were made knowledgeable about Western politics and culture. It also made known its wish to bring greater democracy to the country, accelerate reforms and establish more dialogue with the West.

However, a number of factors have served to impede rapid change and have delayed the realisation of the Islamic republic's ideals, as manifested in the Constitution. Among the factors impeding progress have been: the 'traditional texture' of Iran's social strata; US trade embargoes; as many as 55,000 development projects uncompleted as a result of financial indiscipline and the failure to secure the necessary funding; inexperience and disharmony among statesmen; and serious structural problems in the economy.

In the political context, the diversity of opinions between parliamentarians, the Guardians' Council and the Expediency Council have restricted the elected government's ability to pursue its policies successfully.

There has been some effort to privatise those state-owned organisations that are centrally organised as these are inefficient and present a major obstacle to social and economic growth. Above all, the country suffers from massive unemployment. About two-thirds of the population are under 25 and the goal of the Third Five-year Economic Development Plan (2000-05) is, amongst other things, to create 750,000 jobs per year, but this goal seems as far away as ever.

Nevertheless, there are some hopeful signs, and among the positive developments has been the US\$3.0 billion in new investments made last year, and the commitment for a further US\$4.0 billion.

Iran's GDP reached US\$87 billion in 2002, with per capita income at US\$1,330. The inflation rate was predicted at 15%. The government faced a budget deficit of IR3.38 trillion (US\$1.00 = IR8,250) and met the shortfall by issuing bonds, foreign borrowing and from the proceeds of partially privatising some enterprises.

Oil and gas

Oil and 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 90,000 Mbbl of oil and 24,000 billion m³ of natural gas, representing 9.5% and 16% respectively of the world's known reserves.

In 2002, Iran was the second-largest OPEC producer of crude oil, with a daily production of some 3.72 Mbbl, of which around 2.1 Mbbl were exported. Natural gas production totalled 63.5 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 10% of the world's total gas reserves. The project includes, as well transfer of the sour gas, the construction of refineries 105 km away at the port of Assalouyeh.

Mining priority

Iran is an exceptional country in its mineral diversity, ranking among the world's 15 major mineral-rich countries with 60 kinds of mineral production. Based on the records released by the Ministry of Mines and Industry, total measured and indicated resources are estimated at about 52,000 Mt, (resources of metallic ores are estimated at about 6,000 Mt and resources of non-metallic and construction minerals exceed 26,000 Mt).

In 2002, almost 130 Mt of raw commodities of over 50 different types of minerals (excluding sand and gravel) were mined from 2,100 operations, mostly small-scale quarries, of which 67% comprised construction materials and decorative stone. Some 105,000 people were directly involved in the mining sector and production had a market value of over US\$4.5 billion.

Almost 90% of the operations are in the private sector. However, the majority of the large-scale mines, as well as large steelworks and copper, lead-zinc and aluminium smelters, are partially or entirely state-owned. Exports of mineral products and metals last year were valued at the equivalent of US\$680 million and are expected to be worth in excess of US\$800 million in 2003. The government has decided to allow foreign investment in Iran's mines and metals industries, and methods of encouraging foreign investors are under consideration.

Iron and steel

The National Iranian Steel Co. (NISCo) is one of the largest state-owned enterprises and is currently producing about 7 Mt/y of total products; there is a target of 10 Mt/y by 2005.

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, and 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 southeastern 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 2.5 Mt this year and to 3.4 Mt in 2004. Chadormalou has reserves of 400 Mt of which 320 Mt averaging 55% Fe can be mined.

Within the next few years, NISCo plans to expand production capacity at Gol-e-Gohar from 2.7 Mt to 5.0 Mt/y, and concentrate production at Chadormalou from 5.1 t 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.

Coal

Coal is one of Iran's most abundant but least developed mineral resources. Proven reserves are estimated at some 1,075 Mt, mainly coking and bituminous coal. There are three main operations and processing plants located in Kerman Province and in the Alborz Mountains at Zirab and Shahroud. The total amount of washed coal is running at some 1.3 Mt/y and the Isfahan steelworks is obliged to augment its supply of coking coal by importing around 700,000 t/y.

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

Non-ferrous metals

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

Output of primary ingot from the state-owned National Iranian Copper Industries Co. (NICICo) aluminium smelter at Arak in central Iran reached 120,000 t last year. Efforts are being exerted to complete the first phase of the 110,000 t/y capacity Almahdi smelter at Bandar Abbas in the Straits of Hormoz which is currently producing at the rate of 55,000 t/y. A second phase is envisaged which will expand 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 prefeasibility study is also under way for the production of 80,000 t/y of alumina from a nepheline syenite deposit in eastern Azerbaijan.

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.

The world-class SarCheshmeh open-pit mine, concentrator, smelter and refinery near Rafsanjan in Kerman Province are operated by state-owned NICo. Last year, it processed some 16 Mt of ore and produced 388,500 t of copper concentrates yielding (with some imported concentrates) about 143,000 t of copper metal. In addition, the heap leach/SX-EW operation at SarCheshmeh yielded 153,500 t of cathode copper. The mine also produced 4,590 t of molybdenum in concentrate, plus 400 kg of gold and 16,000 kg of silver as by-products.

Separately, a new 80,000 t/y flash smelter is being built, by NFC of China at Khatoon-Abad, 40 km southeast of SarCheshmeh.

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.

To the west of SarCheshmeh, at Miduk near the town of Shahr-e-Babak, a new mine and concentrator is under construction. 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 flash smelter at Khatoon-Abad. Metso Minerals of Sweden is constructing the plant, having acquired the contract in its takeover of Svedala over two years ago.

Metso also has a contract to expand and modernise the SarCheshmeh concentrator, and will provide equipment for the Sungun copper project in northwestern Iran near the town of Ahar. Sungun is based on a large porphyry copper with an average grade of 0.61% Cu and 0.1% Mo, and a US\$450 million mine will be developed producing initially, 150,000 t/y of copper concentrates in phase I and 300,000 t/y in phase II after six years. Total

annual copper production will reach 250,000 t in the third Five-year Economic Development Plan and 350,000 t in the fourth.

Under the Iranian Government's investment protection guarantee system, the Canadian company, Zarcán 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 located about 15 km north of Zahedan in Baluchistan Province in southeastern Iran.

Zarcán is also exploring for gold at Agh-Darreh in Azerbaijan Province, and a measured and indicated resource of 3.46 Mt averaging 3.9 g/t 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. Iran possesses only one active gold mine, at Mouteh north of Isfahan, where annual production amounts to about 200 kg.

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.

No progress is reported at the Mehdiabad zinc project south of Yazd. Foreign investors are involved in the project and the deposit contains an indicated resource of some 42.5 Mt averaging 10% Zn, 2.6% Pb and 4 g/t Ag.

Iran's other metal-mining activities include chromite mining, and there are three active 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 166,000 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 most favourable province, where a few small deposits are known, is the central domain, specifically the Bafq/Posht-e-Badam metallogenic zone

northeast of Yazd which hosts the Saghand, Narigan, Zarigan and Sechahun discoveries. There is potential in this zone for metasomatic and hydrothermal vein deposits associated with Upper PreCambrian magmatic and metasomatic complexes. Existing resources at Saghand (reasonably assured resources plus estimated additional resources) amount to some 1,367 t of contained uranium.

Separately, 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 within two years. The plant will 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.

Finally, Iran is a major producer of industrial minerals. For example, it produces in excess of 10 Mt/y of gypsum and around 8.5 Mt/y of decorative and dimension stone (mainly travertine, onyx, marble and granite).

Mineral Production ('000 t except where stated)

Commodities	2000	2001	2002
Crude oil	193,300	193,500	198,700
Natural gas (bn m ³)	57	60	63
Hard coal	1,815	2,002	2,020
Iron ore	12,370	12,208	13,950
Copper ore	14,500	14,415	16,100
Manganese ore	160	101	121
Chromite conc.	151	161	166
Lead – zinc ore	1,260	1,450	1,200
Gold bar (kg)	765	770	650
Barytes	183	218	195
Bentonite	735	790	700
Kaolin	860	806	810
Bauxide	440	405	420
Refractory clays	400	485	490
Magnesite	140	143	130
Dolomite	285	303	310
Feldspar	156	168	200
Salt	1,560	1,985	1,970
Quartzite & silica	960	1,710	1,780
Sodium sulphate	420	387	580
Gypsum	10,700	10,890	10,380
Limestone	35,000	41,800	41,100
Dimension stone	7,810	7,930	8,450
Pumice	600	760	810
Others+	14,800	10,800	18,000

(+ Except sand & gravel)