



Examining the orebody at Surda copper mine

Indian resolve

John Chadwick reports on the big plans for increased aluminium output, rare earth potential, burgeoning iron ore and more

India's economy has emerged as one of the fastest growing economies globally with GDP consistently growing at 8 to 9%. With such high economic growth, it has become one of the most energy-hungry countries and as living standards are raised so too the purchase of goods that make great demand on mined products for manufacturing and construction has risen. It has been reported that to support and sustain high economic growth, the country will need investments to the magnitude of \$11.5 billion in the mining sector.

World Bank Group President Robert B. Zoellick visited India in January aiming to strengthen co-operation with the country as it aims to accelerate growth to provide better infrastructure and efficient social services for its people. "India's return to high levels of growth is helping the global economy recover from the crisis," said Zoellick. "While developing countries have been a key driver of global growth, challenges remain for both the developed and developing worlds. We will work with our partners to meet those challenges, strengthening local opportunity and global growth."

"India is a player on the global stage. The country's status as a rising economic power is closely connected with how it manages this next phase of growth, balancing rapid development with the environment and most importantly, the need to ensure all people have opportunity. We support the government's

strategy of boosting growth while helping the most vulnerable people be able to seize the opportunities afforded by an expanding economy."

India is gearing up for the XII Five Year Plan. The US Geological Survey notes India's "globally significant mineral resources; its deposits of coal, bauxite, and iron ore account for 10%, 4%, and 3% of the world's total resources, respectively. In terms of the relative size of its mineral resources, India's barite resource was the second largest in the world after China; iron ore, the third largest.

"In terms of production, India was among the leading producers in the world of mica (first); barite, chromium, and talc (second); bauxite and coal (third); iron ore and kyanite (fourth); manganese ore and steel (fifth); zinc (seventh); and aluminium (eighth).

When Coal India Ltd (CIL) put out its very successful Initial Public Offering (IPO), *The Times of India* (TOI) reported "even the biggest bulls in the ring were left stunned by the money it mined by the time it closed." The figure was \$53 billion – more than the GDP of Sri Lanka (\$42 billion) and four times that of Nepal (\$12.5 billion). "The success of Coal India also sets an impressive benchmark for biggies like SAIL [Steel Authority of India Ltd], Hindustan Copper, Manganese Ore and Power Grid which are lined up to tap the capital markets in coming months."

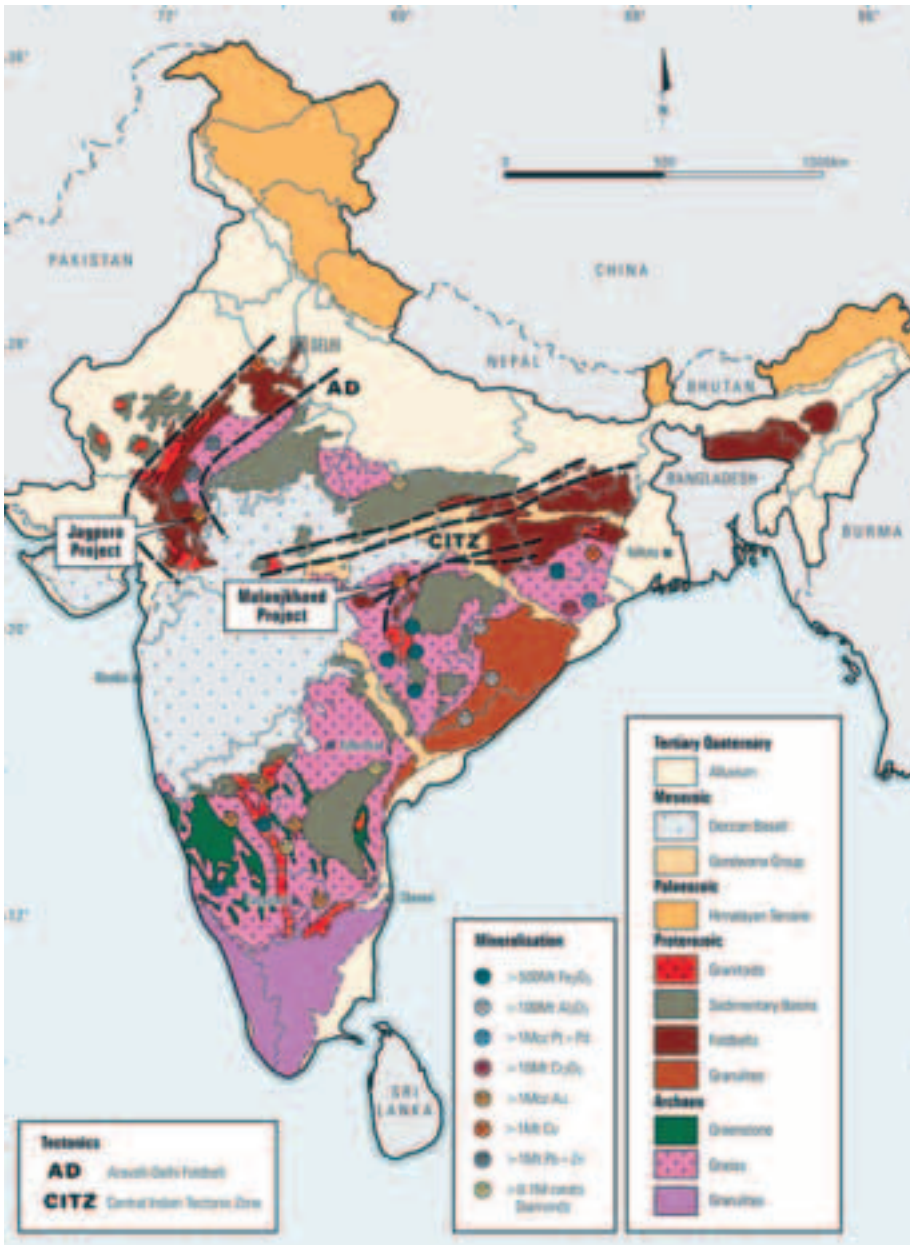
"This is one of the best PSUs (CIL is the

world's largest coal producer and accounts for 80% of India's coal production) and was offered at a very good valuation," explained Dharmesh Mehta, MD, institutional equities, Enam Securities.

"Don't underestimate a government company. These are like hidden treasures," Coal India Chairman Partho Bhattacharya told TOI. "The size of the IPO is only befitting. Look at it this way: Coal India is the (world's) largest reserve holder and the largest producer. Nobody understood the company. But today everyone is taking it seriously."

Rare earths are a 'hot' subject, and Indian Rare Earths Ltd (IREL) is an interesting company. There are three mineral sands operations, Chavara, Manavalakurichi (MK) and the Orissa Sands Complex (OSCOM). There is also the Rare Earths Division (RED) Aluva. RED is a value adding chemical plant where monazite produced by MK, is chemically treated to separate thorium as hydroxide upgrade and rare earths in composite chloride form. Established back in 1952, over the years, the capacity of the plant has been gradually expanded to treat about 3,600 t/y of monazite. Elaborate SX and ion exchange facilities produce individual rare earth oxides, like oxides of Ce, Nd, Pr and La.

National Aluminium Co (Nalco) has entered into a Memorandum of Understanding with IREL to produce value-added products from beach sand minerals, which would



Indo Gold projects shown on a geological map of the country

subsequently be used for making titanium and allied products. The project is estimated to cost Rs.400 crore and is planned to be set up at Chhatrapur in the Ganjam district of Odisha.

Titanium has strategic importance but there is currently no domestic production, all current need is met by imports. IREL has large resources of beach sand and currently exports monazite and ilmenite without value-addition. The development of these value-added products will be an important step towards import substitution.

Asian aluminium leader

Aluminium output is rising steadily. Between April and November last year (the first nine months of the 2010-11 financial year) the country's five major producers (total capacity

over 1.6 Mt/y) registered a cumulative figure of 1,060,875 t, compared with 984,238 t in the same period of the previous year. The main companies, with their existing annual capacity are:

- Nalco – 435,000 t
- Bharat Aluminium Co (Balco) – 245,000 t
- Hindustan Aluminium Co (Hindalco) – 500,000 t
- Madras Aluminium Co (Malco) – 38,000 t, but its operations have been shut down since December 2008
- Vedanta Aluminium Ltd (VAL) – 500,000 t

Nalco achieved the highest-ever metal production of 431,000 t in the financial year 2009-10 against the previous best of 361,000 t achieved in 2008-09, registering an increase of 14.4%. This was particularly impressive in the light of the severe coal shortage faced by Nalco.

Nalco operates a 4.8 Mt capacity open-pit mine in the Panchpatmali hills of Koraput district in Orissa. Via a 14.6 km long, single-flight, multi-curve cable belt conveyor of 1800 t/h, it feeds the alumina refinery at Damanjodi located in the foothills. Currently, the mine capacity is being expanded to 6.3 Mt/y of bauxite. The deposit covers an area of 16 km² and has a known resource of 310 Mt of ore containing 45% Al and 2% Si. It is over 90% gibbsitic. The overburden depth averages 3 m and the ore thickness 14 m.

The 1,575,000 t/y alumina refinery has three parallel streams of equal capacity, providing alumina to Nalco's smelter at Angul and exports the balance to overseas markets through Visakhapatnam Port. Its capacity is being expanded to 2.1 Mt/y. Angul's capacity is being expanded to 460,000 t/y.

VAL is the country's newest producer having commissioned its smelter at Jharsuguda from April, 2008. Although it is still classified as being "under trial production" it produced 243,104 t in the period under review, well ahead of the 157,575 t produced in April to November 2009.

Sterlite is India's largest nonferrous metals and mining company with interests and operations in aluminium, copper, zinc and lead. It is a subsidiary of Vedanta Resources, a London-based diversified FTSE 100 metals and mining group.

Sterlite, which majority owns Balco, holds a 29.5% minority interest in VAL, which is a 70.5% subsidiary of parent Vedanta. VAL is a fully integrated alumina and aluminium producer with a 1.4 Mt/y refinery at Lanjigarh and a 500,000 t/y smelter in Jharsuguda – both in the state of Orissa in eastern India – together with their associated captive power plants.

Vedanta recently announced a \$7.8 billion investment program to increase its fully integrated aluminium smelting capacity to nearly 2.5 Mt/y by 2012. Upon completion, this is expected make it Asia's largest and among the top five integrated producers of aluminium worldwide.

The company says "India is positioned to become one of the world's largest producers of aluminium, with the fourth largest reserves of bauxite globally of some 2,300 Mt and the fourth largest reserves of coal worldwide of over 250,000 Mt. Of these reserves, over 1,400 Mt of bauxite and 62,000 Mt of coal reserves are co-located in the State of Orissa alone. Vedanta's existing presence in the region, together with its excellent track record of executing projects ahead of time and at low capital costs; make it ideally placed to lead the development of these abundant bauxite and coal reserves.

Coal India's IPO was a huge success

"India also has the benefit of a fast growing domestic market with close proximity to the high growth markets of Asia and the Middle East. Demand for aluminium globally is projected to grow strongly at a compound rate of 5.7% between 2007 and 2020, with India and China projected to grow at 8.2% and 9.7%, respectively in the same period.

The next phase of brownfield growth projects comprises a 1.25 Mt aluminium smelter project in Jharsuguda, Orissa (the Jharsuguda II project), as well as a 325,000 t aluminium smelter project together with an associated 1,200 MW captive thermal power plant in Korba, Chattisgarh (the Korba III project). Vedanta says it will "also increase alumina production capacity at Lanjigarh from 1.4 to 5 Mt/y."

Jharsuguda II will comprise four pot lines, each containing 336 cells. First production from Jharsuguda II is scheduled for Q2FY2011 and it is expected to be fully commissioned by Q2FY2013. Korba III will comprise one single pot line containing 336 cells. The 325,000 t/y smelter and 1,200 MW captive power plant will be fully commissioned by Q2FY2012.

"The increase in alumina production capacity will be achieved by debottlenecking the capacity of the existing 1.4 Mt/y alumina refinery by an additional 0.6 Mt/y by Q3FY2011 and building three new production streams of 1 Mt/y each. The first production is scheduled for Q4FY2011 and it will be fully commissioned by Q3FY2012.

"The estimated investment in the smelter projects is \$2.9 billion for Jharsuguda II and \$1.8 billion for the Korba III project, to be phased over four years. The total additional investment in Lanjigarh is estimated at \$1.7 billion. This investment includes the cost of building the aluminium smelters and the alumina refinery, all necessary infrastructure including railway networks and water pipelines.

Hindalco says "due to the high quality of bauxite and close proximity between bauxite mines and alumina refineries, Hindalco ensures quality aluminium at competitive costs. Our captive bauxite mines in Jharkhand, Chhattisgarh, Maharashtra and Orissa, provide the raw material to our alumina refineries located at Belgaum in Karnataka, Muri in Jharkhand and Renukoot in Uttar Pradesh."

Voracious Vedanta

Vedanta Resources is India's big private sector miner and has successfully spread outside the country. Its copper business comprises operations in India, Zambia and Australia. The



Indian copper business is principally one of custom smelting and is operated by Sterlite, while the Zambian copper business is owned and operated by KCM. Vedanta owns 54% of the share capital of Sterlite and 79.4% of the share capital of KCM.

The Zambian operations comprise four mines, one at Konkola, two at Nchanga and one at Nampundwe, a tailings leach plant at Nchanga and a smelter at Nkana. Copper cathode production increased from 436,000 t in fiscal 2006 to 507,000 t in fiscal 2010.

Sterlite has worldclass copper smelter and refinery operations in India. Its main operating subsidiaries are Hindustan Zinc Ltd (HZL – in which the government owns 29.54%) for its zinc and lead operations and Copper Mines of Tasmania for its copper operations in Australia.

Sterlite is one of the two custom copper smelters in India, with a leading 43% primary market share by volume in India in recent years.

Vedanta notes that its "fully integrated zinc business is owned and operated by HZL, India's leading zinc producer with a 79.7% market share by volume of the Indian zinc market in fiscal 2008, according to the Indian Lead Zinc Development Association. HZL is the world's largest integrated zinc lead producer with current capacity of 964,000 t.

HZL's operations include three lead-zinc mines, three hydrometallurgical zinc plants, one lead smelter and one lead-zinc smelter in northwest India and one hydrometallurgical zinc smelter in southeast India. HZL's zinc production increased from 284,000 t in fiscal 2006 to 578,000 t in fiscal 2010.

HZL recently commissioned the 210,000 t zinc smelter in Rajpura Dariba. The 100,000 t

lead smelter and the associated 160 MW captive power plant is progressing well and on schedule for completion by Q2FY2011

HZL expects to increase its silver production from the current levels of approximately 100-120 t/y to a level of some 500 t/y in the form of silver and silver bearing residue. A large part of this increase would be from the Sindesar Khurd (SK) mine where silver levels are some 200 ppm and from the use of appropriate technology in the new smelters.

HZL's total reserves and resources, at March 31, 2010, stood at 298.6 Mt containing 34.1 Mt of zinc and lead metal and 832.7 Moz of silver.

HZL's Rampura Agucha lead-zinc mine is the third largest in the world in terms of contained zinc. It is being expanded from 5 to 6 Mt/y of ore. Reserves are over 60 Mt and resources over 40 Mt at 13.9% Zn and 2.0% Pb. Elsewhere, by 2012 the SK mine is to be expanded from 300,000 t/y to 1.5 Mt/y (5.8% Zn, 3.8% Pb and 215 ppm Ag) and a new 300,000 t/y mine developed at Kayar 10.6% Zn and 1.7% Pb.

These mines feed the Chanderiya pyrometallurgical smelting complex – 105,000 t/y zinc, 35,000 t/y lead and 150 t/y silver. There is also a hydrometallurgical facility there with a capacity of 420,000 t/y zinc and an Ausmelt lead smelter capable of 50,000 t/y lead and 851,000 t/y sulphuric acid.

At Debari the original hydrometallurgical facility can produce 88,000 t/y zinc and 419,000 t/y sulphuric acid. Debari Phase III has a 210,000 t/y hydrometallurgical zinc plant a 100,000 t/y lead smelter and a 350 t/y silver refinery. Vizag hydrometallurgical facility can



produce 56,000 t/y zinc and 91,000 t/y sulphuric acid.

Sterlite is developing a commercial power generation business, based on its expertise in building and managing captive power plants across its operations. Work on the 2,400 MW (600 MW x 4) greenfield coal-based independent thermal power plant at Jharsuguda should be completed in the first half of 2011. The project includes 112 Mt of coal in the blocks allotted.

More base metals

Binani Zinc Ltd (BZL) reports "demand for zinc in India is estimated at approximately 550,000 t." The Compounded Annual Growth Rate for zinc metal in the country was around 8% over the last 5 years. "Demand is expected to grow at 10% over the next three years driven by transportation, consumer durables and construction sector."

Production of zinc metal recorded the highest ever in 2009/10 at 35,552 t. Plant capacity utilisation was at a high of 93%. The successful commissioning of the fine zinc dust plant has helped significantly reduce operating costs and improve plant efficiencies. The company is also in the process of identifying markets for high quality zinc dust.

The company has acquired the Deri, Ambaji and Basantgarh mines in Rajasthan through its wholly owned subsidiary, R.B.G.Minerals Industries. BZL is also looking overseas and is investing in zinc mines in Australia. It has incorporated a wholly owned subsidiary in Australia, BZ Minerals (Australia).

Hindustan Copper Ltd (HCL), a Government of India enterprise, is India's sole integrated producer of primary copper. It operates plants and mines at Khetri Copper Complex in Rajasthan (mines, concentrator, smelter and refinery plants), Malanjkhand Copper in Madhya Pradesh (mine and concentrator), the Taloja continuous cast copper complex in Maharashtra and its Indian Copper Complex in Jharkhand (concentrator, smelter, refinery and wire bar plants).

Approval of all the projects proposed recently is in place. These include expansion of Malanjkhand, Khetri, Kolihan and re-opening/expansion of Rakha, Kendadih and Chapri-Sideshwar underground mines. After execution of these projects, the annual mining capacity of the company will rise from the present 3.2 to 12.4 Mt in seven years. The tenders for shortlisting bidders for execution of these projects have been floated and are



Breaking oversize rocks at Surda mine

available on the company's website.

Malanjkhand mine will be expanded from 2 to 5 Mt/y by developing underground below the existing open pit. Khetri & Kolihan mines will be expanded to 1 Mt/y and 1.5 Mt/y respectively.

Burgeoning iron ore

About half of India's total output of more than 200 Mt is exported to China. Orissa is the top producing state but in late January it stopped 23 iron ore mines from operating as they had not submitted proof of the necessary clearances. Deputy Director (Mines) of the state government U.C Jena said of the mines in Keonjhar district that "they have been asked to supply documents like forest clearance, mining lease, surface rights etc within seven days. If they submit we will issue permissions," he said.

Orissa is host to some 600 mines, but more than half of these have been closed for over a year after stronger state government enforcement of regulations. The state, which produces about 75 Mt/y of iron ore fines and lumps, began a crackdown in July 2009 following allegations some mines had no licences.

Government of India Enterprise Kudremukh Iron Ore has been renamed KIOCL Ltd. It is

producing some 1.3 Mt/y of iron ore pellets at present. Based in the State of Karnataka, it is known to have one of the largest deposits of iron ore in the world. KIOCL produces both iron ore concentrates and iron oxide pellets. Its products are now exported to China, Japan, Iran and Taiwan.

KIOCL Chairman-cum-Managing Director, Sri. K. Ranganath, reported in his last address that "India is the world's fourth largest producer of iron ore. Its iron ore production has increased continuously over the last ten years and in 2009 it rose by 20%, to 257.4 Mt, compared to 223 Mt in 2008. Exports increased by 9% to 115.5 Mt, up from 106 Mt in 2008. Producers and exporters have been quick to exploit the exceptionally profitable spot market opportunities created by rapidly growing Chinese demand. Since 1996 exports to China have increased from 4.3 to 107.5 Mt. On the other hand, exports to Japan fell by 66 % between 1999 and 2009. The entire increase in production since 2003 was export driven and came from existing mines.

"India is a relatively important producer of pellets and both production and capacity have been increasing over the last couple of years. In 2008, production reached its highest level to date at an estimated 17.5 Mt, which is close to the capacity ceiling. Production fell considerably in 2009 to 10.5 Mt. Exports of pellets decreased to 3 Mt in 2009. About 65% of pellets exports go to China. The present pellet production capacity in India is about 19.5 Mt/y. Many new projects are in the pipeline."

Incorporated in 1958 as a Government of India fully owned public enterprise, NMDC is under the administrative control of the Ministry of Steel, Government of India. Since inception it has been involved in the exploration of wide range of minerals including iron ore, copper, rock phosphate, limestone, dolomite, gypsum, bentonite, magnesite, diamond, tin, tungsten, graphite, beach sands, etc.

India's single largest iron ore producer and exporter, it is currently producing about 30 Mt/y of iron ore from three fully mechanised mines – Bailadila deposit-14/11C, Bailadila Deposit-5, 10/11A (Chhattisgarh State) and Donimalai mines (Karnataka State).

Last December NMDC signed an MoU with OJSC Severstal, a leading vertically integrated international steel and mining company in Russia to establish a JV company to build an integrated steel plant in Karnataka state. Its



Handheld drilling operations at Surda mine

capacity will be 2 Mt/y, expandable to 5 Mt/y. Coking coal will be mined in Russia and iron ore in India.

Vedanta's Sesa Goa is India's largest private sector producer and exporter of iron ore and says it "is on course to be in the league of top four iron ore producing companies in the world." Apart from Iron ore it also produces pig iron and metallurgical coke. In the six months to September 30, 2010 it sold 7.461 Mt of iron ore (6.354 Mt in 2009).

Tata Steel's Indian operations are one of the most competitive assets in the global steel industry and therefore, capacity expansion in India is one of its key strategies. Its competitive position is as one of the lowest cost producers of steel in the world from the quality and yield of its raw material units. The mines have successfully offered raw material security and have partially insulated Tata Steel from the volatility of the global markets. Tata has, therefore, continuously modernised and expanded its raw material facilities right from the 1950s, when it had launched its 2 Mt expansion program.

In FY 2009-10, the steel division of Tata Steel's Indian operations registered an increase of 20% in their saleable steel from 5.37 to 6.44 Mt. In recent years it has looked to mining operations outside India, like the joint venture with Vale in Australia for a coking coal mine. The project life of the Carborough Downs mine near Moranbah in Central Queensland is currently estimated to be 14 years and some 58 Mt of raw coal is expected to be mined during this period.

Tata Steel, through its subsidiaries, became involved in New Millennium Capital Corp (NML), Canada. In June 2010, Tata Steel subscribed to a private placement of C\$20 million by NML pursuant to which Tata Steel Global Minerals Holding now holds a 27.4% stake in NML. NML controls a direct shipping ore resource estimated to be about 100 Mt. The LabMag deposit consists of 3,500 Mt of Proven and Potential mineral resources. These reserves are contained in the 4,600 Mt of Measured and Indicated resources and 1,200 Mt of Inferred resources.

Tata Steel, along with NML is trying to work out an economically viable solution to advance the project. NML has completed a feasibility study which is being reviewed by Tata Steel. This study estimates Proven and Probable mineral reserves of 64.1 Mt for the DSO project. Subject to receiving all regulatory approvals, production is expected to commence in 2011.



Tata Steel and SODEMI (State Owned Company for Mineral Development) entered into a Joint Venture agreement for the development of Mount Nimba Iron ore deposits in Ivory Coast in December 2007.

Tata Steel and Riversdale Mining could extract up to 720 Mt by open-pit mining from a major coal resource in the Benga Licence, Mozambique. Stage I, entails initial production of 5.3 Mt/y ROM to produce approximately 1.7 Mt/y of high quality hard coking coal and 300,000 t/y of export thermal coal by Q2 2011.

Jindal Steel and Power Ltd (JSPL) is also looking beyond India's borders for iron ore and will invest \$280 million this year to start work on an iron ore and steel project in Bolivia that has been plagued by delays, the company's Managing Director said in January. The investment plan anticipates total spending of \$2.1 billion over an eight-year period.

Under a 40-year contract, Jindal has the right to mine about half the El Mutun resource in the Santa Cruz area -- believed to contain one of the world's largest reserves of iron ore, though reported to be of medium quality. The project should start producing steel in 2014. The complete project aims at:

- Pellet plant: 10 Mt/y
- Sponge iron plant: 6 Mt/y
- Steel plant: 1.7 Mt/y
- Power plant: 450 MW

The \$12 billion Jindal Group is one of the largest steel producers in India with 12 plants there and two in the US. JSPL produces steel and power from its captive coal and iron-ore mines.

JSPL is the first Indian company to go into Coal to Liquid (CTL), with its project in Odisha – the Ramchandi Promotional Coal Block in Angul district. The company will use

'Indirect Coal Liquefaction Technology' and produce 80,000 barrels daily.

This plant will use Lurgi 'fixed-bed dry bottom coal gasification' for processing liquid fuel from high ash coal. The Syngas produced at this plant will replace natural gas used in the steel making process. Diesel production will be maximised (up to 60-70%) and the project will make environmentally friendly and optimum use of harmful byproducts and using ash in road building, brick making, cement manufacturing and backfilling of mines.

Hindalco's Essel Mining & Industries is one of India's largest iron ore mining companies in the private sector, and the largest producer of noble ferro alloys. The mining division has its operations in the mineral rich Barbil-Barajamda belt of Odisha. The mines have a substantial resource base of superior quality iron ore with Fe content of 63 to 66%, some of the best quality available in the country. Essel operates three mining assets in Odisha – Jilling, Kasia and Koira and has plans to venture into coal.

SAIL says it has "the second largest mining outfit in the country. The mines of SAIL started as captive sources of raw materials for its integrated steel plants. Major portion of its mining activities is managed by Raw Materials Division (RMD)" Other mines are the Bhilai steel plant's captive mines and the mines of VISL (Visvesvaraya Iron and Steel Ltd).

RMD, with its headquarters at Kolkata, manages seven iron ore mines (three with capacities above 4 Mt/y), two limestone mines and one dolomite mine. As part of the 2012 corporate plan various capacity expansion projects have been started at the RMD mines. The major projects cover the expansion of capacity of Bolani ore mines, development of the central block at Meghahatuburu iron ore



17 coal beneficiation facilities with an aggregate designed feedstock capacity of 39.40 Mt/y. The company intends to develop an additional 20 coal beneficiation facilities with an aggregate additional proposed feedstock capacity of 111.1 Mt/y. For an ultimate coal capacity of 309 Mt/y, CIL has identified 134 new projects – 34 underground and 100 open pits. It produces non-coking coal (about 93%) and coking coal (about 7%) of various grades for diverse applications.

CIL's net profit rose by 29.06% to Rs4,020 crore in the first half of

projects have not yet received environmental and forest clearance. "These 17 projects were supposed to produce 54 Mt. So, the production target had to logically come down to 466 Mt. However, we have said we can make up 20 Mt. So the revised target for 2011-12 is 486 Mt," said a CIL spokesman.

Several mining projects are stuck with the Environment and Forests Ministry extending the time-frame for the Composite Environment Pollution Index (CEPI) that bars mining activities where the CEPI is 70% up to March next year.

Coal is known to be present in 14 out of India's 28 states. It is generally high in ash and low sulphur. The total resources are over 260,000 Mt of which just over 100,000 are Proven and some 160,000 Mt are Indicated/inferred. CIL's reserve base is around 70,000 Mt. As of 2009, 88% of production came from open pits and 12% from underground mines. CIL's eight subsidiaries are Eastern Coalfields Ltd (ECL), Bharat Coking Coal Ltd (BCCL), Central Coalfields Ltd (CCL), Northern Coalfields Ltd (NCL), Western Coalfields Ltd (WCL), South Eastern Coalfields Ltd (SECL), Mahanadi Coalfields Ltd (MCL), Central Mine Planning & Design Institute. The North Eastern Coalfields unit comes under CIL headquarters.

CIL wants to outsource seven of its coal blocks to private operators and at the beginning of February invited companies to bid for six of these. Those six blocks include two owned by WCL, while the company said the bid for the seventh block, which is at Khairaha, under the Bilaspur-based SECL, is under consideration and would be announced soon. According to company officials, some 15

Rampura Agucha - HZL

mine, development of the South Block at Kiriburum mine, mechanisation and development of Chiria mines, development of Taldih Block, and opening a new mine at Thakurani.

Rio Tinto India was recently reported to be in talks with an Indian company to develop iron ore mines. The company is known to be very keen to have iron ore operations in India. Indian demand for steel is expected to grow in double digits.

Rio Tinto holds a 51% stake in an iron ore project with the government of Orissa state and said it is in the final stages of renegotiating this agreement with Orissa Mining Corp (OMC). The joint venture, which covers three deposits in the Keonjhar district of eastern Orissa — Sakradihi Dubna, Malangtoli and Gandhamardan — will give it access to 3,600 Mt of iron ore reserves in the state. Any mining is probably two years away, at least.

Much of India's known iron ore has a high alumina content. This needs to be blended with higher-grade ores from overseas markets. Such imports are not favoured by many in the Indian iron ore sector, fearing it would dampen demand for their ores and that prices would fall.

The coal giant

As of March 31, 2010, CIL operated 471 mines in 21 major coalfields across eight states in India, including 163 open-pit mines, 273 underground mines and 35 mixed mines (both open pit and underground). CIL also operated

the 2010-11 fiscal year, compared with the corresponding period last year. Its coal production, however, rose only marginally by 0.67% to 185.68 Mt in the April-September period, from 184.44 t in the same period last year. There was a shortfall of 18.27 Mt below the production target of 203.95 Mt.

CIL cites the main problems as environmental clearance, huge pithead stocks and offtake problems. It has revised its target for 2010-11 to 460.5 Mt from the original aim of mining 486 Mt. For 2011-12, the production target has been scaled down to 486 Mt from the original 520.5 Mt, mainly because 17 new





Neyveli Lignite bucketwheel excavator

companies, all with a global coal mining presence, were in Kolkatta at the end of January, to take the discussions ahead.

CIL is also looking to develop 50:50 joint ventures with private players for its 18 abandoned underground mines. The reserves in these mines are estimated at 1,647 Mt, which includes coking and high grade non-coking coals. These mines have been abandoned for reasons like excessive water, spontaneous combustion or difficult mining conditions. CIL says underground mining would be revived in six abandoned mines of ECL, eight mines of BCCL and four mines of CCL, and that it has received expressions of interest over the last year from 12 parties to form 50:50 joint ventures for re-opening the mines. Among the parties interested, according to *Mineweb*, "were global majors such as ArcelorMittal, Rio Tinto and Australian-based, Titan Mining.

It has already entered into an arrangement for its Tansi and Kumbarni mines, where Joy Mining and SMS Infrastructure, a company from Nagpur, Maharashtra," are involved

To ensure access to resources CIL has a number of targets:

Open pit mining

- Computer-aided mine planning for deeper open pits
- Deploying high capacity equipment to achieve economy
- Efficient fleet management
- State-of-the-art mass production technology - high capacity equipment matching with bench height and stripping ratio are being introduced. Truck with higher capacities are being purchased
- Maintenance and Repair Contracts (MARC)

with OEMs are being introduced

- Focus on automation and use of IT. Three OITD (Operator Independent Truck Dispatch) systems are already in operation and 11 more mines are being equipped with them.

Underground mining

- Tapping large reserves below 300 m depth
- Seven greenfield properties being developed
- Introduction of mass production and longwall technology
- Manual loading is being phased out by deployment of LHDs and reorganisation of transport system, wherever feasible
- 18 abandoned mines (1,600 Mt) identified for development.

Highwall mining

- Mining of good quality thin seams
- Recovery of good quality coal in open-pit mines beyond economic stripping ratio.

CIL also plans the recovery and commercial utilisation of coalbed methane and underground coal gasification of deep seated seams. January saw talks with Sasol in South Africa on coal-to-liquids technology.

For efficient open pit management, Leica Geosystems is supplying seven CIL mines with Jigsaw360 Mine Management Systems. One of CIL's key areas of focus is to improve productivity at existing mines by implementing OITDS, advanced optimisation and production monitoring systems.

Under the XI Plan (2011-12) India is to produce 680 Mt, comprising 520.5 Mt from CIL, 45 Mt from Singareni Collieries Co Ltd (SCCL) and 119.7 Mt from 'others'. The latter are to make an important contribution to the major growth planned for the XII PLAN (2016-17), to 1,055 Mt. Others will provide 346 Mt, SCCL 45 Mt and SCCL 664 Mt.

Coal imports are currently around 60 Mt/y.

CIL (28.58%) has established a joint venture company International Coal Ventures Ltd (ICVL) to acquire metallurgical coking coal and thermal coal assets overseas with SAIL (28.58%), NTPC (14.28%), NMDC (14.28%) and Rashtriya Ispat Nigam Ltd (RINL) (14.28%). It will acquire coal resources abroad through equity stakes in working or greenfield projects. It has acquired two virgin coal blocks in Mozambique. India has urged Mozambique to consider allocation of more coal blocks to Indian companies.

India's largest power company, NTPC was set up in 1975 to accelerate power development. It is emerging as a diversified power major. Its total installed capacity of the company is 33,194 MW (including JVs) with 15 coal-based power stations and seven gas ones, located across the country. In addition, five JV stations are coal based. The company has set targets to have an installed power generating capacity of 75,000 MW by 2017 and 128,000 MW by the year 2032. The plan is for a diversified fuel mix comprising 56% coal, 16% Gas, 11% nuclear and 17% renewable, including hydro.

NTPC is in a 50/50 JV with SCCL to jointly undertake development and operation of coal blocks and Integrated coal-based power projects in India and overseas. Recently NTPC awarded one of the largest contracts in the company's history, worth A\$5.5 billion, to Thiess to develop and operate the 300 Mt Pakri Barwadiah project over the next 22 years. The low cost mine is the first of six that NTPC plans to develop in an attempt to cut costs at its Indian power stations.

Thiess's contract involves the construction of site infrastructure and coal processing plants during the first two years, followed by overburden removal, coal mining and operation of processing and rail loading facilities over the life of mine. Production is planned to ramp up to 15 Mt/y over the first three years of mining and more than 300 Mt of coal will be mined over the contract duration, expected to be 22 years. The Pakri Barwadiah (PB) coal block is located near Hazaribagh in the State of Jarkhand in the eastern part of India. The mine and associated infrastructure will be constructed, operated and maintained by Thiess Minecs.

Coal production in India is targeted for domestic consumption and is quarantined from the international export market. The PB Block is estimated to have coal reserves of about 1,436 Mt of non-coking and semi-coking grades.

Thiess Mining Chief Executive Bruce Munro: "India has the fourth-largest coal reserves in the world and is the third largest producer. We believe this project will lead to more



One of SAIL's RMD operations

opportunities in India, particularly given the strong economic growth currently occurring."

Thiess intends to recruit locally, providing a significant economic boost to the regional economy. During the construction and ramp-up period, Thiess will introduce sophisticated training simulators to train local people in heavy mining equipment operation.

SCCL operates 36 underground mines and 14 open pits. Its actual production (2009-10) was on target at 50.42 Mt. The target for the current financial year is 51.3 Mt. Its output per manshift (mines and departments in 2009-10) was 2.72 t.

Neyveli Lignite produces from Mine- 1 (capacity 10.5 Mt), Mine-2 (capacity building up to 15 Mt) and the smaller 3 Mt/y Mine- 1A . Production in 2009-10 was just over 22.3 Mt.

Golden enigma

Despite the recent boom in China, India is still the largest importer and consumer of gold in the world (700-750 t in 2010); but gold mining remains at very low levels. The production of primary gold in 2008-09 was just 2,464 kg (excluding byproduct gold recovery from imported concentrates).

The country has a long history of mining for gold and references for old mine sites dating back to 200 years are available from official records.

Starting this year, India's central bank has allowed seven more banks to import gold and silver. This has taken the total number of banks that can ship precious metals into the country to 30, raising the prospect of better competition and helping supplies. India, which hardly mines any gold of its own, imported 624 t in the first three quarters of 2010, up 120% on the previous year, World Gold Council data shows. Banks contribute 80% of the annual gold imports.

Hutti Gold Mines Ltd (HGML), located in the state of Karnataka, was first established as Hyderabad Gold Mines in 1947. Owned by the Government of Karnataka, HGML consists of the main mine at Hutti and the satellite mines, Uti and Hirabuddini, all of which are located in the Raichur district. Hutti is an underground mine, Uti is an open-pit and Hirabuddini is an exploration project. The Chitradurga Gold Unit is an open pit located in Ajjanahalli in Tumkur district and an exploration underground mine at G. R. Halli in Chitradurga district.

These mines in total produce about 3,000 kg/y of gold. With the closure of the Bharat Gold Mines, which had operations in the Kolar Gold Fields (KGF) in Karnataka and at Chittoor



district in Andhra Pradesh, HGML is the only primary gold producer in India. It says it "has gold ore reserves of about 31.02 Mt which could last for about 60 years and yield about 150.4 t of gold." There is talk of re-opening the KGF.

Indo Gold Ltd (IGL) was set-up in late 2004 specifically to undertake exploration for gold in India under a Joint Venture with an Indian company which had identified and applied for some excellent exploration properties in various states, but principally in Rajasthan.

The key mineral properties over which IGL has rights are located in Southern Rajasthan and are known collectively as the Jagpura project. State-sponsored research and exploration was initiated here some 14 years ago to follow-up ancient, perhaps +2000 year old gold mining sites centred on Bhukia village, and has continued sporadically under the auspices of the Geological Survey of India (GSI) and Hindustan Zinc Ltd (HZL). The JV acquired mineral rights in early 2005 and its resulting work, including two campaigns of drilling and acquisition of old data, resulted in the identification of gold (-copper) mineralisation estimated to be in excess of 2 Moz.

IGL says that in late 2007, it "was forced to postpone its planned listing on the London-AIM exchange due to inappropriate actions undertaken by the previous Rajasthan Government. Since then IGL has been involved in a difficult legal process to attempt to find a solution with the new Rajasthan Government to renew and upgrade its mineral rights, which process is ongoing. The JV also holds granted ground around the Malanjhand copper mine in Madhya Pradesh over which it is engaged in early stage exploration for porphyry copper-gold targets.

"Separately in southern India, IGL has

extensive applications pending, some as old as three to four years due to the tortuous approval and awarding process throughout India. IGL also has a 21.6% shareholding in Bengal Minerals, which holds large areas of granted ground as well as some still under application in Rajasthan for polymetallic and diamond exploration targets."

The company concludes that "due to the excellent quality of its properties in India, notwithstanding the extreme difficulty in achieving secure mineral tenure, IGL is encouraged to play a waiting game."

Mineweb reported in January that an announcement of the discovery of gold, said to be valued at several billion dollars, in the Northern part of Goa, created quite a stir in India's mining circles. Mineweb talked of "a very large tonnage of secondary gold deposits reportedly lie just 60 m below the ground spread over 40,000 ha."

Prof Frank Reith from the University of Adelaide Australia who is reported to have conducted research into the creation of gold by bacteria in Australia is said to have confirmed that the metal found in Goa was also created by bacteria. The gold deposits are scattered across Goa from the North of Pernem and cross the capital city of Panaji and extend up to Salcette.

Currently, the mines and geology department is processing some 470 licences to conduct reconnaissance surveys in Goa, including those for renewal of mining leases. Nine applications by three firms are for prospecting for gold, copper, nickel, platinum, diamonds and other elements.

Diamonds may also have future potential. India was the only source of diamonds in the world for over 3,000 years, until deposits were located in Brazil and South Africa. Today,



Mangalgatti gold prospect north of Dharwad, an ancient working being examined by Mark Creasy, a key shareholder in Deccan Gold Mines Ltd (DGML), which is listed on the Mumbai Stock Exchange. It is involved in gold exploration activities in the States of Karnataka, Andhra Pradesh, Rajasthan and Kerala. DGML has entered into agreements with its associated company, Geomysore Services (India) and its 100% owned subsidiary Indophil Resources Exploration Services for the transfer of Prospecting Licences to DGML in the Dharwar-Shimoga, North and South Hutti, Ramgiri and Mangalur Prospecting blocks. The associated companies have made several applications for the grant of Prospecting Licences in these prospecting blocks and are awaiting grant of licences from the Government. The associated companies were originally granted Reconnaissance Permits (RPs) to undertake exploration activities in these prospecting blocks

NMDC is the only organised producer in India from its Majhgawan mine at Panna, Madhya Pradesh. Its capacity is 84,000 ct/y at a grade of 10 ct/100 t.

Foreign investment

Foreign involvement in India's mining industry is at a low level, but growing. From Australia, India Resources Limited (IRL) selected the country "on the basis of its favourable geology and culture; its recent rapid growth and relaxation of foreign involvement in mining; and its nascent mining and exploration industry.

"One key issue that has historically plagued the Indian resources sector is not its lack of resources, rather the mining methods that result in a high cost base in comparison to countries such as Australia. This together with the need for strong exploration expertise provides an opportunity to combine Australian mining and exploration skills with the vast Indian minerals prospectivity.

The company has developed a close commercial alliance with HCL and also is conducting exploration and aiming ultimately to develop several of its prospective copper tenements.

The "alliances with HCL are a first for an overseas group and are indicative of the Indian

resource industry's willingness to embrace Australian exploration and mining expertise. IRL has assembled a mix of projects in a range of commodities and areas of India." The company's portfolio is fairly diverse.

At Surda mine, the alliance with HCL has the initial focus to identify existing operations and areas where large-scale mineralisation has been proven. IRL has re-opened Surda Mine with an initial objective of delivering annual production of 4,500 t of copper metal in concentrate. In October last, a new monthly copper production record was achieved - at 327 t of metal-in-concentrate. The average feed grade for the month was 0.94% Cu. The previous copper production record for the mine was 313 t in April 2009.

At the Aravalli project, IRL has acquired two Reconnaissance Permits (RPs) in Rajasthan (northwest India). The Aravalli Proterozoic metamorphic belt is prospective for copper, lead, zinc as well as gold. IRL has recently completed a reconnaissance drilling program with positive results. The company has lobbied the Indian State and Federal Governments to progress the application for a mining lease on the Aravalli project.

IRL has taken a placement comprising about 8.3% of the share capital of Pebble Creek

Mining (see below). Pebble Creek's main asset is the Askot Project: a VMS deposit of copper, lead, zinc, gold and silver mineralisation in northern India. Pebble Creek is currently compiling a resource estimation.

IRL's diamond initiative focuses on the Bhandara project which currently consists of five granted RPs in Orissa, as well as three RP applications in Chhattisgarh, located in the region of several kimberlite fields. In addition bulk sampling is planned at two diamondiferous kimberlites on IRL's granted PLs of the Dharwar project in Andhra Pradesh.

Finally, IRL notes that like China, "India's rapidly growing economy is driving a surge in demand for power and steel. IRL is currently seeking suitable projects for rights to explore and develop coal or iron ore in India." Prism Cement has appointed IRL Coal India as the preferred contractor for the development of the Sial Ghogri underground coal mine in the state of Madhya Pradesh.

Canadian Pebble Creek is also "focused on India, a dynamic economy and voracious metals market. For many decades India was closed to foreign and private-sector investment in mining gold, diamonds, copper, nickel, zinc, platinum and certain other metals." It is among the first companies to acquire mineral rights in India since the mineral sector opened up in 1993.

An independent 43-101 mineral resource estimate for Askot is 1.9 Mt of Inferred high-grade copper, zinc and lead, with some silver and gold. "The deposits boundaries are not yet known and potential is many times larger." **IM**

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